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**Study on the Influence of Travelers' Satisfaction with Intercity Smart Travel and their Choice Behavior: based on their Heterogeneity**

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Master in Digital Technologies for Business

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TECNOLOGIAS
E ARQUITETURA

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**Dedication**

Time flies. Looking back, there is the hardship of learning, the joy of success, and the beautiful moments are vividly remembered. I would express my heartfelt thanks to professors Rúben Pereira and José Brás for imparting their knowledge. Their profound knowledge, pragmatic style, and diverse teaching methods have greatly benefited me. At the same time, the various learning platforms, lectures, and practical opportunities provided by the university have broadened my horizons and clarified the direction for me to move forward. As the thesis is about to be completed, I would like to express my sincere gratitude to all the teachers, classmates, colleagues, and family members who have cared about and helped me.

Firstly, I would like to thank my supervisors for their rigorous and approachable academic approach. They place great emphasis on integrating theory with practice, often teaching us to combine the knowledge learned in the classroom with our work in the enterprise, and flexibly apply what we have learned to solve practical problems. My thesis cannot be separated from the meticulous and professional guidance of them at every step, from topic selection, writing and revising the thesis, to finalizing it. They provided me with very valuable opinions and suggestions. Here, I once again express my gratitude and sincerest wishes to my supervisors.

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Lastly, I would like to express my gratitude to my family for their unwavering support and encouragement throughout my academic journey, enabling me to study without any worries!

**Abstract**

This study first integrates the current development status and travel characteristics of intercity transportation in urban agglomerations to analyze the demand for smart intercity travel. It then analyzes and compares the behavioral characteristics and perceptions of smart travel among potential groups labeled as "indifferent type," "rational type," and "enthusiastic type."

Subsequently, it examines the satisfaction characteristics of intercity travel latent subcategories in urban agglomerations, with a focus on analyzing the heterogeneity of perceived smart travel services among different groups. Finally, it investigates the impact of perceived smart travel services on intercity mode choice behavior and the characteristics of intercity mode choice behavior among different groups.

The study finds that elderly individuals and female groups are more likely to be classified as the "indifferent type" group, while those traveling for official business purposes and highly educated individuals are more likely to be classified as the "enthusiastic type" group. Satisfaction levels follow the order: "enthusiastic type" > "rational type" > "indifferent type."

The results of this study suggest the need for relevant departments and enterprises to formulate differentiated management strategies for smart travel services. Optimization of service levels for different intercity transportation modes should focus on enhancing convenience, comfort, protection of personal privacy information, and environmental friendliness to increase the value-added for passengers in the smart intercity travel process. This will contribute to creating a more efficient, comfortable, safe, and environmentally friendly new experience of smart intercity travel for travelers.

**Keywords:**

Smart Travel Service, heterogeneity, travel satisfaction, mode choice.

**Resumo**

Este estudo integra primeiramente o estado atual de desenvolvimento e as características de viagem do transporte interurbano em aglomerações urbanas para analisar a demanda por viagens interurbanas inteligentes. Em seguida, analisa e compara as características comportamentais e percepções de viagens inteligentes entre grupos potenciais rotulados como "tipo indiferente", "tipo racional" e "tipo entusiasta".

Posteriormente, examina as características de satisfação das subcategorias latentes de interurbanas em aglomerações urbanas, com foco em analisar a heterogeneidade dos serviços de viagens inteligentes percebidos entre diferentes grupos. Investiga o impacto dos serviços de viagens inteligentes percebidos sobre o comportamento de do modo interurbano e as características do comportamento de interurbano entre diferentes grupos.

O estudo constata que idosos e grupos femininos são mais propensos a serem classificados como o "tipo indiferente", enquanto aqueles que viajam para fins comerciais oficiais e indivíduos altamente instruídos são mais propensos a serem classificados como o "tipo entusiasta". Os níveis de satisfação seguem a ordem: "tipo entusiasta" > "tipo racional" > "tipo indiferente".

Os resultados deste estudo sugerem a necessidade de departamentos e empresas relevantes formularem estratégias de gestão diferenciadas para serviços de viagens inteligentes. A otimização dos níveis de serviço para os diferentes modos de transporte interurbano deve centrar-se no aumento da conveniência, conforto, proteção da privacidade pessoal e respeito pelo meio ambiente, a fim de aumentar o valor acrescentado para os passageiros no processo inteligente de viagens interurbanas. Isso contribuirá para criar uma nova experiência mais eficiente, confortável, segura e ambientalmente amigável de viagens intercidades inteligentes para viajantes.

**Palavras-chave:**

Smart Travel Service, heterogeneidade, satisfação de viagem, escolha de modo.

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## CHAPTER 1 Introduction

In the current transportation field, intercity smart travel, as an innovative solution, is gradually changing the way people travel and the interconnectivity between cities. With the rapid development of information technology and mobile Internet, smart travel technology uses advanced technologies such as big data, cloud computing, and the Internet of Things (IoT) to provide travelers with a more efficient, personalized, and comfortable travel body [1]. This not only optimizes the allocation of transportation resources, reduces energy consumption and environmental pollution, but also greatly improves passenger satisfaction and travel efficiency. However, the actual application effect of intercity smart travel system and its impact on travelers' choice behavior is still an area that needs to be explored in depth [2]. In particular, analyzing from the perspective of user heterogeneity, there may be significant differences in the satisfaction and behavioral responses of different groups of travelers in accepting and using smart travel services, which is of great significance for further optimizing the design and services of intercity smart transportation systems [3].

When studying the impacts of intercity smart travel systems, travelers' choice behavior patterns become a central object of analysis. Such patterns usually involve a variety of factors, including travelers' personal preferences, travel costs, time efficiency, service quality, and technology acceptance. From the perspective of behavioral economics, a traveler's decision-making process is not only a simple trade-off between costs and benefits, but is also profoundly influenced by psychological factors and the social environment. By providing real-time data, personalized recommendations and more flexible travel options, smart travel solutions aim to meet the specific needs of different travelers and thus influence their choice behavior. Therefore, an in-depth understanding of travelers' behavioral patterns in intercity smart travel environments plays a crucial role in predicting travel demand, guiding transportation policy making and improving the overall service effectiveness of the system [4].

There is a close interaction between the effectiveness of intercity smart travel systems and travelers' choice behavior. On the one hand, the design and service quality of the system directly affect travelers' satisfaction and final travel decisions [5]. For example, whether the system can provide accurate and timely traffic information, personalized travel advice and a comfortable and safe environment all directly affect whether passengers choose to use such services. On the other hand, passengers' feedback and behavioral patterns are also crucial to the optimization and adjustment of smart travel systems. By analyzing the travel data and satisfaction surveys of different user groups, problems and directions for improvement in the system can be revealed, which in turn can enhance the user experience through technological upgrades and service improvements. Therefore, understanding and optimizing the dynamic relationship between intercity smart travel systems and travelers' choice behaviors can not only enhance the overall satisfaction of travelers, but also promote the continuous development and innovation of smart transportation systems [6].

Despite the significant convenience and benefits provided by intercity smart travel systems, a number of challenges and issues remain in their development. First, the high cost of technology implementation and maintenance issues are a major barrier to the popularization of smart travel systems. The introduction of advanced technologies and data processing needs often require huge initial investments and ongoing technical

support, which is a considerable financial burden for many cities. Secondly, data privacy and security issues cannot be ignored [7]. With the wide application of big data and IoT in smart travel systems, how to ensure the security of travelers' personal information and prevent data leakage and misuse has become an important public concern. In addition, user acceptance may also be an obstacle to the promotion of smart travel systems. Travelers of different ages and backgrounds have different levels of adaptability and acceptance of new technologies. How to design user interfaces that are easy to understand and operate, as well as how to increase user acceptance and trust through effective marketing strategies are all issues that need to be addressed in smart travel systems. Therefore, these challenges require policy makers, technology developers, and service providers to work together to seek innovative solutions and cooperative mechanisms to overcome existing barriers and promote the healthy development of intercity smart travel systems [8].

In response to the above challenges, this study aims to assess the impact of intercity intelligent transportation systems on passenger satisfaction and choice behavior in different populations. In order to gain a deeper understanding of the impact of various aspects of an intelligent transportation system on the preferences and decisions of different user groups, this study will focus on the availability of real-time data, the personalization of travel recommendations, and the overall usability of the system; The aim is to define how various user characteristics (such as age, occupation, technical proficiency, etc.) affect their acceptance and satisfaction with intelligent transportation systems. Achieving this research goal is expected to provide a more accurate and practical basis for the design and policy formulation of intelligent travel systems, further promoting the intelligent upgrading and sustainable development of intercity transportation networks.

## CHAPTER 2 Literature Review

With the acceleration of global urbanization, the traffic flow between cities has increased significantly, which puts higher demands on the management and optimization of transportation systems. As a key technology to address this challenge, intercity smart travel system integrates traffic management using advanced information and communication technologies to achieve significant improvement in travel efficiency and effective relief of traffic congestion [9].

From a technological point of view, the smart travel system is able to predict traffic flow and trends and adjust traffic signals and route planning in real time through real-time data collection, processing, and analysis, which greatly improves the responsiveness of the transportation system and the efficiency of resource allocation. For example, through in-vehicle GPS and mobile Internet, the system is able to provide drivers with the best route suggestions, reducing aimless driving and waiting time.

Second, analyzing from the perspective of user experience, the intercity smart travel system provides more personalized and convenient services. Through smartphone apps and other user interfaces, travelers can easily access a full range of travel-related information, including ticket booking, seat selection, and real-time traffic status, which not only improves travel comfort, but also enhances flexibility and personalized experience.

In addition, environmental impacts are an important aspect of research on intercity smart mobility systems. By optimizing routes and increasing the efficiency of vehicle use, the system contributes to lower energy consumption and reduced emissions, thus supporting the Sustainable Development Goals. This is particularly important in addressing global climate change and urban sustainability issues.

However, despite the great potential and advantages demonstrated by intercity smart mobility systems, their development and application still face multiple challenges. Issues such as technological complexity, high investment costs, user privacy protection, and acceptance by different user groups need to be explored and resolved through further research. Therefore, the research background of this chapter lays a solid foundation for the whole thesis, not only explaining the development background and practical significance of intercity smart mobility systems, but also pointing out the direction and focus of future research.

### 2.1 Inter-city Travel

In previous studies, Gao et al. [10] defined inter-city travel in urban agglomerations as the entire process where residents of different cities within an urban agglomeration depart from one city to another within the same agglomeration for the purpose of production and living, using a certain inter-city transportation mode, traveling along inter-city transportation routes, and moving unidirectionally. Geng et al. [11] defined the inter-city travel chain as a unidirectional complete travel process were passengers, in order to achieve their travel purposes, transfer between various modes of transportation through hub points in different cities. Based on the above research, the inter-city travel chain defined in this study refers to the unidirectional complete process in which travelers, in order to achieve inter-city travel purposes, depart from city A within the urban agglomeration to the

destination city B within the urban agglomeration, utilizing different modes of transportation through transportation hubs.

### 2.1.1 Customer Satisfaction Theory

Customer satisfaction was first proposed in the 1980s by Churchill & Surprenant and was initially applied in the fields of marketing and services [12]. Customer satisfaction is defined as consumers' evaluation of a product or service based on their past experiences or expectations after purchasing it. Customer satisfaction with a product or service largely influences repeat purchases and generates positive word-of-mouth effects. Because customer satisfaction is a subjective psychological state that is difficult to identify and measure, quantifying customer satisfaction has become a focus of research. After years of development, there are currently four classic models: the American Customer Satisfaction Index Model, the European Customer Satisfaction Model, the Swedish Customer Satisfaction Model, and the Chinese Customer Satisfaction Model. As the discipline continues to evolve, research on customer satisfaction has expanded into different fields. In the travel field, researchers define travel satisfaction as the overall realization level of travelers' expectations, the fulfillment of needs, and the outcomes of cumulative or single experiences. When modeling service quality and passenger satisfaction in transportation systems, there are two different perspectives: perceived quality based on passenger experience and expected quality that determines user expectations in the transportation system. Due to varying levels of traveler expectations and the close relationship between service quality, customer satisfaction, and perceived value, this study focuses on travelers' perceptions of service quality.

Customer perceived value refers to the total utility consumers receive during the process of enjoying a service. Customer perceived value originated from Eggert & Ulaga's equity theory, which emphasized customers' return on the services received, not just service quality [13]. According to Yuan et al.’s study, there was a noticeable "value-driven" behavior among customers during the service purchasing process, where obtaining value was the most important goal for customers when buying services. Based on current researches, customer perceived value is generally divided into three categories: functional value, emotional value, and social value. Generally, functional value is most important, but the dimensions of perceived value vary depending on the type of service customers receive [14].

## 2.2 Smart Travel Services

After the concept of smart cities was proposed in 2010, smart transportation has gained attention as an important task within the scope of smart cities. Gokasar & Bakioglu [15] defined smart transportation as the integration of information technology to provide integrated door-to-door transportation services for people and goods based on existing transportation infrastructure. Huang et al. [16] proposed the concept of a smart transportation system, which integrates electronic, information, communication, control, vehicle, and mechanical technologies into the field of transportation to improve traffic conditions and enhance transportation efficiency. Jan et al. [17] highlighted that the characteristics of smart transportation include systematization, real-

time information exchange, and extensive service provision. Kim et al. [18] suggested that compared to intelligent transportation, smart transportation emphasized the intelligence of data collection and information transmission.

Based on the definitions of intelligent transportation systems abroad and the concept descriptions of smart transportation in China, this study proposes the following definition for smart transportation: the comprehensive application of information and communication technology, big data, cloud computing, GPS, and other advanced technologies to the transportation system. Through real-time travel information guidance, integrated ticketing/payment services, shared transportation modes, and other intelligent travel services, smart transportation aims to achieve seamless coordination of residents' travel, providing personalized door-to-door travel services and constructing a more efficient, smooth, convenient, and cost-effective comprehensive transportation management system.

According to the defined concept of smart transportation in this study, smart travel services are divided into six dimensions: trip planning, route recommendations, ticketing and vehicle reservations, real-time travel information provision, mobile payment for travel expenses, Wi-Fi and smart facility provisions, and online problem feedback and service evaluation after travel.

### 2.3 Relevant Theoretical Foundations

#### 2.3.1 Heterogeneity Theory

Heterogeneity and homogeneity are opposing concepts, with heterogeneity used to describe differences among different substances, organisms, and individuals [19]. Heterogeneity can be further divided into individual heterogeneity and group heterogeneity. Individual heterogeneity leads to the overall lack of homogeneity, allowing the grouping of populations into meaningful homogeneous subgroups based on certain individual attributes. In the field of travel behavior research, traveler heterogeneity encompasses both individual and group heterogeneity, primarily used to describe the differences among travelers in terms of individual socio-economic attributes and underlying characteristics [20].

For individuals, travel activities represent the consumption of a special commodity that is not a tangible product but rather a series of choice behaviors aimed at achieving a certain purpose through spatial movement. Therefore, travelers can be seen as consumers of transportation, with their activities during travel representing the purchased travel services. Previous analyzes of travel behavior have largely targeted the entire population, following a strategy of maximizing average effects. However, due to the influence of external environments, individual socio-economic attributes, subjective perceptions, and other factors, significant differences exist among travelers. Therefore, it is necessary to segment travelers into groups based on one or more factors when analyzing traveler behavior, exploring the demand characteristics of each subgroup, and proposing targeted strategies to enhance and improve differentiated travel services. Eom et al. believed that segmenting travelers can better reflect the complexity of the transportation system; similarly, numerous studies indicate that one effective strategy for increasing public transport modal share is to segment travel groups [21].

Researches have shown significant heterogeneity among different travelers in terms of travel, indicating that all travelers should not be analyzed as a single group. Some studies directly group travelers based on individual socio-economic attributes and travel characteristics. For example, Yilmaz & Ari [22] categorized travelers into three groups based on individual information such as gender and age and further estimated their differences in mode choice. Golob [23] considered the heterogeneity of intercity travel choice behavior under changing factors such as in-travel time, non-travel time, and cost. Other studies combine unobservable individual latent trait factors, such as attitudes and preferences, or use latent variables combined with individual socio-economic characteristics as mixed segmentation variables for division. They then use factor analysis to reduce dimensionality and cluster analysis to segment groups. For instance, Halim et al. [24] classified travelers into two heterogeneous groups based on latent psychological variables: high-speed rail enthusiasts and coach enthusiasts, analyzing their inter-provincial passenger travel mode preference behavior. Zhao et al. [25] cross-classified respondents into four categories based on attitude and behavioral dimensions, analyzing the loyalty of heterogeneous groups to public transport. Li et al. proposed a concept framework for market segmentation considering traveler attitude preferences and behavioral frequencies, setting high and low levels for each dimension. This framework forms four specific segmented groups: disloyal travelers, pseudo-loyal travelers, potential loyal travelers, and loyal travelers [26].

Based on the above, this study's focus on traveler heterogeneity mainly lies in segmenting groups based on travelers' attitudes toward smart travel services and their usage of these services in the context of smart travel.

#### 2.3.2 Random Utility Theory

The theory of random utility originated from classical microeconomic theory by Sher & Pinola, and utility in economics usually refers to the degree of happiness or satisfaction that consumers obtain from participating in consumption activities [27]. The utility theory from Wang & Shi is mainly applied to multiple choice scenarios and serves as the theoretical basis for quantifying individual decision-making behavior. Specifically, when making decisions, consumers will subjectively choose the alternative solution that maximizes utility based on their judgment of benefits or costs [28].

In the field of transportation behavior research, travelers' decision-making behavior can also be viewed as a form of consumption behavior, allowing utility theory to be applied to the analysis of travel behavior decisions. Currently, in studies on mode choice behavior, the most widely used approach is discrete choice models based on random utility theory.

### 2.4 Related Work

In the field of intercity smart mobility, numerous insights have been provided through theoretical analysis and empirical studies. This helps to further understand travelers' choice behavior and the impact of the development of smart mobility systems on intercity transportation.

Lemon & Verhoef [29] proposed the Travel Efficiency Theory in their study, which stated that smart travel systems can significantly improve the efficiency of intercity transportation by integrating real-time data and user feedback. Their research, which analyzed transportation data from several major U.S. cities, demonstrated that smart transportation systems can reduce travel time by about 20% and carbon emissions by 30%.

Focusing on the Technology Acceptance and Satisfaction Model, Lucas [30] found that the personalized features of smart mobility services are the key factors influencing user satisfaction and willingness to continue using them. It is found that personalized features of smart mobility services are a key factor influencing user satisfaction and willingness to continue using them. Specifically, this survey showed that the ability to provide real-time traffic updates and personalized travel advice is an effective way to increase user satisfaction.

Maitre [31] explored research on the environmental impacts of smart mobility systems by developing an Environmental Impact Mitigation Model, which evaluated the environmental benefits of different smart transportation technologies. This model showed that emissions can be reduced by up to 40% by optimizing traffic flow and improving vehicle efficiency.

Moreno et al. [32] used the Heterogeneous User Behavior Model in their study to analyze the acceptance of smart mobility systems by users of different ages and occupational backgrounds. They found that while younger users are more receptive to new technologies, older users' acceptance and satisfaction can also increase significantly after appropriate training and positive experiences.

Rathore et al. [33] proposed the Traffic Pattern Dynamic Adaptation Theory. The theory emphasized that the successful implementation of smart mobility systems relies on their ability to dynamically adapt to changing traffic patterns and user needs. By analyzing traffic management systems in several large European cities, they found that optimizing traffic signal control using machine learning algorithms can effectively reduce congestion on intercity roads and improve the efficiency of overall traffic flow.

Rayle et al. [34] focused their research on travel data security and privacy protection strategy. With the increased reliance on big data in smart mobility systems, data security and privacy protection have become a major concern for both users and service providers. It developed a set of encryption and data access control mechanisms that aim to protect user data from unauthorized access or misuse without compromising the efficiency of data processing and services.

The research of Sallis et al. [35] assessed the impact of smart mobility systems on the quality of life of urban residents through sociological and economic methods. The study found that, while smart mobility systems improve transportation efficiency, there is a need to consider the potential exclusion of low-income groups who may not be able to afford the cost of using the new technology.

In exploring the issue of risk in intercity smart travel systems, several researchers have provided insights and analyzes that help us identify and mitigate possible risk factors. Several scholars made their statements on the risks of smart travel systems.

Santouridis & Trivellas [36] noted in their study that over-reliance on complex technological systems can lead to serious vulnerabilities. In the face of a cyber-attack or system failure, the entire intercity transportation network may be at risk of paralysis. They emphasized the need to establish robust system redundancy and

recovery strategies to ensure that basic operational capabilities are maintained in the event of any technical failure.

Schakenbos et al. [37] explored the issue of data privacy in smart travel systems. As personal travel data continues to be collected and analyzed, the question of how to ensure that this information is secure and users' privacy is not violated is an important one. They suggested introducing stricter data management regulations and technologies, such as the use of blockchain technology to improve data transparency and security.

Shen et al. [38] examined the social equity issues that may arise from smart mobility systems. They point out that while smart mobility systems can provide more efficient transportation services, these services tend to be more inclined to serve more technologically skilled and economically capable user groups, potentially exacerbating social inequalities. They recommend the development of inclusive policies and subsidy schemes to ensure that all social groups can benefit from smart mobility technologies.

Stuart et al. [39] explored the long-term sustainability of smart mobility systems. They analyzed the long-term impacts of these systems on urban infrastructure, particularly in terms of resource consumption and environmental stress. The study suggested that when designing smart mobility solutions, there is a need to consider their impact on the environment and promote efficient use of resources and sustainability.

These studies provide a more comprehensive view of the complexity and multidimensional impacts of intercity smart mobility systems, provide an important framework for understanding and evaluating intercity smart mobility systems, highlight the risk issues that need to be addressed during the promotion and implementation of intercity smart mobility systems, provide key risk management strategies and directions for thinking, and point to the direction of future research, including technology improvement, user acceptance enhancement, and environmental impact reduction, among other areas, providing valuable references and guidance for future research and practice[40].

In summary, this chapter explores the critical role of intercity smart mobility systems in enhancing transportation efficiency, user experience, and environmental sustainability. It discusses the development of smart travel technologies, such as big data analytics and real-time information processing, and their impact on optimizing traffic management and reducing environmental impacts. The chapter also examines travelers' choice behaviors, emphasizing how personal preferences and technology acceptance influence travel decisions and highlight the importance of personalized services in increasing system usage. Additionally, it addresses challenges like technology dependency, data security, and social equity, underscoring the need for comprehensive legal and policy frameworks to support the equitable and sustainable growth of smart mobility solutions. By synthesizing various research findings, this chapter lays a theoretical and empirical groundwork for advancing the design and implementation of intercity smart mobility systems, thereby supporting future urban mobility needs.

## CHAPTER 3 Research Methodology

This chapter delineates the conceptual framework and methodological approach for studying inter-city smart travel services and satisfaction. Initially, it clarifies the definitions of inter-city travel and smart travel services within the scope of this research, highlighting the relevance of smart transportation systems and their dimensional structure. Subsequently, it explores travel heterogeneity and the classification criteria essential for segmenting target groups [41-42].

Following the conceptual groundwork, this chapter delves into the theoretical underpinnings necessary for constructing models of inter-city smart travel satisfaction and mode choice. It integrates customer satisfaction theory and random utility theory to preliminarily determine the research model, setting the stage for empirical investigation.

Figure 3. 1 Smart Intercity Travel Satisfaction and Choice Behavior Research Framework


### 3.1 Research Design and Data Collection

The empirical part of this study involves a survey targeting travelers within the Guanzhong urban agglomeration. The primary goal is to collect genuine, complete, and precise data to analyze travel behavior comprehensively. This segment discusses the survey questionnaire design, the definition of the survey scope, and the plan for data collection and cleaning. These steps form the foundation for the analysis presented in subsequent chapters.

A semi-structured questionnaire was developed to evaluate the smart travel services proposed in this study. The questionnaire design was informed by literature on social science research methodology and structured to assess the artifact using constructs and models based on principles such as completeness, ease of use, and fidelity to real-world phenomena.

### 3.2 Evaluation of Questionnaire Responses

To assess the impact of smart travel services on inter-city travel satisfaction and choice, responses to the questionnaire are evaluated using exploratory and confirmatory factor analyzes. The Exploratory Factor Analysis (EFA) initially analyzes data collected through the structured questionnaire, exploring dimensions such as service responsiveness, system reliability, and user satisfaction. These aspects are vital for understanding the nuances of smart travel systems.

Following the EFA, a Confirmatory Factor Analysis (CFA) using Structural Equation Modeling (SEM) is conducted. This step is crucial for validating the relationships among the identified indicators and confirming the structural integrity of the research model.

#### 3.2.1 Challenges and Considerations

The implementation of smart travel services, while promising, introduces challenges related to system adaptability and cost implications for reconfiguring traditional travel infrastructures. These issues are directly explored in the questionnaire, assessing their impact on the efficacy and acceptance of smart travel solutions within the context of inter-city travel.

#### 3.2.2 Research Questionnaire and Data Collection

This questionnaire is aimed at travelers in the Guanzhong urban agglomeration. Obtaining authentic, complete, and accurate survey data is crucial for the study of travel behavior. This chapter mainly discusses the design of the survey questionnaire, the definition of the survey scope, the survey plan, data cleaning, and sample characteristic analysis, as the foundation for subsequent chapters' research.

### 3.3 Questionnaire Design Principles

Behavioral survey design should adhere to the following three principles.

Ensure the rigor of questionnaire design. During the questionnaire design process, it is essential to repeatedly examine the logical consistency of the research framework and research hypotheses. Furthermore, efforts should be made to ensure the scientificity of the questionnaire content, survey methods, and other aspects. Each step of the entire questionnaire design should be rigorous to maximize the quality of the survey data and meet the research requirements.

Ensure ethical standards in questionnaire surveys. It is important to avoid causing any harm to the respondents during the survey. Ethical standards in surveys mainly include voluntary participation of respondents, protection of respondents' privacy, and safeguarding the rights of vulnerable groups. This ensures that the research does not violate scientific research ethics, avoids privacy breaches, and ensures the reasonable

use of data. This survey is primarily aimed at adults, conducted anonymously, and strict measures are taken to protect the confidentiality of the survey information.

Ensure the authenticity of survey data. Every survey may contain errors or mistakes. This study requires obtaining genuine and reliable data, without fabrication or arbitrary modifications. Respect for the results reflected by the data is crucial.

## CHAPTER 4 Research Survey and Data Collection

### 4.1 Questionnaire Design

Questions are a fundamental component in social science research, extensively discussed in various public relations personnel by these principles, a semi-structured questionnaire was developed.

Table 4. 1 Semi-Structured Questionnaire for Evaluation of the Purposed Artifact

| | Criterion | Statement |
|---|---|---|
| 1 | Completeness | The introduction of Inter-city smart travel leverages cutting-edge technologies like IoT, AI, big data, and blockchain to create an efficient, integrated transportation system that enhances convenience, reduces travel time, and improves the overall user experience. |
| 2 | Ease of use | The introduction of Inter-city smart travel is well-described and easy to verify and implement in both contexts. |
| 3 | Fidelity with real-world phenomena | The proposed artifact corresponds to possible solutions. |
| 4 | Internal consistency | The findings to introduce automation into the Inter-city smart travel - use adequate terminology, are well-written, and are justified by the theory. |
| 5 | Level of Detail | The proposed artifact contains a sufficient level of detail in each mechanism for each area. |
| 6 | Simplicity | The proposed artifact contains the necessary practices and it is easy to implement. |
| 7 | Understandability | The proposed artifact is easily understood as a good practice for Inter-city smart travel. |
| 8 | Importance | The proposed artifact is important for both practitioners and academics. |
| 9 | Accessibility | The proposed artifact has an understandable terminology with a practical perspective, not only a theoretical one. |
| 10 | Suitability | The proposed artifact of practices is applicable in the practice of realms. |

### 4.2 Questionnaire Questions

To gather conclusive data, it was essential to ask respondents the right questions, covering basics like age, gender, and professional background, as well as their experience with smart travel services. Initial questions gauged professionals' awareness and perceptions of smart travel technology in their company and its impact on management practices. Subsequent inquiries sought evaluations of specific activities, such as the utilization of intelligent trip planning, real-time travel updates, and mobile ticketing services. The questions rated the value on a scale from 0 (not useful) to 5 (very useful). Finally, two optional open-ended questions were posed to collect feedback on desired solutions and potential improvements in the development process.

Based on the content of the document, the detailed questionnaire designed for this study on intercity smart travel is outlined in Appendix. A summary of this comprehensive questionnaire, covering various aspects of traveler satisfaction and choice behavior can be found in Table 4.2. It provides valuable insights into the effectiveness and areas for enhancement of smart travel services.

Table 4. 2 Questionnaire on Traveler Satisfaction and Choice Behavior in Intercity Smart Travel

| Part | Category | Questions and Options |
|---|---|---|
| Part 1: Demographic Information | Gender | Male, Female, Other |
| | Age group | Age ranges (18-25, 26-35, etc.) |
| | Education level | High school or below to Master's degree or higher |
| | Monthly income | Income ranges (Less than 5,000 RMB, etc.) |
| | Occupation | Various professions |
| | Driver's license | Yes/No |
| | Car ownership | Yes/No |
| Part 2: Travel Information | Frequency of travel | Daily, Weekly, Monthly, Occasionally |
| | Purpose of travel | Business, Leisure, Education, Other |
| | Mode of transportation | Various transportation modes (High-speed rail, Ordinary train, etc.) |
| | Ticket purchasing method | Online, At the station, Through an agent, Other |
| Part 3: Experience with Intelligent Travel Services | Usage of intelligent travel services | Multiple choice services (Trip planning, Map navigation, etc.) |
| | Satisfaction levels at different travel stages | 5-point satisfaction scale (Very dissatisfied to Very satisfied) at Pre-travel, Pre-connection, Travel, Post-connection, and post - travel stages |

| Part | Category | Questions and Options |
|---|---|---|
| Part 4: Attitude Towards Intelligent Travel Services | Opinions on convenience, comfort, safety, and environmental impact | 5-point agreement scale (Strongly disagree to Strongly agree) for each attribute of intelligent services |
| Part 5: Evaluation of Intelligent Services | Importance of specific intelligent services<br>Overall satisfaction with services<br>Preferred mode for next trip | 5-point importance scale (Not important to Very important) for services like Real-time info, Personalized recommendations, etc.<br>5-point satisfaction scale (Very dissatisfied to Very satisfied)<br>Preferred transportation mode choice |
| Part 6: Open-ended Questions | Suggestions for improvement<br>Meeting needs better | Open text response for suggestions and improvements |

**4.3 Questionnaire Design Content**

This study adopts a questionnaire method for data collection. The questionnaire design combines research questions and draws on existing literature questionnaire item design, while also innovating and modifying the questionnaire items. The specific scale design can be found in the appendix.

The questionnaire requires respondents to have traveled within the Guanzhong City Cluster area and be above 18 years old at the beginning, in order to ensure that the questionnaire results accurately and fully reflect the characteristics of passengers' intercity travel within the Guanzhong City Cluster.

The main body of the questionnaire mainly includes five parts.

Part 1 is Guanzhong City Cluster Travel Information. This section consists of 9 items to understand the respondent's complete travel process within the Guanzhong City Cluster on their most recent trip. The content mainly involves the respondent's starting point of travel, purpose of travel, ticket purchasing method, intercity travel frequency within the Guanzhong City Cluster, choice of travel mode during pre- and post-connection processes, travel duration, travel expenses, choice of travel mode and associated duration and expenses during intercity travel within the Guanzhong City Cluster.

Part 2 is Experience of Intelligent Travel Services in Guanzhong City Cluster. This section emphasizes to the respondents that intelligent travel services include planning travel itineraries, map navigation, real-time travel information inquiry, mobile travel payment/ticket purchase, use of shared ride-hailing services (such as Didi),

shared bicycles, using station or on-board Wi-Fi, self-service ticketing/check-in machines, and other intelligent facilities through mobile apps or websites. It consists of 8 items to understand the respondent's usage of intelligent travel services at five stages of intercity travel within the Guanzhong City Cluster (1. pre-travel planning stage, 2. pre-connection stage, 3. intercity travel stage, 4. post-connection stage, 5. post-travel evaluation stage). The options for intelligent travel services vary at different stages, and a 5-point Likert Scale is used to survey the respondent's satisfaction with the intelligent travel services at each stage (from very dissatisfied to very satisfied).

Part 3 is Attitude towards Using Intelligent Travel Services in Guanzhong City Cluster. This section aims to understand the respondent's (1) attitude towards using intelligent travel services, including 22 items; (2) intercity intelligent travel experience, including 7 items; (3) overall satisfaction with the entire process of intercity travel, including 6 items; (4) attitude towards the use of new technologies, including 3 items. All the items are measured using a 5-point Likert Scale.

Part 4 is Evaluation of Intelligent Services for Intercity Transportation in Guanzhong City Cluster. This section first uses a 5-level Likert scale to investigate the importance rating of 7 dimensions of intelligent travel services for intercity travel within the Guanzhong City Cluster and the overall importance rating of intelligent travel services. Question 2 understands the overall evaluation of the intelligent service for intercity transportation by the respondents regarding high-speed rail/CRH (G/D), ordinary train (K/T/Z), intercity long-distance bus, intercity ride-hailing, and personal car in terms of intelligent service for transportation. Question 3 inquires the respondent's preference for using intercity transportation on their next trip within the Guanzhong City Cluster.

Part 5 is Personal Economic Attributes. This section aims to understand the respondent's gender, age group, income level, occupation, education level, possession of a driver's license, and ownership of a family car [43].

### 4.4 Overview of Sampled Population Characteristics

Population and Sample

The population considered includes 257 travelers who travel between cities within the Guanzhong Plain urban agglomeration during 2023. This includes adult tourists from Xi 'an, Baoji, Xianyang, Tongchuan, Weinan, Shangluo and other cities in Shaanxi; Yuncheng, Linfen, Shanxi; Tianshui, Pingliang and Qingyang in Gansu Province. The study provides insight into the makeup of these travelers in terms of seniority, age, roles and gender etc.

Demographic Information

Table 4. 3 Overview of The Characteristics of The Sampled Population

| Characteristic | Details | Percentage |
|---|---|---|
| Gender Distribution | Male | 44.1% |
| | Female | 55.9% |
| Age Distribution | 18-35 years | 70% |
| | 36-55 years | 26.2% |
| | 65 and above | 3.8% |
| Income Distribution | Less than 100000 RMB annually | 75% |
| | More than 100000 RMB annually | 25% |
| Occupation | Students | 33.3% |
| | Professionals | 22.8% |
| | Leaders in state organs, enterprises, and institutions | 43.9% |
| Education Level | High school or below | 9% |
| | Junior college/ | 12.4% |
| | Undergraduate | 50.7% |
| | Master's degree or higher | 27.9% |
| Car Ownership | Do not own a car | 23.2% |
| | Own at least one car | 76.8% |

Table 4. 4 Overview of Respondent Travel Information and Intelligent Travel Service Experience

| Category | Details |
|---|---|
| Travel information | |
| Travel frequency | The respondents' travel frequency ranges from daily to occasional, providing insights into both regular and occasional travelers. |
| Travel purpose | The travel purposes include business, leisure, education, etc., indicating that there are diverse motivations for cross city travel. |
| mode of transportation | The surveyed modes of transportation include high-speed rail, regular trains, buses, and private vehicles, showcasing the diversity of travel preferences. |
| Ticket purchase method | The purchasing habits (online, at stations, through agents) have also been explored, which can indicate technology adoption and convenience preferences. |
| Intelligent service experience | |
| Usage situation | The surveyed population uses various intelligent travel services, such as itinerary planning, map navigation, and real-time travel information. |
| Satisfaction level | Satisfaction is evaluated at different stages of travel (pre travel, pre connection, during travel, post connection, post travel), providing a comprehensive view of the user's experience with these services. |
| Attitude towards intelligent travel services | |
| Viewpoint | The study evaluated respondents' opinions on the convenience, comfort, safety, and environmental impact of smart travel services using a 5-point agreement scale. |
| Intelligent Service Evaluation | |
| Importance | The importance of specific intelligent services such as real-time information, personalized recommendations, and mobile payment options was rated to help prioritize service development. |

Open-ended Questions

Respondents' feedback reveals both appreciation for intelligent travel features, such as real-time updates, personalized recommendations, and mobile payments, and areas for improvement to better meet user expectations. While these features enhance convenience, usability and accessibility remain issues, especially for older users who often find digital interfaces challenging. Privacy and data security concerns are also notable, as users desire stronger protections and transparency. Satisfaction varies by demographic, with younger, tech-savvy travelers generally more satisfied, while business travelers emphasize the need for greater reliability and efficiency. Notably, some gaps exist between service expectations and actual performance, particularly regarding feature availability and system speed. These insights highlight opportunities for service providers to refine usability, enhance security, and improve reliability, ultimately strengthening user satisfaction across a diverse traveler base.

Overall, the questionnaire underscores a well-educated, age-diverse population with a balanced gender representation, primarily consisting of individuals from various professional backgrounds. This demographic mix suggests a dynamic and adaptable travel behavior cohort, which is crucial for evaluating modern travel and transportation solutions. Such diversity helps ensure that the study's findings are comprehensive and reflective of a broad range of experiences and preferences in intercity smart travel.

In the context of determining the requisite number of responses for robust qualitative and quantitative research, the theory often suggests that more is typically better to ensure a representative sample; however, the actual number needed can vary greatly depending on the specific goals and complexities of the study.

In current research, it is considered necessary to continue collecting survey responses in order to explore and understand the factors that affect the satisfaction and choice behavior of intercity intelligent travel, until these factors are fully understood in different population groups. The survey received 100 valid responses, but the diversity and richness of these responses ensured that the study effectively captured various preferences and needs related to modern intercity travel. This powerful dataset supports the development and refinement of models aimed at improving travel efficiency and satisfaction.

### 4.5 Questions for Questionnaire

The selection of the measurement scale for satisfaction largely depends on the research background. In the field of travel, satisfaction factors not only include the transportation infrastructure and individual socio-economic attributes, but also traditional dimensions such as convenience and comfort. However, as smart travel services are currently an essential part of intercity travel, their service quality, perceived value, and experiential impact will influence the overall satisfaction of the intercity travel chain. This study focuses on the contribution of the attributes and perceived value of smart travel services to the overall travel satisfaction [44]. Therefore, it explores travelers' perception of the quality of smart travel services based on five related dimensions (informatization, usability, personalization, interactivity, and safety). Simultaneously, it investigates the value perception brought by travelers using smart travel services for intercity travel from the aspects of convenience, safety, comfort, and environmental friendliness, in order to prepare for subsequent research on smart travel. There are many factors

that influence the choice of travel mode for residents between cities, mainly divided into four categories: the socio-economic characteristics of travelers, the travel characteristics of travelers, the characteristics of the travel mode itself, and the subjective factors of travelers. The socio-economic characteristics of travelers mainly include income, age, gender, occupation, and car ownership, while the travel characteristics of travelers mainly include travel purposes, travel distances, and travel frequencies. The characteristics of the travel mode itself include transfers, connections, service frequencies, travel times, and travel costs. The subjective factors of travelers include satisfaction, attitudes, preferences, etc., which are not only influenced by objective variables (travel attributes and personal attributes) but also have a significant impact on the travel mode choices of travelers. Currently, the development and application of smart transportation provide intercity travelers with more smart travel services, and it is urgent to explore their impact on the choice of intercity travel modes.

### 4.6 Survey Scope and Plan

#### 4.6.1 The Target Cities for the Survey

The scope of this study mainly targets intercity travel within the Guanzhong Plain City Cluster. The scope of the Guanzhong Plain City Cluster is based on the "Development Plan for the Guanzhong Plain City Cluster" released by the National Development and Reform Commission in 2018, including Xi'an, Baoji, Xianyang, Tongchuan, Weinan, and Shangluo in Shaanxi Province, Yuncheng and Linfen in Shanxi Province, Tianshui, Pingliang, and Qingyang in Gansu Province.

The survey objects are travelers who have traveled between cities in the Guanzhong Plain City Cluster within the past year. "The past year" refers to the one-year period prior to the survey date. Trips that occurred more than a year ago, trips within a single city, and trips with both the origin and destination within different cities within the Guanzhong Plain City Cluster are not included in this survey. Additionally, the respondents of this survey are all adult travelers.

#### 4.6.2 The Survey Plan

In order to analyze the characteristics of overall satisfaction with intercity travel in the context of intelligent travel and the impact of latent variables of intelligent travel service characteristics on travelers' choice of intercity travel mode in the structural equation model constructed in subsequent chapters, it is necessary to conduct a survey of intercity travelers in the Guanzhong City Cluster to obtain relevant data for model validation. Common survey methods include Revealed Preference (RP) and Stated Preference (SP). This study adopts the reliable and precise RP survey method, which obtains information related to travelers' current actual behaviors or past completed travel activities.

Due to the impact of the epidemic, this survey mainly combines online questionnaire surveys with on-site surveys. Professional online questionnaire design survey website Wen Juan Xing (https://www.wjx.cn/) is used

to generate questionnaire links. The survey will be conducted by recruiting survey personnel within the Guanzhong City Cluster to distribute questionnaires online and at major transportation hubs in Xi'an.

When conducting the questionnaire survey, it is generally necessary to determine the maximum sample size, the calculation formula of which is represented as follows.

$$N = \frac{Z^2 S^2}{d^2} \tag{4.1}$$

Here, n represents the maximum sample size; Z corresponds to the value associated with a statistical quantity at a certain confidence level, and S denotes the standard deviation; d represents the allowable error, which is the value corresponding to the midpoint of the confidence interval. We have selected the minimum sample size values corresponding to relative errors ranging from 1% to 5% when calculating at a 95% confidence level.

Table 4. 5 Minimum Sample Size Selection Table (95% Confidence Level)

| Relative error | 1% | 2% | 3% | 4% | 5% |
|---|---|---|---|---|---|
| Minimum sample size | 400 | 320 | 200 | 150 | 100 |

It is generally believed that at a 95% confidence level and a 5% relative error level, the corresponding minimum sample size can meet the statistical requirements of random sampling, with a minimum sample size greater than 50 [45]. Considering the distribution and development of cities in the Guanzhong urban agglomeration, as well as the limitations of survey time and budget, this study plans to determine a sample size of 100 for subsequent research.

**CHAPTER 5 Results**

Initially, an offline pre survey was conducted in April 2024. Based on the questionnaire design suggestions and completion status provided by the respondents during the pre-survey period, targeted adjustments and modifications were made to the questionnaire. The formal investigation began on May 21, 2024.

Table 5. 1 Summary of Questionnaire Process and Results for Intercity Travel Study

| Category | Details |
|---|---|
| Preliminary Survey Phase | - Timing: April 2024<br>- Method: Offline pre-survey<br>- Purpose: To gather feedback on questionnaire design and completion status; adjustments made based on feedback |
| Formal Survey Launch | - Start Date: May 21, 2024<br>- Locations: Xi'an Railway Station, Xi'an North Railway Station, and Xi'an Bus Station<br>- Method: On-site; respondents scanned QR codes to complete the questionnaire |
| Survey Duration | - End Date: June 2024 |
| Survey Response | - Total Link Visits: 257<br>- Total Collected: 120<br>- Response Rate: 46.6% |
| Quality Control Measures | - Answering Time: Checked if it meets the minimum time required for completion<br>- Validation Questions: Included in the subjective parts of the questionnaire<br>- Survey Scope: Intercity travelers over 18 within the Guanzhong urban agglomeration |
| Valid Responses | - Valid Questionnaires: 100<br>- Effective Recovery Rate: 83% |

Recruit volunteers from different cities in the Guanzhong City Cluster and randomly send online questionnaires to residents of major cities in the Guanzhong City Cluster. The survey lasted until June 2024, with a total of 257 visits to the survey questionnaire link. A total of 120 questionnaires were collected, with a response

rate of 46.6%. In order to ensure the quality of the questionnaire, effective questionnaire judgments were made from several dimensions.

(1) Response time: whether the minimum time requirement for normal completion is met;

(2) Verification question: The verification question is set in the subjective part of the questionnaire;

(3) Survey scope: The intercity travel scope of the survey questionnaire needs to be between different cities within the Guanzhong urban agglomeration, and participants should be at least 18 years old. After questionnaire evaluation and data organization, a total of 100 valid questionnaires were obtained, with an effective response rate of 83%.

Analysis of target city characteristics

Statistical analysis was conducted on the basic socio-economic attributes such as gender and age of 100 valid questionnaires, and the detailed distribution of statistical characteristics is shown in Figure 5.1-5.3.

Firstly, it can be seen that 44.1% of the respondents are male and 55.9% are female, with slightly more female respondents than males. In terms of age distribution, the majority of respondents are between the ages of 18 and 35, accounting for nearly 70% of the total sample, which is consistent with the general youthfulness level in online communities. The age group of 36 to 55 years old accounts for 26.2%, and there are 7 respondents aged 65 and above. In terms of income distribution, the majority of respondents have a monthly income below 100000 yuan, and about 25% of respondents report an annual income exceeding 100000 yuan. In terms of profession, students account for the highest proportion at 33.3%, followed by professionals and leaders from government agencies, enterprises, and public institutions at 22.8% and 43.9%, respectively. From an educational perspective, 9% of people have received high school or lower education, 12.4% have completed vocational education, and the majority (50.7%) have completed undergraduate education. Individuals with a master's degree or above accounted for 27.9% of the total sample. In terms of household car ownership, 23.2% of respondents do not have a car, while the vast majority of households have at least one car. Based on these sample characteristics, it is evident that the representation of young people and student groups is higher, which to some extent deviates from the basic resident structure. This is mainly due to the higher response rate and effective response rate of young people. Due to the focus of this study on influencing factors and heterogeneity analysis, the effective samples of this study meet the research requirements.

Figure 5. 1 Sex distribution

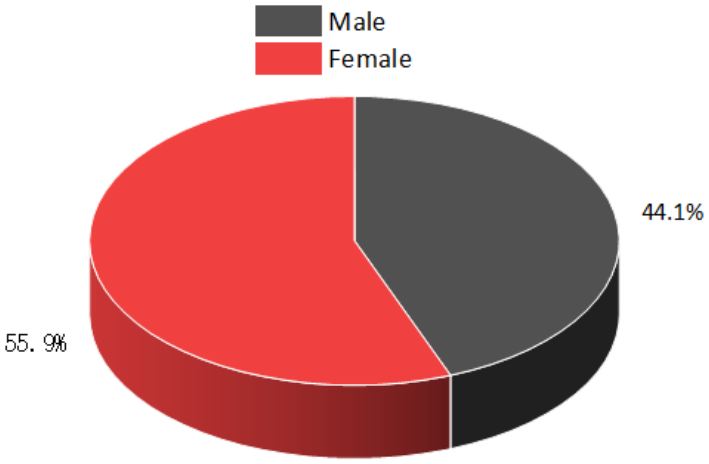



Figure 5. 2 Age distribution

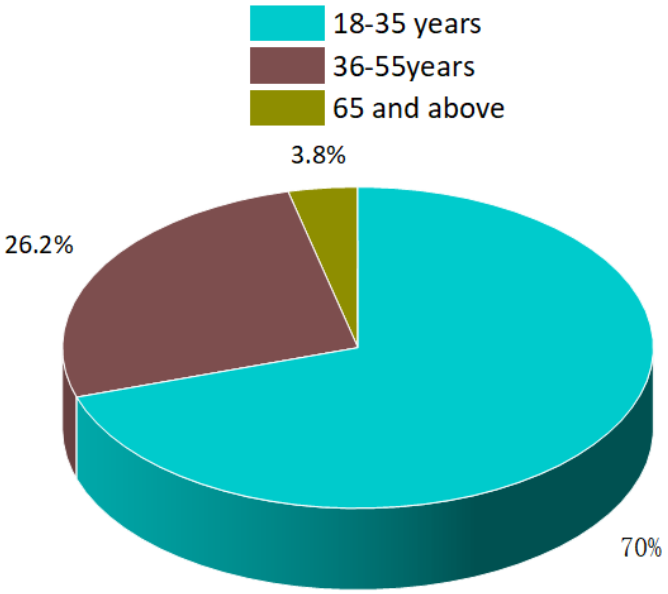
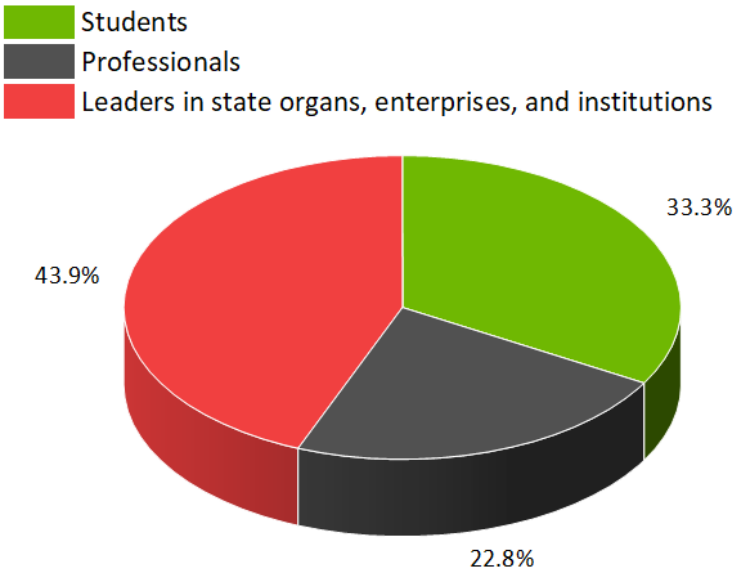


Figure 5. 3 Occupational distribution




In conclusion, the results of this study present a vivid depiction of the socioeconomic and demographic attributes of intercity travelers in the Guanzhong urban agglomeration. The surveyed cohort demonstrates a substantial representation of young adults and students, which likely reflects the growing influence and integration of digital platforms in travel-related activities. This age distribution aligns with the observed propensity towards adopting intelligent travel solutions, as younger individuals are generally more receptive to technological advancements. The gender distribution shows a slight female predominance, which contributes to a balanced perspective on travel preferences and experiences in the analysis.

The diversity in educational backgrounds and income levels enriches the data, offering a broader understanding of travel behavior across different socioeconomic strata. Notably, the high percentage of respondents with at least an undergraduate education suggests a well-informed participant group, potentially indicative of greater awareness and expectation concerning smart travel services.

Furthermore, the effective recovery rate of 60.8% and the detailed characteristics of the respondents provide robust support for the reliability of the study's findings. These insights are crucial for developing targeted strategies to enhance intercity travel services, ensuring they meet the varied needs and preferences of a diverse traveler population. The comprehensive data captured through both online and offline methodologies underscore the study's adaptability and responsiveness to external challenges, such as the pandemic, ensuring a wide and representative sample was achieved.

This section sets the stage for the subsequent analysis, where these demographic insights will be correlated with travel behaviors and preferences to draw meaningful conclusions that could guide future improvements in intercity travel infrastructure and services.

### 5.1 Analysis of the impact of user preferences and smart travel functions

Starting from the diversity of users, this section analyzes in detail the differences in the preferences of different groups in smart mobility services, and the specific impact of these differences on travel satisfaction. First, research shows that different age groups, income levels, and educational backgrounds significantly affect users' acceptance and demand for smart mobility features. Younger users, especially those between the ages of 18 and 35, are more receptive to high-tech travel modes such as high-speed rail, and tend to use smart features such as real-time information and personalized recommendations. This may be closely related to the high adaptability of young people to technology and the need for efficient and convenient transportation. Older people and some of the lower-income users are less receptive to new technologies, and these groups may be less likely to use smart mobility services due to reasons such as unfamiliarity with technology or concerns about data privacy.

Analysis of specific smart mobility features shows that features such as real-time information, mobile ticketing, and personalized travel recommendations have a particularly significant impact on user satisfaction. These features effectively alleviate uncertainties in travel, such as travel information delays, complex itinerary arrangements, and other problems. Through real-time data updates and convenient operation processes, users can achieve higher travel efficiency and a stronger sense of control, which also improves the overall user experience at different stages of travel. Therefore, in order to improve the overall service level of smart mobility, service providers should prioritize optimizing these high-demand functions to ensure the usability of services and the continuity of user experience, so as to maximize the actual needs of various users.

### 5.2 Challenges and policy recommendations for improving user satisfaction

Based on the survey data, this section discusses in detail the challenges of smart mobility services in practical applications, and puts forward practical policy and service optimization suggestions. First, data privacy and user interface design were identified as one of the key issues affecting user satisfaction at the moment. With the popularization of smart travel technology, users are showing increasing concern about the security of their personal information. These concerns are mainly due to the extensive collection and processing of users' travel information by smart devices and data platforms. Service providers should implement strong data protection measures, such as encryption and access controls, to ensure the security of user data and enhance users' trust in smart mobility services through transparent privacy policies. In addition, it is equally important to simplify the user interface and improve the ease of operation, especially for older users and users with low technical adaptability, which will directly affect their acceptance of smart mobility services. By optimizing the design and ensuring the intuitiveness of the operation process, the user base of the smart mobility service can be effectively expanded.

At the policy level, it is recommended that relevant departments adopt differentiated service promotion strategies to promote the popularization of smart mobility services among different user groups. For example, for those "rational" and "enthusiastic" users, precision marketing can be used to highlight the advantages of smart travel in terms of time efficiency and convenience, and strengthen their dependence on smart travel. For "apathetic" users, they can be relieved by promoting privacy protections and introducing an easy-to-use interface. In addition, to further enhance public acceptance of smart mobility, authorities can implement incentives or

provide technical support to help users of all ages and backgrounds adapt to these emerging technologies more quickly. Through multi-angle and multi-level promotion and service optimization strategies, it can meet the diverse needs of various users, promote the wide application of intelligent travel services, and lay a solid foundation for the development of intelligent transportation in the future.

### 5.3 Impact of Smart Travel Service Features on Satisfaction

The effectiveness and appeal of smart travel services lie in their ability to meet travelers' diverse needs through convenience, reliability, and personalized offerings. Among the array of smart travel service features, elements like real-time updates, mobile payments, and advanced route planning significantly impact overall traveler satisfaction. Real-time updates, for instance, provide critical information about delays, alternative routes, or estimated travel times, allowing travelers to make informed, timely decisions. These updates reduce uncertainty during travel and grant users a sense of control, which is especially appreciated in high-density, time-sensitive urban settings where delays or unexpected disruptions can significantly impact daily schedules. For younger travelers, who tend to be more technologically adept, this feature is particularly beneficial as they often rely on mobile apps to access such information, valuing immediacy and flexibility in their travel plans.

Mobile payment options further enhance the convenience and efficiency of smart travel. By streamlining transactions, reducing the need for physical tickets, and integrating with various payment platforms, mobile payments simplify the travel experience. This feature appeals across age groups but holds particular importance for frequent travelers, such as business commuters, who prioritize ease of use and speed. For older travelers, mobile payments offer a user-friendly alternative to traditional payment methods, though they may require initial support or tutorials to navigate the technology confidently. Nonetheless, the presence of a secure and easy-to-use payment system increases overall satisfaction by removing friction from the travel process, making it an appealing choice for many user demographics.

Route planning and navigation tools also play a significant role in enhancing the smart travel experience. These tools allow users to personalize their routes based on preferences for speed, scenic options, or minimal connections. The ability to customize routes aligns with travelers’ desire for tailored experiences, as it enables them to save time, avoid congested areas, and choose environmentally friendly options. Additionally, by integrating with other smart features, such as real-time data on public transport schedules or traffic conditions, route planning tools can adapt to changing conditions dynamically, ensuring a smoother journey.

Overall, the impact of these smart travel service features on traveler satisfaction is profound, as they address the core needs of convenience, flexibility, and efficiency in a rapidly urbanizing environment. Each feature serves a unique purpose yet collectively enhances the holistic experience of smart travel. To maximize satisfaction, service providers should focus on improving these high-demand functions, ensuring their accessibility and reliability across user demographics. As smart travel services continue to evolve, integrating these essential features while addressing any usability concerns will likely deepen their acceptance and foster greater satisfaction among diverse traveler groups.

### 5.4 Behavioral Segmentation of Travelers

Understanding the diverse behavioral patterns of travelers is crucial in tailoring smart travel services to meet distinct user needs and preferences. In this study, travelers are categorized into three primary groups based on their response to smart travel services: the "indifferent," "rational," and "enthusiastic" types. Each group exhibits unique characteristics that influence their travel behavior and satisfaction levels with smart travel offerings. The "indifferent" group, often comprised of older individuals or those less familiar with technology, tends to have lower engagement with smart travel features. They are generally satisfied with basic travel services and are less likely to actively seek out or rely on real-time updates, personalized recommendations, or mobile payments. This group values simplicity and may be slower to adopt advanced features due to concerns about data privacy, security, or technological complexity. To increase their satisfaction, service providers could consider offering straightforward, accessible interfaces and emphasizing data protection to build trust and encourage gradual adoption of smart features.

The "rational" group, which includes a mix of young and middle-aged travelers with varying levels of technological comfort, uses smart travel features selectively, focusing on those that provide tangible convenience or time savings. These travelers are pragmatic in their approach, utilizing real-time updates and route planning tools to enhance efficiency but may disregard features they view as non-essential, such as social sharing options or optional notifications. The rational group is more sensitive to the usability and accuracy of smart travel services, as they prioritize functional benefits over novelty. Service providers aiming to appeal to this segment should prioritize reliability and precision in essential features, minimizing any extra functionalities that could complicate the user experience.

Finally, the "enthusiastic" group is highly engaged with all aspects of smart travel and includes younger, tech-savvy individuals as well as business travelers who rely on technology for productivity and flexibility. Enthusiastic users embrace the full suite of smart travel offerings, from real-time alerts to personalized travel recommendations and seamless mobile payments, often valuing these features as integral to a modern travel experience. This group also tends to be more accepting of new technology, willing to experiment with emerging features and even provide feedback for improvement. They are likely to value features that enhance connectivity, enable customization, and offer a seamless experience across different travel stages. For service providers, engaging this group involves consistently innovating and integrating new technologies, as well as maintaining high standards for feature usability and personalization.

This behavioral segmentation reveals the varying expectations and usage patterns of travelers, emphasizing the importance of a targeted approach to smart travel service design. By addressing the specific needs of each group, service providers can enhance satisfaction across diverse traveler profiles, ultimately creating a more inclusive and responsive smart travel ecosystem.

### 5.5 Analysis of Mode Choice Influences

The decision-making process behind travelers' mode choice is multifaceted, involving a blend of practical, economic, and personal preference factors. In the context of smart travel, certain features of these services significantly sway mode choice, particularly when users are faced with multiple transportation options. For many travelers, cost and convenience remain the primary determinants in selecting a mode of travel, as affordability and accessibility continue to be fundamental priorities. However, the introduction of smart travel features has added new dimensions to this decision process, such as real-time traffic updates, route optimization, and personalized travel recommendations. These features, by enhancing both the predictability and flexibility of travel, have particularly influenced the adoption of high-speed rail and shared mobility options over traditional transportation modes, as they offer efficiency and modern connectivity.

Among frequent travelers and business commuters, time efficiency is often paramount, making high-speed rail an attractive option due to its rapid transit capabilities combined with reliable, integrated smart services. Real-time updates and mobile ticketing streamline the experience, reducing time spent in queues or dealing with unexpected delays. For leisure travelers, who might prioritize comfort or scenic routes, smart features such as personalized recommendations and optimized route planning add value by enabling them to tailor their journeys according to their preferences. In this way, smart travel services encourage travelers to consider modes that align more closely with their lifestyle or values, be it convenience, speed, or environmental consciousness.

Interestingly, these smart features are also shaping preferences across demographic lines. Younger, tech-savvy users, more inclined toward sustainable options, may be drawn to eco-friendly modes like shared electric vehicles or public transport with smart integrations, while older users might still prefer modes with simpler smart interfaces that cater to ease of use. Yet, for each demographic, the emphasis on data security and privacy remains crucial. The trust that smart travel services can build by ensuring these aspects affects not only mode choice but also the broader adoption of smart travel technology.

Ultimately, the integration of smart travel services has not only improved the functionality and appeal of various transportation modes but also redefined travelers' expectations, encouraging them to choose options that meet both practical needs and personal preferences. By understanding these influencing factors and enhancing the relevant smart features, service providers can better align transportation offerings with the diverse requirements of modern travelers, fostering a balanced and adaptable transportation ecosystem.

### 5.6 Challenges and Opportunities in Smart Travel Adoption

The adoption of smart travel services presents both significant challenges and promising opportunities as these technologies continue to reshape the way people move between cities. One of the primary challenges is data privacy and security, as smart travel services often rely on collecting and processing vast amounts of personal data, including travel habits, location, and payment information. With increasing public concern over data breaches and unauthorized data usage, many travelers—particularly those who are less familiar with technology—hesitate to fully engage with smart travel features. Service providers must therefore prioritize robust data protection measures, such as encryption and strict access controls, along with transparent privacy policies that clearly communicate how user data is managed and safeguarded. Building trust in these systems is essential to encouraging broader adoption and long-term engagement with smart travel services.

Another challenge lies in the accessibility and usability of smart travel interfaces. While younger, tech-savvy travelers may find smart features intuitive, older travelers or those less comfortable with technology may struggle with complex interfaces or multi-step processes. Simplifying these interfaces and offering user-friendly design options are crucial steps to make smart travel services more inclusive. Additionally, providing tutorials or customer support, especially in high-traffic areas such as train stations and airports, could help ease the learning curve and increase confidence among a broader demographic.

Despite these challenges, the opportunities for enhancing traveler satisfaction and operational efficiency are immense. By providing real-time information, optimizing routes, and enabling seamless digital transactions, smart travel services can alleviate common pain points, such as waiting times, route planning confusion, and lack of flexibility. These improvements not only create a more convenient experience but also contribute to reducing congestion and lowering environmental impact, appealing to increasingly sustainability-minded travelers. Moreover, the data collected through smart travel systems offers a valuable resource for service providers to better understand user preferences and predict travel patterns, leading to more tailored services and strategic improvements in infrastructure.

From a policy perspective, promoting widespread smart travel adoption may require targeted incentives and partnerships between government bodies and service providers. For instance, subsidies for low-income travelers or incentives for using sustainable travel modes could encourage more inclusive and environmentally friendly adoption. Additionally, partnerships with educational institutions or community organizations can promote digital literacy, helping users of all backgrounds feel more comfortable and informed about using smart travel technology. By addressing these challenges and leveraging the opportunities that smart travel presents, service providers can pave the way for a more connected, efficient, and user-centric travel ecosystem that meets the evolving needs of a diverse traveler base.

### 5.7 Summary of Findings and Policy Implications

This study reveals valuable insights into the factors that shape traveler satisfaction and choice behavior in the context of smart intercity travel, as well as the broader implications for policymakers and service providers. Through a detailed analysis of demographic influences, service feature preferences, and behavioral segmentation, it becomes clear that smart travel services impact travelers differently based on age, technological comfort, and travel purpose. For instance, while younger and business-oriented travelers tend to embrace features like real-time updates, mobile payments, and personalized route recommendations, older or less tech-savvy users may require additional support and assurances regarding data privacy and interface simplicity. Recognizing these diverse user needs is essential for creating inclusive smart travel services that are widely accepted and valued.

The findings emphasize that to maximize satisfaction, service providers must prioritize ease of use, data security, and customization. These elements not only enhance user experience but also build trust, which is crucial for encouraging adoption. In particular, the role of data privacy is prominent, as travelers are increasingly cautious about how their information is collected and used. Transparent data policies and robust security measures can address these concerns and improve confidence in smart travel technologies. Additionally,

features like real-time updates and seamless digital transactions have been identified as high-impact factors that reduce travel uncertainty and create a more efficient journey, ultimately supporting more reliable and predictable intercity travel.

From a policy perspective, the adoption of smart travel services could be bolstered by initiatives that target accessibility and sustainability. Subsidies or incentives for using digital travel solutions, particularly among lower-income groups, can promote inclusivity, ensuring that the benefits of smart travel reach a broader segment of the population. Furthermore, promoting sustainable travel options, such as shared mobility and eco-friendly modes supported by smart infrastructure, aligns with environmental goals and appeals to a growing segment of eco-conscious travelers. Partnerships with public and private entities can facilitate the development of a seamless and integrated smart travel ecosystem, where transportation modes and digital features work harmoniously to deliver convenience, efficiency, and sustainability.

In conclusion, this study highlights the potential of smart travel services to transform intercity travel by enhancing user satisfaction, influencing mode choices, and contributing to environmental sustainability. By addressing the challenges of accessibility, usability, and data security, while leveraging the opportunities for personalization and eco-friendly travel, policymakers and service providers can create a travel environment that adapts to evolving traveler expectations. This approach not only supports the development of smart cities but also paves the way for a future where intercity travel is more efficient, accessible, and environmentally responsible.

**CHAPTER 6 Discussion**

The survey results provide a comprehensive insight into the current state of intercity smart travel within the Guanzhong Plain City Cluster, highlighting various aspects that influence traveler satisfaction and choice behavior. This section will discuss the key findings, their implications, and potential areas for improvement based on the collected data.

## 6.1Key Findings

1. Traveler Demographics and Characteristics

The survey sample predominantly consisted of young travelers aged 18-35, which may reflect the higher engagement of this demographic with online surveys and digital technologies. Female respondents slightly outnumbered males, indicating a balanced gender representation.

Educational background varied, with a significant portion holding undergraduate and master's degrees, suggesting a relatively educated sample. The majority of respondents had a monthly income below 10,000 RMB, aligning with the general economic profile of the region.

2. Usage and Satisfaction with Intelligent Travel Services

The survey revealed high usage rates of various intelligent travel services, including trip planning, real-time travel information, and mobile payments. Satisfaction levels varied across different stages of travel, with the highest satisfaction reported during the intercity travel stage.

Respondents rated the importance of real-time travel information and personalized travel recommendations highly, indicating a strong preference for services that enhance convenience and reduce uncertainty.

3. Attitudes Towards Intelligent Travel Services

Overall attitudes towards intelligent travel services were positive, with respondents appreciating the convenience, comfort, and safety these services provide. However, there were concerns regarding data privacy and the user-friendliness of some technologies, especially among older travelers.

4. Impact on Mode Choice Behavior

Intelligent travel services significantly influenced mode choice behavior, with many respondents preferring high-speed rail due to its efficiency and the availability of smart services. The study identified three distinct traveler groups—indifferent, rational, and enthusiastic—with varying levels of satisfaction and service usage.

## 6.2 Implications

The findings underscore the critical role of intelligent travel services in shaping traveler satisfaction and choice behavior in the Guanzhong Plain City Cluster. To enhance the overall travel experience and encourage the adoption of smart travel solutions, several measures should be considered.

1. Enhanced Personalization and Real-time Information

Providing highly personalized travel recommendations and up-to-date real-time information can significantly improve traveler satisfaction. Investing in advanced data analytics and AI technologies can help achieve this goal.

2. User Interface and Accessibility Improvements

Simplifying user interfaces and making intelligent travel services more accessible to older and less tech-savvy travelers will increase overall acceptance and usage. Comprehensive training programs and intuitive design can help bridge the technology gap.

3. Data Privacy and Security

Addressing data privacy concerns is essential for building trust in intelligent travel services. Implementing robust data protection measures and transparent privacy policies can alleviate traveler apprehensions.

4. Targeted Marketing and Awareness Campaigns

Differentiated marketing strategies tailored to the three identified traveler groups can effectively promote the benefits of intelligent travel services. Highlighting the advantages for business travelers and highly educated individuals can drive higher engagement among these segments.

### 6.3 Areas for Improvement

1. Broader Demographic Engagement

Future surveys should aim to include a more diverse age group to obtain a holistic view of traveler preferences and satisfaction across different demographics. This can provide deeper insights into the needs of elderly travelers and those with varying levels of technological proficiency.

2. Service Integration and Coordination

Enhancing the integration and coordination between different transportation modes and smart services can streamline the travel process, making it more seamless and efficient. This includes better connectivity between pre-connection, intercity travel, and post-connection stages.

3. Sustainability and Environmental Impact

Promoting the environmental benefits of intelligent travel services, such as reduced emissions and energy efficiency, can appeal to environmentally conscious travelers. Developing sustainable travel solutions can also contribute to the broader goals of urban sustainability.

### 6.4 Implications of Traveler Demographics on Service Design

In the design of intelligent travel services, the different demographic characteristics of passengers have a significant impact on service demand and functional design. The survey results show that younger and tech-savvy travelers show higher usage and satisfaction with smart travel services, especially those who use features such as real-time messaging, mobile payments, and personalized trip recommendations. The preferences of this group not only put forward higher requirements for the service content of smart mobility, but also drive the market demand for functional innovation. However, other groups of travelers who are older or less tech-savvy often face

barriers to adoption, especially when it comes to complex user interfaces and multi-step processes. These travelers are often more concerned about privacy and data security, and tend to opt for easy-to-use service features. Therefore, in order to meet the needs of passengers with different demographics, service providers should design more intuitive and concise interfaces, and provide operation tutorials or support services, especially in high-traffic places such as stations, to help users quickly adapt to and improve their trust and dependence on smart mobility services. By fully considering the needs and habits of different user groups in the design, smart mobility services can be more inclusive and widely applicable, thereby promoting users' acceptance and willingness to use smart mobility.

### 6.5 Influence of Intelligent Travel Services on Mode Choice Behavior

The impact of intelligent travel services on travelers' mode choice behavior is substantial, as features such as real-time updates, mobile payments, and personalized route recommendations enhance both the predictability and flexibility of travel options. These smart features make modes like high-speed rail and shared mobility services more attractive by offering greater efficiency and connectivity compared to traditional transportation options. For frequent travelers and business commuters, time efficiency is crucial, making high-speed rail a preferred choice due to its speed combined with integrated smart services that reduce wait times and improve convenience. Leisure travelers, on the other hand, may prioritize comfort and scenic options, benefiting from personalized route planning that allows them to tailor journeys to suit their preferences. Additionally, younger, tech-savvy users are often more inclined toward sustainable options, such as shared electric vehicles or public transit with smart integrations, aligning their mode choice with environmental consciousness. Meanwhile, older travelers may prefer modes with simpler interfaces and higher reliability, highlighting the importance of user-friendly smart travel designs across all demographics. Ultimately, intelligent travel services have not only broadened travelers' choices but have also introduced new considerations—such as data security and environmental impact—that influence their preferences. By optimizing these smart features, service providers can better align transportation offerings with the evolving demands and diverse preferences of modern travelers, fostering a more adaptable and balanced transportation ecosystem.

### 6.6 Opportunities for Service Providers

The adoption of intelligent travel services faces both significant challenges and promising opportunities as these technologies continue to reshape intercity travel. One primary challenge lies in ensuring data privacy and security, as smart travel services often require collecting and processing large amounts of personal information, including travel habits, locations, and payment data. Growing

concerns over data breaches and unauthorized access can discourage users from fully engaging with these services. Addressing these issues requires robust security measures, such as encryption, controlled data access, and transparent privacy policies to build user trust. Another challenge involves accessibility and usability, especially for older travelers or those less comfortable with technology. Simplifying user interfaces and offering intuitive, easy-to-navigate designs can make smart travel more inclusive and appealing to a wider demographic. On the opportunity side, smart travel services significantly enhance convenience, efficiency, and sustainability, making travel more adaptable to individual needs. Real-time information, optimized routes, and seamless digital transactions help alleviate common travel issues, such as long wait times and route uncertainties, while also supporting sustainability goals by reducing congestion and emissions. Policymakers can further encourage the adoption of smart travel through targeted incentives, subsidies, or partnerships with private companies to promote sustainability and inclusivity. By addressing these challenges and leveraging the opportunities that smart travel offers, service providers and policymakers can foster a more efficient, secure, and user-centered travel ecosystem that meets the diverse needs of modern travelers.

The discussion highlights the importance of intelligent travel services in enhancing traveler satisfaction and influencing mode choice behavior. By addressing key areas for improvement and leveraging the strengths of current smart travel solutions, policymakers and service providers can create a more efficient, comfortable, and sustainable intercity travel experience for all travelers in the Guanzhong Plain City Cluster.

## CHAPTER 7 Conclusion

### 7.1 Summary of this Thesis

This study comprehensively examines the satisfaction of intercity intelligent travel and its impact on passenger choice behavior, revealing the behavioral characteristics and satisfaction heterogeneity of different passenger groups when receiving intelligent travel services. The research results indicate that individuals with high educational levels and official business trips are more likely to become "enthusiastic" groups, while the elderly and female population are more likely to be classified as "indifferent".

These findings suggest that government departments and enterprises should develop differentiated intelligent travel service management strategies for different passenger groups. Optimizing service levels should focus on improving the convenience, comfort, personal privacy information protection, and environmental friendliness of various transportation modes, in order to increase the added value of passengers in the process of intercity intelligent travel. This will help create a more efficient, comfortable, safe, and environmentally friendly new intelligent intercity travel experience for passengers.

In addition, this study also provides a reference basis for relevant departments to optimize intelligent transportation systems, in order to adapt to the needs of future urban agglomeration development and promote the healthy development of intelligent transportation systems.

### 7.2 Research Limitations

Although this study provides an in-depth analysis of satisfaction with intercity intelligent travel services and their impact on passenger choice behavior, there are some limitations. Firstly, this study mainly relies on questionnaire survey data and may be influenced by sample selection bias, as the population participating in the survey may have a higher level of technical acceptance and education. Secondly, as research mainly focuses on specific urban clusters, the results obtained may not be easily generalizable to other regions or countries. Furthermore, although this study attempts to reveal differences in satisfaction and behavioral choices among different user groups, the exploration of the underlying psychological and social factors that influence these differences is not sufficient. Finally, this study did not fully consider the long-term impact that the rapid development of intelligent transportation technology may bring, which may affect the timeliness and relevance of the study. Future research can overcome these limitations by expanding the sample size, delving deeper into influencing factors, and regularly updating data to provide more comprehensive insights.

### 7.3 Future Research Directions

In response to the limitations of this study, future research can consider the following directions to expand and deepen existing research results. Firstly, in order to improve the universality and transferability of research results, future research should expand the sample range to include more users from different regions and

backgrounds, to ensure that the research results are more representative and widely applicable. Secondly, using various research methods such as survey questionnaires and literature analysis, to supplement and validate the results of the questionnaire survey, and to obtain deeper levels of user experience and behavioral motivation information. In addition, attention should be paid to the rapid development of intelligent travel technology and its potential long-term impact on passenger behavior, and research data should be regularly updated to track and analyze the impact of technological changes on user choice behavior. Finally, future research should explore more psychological and social factors behind individual differences, such as personal values, socio-economic status, and cultural background, in order to comprehensively understand the deep-seated factors that affect passenger satisfaction and choice behavior. Through these methods, future research can provide more comprehensive and in-depth insights, providing more effective support for the design and policy-making of intelligent transportation systems.

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**Appendix**

1. What is your gender?
   - Male
   - Female
   - Other
2. What is your age group?
   - 18-25
   - 26-35
   - 36-45
   - 46-55
   - 56-65
   - Above 65
3. What is your highest level of education?
   - High school or below
   - Junior college
   - Undergraduate
   - Master's degree or higher
4. What is your monthly income level?
   - Less than 5,000 RMB
   - 5,000-10,000 RMB
   - 10,001-20,000 RMB
   - More than 20,000 RMB
5. What is your occupation?
   - Student
   - Professional
   - Government/Enterprise leader
   - Other
6. Do you have a driver's license?
   - Yes
   - No
7. Does your household own a car?
   - Yes
   - No

Part 2: Travel Information

1. How often do you travel between cities within the Guanzhong City Cluster?
   - Daily
   - Weekly

- Monthly
- Occasionally

2. What is the primary purpose of your intercity travel?
- Business
- Leisure
- Education
- Other

3. What mode of transportation do you primarily use for intercity travel?
- High-speed rail/CRH (G/D)
- Ordinary train (K/T/Z)
- Intercity long-distance bus
- Ride-hailing service
- Personal car
- Other

4. How do you purchase your travel tickets?
- Online
- At the station
- Through an agent
- Other

Part 3: Experience with Intelligent Travel Services

1. Which of the following intelligent travel services have you used? (Select all that apply)
- Trip planning
- Map navigation
- Real-time travel information
- Mobile payment/ticket purchase
- Shared ride-hailing services
- Shared bicycles
- Station or on-board Wi-Fi
- Self-service ticketing/check-in machines

2. On a scale of 1 to 5, how satisfied are you with the intelligent travel services at the following stages:
- Pre-travel planning stage
  - Very dissatisfied (1)
  - Dissatisfied (2)
  - Neutral (3)
  - Satisfied (4)
  - Very satisfied (5)
- Pre-connection stage
  - Very dissatisfied (1)

- Dissatisfied (2)
- Neutral (3)
- Satisfied (4)
- Very satisfied (5)

- Intercity travel stage
  - Very dissatisfied (1)
  - Dissatisfied (2)
  - Neutral (3)
  - Satisfied (4)
  - Very satisfied (5)
- Post-connection stage
  - Very dissatisfied (1)
  - Dissatisfied (2)
  - Neutral (3)
  - Satisfied (4)
  - Very satisfied (5)
- Post-travel evaluation stage
  - Very dissatisfied (1)
  - Dissatisfied (2)
  - Neutral (3)
  - Satisfied (4)
  - Very satisfied (5)

Part 4: Attitude Towards Intelligent Travel Services

1. Please rate the following statements about intelligent travel services on a scale of 1 to 5:
   - Intelligent travel services are convenient.
     - Strongly disagree (1)
     - Disagree (2)
     - Neutral (3)
     - Agree (4)
     - Strongly agree (5)
   - Intelligent travel services improve travel comfort.
     - Strongly disagree (1)
     - Disagree (2)
     - Neutral (3)
     - Agree (4)
     - Strongly agree (5)
   - Intelligent travel services are safe.
     - Strongly disagree (1)

- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly agree (5)

- Intelligent travel services are environmentally friendly.
  - Strongly disagree (1)
  - Disagree (2)
  - Neutral (3)
  - Agree (4)
  - Strongly agree (5)

Part 5: Evaluation of Intelligent Services

1. How important are the following intelligent travel services for intercity travel on a scale of 1 to 5?
   - Real-time travel information
     - Not important (1)
     - Slightly important (2)
     - Moderately important (3)
     - Important (4)
     - Very important (5)
   - Personalized travel recommendations
     - Not important (1)
     - Slightly important (2)
     - Moderately important (3)
     - Important (4)
     - Very important (5)
   - Mobile payment options
     - Not important (1)
     - Slightly important (2)
     - Moderately important (3)
     - Important (4)
     - Very important (5)
   - Safety features
     - Not important (1)
     - Slightly important (2)
     - Moderately important (3)
     - Important (4)
     - Very important (5)
   - Environmental impact
     - Not important (1)

- Slightly important (2)
- Moderately important (3)
- Important (4)
- Very important (5)

2. Please rate your overall satisfaction with intercity intelligent travel services:
- Very dissatisfied (1)
- Dissatisfied (2)
- Neutral (3)
- Satisfied (4)
- Very satisfied (5)

3. Which mode of intercity transportation do you prefer for your next trip within the Guanzhong City Cluster?
- High-speed rail/CRH (G/D)
- Ordinary train (K/T/Z)
- Intercity long-distance bus
- Ride-hailing service
- Personal car
- Other

Part 6: Open-ended Questions

1. What improvements would you suggest for intercity intelligent travel services?

2. How do you think intelligent travel services can better meet your needs?

This questionnaire aims to gather comprehensive data on travelers' satisfaction and choice behavior related to intercity smart travel services, taking into account their heterogeneity and preferences.