

Article

Research on Consumer Identity in Using Sustainable Mobility as a Service System in a Commuting Scenario

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Abstract: Social and economic development leads to the continuous urbanization process, accompanied by the increasingly prominent traffic congestion problem. Traffic congestion also brings problems such as serious environmental pollution and intensified social conflicts. Therefore, how to alleviate traffic congestion has become a concern of the government and related researchers. As the main cause of urban traffic, the efficiency of urban commuting is considered as the best embodiment of urban functionality. The mobile as a service (Maas) system may be a better solution. In order to make the mobile as a service system more popular, it is necessary to understand the internal motivations driving people's corresponding behaviors. Therefore, this study aimed to explore the internal logic of consumer identity, attitude and related intentions through a structural equation model and chi-square analyses. The final behavioral intention of commuting consumers towards MaaS was explored by integrating relevant theoretical models and comparing different levels of identification and the views of different consumers towards MaaS. A result was provided that can be used by relevant government agencies or practitioners in order to gain a deeper understanding of the internal perceptions of consumers and promote the optimization and innovation of MaaS systems. In addition, the results of this study also identified the potential necessary factors for the adoption of MaaS by commuting consumers, which may influence the improvement or development of relevant policies. The results showed that the model used in this study was applicable to the consumption cognition of the MaaS system in the commuting scenario, which shows that the model has a certain effect in explaining consumers' sustainable consumption attitudes, identities and intentions. The internalization of sustainable identity is the most important part for consumers, which indicates that consumers attach great importance to self-value affirmation and mutual affirmation of sustainable concepts. However, in the consumer group, there were still some consumers who had not transformed their sustainable attitudes and recognitions into actual behavior. Converting such consumers is, therefore, crucial and an important step towards sustainable development.



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Keywords: commuting scenario; mobility as a service; sustainability; consumer perception; system innovation design

1. Introduction

1.1. Background and Motivation of the Research

Social and economic development leads to the continuous urbanization process, accompanied by the increasingly prominent traffic congestion problem. Traffic congestion also brings problems such as serious environmental pollution and intensified social conflicts. Therefore, how to alleviate traffic congestion has become a concern of the government and related researchers. As the main cause of urban traffic, the efficiency of urban commuting is considered as the best embodiment of urban functionality [1].

In order to solve the problem of urban commuting in the future, a better commuting service system must be adopted. Mobility as a service (MaaS) may be a more effective approach. MaaS, as an innovative and iterative means of transportation and technology, has led to the innovation of various modes of transportation and mobile services to solve

traffic congestion, accessibility, air pollution, energy issues and social inclusion [2], and to contribute to the environmental sustainability of cities. MaaS is a mobile management and distribution system with flexible, efficient, consumer-centered and personalized services [3], which can solve the commuting needs of consumers in a more intelligent way. The integrity of a commuting trip is largely determined by its first and last mile connections, which are from the public transport station to the company, and from the public transport station to the home. The MaaS system is a system that takes commuters from point A to point B in an optimal form [4], which is considered to be an effective solution to the first/last mile problem. As a system that has been developed for the needs of different situations in the overall commuting scenario, different solutions can be generated according to the situation of the consumers.

MaaS systems are often associated with circular or sharing economies [5]. Under the concept of a circular economy, MaaS has a closer relationship with environmental sustainability. On the premise of the low-carbon development of transportation trips, the proportion of green trips in the market can be expanded through commercial means. The proportion of private trips with high carbon emissions will also be reduced, and a shared transportation mode with low energy consumption, low pollution and low emissions will be established. Electric vehicle sharing as a service (EVSaaS), for example, takes advantage of the low usage of electric vehicles to provide consumers with short-distance and medium-distance convenience. MaaS, thus, coincides with the concept of product-service systems as a system of products, services, network actors and supporting infrastructure. The competitiveness is maintained through continuous updates, aimed at meeting consumer demands [6]. The development of MaaS can improve the accessibility, convenience, comfort and safety of commuters, while taking into account the use efficiency of the transportation system, and can reduce air pollution, energy loss and traffic congestion caused by too many private cars. Therefore, MaaS has become the core proposition and future trend for all countries to actively promote public transport [7].

1.2. Purposes of the Research

As an information-based travel innovation system, MaaS has been preferred by many countries, and has been promoted in demonstrations in order to improve the utilization rate of public transportation, improve the efficiency of public commuting, reduce the use of private transportation and reduce congestion. Examples include Trainline in the United Kingdom, Smile in Austria, Conmuauto in Canada, and Mobility Mixx in the Netherlands, etc. [8,9]. Although MaaS implementation may face several challenges, such as institutional change obstacles, structural rigidity and social acceptance, the benefits of MaaS implementation outweigh the risks. Additionally, the industry-university-research community studies the system itself [7], institutional logic [10] and recommendation models [11]. It is generally accepted that most consumer research focuses on behavioral factors [12], payment preferences [13], consumption attitudes and personalities [14], and that less attention is paid to the identity of the consumers themselves. Self-driving is still the first choice for consumers in the transportation sector due to its convenience. In the field of transportation, public transport may be the main choice of commuters, however, most of them simply choose the nearest bus or subway line, and they complete the commuting route by walking, without using the MaaS system to more effectively plan their commuting route. Therefore, the MaaS adoption rate is not as high as the developers' expected. It is necessary to understand the inner thoughts of consumers to increase the adoption and cover rate of the MaaS system.

MaaS is considered to have environmentally friendly properties, so the use of MaaS is considered a green behavior. Consumers may support it for environmental reasons, but without following it themselves. Therefore, there is a need to understand the factors and relationships that influence consumers' sustainability identity, consumer attitudes and behavioral intentions, and to find ways to narrow the gap to improve the situation.

As a result, the purpose of this study was as follows: (1) to explore commuting consumers' identities, attitudes and the related intentions of MaaS system use; (2) to integrate relevant theoretical models to explore the final behavioral intentions of commuting consumers towards MaaS; and (3) to compare the different degrees of identity of different consumers towards MaaS, with different points of view.

In addition, the results of this study may serve as a reference for government units or practitioners seeking to gain a deeper understanding of commuting consumers' internal perceptions and to improve the related MaaS systems. It may also be useful to identify potential factors that may influence the adoption of specific policies.

2. Literature Review

2.1. Consumer Identity in the Commuting Scenario

In the commuting scenario, meeting the needs, preferences and overall satisfaction of consumers is the basic principle for the successful implementation of MaaS [15]. Therefore, many studies on the multi-dimensions of consumers have been conducted. Meng et al. argued that a traveler's age, gender and income influence their choice of travel mode for the last mile at a train station [16]. Contreras and Paz believe that sharing travel modes can help to reduce traffic congestion and improve social interaction [17]. Polydoropoulou et al., investigated stakeholders' and end users' expectations, views and worries about MaaS. Mola et al. emphasized the importance of promoting the advantages (perceived usefulness) that MaaS provides to users [12]. Therefore, it is necessary to establish a good impression or the recognition of consumers about MaaS, and then to stimulate consumers to use the MaaS system. It also provides a deeper insight into hesitant consumers and their characteristics. So far, these questions have not been addressed directly in the literature.

2.1.1. Sustainable Self-Identity

As an environmentally conscious concept, sustainable self-identity is affected by mainstream social and cultural forces and can guide consumers to engage in environmentally friendly activities [18]. Consumers with this sense will maintain their environmental friendliness through recognized methods (such as sorting, recycling and reducing their use of plastics), which will bring them into a sustainable consumption lifestyle. Turner interpreted this awareness as "ordinary environmentalism", which promoted the new concept of green and sustainable consumption, after the mainstream forms of economic growth and consumption were widely accepted [19]. Sustainable self-identity is defined in MaaS as a dynamic, multidimensional, contextual self-suggestion that affects consumers' consumption behaviors and their perceptions of the surrounding environment, consciously or unconsciously [20]. The success or reward may motivate the consumer's self-identity and act on their continuous behavior. Especially in the commuting scenario, the MaaS system can provide consumers with a more effective experience when they are shifting between different transport vehicles, so as to gain consumer recognition or develop user habits. Users' behavior would be directly considered environmentally friendly behavior by travelling with the MaaS system. Of course, self-identity is often spontaneous. Bryan et al. pointed out that sustainable self-identity is a self-action [21], and an important predictor of environmental protection behavior [22] and that people with a strong sustainable self-identity will protect the environment even without external factors [23].

2.1.2. Sustainable Social Identity

Based on the social identity theory, sustainable social identity is used to understand the relationship between people and the environment, including personal identity and social identities. Personal identity covers self-characteristics (sustainable self-identity), while social identity depends on the group to which one belongs, such as gender, race or environmental groups. When individuals are categorized according to specific social identities, there will be increased similarities between individuals and members within the group, or increased differences between individuals and those outside the group [24].

Sustainable social identity has been used to predict attitudes, intentions and behaviors regarding environmental protection—for example, the membership of an environmental protection group will be used to predict the intention of environmental activism, while the sustainable identity of environmentalists will be used to predict their environmental protection behavior [25]. Furthermore, consumers using the same MaaS app may set up WeChat groups. In addition to sharing experiences, they will also talk about route experience, money-saving skills, group purchasing activities and other multi-party behaviors, and they will promote the mutual recognition of commuting behaviors that use the MaaS system to form group (social) recognition. Using this form of identification may indirectly influence more consumers to engage in MaaS activities.

Moreover, the perception of consumers' sustainable identities also differs, with a significant percentage of consumers with environmentally friendly behaviors not identifying themselves as green. Consequently, in their study, Brick and Lai divided consumers with environmental behaviors into two groups, one with explicit environmentalist identities and one with implicit environmentalist identities. These two identities were positively correlated with a considerable degree of preference for environmental behaviors and the corresponding policies [26]. In other words, the more support the group members show towards their environmental identity, the more significant their environmental standards will be, and the more likely they are to influence their behaviors.

2.2. Sustainable Consumption Attitudes and Intentions

Studies of consumer behaviors have found that values influence beliefs about the attributes of a product or service by affecting consumption values, thus, product or service attribute beliefs will influence product or service attitudes [27]. Sustainable consumption, often called green consumption in the past, means that consumers realize that environmental deterioration has affected the overall quality of life, and they try to buy and require manufacturers to produce or provide products or services with less impact on the environment. This is a practice that ensures environmental protection during consumption. In general, consumers' sustainable attitude refers to the extent to which individuals evaluate sustainable products positively or negatively, while sustainable intention refers to their self-commitment to purchasing sustainable products [28]. Therefore, there is a correlation between sustainable attitudes and intentions, especially when evaluating specific environmentally friendly products or behaviors—such as sustainable products, green hotels or organic foods. Verma et al. suggested that the role of attitude is more positive in environmental behaviors, and that consumers' specific attitudes towards energy-efficient products positively influences their purchase intentions [29]. The findings of Malik and Singhal suggested that consumers are more likely to buy sustainable products or services if they have a strong commitment to sustainability [30], which suggests that further changes in environmental intentions and behaviors are possible if attitudes towards the environment are changed [31]. There are a growing number of consumers who want to change their purchasing habits by buying more sustainable products [32].

MaaS is a collective sharing, leasing and transportation integration system, designed to reduce the purchase or use of non-environmentally friendly vehicles, with the intention of reaching sustainability. Integrated forms of transportation can also reduce traffic pressure and reduce carbon emissions. Jang et al. believe that the sustainability of MaaS depends on the transportation mix that consumers end up using, and may vary depending on how environmentally friendly it is [33]. If the service provider (car owner) provides a ride on the way to work, the electric vehicle manufacturer provides a quick battery swap service, which is a considerable travel-sharing incentive, and various efforts may have a high degree of environmental benefits. However, behaviors such as renting a traditional car and requiring other means of movement to reach the pickup location, or the ride provider taking a detour to pick up passengers—which leads to an increase in the actual travel range—will lead to worse sustainable results than expected. After using MaaS, consumers in different countries can confirm the actual degree of sustainability through different apps. For example, it

is intuitive to see how much green energy Chinese consumers receive from Alipay. In general, most consumers will choose the most economical and efficient travel combination, so consumers' use of MaaS as a sustainable behavior is still considered sustainable.

2.3. Extended Model of the Theory of Planned Behavior

The theory of planned behavior (TPB), proposed by Ajzen in 1985, is based on the theory of reasoned action (TRA), the difference is the added perceived behavioral control to explain the limitations of TRA [34]. According to TRA, there is a relationship between the attitude towards behavior, behavior intention and actual behavior [35], while a complete TPB model [36] can be built with the continuous development and validation of TRA, as well as the subjective norm. TPB is also considered to be an important model in the field of sustainable consumption [37].

Some scholars have argued that, although TPB can largely explain intention, if other theories or dimensions were added, the explanatory power of the model would be greatly improved [38]. Jiang et al. put forward an extended model of TPB in 2016 (Figure 1) and mentioned that if the categories of self-identity and social identity were added to the TPB model, it would be more helpful in explaining consumers' specific behaviors regarding specific issues [39]. This conclusion has been confirmed by previous scholars and applied to environmental [40] and food issues [41]. Jiang et al. expanded the TPB model and applied it to the social network. They suggested that social identity would be the intermediary variable of subjective norm and behavioral intention, while self-identity was the intermediary variable of attitude and perceived behavioral control. At the same time, they thought that self-identity also affects social identity in influencing intention. The results showed that social identity was the largest predictor of intention, followed by attitude and perceived behavior control and social identity, which completely interfered with the influence of subjective norm and self-identity on intention. In contrast, intention significantly predicted users' microblogging behaviors [39].

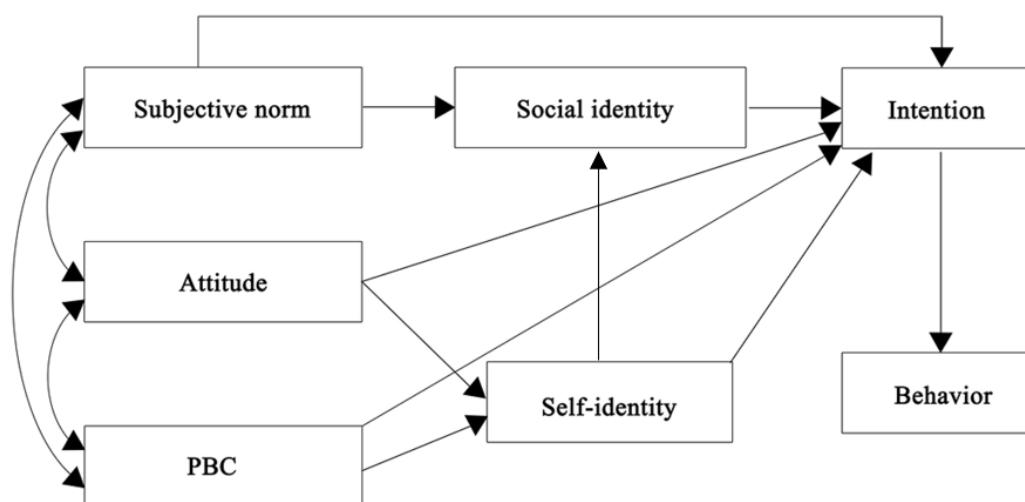


Figure 1. Extended Model of the theory of planned behavior. Reprinted with permission from ref. [39]. Copyright 2016 Elsevier.

3. Research Structure and Methodology

3.1. Research Hypotheses

In Section 2, relevant theories affecting the sustainable consumption identities, attitudes and intentions of commuting consumers in the sustainable MaaS system are discussed. This study summarized and integrated the research of past scholars and built a theoretical model based on the extended model of the theory of planned behavior, established by Jiang et al. [39], to explore the mediating effect of consumers' sustainable consumption identity in sustainable mobility as a service systems, under the commuting scenario. (As

this study will not discuss the actual behavior of consumers, the actual behavior was deleted).

According to Jiang et al., this study adopted the extended model of the planned behavior theory. This was because, while consumer research on MaaS has reached a considerable extent, there is still a lack of research on consumer identity and self-identity. Hence, the identification models from other related fields should be introduced into this topic first to reduce the instability of the results caused by the introduction of different variables. Jiang et al.'s model combines the theory of planned behavior and consumer identity and is applied to software interaction. Considering that MaaS is also based on APP, the theory of planned behavior can be expanded and developed differently than it has been in the fields of consumer behavior and perception. Therefore, in this study we believed that this version of the extended model of planned behavior theory was suitable for use as our core theoretical framework.

In this study, our research hypotheses were established based on the theoretical basis for each factor as the basis for the subsequent hypothesis testing. In this study, the hypothesis of each factor was established as the basis for the subsequent hypothesis verification. The role of the hypotheses was to confirm the causal relationships between the factors and to understand the influence among the factors. The model and hypotheses are shown in Figure 2.

Hypothesis 1 (H1). *Subject norm (H1a), attitude (H1b) and perceived behavioral control (H1c) significantly influence commuting consumers' behavioral intentions for sustainable consumption in mobility as a service systems.*

Hypothesis 2 (H2). *Social identity (H2a) and self-identity (H2b) significantly influence commuting consumers' behavioral intentions for sustainable consumption in mobility as a service systems.*

Hypothesis 3 (H3). *Self-identity significantly influences commuting consumers' social identity for sustainable consumption in mobility as a service systems.*

Hypothesis 4 (H4). *Subject norm (H4a) significantly influences consumers' self-identity and attitude (H4b), and perceived behavioral control (H4c) significantly influence consumers' social identity.*

Hypothesis 5 (H5). *Social identity has a positive mediating effect on the effect of the subject norm (H5a) and self-identity (H5b) on commuting consumers' sustainable consumption behavioral intentions in mobility as a service systems.*

Hypothesis 6 (H6). *Social identity has a positive mediating effect on the effects of attitude (H6a) and perceived behavioral control (H6b) on commuting consumers' sustainable consumption behavioral intentions in mobility as a service systems.*

Hypothesis 7 (H7). *Self-identity and social identity appear to play a positive mediating role in influencing attitudes (H7a) and perceived behavioral control (H7b) on the sustainable consumption intentions of commuting consumers in mobility as a service systems.*

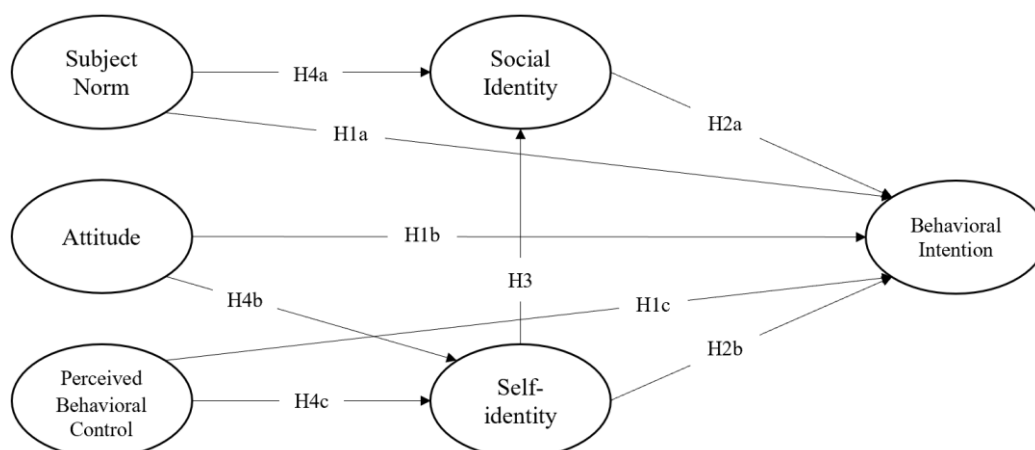


Figure 2. Model and hypotheses.

3.2. Questionnaire and Scale Design

According to the established research model, this study explored the perceptions and attitudes that influence commuting consumers' sustainable consumption in mobile-as-a-service environments. The six factors that ultimately influence behavioral intent include the following: subjective norm, attitude, perceived behavior control, social identity, self-identity and behavioral intention. After referring to the structure and design of the questionnaire and scale of Ajzen et al., this study established 33 questions that addressed consumers' identities, attitudes and intentions towards sustainable consumption in MaaS (Table 1). We distributed the questionnaire to the subjects via the Internet, with a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The reason for using the 7-point scale was that, compared to the 5-point scale, the former can reduce the excessive skewness of data, and it is easier to conform to the normal distribution and residual independence [42].

Table 1. Definition of factors and reference.

| Factor | Definition | Item | Reference |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Attitude (ATB) | Consumer attitude towards sustainable consumption behaviors. | MaaS contributes positively to the protection of the environment. | [34,39,43,44] |
| | | MaaS products and services are forward-looking. | |
| | | MaaS is a smart activity, in my opinion. | |
| | | If a product or service reduces environmental damage, I am willing to pay a little more. | |
| Subjective Norm (SN) | Subjective perceptions of sustainable consumption behaviors from friends, family, mass media, government policies and online users. | It is important to me to hear the opinions of family, friends, colleagues and company executives regarding MaaS. | [34,39,43,44] |
| | | I will act in accordance with the views expressed by my influential family, friends and colleagues, and by the executives of my company regarding MaaS. | |
| | | In my opinion, MaaS is dependent upon the opinion of the mass media, government policy, online information, expert opinion and salespeople. | |
| | | Considering the opinions of influential mass media, government policies, online information, expert opinions and salespeople regarding MaaS, I will act accordingly. | |

Table 1. Cont.

| Factor | Definition | Item | Reference |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Perceived Behavior Control (PBC) | The ability of consumers to control the opportunities and resources needed for sustainable consumption behaviors. | My decision to participate in MaaS is not influenced by anyone else and I am free to do so. | [34,39,43,44] |
| | | The external resources (time, opportunity and money, etc.) that are required to conduct MaaS are clear to me. | |
| | | Having a full understanding of my own internal capabilities (professional knowledge and shopping experience, etc.) is essential in order to carry out MaaS. | |
| | | My willingness to purchase MaaS is affected by the cost. | |
| Self-identity S (S) | The degree of self-affirmation generated by a consumer after sustainable consumption behaviors. | Environmental protection and resource conservation are very important to me. | [39,45] |
| | | In my opinion, sustainable development and low carbon emissions are necessary. | |
| | | In my opinion, I am a green and sustainable consumer. | |
| | | As a user of MaaS, I feel like a green, sustainable consumer. | |
| Social Identity (SI) | The degree of mutual affirmation generated by a consumer on others with sustainable consumption behaviors. | I would feel good about myself if I was involved in MaaS. | [39,46] |
| | | I feel a strong sense of identity with the other individuals or groups involved in MaaS. | |
| | | I feel a strong sense of belonging to the other people or groups participating in MaaS. | |
| | | I see the other people or groups using MaaS as mirroring my own image. | |
| | | I align my expectations with the values conveyed by others or groups through the use of MaaS. | |
| Behavioral Intention (BI) | Consumers' willingness to participate in sustainable consumption behaviors | MaaS conforms to society's trend. | [34,39,43,45] |
| | | I am strongly motivated to participate in MaaS due to environmental factors. | |
| | | In the next few weeks, I will be participating in MaaS. | |
| | | I would be delighted to participate in MaaS. | |
| | | I will promote MaaS to others. | |

4. Research Results

4.1. Descriptive Analysis of Demographic Variables

This study confirmed that the questionnaire and scale were reasonable and reliable, and the formal questionnaires were issued between March and May 2021. Surveys were conducted in coastal areas of China. As a relatively developed area in China, the coastal area has a high commuter population, and MaaS systems are relatively popular, making it an appropriate study area. Furthermore, the results of the study in coastal areas may be useful for the design and optimization of MaaS systems in China, and could be extended to other cities and regions in China.

A total of 500 web-based questionnaires and scales were distributed through the “credamo” platform, where all subjects clicked on the web link to view the study description, and they could voluntarily answer the research questions or withdraw from the survey at any time. Therefore, all the subjects who agreed to participate in this study were fully informed and their participation was voluntary. After completing the questionnaires,

participants received a CNY 15 payment and a platform raffle as a token of appreciation for their responses.

Finally, a total of 477 questionnaires and scales were collected. After invalid samples (with logical errors or too many of the same options) were excluded, there was a total of 413 samples, for a valid recovery rate of 92.3%. There were 26 questions regarding parameter estimation in the questionnaire, and the 413 samples were close to Jackson's proposal, meaning that the ratio of the estimated parameter to sample number ($p:n$) should have been 1:20 in the maximum likelihood estimate [47], which was much higher than the minimum requirement of 1:10. As a result, this was used for the subsequent data analysis. The distribution of the demographic variables in this study was statistically analyzed based on the data of the validated questionnaires, as shown in Table 2.

It was not the intention to limit the research questionnaire to either men or women, nor was it gender-specific. The sample consisted of 195 men, accounting for 47.2%, and 218 women, accounting for 52.8%. In terms of the age group, we had the following: (1) under 20 years old—11 people, accounting for 2.7%; (2) 21–30 years old—214 people, accounting for 51.8%; (3) 31–40 years old—155 people, accounting for 37.5%; (4) 41–50 years old—25 people, accounting for 6.1%; and (5) over 51 years old—8 people, accounting for 1.9%. The monthly income of the respondents was divided into the following five categories: (1) incomes below 20,000, which accounted for 48 people, 11.6%; (2) incomes between 20,001–40,000, which accounted for 125 people, 30.3%; (3) incomes between 40,001 and 80,000, which accounted for 181 people, 43.8%; (4) incomes between 80,001 and 150,000, which accounted for 47 people, 11.4%; and (5) incomes above 150,001, which accounted for 12 people, 2.9%. In terms of educational level, we had the following groups: (1) junior high school or lower—16 people, accounting for 3.9%; (2) high school or technical secondary school—90 people, accounting for 21.8%; (3) undergraduate or college—283 people, accounting for 68.5%; and (4) graduate degree or higher—24 people, accounting for 5.8%. According to the marital status, there were 272 married people, which accounted for 65.9%, and 141 unmarried people, which accounted for 34.1%. The occupations were categorized as follows: (1) manufacturing—87 people, representing 21.1%; (2) medical—67 people, representing 16.2%; (3) financial—91 people, representing 22%; (4) design—52 people, representing 12.6%; (5) service—92 people, representing 22.3%; and (6) other—24 people, representing 5.8%. Lastly, the subjects were asked if they were using MaaS, and the results were divided into the following two categories: (1) yes—359 people, accounting for 86.9% and (2) no—54 people, accounting for 13.1%.

As a relatively new technology, with a certain technical content, the MaaS system appeals to young people, while older individuals have a relatively difficult time in starting to use it. Additionally, commuters are primarily young individuals. As a result, the age distribution of the samples in this study corresponded with this to a certain extent, indicating that the samples were representative of the overall population. We did not discuss any demographic variables other than age in this study, so they were merely used to collect data. The next section describes the specific reliability and validity tests conducted on the samples in this study.

Table 2. The distribution of demographic variables in the formal questionnaire.

| Category | Item | No. of People | Percentage |
|----------|------------------------|---------------|------------|
| Sex | Male | 195 | 47.2% |
| | Female | 218 | 52.8% |
| Age | 20 years old or below | 11 | 2.7% |
| | 21–30 years old | 214 | 51.8% |
| | 31–40 years old | 155 | 37.5% |
| | 41–50 years old | 25 | 6.1% |
| | 51 years old and above | 8 | 1.9% |

Table 2. Cont.

| Category | Item | No. of People | Percentage |
|-----------------------------------------|--------------------------------------------------|---------------|------------|
| Monthly Salary | Below 4000 | 48 | 11.6% |
| | 4001–8000 | 125 | 30.3% |
| | 8001–16,000 | 181 | 43.8% |
| | 16,001–30,000 | 47 | 11.4% |
| | 30,001 and above | 12 | 2.9% |
| Educational Level | Junior high school or below | 16 | 3.9% |
| | Senior high school or technical secondary school | 90 | 21.8% |
| | Associate or bachelor's degree | 283 | 68.5% |
| | Graduate school and above | 24 | 5.8% |
| Marital Status | Married | 272 | 65.9% |
| | Single | 141 | 34.1% |
| Occupation | Manufacturing industry | 87 | 21.1% |
| | Healthcare industry | 67 | 16.2% |
| | Financial industry | 91 | 22% |
| | Design industry | 52 | 12.6% |
| | Service industry | 92 | 22.3% |
| | Others | 24 | 5.8% |
| Whether you have performed related MaaS | Yes | 359 | 86.9% |
| | No | 54 | 13.1% |

4.2. Analysis of Reliability and Exploratory Factors

The reliability was analyzed first in the formal questionnaire. As shown in Table 3, Cronbach's α coefficients in the reliability analysis were higher than 0.8, and there was no significant increase in the reliability coefficients after removing the questions, which meant that the data had high reliability and could be used for further analyses. Next, this study used exploratory factor analysis to test the singularity of six dimensions in the hypothetical model. A principal component analysis was first used to extract new factors with eigenvalues greater than one for each dimension. The results showed that the KMO value was greater than 0.7 and the significance in Bartlett's test of sphericity was less than 0.05 for each dimension, which indicated its suitability for exploratory factor analysis [48,49]. Six factors with eigenvalues greater than one were extracted. The cumulative variance was 75.14% and the explanatory degree of a single factor was less than 40%. In addition, there was no common factor to explain most of the variations, which met Thompson's standard. From this, it was known that there was no common method variation found in this questionnaire [50]. Furthermore, the number of factors corresponded to the number of dimensions in the default model of this study.

Table 3. Analysis of reliability and exploratory factors.

| Latent Variable | Item | α Coefficient with the Item Deleted | Composition | | | | | |
|------------------------------------------------|------|--------------------------------------------|-------------|-------|--------------------------|--------|--------|----------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| Attitude $\alpha = 0.907$ | ATB1 | 0.870 | | | 0.821 | | | |
| | ATB2 | 0.887 | | | 0.811 | | | |
| | ATB3 | 0.882 | | | 0.837 | | | |
| | ATB4 | 0.880 | | | 0.876 | | | |
| Subjective Norm $\alpha = 0.900$ | SN1 | 0.883 | | | | 0.801 | | |
| | SN2 | 0.857 | | | | 0.832 | | |
| | SN3 | 0.868 | | | | 0.823 | | |
| | SN4 | 0.878 | | | | 0.819 | | |
| Perceived Behavior Control $\alpha = 0.866$ | PBC1 | 0.810 | | | | | 0.807 | |
| | PBC2 | 0.826 | | | | | 0.806 | |
| | PBC3 | 0.843 | | | | | 0.779 | |
| | PBC4 | 0.834 | | | | | 0.797 | |
| Self-identity $\alpha = 0.908$ | S1 | 0.880 | | 0.802 | | | | |
| | S2 | 0.885 | | 0.803 | | | | |
| | S3 | 0.894 | | 0.735 | | | | |
| | S4 | 0.897 | | 0.772 | | | | |
| | S5 | 0.884 | | 0.833 | | | | |
| Social Identity $\alpha = 0.903$ | SI1 | 0.875 | 0.828 | | | | | |
| | SI2 | 0.885 | 0.790 | | | | | |
| | SI3 | 0.887 | 0.798 | | | | | |
| | SI4 | 0.886 | 0.774 | | | | | |
| | SI5 | 0.874 | 0.824 | | | | | |
| Behavioral Intention $\alpha = 0.897$ | BI1 | 0.854 | | | | | | 0.757 |
| | BI2 | 0.872 | | | | | | 0.758 |
| | BI3 | 0.873 | | | | | | 0.735 |
| | BI4 | 0.871 | | | | | | 0.780 |
| Eigenvalue | | | 9.898 | 2.538 | 2.193 | 1.956 | 1.696 | 1.256 |
| Variance contribution rate | | | 14.411 | 14.33 | 12.176 | 11.961 | 11.378 | 10.888 |
| Accumulative contribution rate | | | | | 75.144 | | | |
| Test of KMO and Bartlett | | | | | | | | |
| Kaiser–Meyer–Olkin metric of sampling adequacy | | | | | | | | 0.927 |
| Bartlett’s test of sphericity | | | | | Chi-square approximation | | | 7285.624 |
| | | | | | df | | | 325 |
| | | | | | Sig. | | | 0.000 |

4.3. Confirmatory Factor Analysis

4.3.1. Convergent Validity

This study used AMOS v22.0 software for the structural equation modeling analysis. As a large number of studies have used AMOS for analysis, it has been proved to be reliable software for structural equation modeling. According to Anderson and Gerbing, the data were analyzed in two stages [51]. The measurement model was used in the first stage, which applies maximum likelihood estimation to estimate parameters, such as factor loadings, reliability, convergent validity and discriminant validity. According to the research of Hair et al. [52], Nunnally and Bernstein [53] and Fornell and Larcker [54] regarding convergent validity, as well as the research by Chin [55] and Hooper [56] et al. regarding standardized factor loadings, as shown in Table 4, the standardized factor loadings in this study were higher than 0.6, the composite reliability of dimension was higher than 0.7, and the average variance extracted (AVE) was higher than 0.5, which indicated good convergent validity for the dimensions [52].

Table 4. Measurement Model.

| Dimension | Item | Unstd. | S.E. | Unstd./S.E. | p-Value | Std. | CR | CV |
|----------------------------|------|--------|-------|-------------|---------|-------|-------|-------|
| Attitude | ATB4 | 1 | | | | 0.826 | 0.907 | 0.709 |
| | ATB3 | 0.975 | 0.050 | 19.680 | 0.000 | 0.830 | | |
| | ATB2 | 0.984 | 0.051 | 19.387 | 0.000 | 0.822 | | |
| | ATB1 | 1.096 | 0.051 | 21.554 | 0.000 | 0.888 | | |
| Subjective Norm | SN4 | 1 | | | 0.000 | 0.810 | 0.902 | 0.697 |
| | SN3 | 1.049 | 0.054 | 19.454 | 0.000 | 0.843 | | |
| | SN2 | 1.092 | 0.053 | 20.600 | 0.000 | 0.883 | | |
| | SN1 | 1.075 | 0.059 | 18.151 | 0.000 | 0.800 | | |
| Perceived Behavior Control | PBC4 | 1 | | | 0.000 | 0.769 | 0.866 | 0.619 |
| | PBC3 | 0.942 | 0.063 | 14.938 | 0.000 | 0.739 | | |
| | PBC2 | 1.025 | 0.064 | 15.922 | 0.000 | 0.784 | | |
| | PBC1 | 1.176 | 0.068 | 17.205 | 0.000 | 0.850 | | |
| Self-identity | S5 | 1 | | | 0.000 | 0.834 | 0.909 | 0.667 |
| | S4 | 0.939 | 0.053 | 17.851 | 0.000 | 0.766 | | |
| | S3 | 0.927 | 0.050 | 18.639 | 0.000 | 0.790 | | |
| | S2 | 0.998 | 0.049 | 20.211 | 0.000 | 0.834 | | |
| | S1 | 1.036 | 0.049 | 20.986 | 0.000 | 0.856 | | |
| Social Identity | SI5 | 1 | | | 0.000 | 0.846 | 0.903 | 0.651 |
| | SI4 | 0.916 | 0.049 | 18.560 | 0.000 | 0.783 | | |
| | SI3 | 0.89 | 0.048 | 18.378 | 0.000 | 0.778 | | |
| | SI2 | 0.918 | 0.048 | 18.950 | 0.000 | 0.794 | | |
| | SI1 | 1.003 | 0.050 | 20.261 | 0.000 | 0.831 | | |
| Behavioral Intention | BI4 | 1 | | | 0.000 | 0.810 | 0.897 | 0.687 |
| | BI3 | 0.981 | 0.053 | 18.608 | 0.000 | 0.815 | | |
| | BI2 | 0.966 | 0.052 | 18.525 | 0.000 | 0.812 | | |
| | BI1 | 1.104 | 0.054 | 20.456 | 0.000 | 0.876 | | |

Note: Unstd.—unstandardized factor loadings; Std—standardized factor loadings; CR—composite reliability; and CV—convergence validity.

The discriminant validity was determined according to the research of Fornell and Larcker [54], meaning the square root of the average variance extracted (AVE) for each dimension was greater than the correlation coefficient between dimensions, which showed that the model had discriminant validity. The results showed that all the diagonal values in this study were greater than the off-diagonal values, which reflected that each dimension in this study had good discriminant validity (as shown in Table 5).

Table 5. Results of discriminant validity test in the formal questionnaire.

| | AVE | ATB | SN | PBC | S | SI | BI |
|------------|-------|-------|-------|-------|-------|-------|-------|
| ATB | 0.709 | 0.842 | | | | | |
| SN | 0.697 | 0.422 | 0.834 | | | | |
| PBC | 0.619 | 0.329 | 0.329 | 0.786 | | | |
| S | 0.667 | 0.345 | 0.435 | 0.402 | 0.816 | | |
| SI | 0.651 | 0.296 | 0.361 | 0.285 | 0.447 | 0.806 | |
| BI | 0.687 | 0.433 | 0.445 | 0.502 | 0.540 | 0.505 | 0.828 |

Note: The items on the diagonal, in bold, represent the square roots of the AVE. Off-diagonal elements are the correlation estimates.

4.3.2. Model Fit Test

This study selected several metrics ($ML\chi^2$, DF, χ^2/DF , RMSEA, SRMR, TLI, CFI, NFI, GFI, PGFI, PNFI, and IFI)—based on the studies of Jackson et al. [57], Kline [58], Schumacker [59], and Hu and Bentler [60]—to assess the goodness of fit of the model. The six dimensions were measured according to the study hypotheses and models. As shown in Table 6, most of the standard model fit evaluation pointers conformed to both

the independent level and combination rules of the recommended fit, which demonstrated that the structural model had a good fit and that the theoretical framework assumed by the study was consistent with the actual findings.

Table 6. Evaluation results.

| Indicators | Norm | Results | Judgment |
|-------------|------------------------|---------|----------|
| ML χ^2 | The smaller the better | 438.618 | Yes |
| DF | The larger the better | 284.000 | Yes |
| χ^2/DF | $1 < \chi^2/DF < 5$ | 1.544 | Yes |
| RMSEA | <0.08 | 0.036 | Yes |
| SRMR | <0.08 | 0.035 | Yes |
| TLI (NNFI) | >0.9 | 0.975 | Yes |
| CFI | >0.9 | 0.978 | Yes |
| NFI | >0.9 | 0.941 | No |
| GFI | >0.8 | 0.926 | Yes |
| PGFI | >0.5 | 0.749 | Yes |
| PNFI | >0.5 | 0.823 | Yes |
| IFI | >0.9 | 0.979 | Yes |

Note: ML χ^2 —ML chi-square; DF—degrees of freedom; χ^2/DF —normed chi-square; RMSEA—root mean square error approximation; SRMR—standardized root mean square residual; TLI—Tucker–Lewis index; CFI—comparative fit index; NFI—normative fit index; GFI—goodness of fit index; PGFI—parsimony goodness of fit index; PNFI—parsimony normed fit index; and IFI—incremental fit index.

4.4. Path Analysis

Table 7 shows the results of path analysis. ATB ($b = 0.264$, $p = 0.000$) and PBC ($b = 0.360$, $p = 0.000$) significantly influenced S. SN ($b = 0.230$, $p = 0.000$) and S ($b = 0.402$, $p = 0.000$) significantly influenced SI. ATB ($b = 0.154$, $p = 0.002$), SN ($b = 0.110$, $p = 0.000$), PBC ($b = 0.296$, $p = 0.000$), SI ($b = 0.257$, $p = 0.000$) and S ($b = 0.231$, $p = 0.000$) significantly influenced BI.

Table 7 shows the normalization coefficient of the structural equation model in this study. The higher coefficient implies that the independent variable plays a more important role in the dependent variable. Figure 3 shows the influence between the variables in the structural model.

Table 7. Regression coefficient.

| Dependent Variable | Independent Variable | Unstd. Estimate | S.E. | Unstd. Estimate/S.D. | p-Value | Std. Estimate |
|--------------------|----------------------|-----------------|-------|----------------------|---------|---------------|
| ATB | S | 0.273 | 0.056 | 4.911 | 0.000 | 0.264 |
| PBC | | 0.427 | 0.067 | 6.363 | 0.000 | 0.360 |
| SN | SI | 0.237 | 0.053 | 4.488 | 0.000 | 0.230 |
| S | | 0.396 | 0.052 | 7.577 | 0.000 | 0.402 |
| ATB | BI | 0.164 | 0.053 | 3.069 | 0.002 | 0.154 |
| SN | | 0.119 | 0.054 | 2.215 | 0.027 | 0.110 |
| PBC | | 0.363 | 0.064 | 5.675 | 0.000 | 0.296 |
| SI | | 0.269 | 0.051 | 5.273 | 0.000 | 0.257 |
| S | | 0.239 | 0.055 | 4.357 | 0.000 | 0.231 |

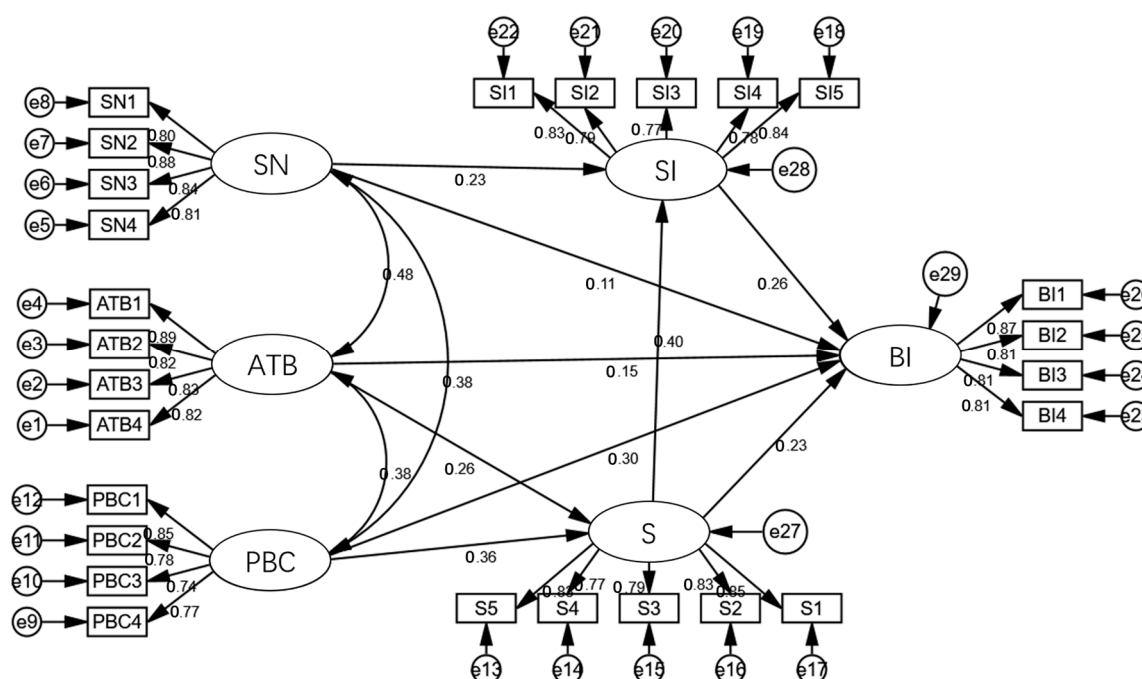


Figure 3. Path estimation diagram of SEM model in the formal questionnaire.

4.5. Mediating Effect

According to the results of the path analysis in Section 4.5, all the direct effects were found to be valid. In order to investigate whether there was a mediating effect in the significant path, AMOS v22.0 software was used to test the mediating effect by the bootstrap method, with 5000 selected operations and a confidence interval criterion of 95%, and the results are presented in Table 8. SN-SI-BI showed a positive, partially mediating effect ($b = 0.059$, $p = 0.001$); ATB-S-BI showed a positive, partially mediating effect ($b = 0.061$, $p = 0.003$); PBC-SI-BI showed a positive, partially mediating effect ($b = 0.083$, $p = 0.002$); S-SI-BI showed a positive, partially mediating effect ($b = 0.103$, $p = 0.000$); PBC-S-SI-BI showed a positive, partially mediating effect ($b = 0.037$, $p = 0.000$); and ATB-S-SI-BI showed a positive, partially mediating effect ($b = 0.027$, $p = 0.001$).

Table 8. Results of mediating effect test in the formal questionnaire.

| Parameter | Estimate | Confidence Interval | | <i>p</i> -Value |
|---------------------------|----------|---------------------|-------|-----------------|
| | | BC | PC | |
| SN-SI-BI (Standardized) | 0.059 | 0.024 | 0.108 | 0.001 |
| ATB-S-BI(Standardized) | 0.061 | 0.016 | 0.124 | 0.003 |
| PBC-S-BI(Standardized) | 0.083 | 0.025 | 0.154 | 0.002 |
| S-SI-BI(Standardized) | 0.103 | 0.052 | 0.170 | 0.000 |
| PBC-S-SI-BI(Standardized) | 0.037 | 0.015 | 0.070 | 0.000 |
| ATB-S-SI-BI(Standardized) | 0.027 | 0.010 | 0.054 | 0.001 |

4.6. Hypothesis Verification

After all the validations, the hypotheses were tested based on the standardized path coefficients of the direct effect path analysis, the mediating effect path coefficients and the p -values, and the results showed that all the direct and mediating hypotheses in this study were valid, and the representative model was explanatory, stable and fit for the default theme.

4.7. Chi-Square Analysis

The topic of this study was consumers' sustainability perceptions of MaaS systems, and the mediating role of identity was discussed. Therefore, it was necessary to consider whether

consumers had carried out relevant behaviors and whether they could tell the differences between the relevant behaviors identified. Therefore, this study conducted chi-square analyses for two dimensions: self-identity and social identity, respectively, according to Item 7. In order to rationalize and streamline the analysis, the 7-point Likert scale (1 point: strongly disagree—7 points: strongly agree) was reduced, as follows: 1 (strongly disagree), 2 (disagree) and 3 (slightly disagree) were reduced to 1 (disagree); 4 (undecided) was reduced to 2 (neutral); and 5 (slightly agree), 6 (agree) and 7 (strongly agree) were reduced to 3 (agree). The results of the chi-square analyses (Table 9) showed no significant differences in whether the consumers had consumed sustainably or not in S3 alone, while all the other items were significantly different.

Table 9. Results of the chi-square analysis for different consumers' perceptions on sustainable identity.

| Item | Opinion | User Experience of MaaS | | Total | χ^2 | p-Value |
|-------|----------|-------------------------|-----------|------------|----------|----------|
| | | Yes | No | | | |
| S1 | Disagree | 49(13.65) | 15(27.78) | 64(15.50) | 7.673 | 0.022 * |
| | Neutral | 63(17.55) | 10(18.52) | 73(17.68) | | |
| | Agree | 247(68.80) | 29(53.70) | 276(66.83) | | |
| S2 | Disagree | 50(13.93) | 11(20.37) | 61(14.77) | 6.629 | 0.036 * |
| | Neutral | 60(16.71) | 15(27.78) | 75(18.16) | | |
| | Agree | 249(69.36) | 28(51.85) | 277(67.07) | | |
| S3 | Disagree | 49(13.65) | 11(20.37) | 60(14.53) | 3.261 | 0.196 |
| | Neutral | 73(20.33) | 14(25.93) | 87(21.07) | | |
| | Agree | 237(66.02) | 29(53.70) | 266(64.41) | | |
| S4 | Disagree | 46(12.81) | 11(20.37) | 57(13.80) | 7.878 | 0.019 * |
| | Neutral | 82(22.84) | 19(35.19) | 101(24.46) | | |
| | Agree | 231(64.35) | 24(44.44) | 255(61.74) | | |
| S5 | Disagree | 52(14.48) | 11(20.37) | 63(15.25) | 6.377 | 0.041 * |
| | Neutral | 54(15.04) | 14(25.93) | 68(16.46) | | |
| | Agree | 253(70.47) | 29(53.70) | 282(68.28) | | |
| SI1 | Disagree | 47(13.09) | 22(40.74) | 69(16.71) | 40.542 | 0.000 ** |
| | Neutral | 47(13.09) | 15(27.78) | 62(15.01) | | |
| | Agree | 265(73.82) | 17(31.48) | 282(68.28) | | |
| SI2 | Disagree | 41(11.42) | 12(22.22) | 53(12.83) | 22.763 | 0.000 ** |
| | Neutral | 72(20.06) | 23(42.59) | 95(23.00) | | |
| | Agree | 246(68.52) | 19(35.19) | 265(64.16) | | |
| SI3 | Disagree | 44(12.26) | 15(27.78) | 59(14.29) | 37.325 | 0.000 ** |
| | Neutral | 53(14.76) | 22(40.74) | 75(18.16) | | |
| | Agree | 262(72.98) | 17(31.48) | 279(67.55) | | |
| SI4 | Disagree | 39(10.86) | 15(27.78) | 54(13.08) | 51.177 | 0.000 ** |
| | Neutral | 53(14.76) | 25(46.30) | 78(18.89) | | |
| | Agree | 267(74.37) | 14(25.93) | 281(68.04) | | |
| SI5 | Disagree | 43(11.98) | 18(33.33) | 61(14.77) | 28.860 | 0.000 ** |
| | Neutral | 55(15.32) | 16(29.63) | 71(17.19) | | |
| | Agree | 261(72.70) | 20(37.04) | 281(68.04) | | |
| Total | | 359 | 54 | 413 | | |

* The level of significance is 0.05. ** The level of significance is 0.00.

5. Discussion

H1 was established, which means that subjective norm, attitude and perceived behavior control positively influenced commuting consumers' behavioral intentions for sustainable consumption in MaaS, which demonstrated that TPB was still applicable in the topic and domain of this study. Among these three factors, perceived behavior control had the highest direct influence on behavioral intention, which showed that consumers believed they could decide whether they needed to use the MaaS service and were aware of the influence of these intrinsic conditions and external resources on them. Attitude ranked second, which demonstrated that consumers' attitudes towards using the MaaS service

were positive, environmentally friendly and forward-looking. The subjective norm came third, implying that consumers' perceptions and attitudes were more important than others' perceptions and attitudes. Nevertheless, family, friends, media, experts, etc., may also play a role in influencing MaaS adoption choices [61,62].

H2 was established, which means that social identity and self-identity positively influenced commuting consumers' behavioral intention for sustainable consumption in MaaS. Social identity and self-identity had a similar influence on behavioral intention, and these two factors ranked second and third, respectively, among the five factors that directly influenced behavioral intention, which indicates that consumption identity is an important part of sustainable consumption. In this study, this finding shows that consumers who identify with MaaS, as well as their use and purchase behaviors, will drive their intentions and promote their related behaviors and practices [63]. Additionally, other studies have shown that self-identity and social identity have an important role to play in influencing green consumption behaviors [64–67].

H3 was established, which means that self-identity had a positive influence on commuting consumers' social identity for sustainable consumption in MaaS, with the highest influence coefficient among all the paths, such as general cognition. Furthermore, consumers will seek approval from others only after they have developed self-identity. This shows that when their sustainable consumption concepts, attitudes or behaviors are accepted, this recognition provides them with encouragement, meaning that there are many people with the same beliefs or ideas, thus, consumers will continue to change in a positive direction. Combined with H2, it is evident that self-identity and social identity are significant to commuting consumers.

H4 was established, which means that subjective norm, attitude and perceived behavior control had a positive influence on commuting consumers' social identity and self-identity for sustainable consumption in MaaS. Consistent with the presupposition of this study, it was suggested that the subjective norm affected consumers' social identity as an external factor (others' opinions). Among these others—such as family, friends, colleagues, media and experts—there are many sustainable green consumers, or at least people who agree with the concept of sustainable consumption; therefore, they will interact with consumers, and recognize and support each other in a positive manner. However, attitudes and perceived behavior control related to the commuting consumers affected their self-identity, meaning that consumers will identify with their own concepts and ideas after forming a sustainable consumption concept, including the process of self-affirmation, which is a result of repeated reflection by consumers. Only when they recognize the concept of sustainable consumption can they engage in sustainable consumption for the sake of the environment and the earth. Additionally, top-down environmental initiatives, such as green consumption campaigns from the APP and a sense of accomplishment in carbon emission reduction visualizations, are likely to help overcome the collective action issues related to environmental issues [68].

H5, H6 and H7 were established, which means that social identity and self-identity served as favorable mediating factors between subjective norm, attitude and perceived behavior control and the behavioral intention of commuting consumers for sustainable consumption in MaaS. Although subjective norm, attitude and perceived behavior control can directly influence behavioral intention (H1), consumer perception and identity were the key links to sustainable consumption and had a positive impact on sustainable consumption intention. Psychologically, consumers identify with their own and others' ideas, attributes and traits, which leads to a convergence of thoughts and behaviors. The firmer this sustainable perception and the resulting attitudes and ideas, the stronger the self-identity. Usually, when consumers are exposed to the concept of sustainability through various channels, they will first identify with their own attitudes, concepts and ideas regarding sustainability, and then seek like-minded people. These people will form groups to identify with each other and influence each other's intentions and behaviors.

In the chi-square analysis, this study divided the sample group into consumers who have used MaaS services and consumers who have not used MaaS services, for cross-comparison. Among them, 359 people had MaaS experience, accounting for 86.9% of the total number, which means that most people have used the MaaS service, proving that the promotion of sustainable concept was effective. There was no distinct difference between the two groups on the third question on self-identity, which means the two groups had similar perceptions regarding whether or not to be green consumers. While the majority of the non-participating consumers classified themselves as sustainable consumers, it was a smaller overall proportion than the participating consumers, which suggests that many of the non-participating consumers may have a broader definition of sustainable consumption. The fourth question, which had a significant difference, shows that consumers with sustainable consumption behavior consider it as proof that they are sustainable consumers, while those without it have a different opinion, which means that consumers without such behavior may be more ambiguous or have their own opinions about the concept of sustainable consumption. According to the responses to the other three questions, this study showed that consumers who had not engaged in sustainable consumption think little of environmental protection and resource conservation, meaning they may only consider the sustainable concept as feasible or practicable, but not as necessary or urgent, and, thus, they do not take actions. There were obvious differences in social identity between the two groups, which means that the consumers who have carried out sustainable consumption have a higher sense of identity and belonging to other consumers and groups, and believe that they can prove their sustainable concept, image and value. Whether it is value identity or role identity, the consumers who have already carried out sustainable consumption have stronger needs and are more eager to achieve their ideal self-worth by being recognized by others.

According to the sample, some consumers had not translated their sustainable attitudes and identity into actual behaviors; therefore, it is crucial to convert such consumers, which is also an important step towards sustainable development in a circular economy. According to the foregoing, consumers with the implicit environmentalist identity of “not believing themselves as an environmentalist, but actually engaging in environmental protection” is inconsistent with the non-participating consumers. Consequently, this study defined non-participating consumers as “having sustainable attitudes and identities, but have not put their beliefs into action”, and, thus, named it “expectant environmental protection identity”. As discussed above, such consumers have the correct concept, know how to conduct the environmental protection behavior and will advocate the concept of sustainability to the people around them. However, due to the conflict between their own interests and the concept or behavior of a sustainable environment, they choose not to engage in sustainable behavior for the time being, which also verifies that perceived behavior control is superior to attitude, regarding sustainable issues.

6. Conclusions and Suggestions

6.1. Conclusions

This study focused on consumers’ perceptions of using MaaS system services in a commuting scenario, and analyzed the association between attitudes, subjective norms, perceived behavioral control, self-identity, social identity and behavioral intention. The results show that all the hypotheses in this study were supported, which means that the model used in this study is applicable to the issue of sustainable MaaS consumption in the commuting scenario. It shows that the model has a certain exploratory power in explaining the relationship between consumers’ sustainable attitude, identity and intention. In addition to providing a reference for consumers, relevant practitioners and the government, the result of this study may also serve as a starting point for innovative activities, including green design, sustainable system design and social innovation design.

The shift towards sustainability will be a social learning process, and continuous exploration, mistakes, conclusions and corrections will help us to determine how to restore

and create a sustainable natural and social environment through more correct consumption and lifestyles. Consumer behaviors must be changed to achieve environmental friendliness and to promote social, economic and environmental sustainability through sustainable consumption. However, the promotion of environmental behaviors is considered by many scholars to be one of the most difficult goals because the impact factors of promoting behavior change are quite complex, which is also the challenge faced by sustainable environmental promoters. As a result, it is necessary to make consumers sustainable through various means. This was also the topic of this study, in which we argued that the servitization of products with circular economy attributes (sustainable product servitization) is one of the solutions. This has also been the subject of a recent study, which argued that sustainable MaaS is one of the systematic innovations in the field of transportation. Whether or not consumers agree that MaaS is sustainable, increasing consumers' use of MaaS systems through different means could indirectly stimulate solutions to traffic congestion, accessibility, air pollution, energy issues and social inclusion.

On the basis of these findings, we make the following recommendations:

1. In developing different routes for the MaaS system—such as tourism, intercity travel, transnational business, etc.—MaaS practitioners and system planners can work with designers and engineers with a sustainable design philosophy to promote sustainable development in multiple directions. Additionally, it will continue to optimize the existing MaaS system and related services, with the aim of converting more ordinary consumers into sustainable consumers.
2. Governments and related groups should increase policy support and subsidies to encourage more talented individuals to engage in MaaS-related industries. It is also possible to offer discounts and services to a greater number of consumers, including commuters, in order to stimulate the market.
3. The education system needs to vigorously promote sustainable education, help more individuals change their behavior and work towards achieving the ultimate goal of environmental protection and sustainability.

In addition, the academic contribution of this study is to confirm that identity is an important component of sustainable consumption cognition, and that these factors are closely related to the attitudes and intentions of commuting consumers. With the continuous development of the MaaS system in China, the relationship between consumer identity, attitude and intention may play a more important role in the whole cognitive system.

6.2. Suggestions and Research Limitations

Some limitations of this study may indicate future research directions, as follows:

1. Although this study simply classified and analyzed the differences of the tested subjects, it did not classify or name them based on certain populations. Therefore, researchers could start from the specific classification of the tested population to study the differences of consumers with different attributes (age, gender, habits and hobbies) to generate more specific results and countermeasures for different populations.
2. In total, 413 valid samples were collected for this study, which was in line with the specification of structural equation modeling but did not consider the differences between different cities regarding the perceptions of local consumers, such as big cities and small cities. Thus, future researchers could consider the differences of consumers in different regions from the perspective of geography, in order to establish different strategies or models for different regions.
3. While all conformations were related in the model of this study, there might be some potential variables or second-order dimensions that were not studied. Future researchers may add new dimensions, including second-order dimensions, to enhance the explanatory power of the model.
4. This study conducted quantitative research using structural equation modeling as the main research analysis method. In the future, qualitative research (expert interviews

and fieldwork) could be added to supplement the deeper meaning that cannot be expressed by quantitative data.

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