

Research Article

Experiencing MaaS (mobility-as-a-service): The role of usefulness, trust, and intention to use in MaaS systems

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Abstract: Mobility-as-a-Service (MaaS) represents an integrated transportation infrastructure system designed to combine multiple transportation modalities, enabling seamless and consistent mobility service delivery. Research documented in academic literature has emphasized the initial adoption phase of MaaS services, while factors determining long-term service utilization have received limited scholarly attention. This study employs an exploratory methodology to examine how Perceived Usefulness (PU) and Perceived Trust and Security (PT) influence users' Continuance Use Behavior (CUB), and the mediating role of Intention to Use (IT) in this relationship. The study included 205 MaaS service users, with data analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings indicate that PU and PT are significant determinants of MaaS service adoption intentions, while IT strongly predicts users' CUB. Both constructs directly influenced users' CUB, demonstrating the presence of partial mediation effects in the model. The model explained 59.4% of the variance in IT and 77.8% of the variance in users' CUB.

Keywords: Mobility-as-a-Service, perceived usefulness, trust and security, user intention, continuance behavior, consumer behavior

MaaS (mobility-as-a-service) deneyimi: MaaS sistemlerinde kullanılabilirlik, güven ve kullanma niyetinin rolü

Özet: Hizmet Olarak Mobilite (Mobility-as-a-Service – MaaS), farklı ulaşım türlerini entegre ederek kesintisiz ve tutarlı bir mobilite hizmeti sunmayı amaçlayan bütünleşik bir ulaşım altyapı sistemi olarak tanımlanmaktadır. Akademik literatürde yer alan çalışmalar, ağırlıklı olarak MaaS hizmetlerinin ilk benimsenme aşamasına odaklanmış; buna karşın hizmetin uzun vadeli kullanımını belirleyen faktörlere yönelik sınırlı sayıda araştırma yapılmıştır. Bu çalışma, Algılanan Fayda (PU) ile Algılanan Güven ve Güvenlik (PT) değişkenlerinin kullanıcıların Sürekli Kullanım Davranışı (CUB) üzerindeki etkisini ve bu ilişkide Kullanım Niyeti'nin (IT) aracılık rolünü incelemek amacıyla keşfedici bir yöntem benimsemektedir. Araştırma kapsamında 205 MaaS kullanıcısından veri toplanmış ve veriler Kısmi En Küçük Kareler Yapısal Eşitlik Modellemesi (PLS-SEM) ile analiz edilmiştir. Bulgular, PU ve PT'nin MaaS hizmetlerini kullanma niyetinin anlamlı belirleyicileri olduğunu, IT'nin ise kullanıcıların CUB'sini güçlü biçimde açıkladığını göstermektedir. Her iki yapı da CUB üzerinde doğrudan etkiye sahip olup modelde kısmi aracılık etkisinin varlığına işaret etmektedir. Model, IT'deki varyansın %59,4'ünü, kullanıcıların CUB'sindeki varyansın ise %77,8'ini açıklamaktadır.

Anahtar Kelimeler: Hizmet olarak hareketlilik, algılanan kullanılabilirlik, güven ve güvenlik, kullanım niyeti, sürekli kullanım davranışı, tüketici davranışı

1. Introduction

Urbanism and the digitalization of transport have created a space for Mobility-as-a-Service (MaaS) to become a paradigmatic innovation in the sharing economy. The main idea behind MaaS is to provide a platform where various transport modes, like public transport, bike-sharing, ride-hailing, etc., are integrated into a single platform through an online interface. The innovation of MaaS is seen as an advancement in on-demand transport over personal vehicle usage, which is expected to improve the efficiency of transport. As a paradigmatic case of platform-based innovation in transport services, MaaS represents the larger dynamics of digitalization, sharing, and access-based service innovation (Ferreira & Fernandes, 2023; Benoit et al., 2017). In the context of Turkey, current scholarship suggests that MaaS is being recognized as an important solution to address transport-related challenges and issues.

Although there exists a study on initial adoption factors of the sharing economy and mobility schemes, tend to focus on utilitarian advantages such as expenses reduction and ease (Fota et al., 2019a; Lang et al., 2020), whereas repeated usage of MaaS services is likely shaped by a multifaceted interplay of cognitive, social, and emotive considerations. Perceived usefulness and perceived trust and security are two such vital constructs that impact users' first time motivation but might also determine long-term actions. Nevertheless, the processes through which such perceptions yield continuance behavior remain underexplored. Further, collaborative consumption literature predominantly adopted dyadic approaches based on user-platform or user-provider interactions, without paying attention to the triadic nature of MaaS ecosystems, consisting of platform governance, peer service providers, and end users (Benoit et al., 2017). This narrow view discourages a holistic view of interplays between trust, value perceptions, and behavioral intention within a platform-mediated setting. Moreover, broader societal outcomes of MaaS remain inconclusive, particularly in emerging markets, where access-based mobility services may in some cases stimulate additional car ownership or increase congestion rather than reduce it (Paundra et al., 2020; Oliveira et al., 2022).

The investigative framework developed in this study's concluding phase comprises four primary dimensional components: perceived usefulness (PU), perceived trust and security (PT), intention to use (IT), and continuance use behavior (CUB). The framework synthesizes Technology Acceptance Theory (Davis, 1989) with information systems persistence doctrine (Bhattacharjee, 2001) and assesses both direct configurative influences of PU and PT on CUB alongside indirect influences channeled through IT. This structural configuration enables simultaneous examination of cognitive mechanisms (perceived usefulness) and trust-based mechanisms (threat reduction) within an integrated framework. A visual representation of the integrated framework is presented in Figure 1. Understanding the factors that determine MaaS long-term viability constitutes a critical requirement for sustainable MaaS infrastructure development. Therefore, identifying the determinants of MaaS utilization can guide long-term organizational efforts aimed at reducing atmospheric pollution, improving vehicular traffic, and advancing urban mobility systems (Cohen & Kietzmann, 2014). Although MaaS is associated with long-term sustainability objectives, this research does not directly examine sustainability outcomes. Instead, it focuses on analytical investigation of user perception systems.

Accordingly, this paper aims to answer the following research question: *How do perceived usefulness and perceived trust and security influence users' continuance use behavior in MaaS services, and what is the mediating role of intention to use?*

2. Literature Review

2.1. Mobility-as-a-Service (MaaS) and Digital Transformation in Transportation

Collaborative consumption (CC) redefines mobility by emphasizing access rights over ownership, providing the theoretical foundation for Mobility-as-a-Service (MaaS) as a platform-managed coordination system designed to enhance the efficiency of existing transportation infrastructure (Ferreira & Fernandes, 2023; Benoit et al., 2017). The MaaS system is based on a triadic structure comprising platform infrastructure, individual service providers, and end-users; this structure aims to improve

incentive alignment, strengthen governance systems, and enhance system-wide coordination processes (Benoit et al., 2017). Previous research has also examined the multifaceted conceptualization of MaaS; for instance, Talih & Tektaş (2022) identified user-centered approaches, multimodal integration, and platform-mediated connectivity as fundamental conceptual elements associated with MaaS. From a practical perspective, existing literature demonstrates that MaaS systems often produce complex and sometimes contradictory outcomes in practice; for example, system expansion may lead to reduced car ownership while simultaneously encouraging investment through user transitions to service provider roles (Paundra et al., 2020). From a socio-technical point of view, MaaS systems are part of a more general institutional framework in which technological development must be reconciled with social and ethical considerations (Singh, A., 2021). For instance, the shift from peer-to-peer (P2P) to 90peer-to-business-to-peer (P2B2P) models, as seen in the case of Uber, has given rise to debates on the governance and sharing of values in the context of platform-mediated MaaS systems (Oliveira et al., 2022). According to Agarwal and Steinmetz (2019), the interfacial dimension of the sharing economy must also be emphasized in the context of MaaS, as the latter is not only a technological innovation but also a socio-economic system. On the other hand, the benefits are also associated with certain definitional ambiguities and difficulties in the governance of MaaS systems. An exemplary case is presented by Guyader (2018) who identifies different types of MaaS users, thereby depicting MaaS as a hybrid model between the market and society. According to Jerónimo (2017), MaaS changes the structure of mobility, and Murillo et al. (2017) argue that its relationship to platform capitalism can create obstacles in the development of MaaS (Singh, S., 2021). Liu et al. (2020) conceptualize the sharing economy as a model characterized by the presence of seven definitional elements, thereby clarifying its boundaries in the context of pseudo-sharing. From a similar understanding, Akbar and Hoffmann (2023) have developed the idea of a ‘collaborative space,’ which considers business models along access/ownership, business/consumer, as well as monetary/non-monetary axes. From this understanding, it is clear how MaaS incorporates both functional utility, as provided through efficiency and convenience, as well as trust-based social exchange, as characterized through safety and transparency, thereby offering a foundation for understanding how perceptions of usefulness and trust are likely mechanisms through which users engage in sustained mobility.

2.2. Perceived Usefulness (PU)

The primary sources of Perceived Usefulness (PU) in shared mobility related to economic and functional benefits, encompassing cost reduction, ease of use, and time efficiency gains. Empirical research has demonstrated that both monetary and functional values possess predictive validity for access-based shared mobility systems (Fota et al., 2019a, 2019b; Shao et al., 2023). Importantly, PU exhibits heterogeneous characteristics, with different user groups assigning varying values to MaaS services. Specifically, consumer-oriented and community-oriented users differ in their value perceptions of MaaS services. Consumer-oriented users derive only functional and monetary benefits from MaaS service use, while community-oriented users obtain relational benefits from participation in shared mobility services (Guyader, 2018). This dual characteristic of PU indicates that MaaS service adoption intentions are influenced by both functional and relational dimensions. PU is associated with user satisfaction regarding MaaS services and long-term utilization patterns. Research demonstrates that perceived values linked to system experiential and operational efficiency dimensions have predictive capacity for both initial adoption intentions and sustained MaaS service utilization (Lang et al., 2020; Arteaga-Sánchez et al., 2018; Minami et al., 2021). These combined research findings confirm that PU is a multidimensional construct encompassing monetary, functional, and experiential dimensions, while relational factors are associated with specific user populations. PU is integrated into the proposed conceptual framework as a predictor of both MaaS service adoption intentions and long-term utilization patterns.

2.3. Perceived Trust and Security (PT)

Trust and security are viewed as key factors affecting user participation on access-based platforms. On digital platforms, users frequently encounter uncertainty regarding services, with payment security, policies, and user reputation serving as essential elements in establishing trust among users (Fota et al.,

2019; Gao et al., 2017). For MaaS platforms, these elements can be instrumental in encouraging users to adopt MaaS services while simultaneously establishing and sustaining a secure and trustworthy user experience. For users on MaaS platforms, reliability is particularly crucial, especially on peer-to-peer sharing platforms, as it influences user social behavior. Security, stability, and user social behavior represent integral components in building trust on MaaS platforms, reducing user concerns and reservations about platform utilization (Guyader, 2018; Cherry & Pidgeon, 2018). For example, empirical evidence demonstrates that users may experience trust erosion due to unreliable factors such as service quality, which can negatively impact their intentions to use MaaS platforms (Jerónimo, 2017; Lang et al., 2020). Furthermore, a robust regulatory framework can be instrumental in establishing security on MaaS platforms, enabling users to maintain continuous service engagement (Dabbous & Tarhini, 2019). The importance of trust in frameworks connecting user perceptions on MaaS platforms to sustained intentions indicates that users can develop habitual usage patterns for MaaS platforms when trust levels are elevated, potentially creating a sustainable usage experience (Arteaga-Sánchez et al., 2018). In this context, reliability and data security are recognized as critical factors affecting users on MaaS platforms, capable of contributing to sustainable usage experiences. Therefore, reliability and data security are identified as significant factors influencing users' intentions to adopt MaaS platforms and their sustained usage intentions.

2.4. Intention to Use (IT)

In shared mobility environments, behavioral intention emerges from the complex interaction of cognitive, emotional, and situational dimensions. Community identity serves as an important mechanism enabling the transition from perceived value and functionality to usage intentions. When users perceive strong congruence between their personal values and those of the shared mobility community, their community identification increases, thereby strengthening their behavioral intentions. Beyond cognitive dimensions, intrinsic motivations such as enjoyment and experiential satisfaction hold significant importance. As noted by Minami et al. (2021), hedonic value, stemming from enjoyment and experiential satisfaction, functions as a complementary force to utilitarian motivations such as cost reduction and operational convenience in intention formation processes. This indicates that both cognitive and affective factors are important in intention formation within MaaS contexts. Additionally, trust and reciprocity are important in strengthening user intention by reducing uncertainty and enhancing governance legitimacy. When users recognize high levels of trust and social values in shared mobility, their intention to participate in shared mobility systems increases. Additionally, users' perception of functionality is a factor that influences users' intention both at the initial stage and during continued participation in shared mobility systems. As noted by Arteaga-Sánchez et al. (2018) and Küper and Edinger-Schons (2020), users' expectations aligned with shared mobility service contexts, which can encompass both utilitarian and hedonic dimensions, enhance users' intention to participate in shared mobility systems. In summary, it is evident that user intention in shared mobility represents a function of multiple interacting factors, which are essential in determining users' continued participation in shared mobility systems. Consequently, user intention in shared mobility has been incorporated into the proposed model as a critical factor linking users' cognitive and emotional evaluations with continued participation in shared mobility systems.

2.5. Continuance Use Behavior (CUB)

Continuance use behavior of shared mobility systems is a further extension of adoption behavior and is subject to the perceptions of value, trust, and satisfaction of users. Continuance use behavior is a stable outcome that is influenced by functional and affective dimensions (Shao et al., 2023). For example, users who experience benefits from MaaS systems with regard to their convenience, cost, and reliability will display continuance use behavior (Lang et al., 2020). Employing theoretical and empirical analytical orientations, continuance use behavior (CUB) function as derivative products of perceived functionality and perceived reliability dimensions. Acknowledging that perceived functionality and perceived reliability operate as foundational predictive factors regarding CUB constitutes an essential recognition. The operational mechanism whereby perceived functionality exerts influence on CUB

functions through reinforcement of cognitive assessment procedures concerning system operational capacity and efficiency dimensional characteristics.

Perceived reliability and perceived protection dimensions maintain significance regarding CUB through their facilitation of uncertainty attenuation and their strengthening of user confidence dimensions regarding system dependability characteristics (Jerónimo, 2017; Arteaga-Sánchez et al., 2018). This highlights the interplay between functional and emotional factors in shaping continuance use behavior. In addition to perceived usefulness and perceived trust, users' satisfaction and social identification with the mobility community can also enhance continuance use behavior. For example, users with high levels of social identification and satisfaction display continuance use behavior and are also likely to display a high level of habituation and advocacy (Möhlmann, 2015; Shao et al., 2023). In summary, continuance use behavior of MaaS systems is a highly complex construct driven by utility and trust-related factors and users' attachment to the system. It is the ultimate dependent variable of the research model. In this study, Continuance Use Behavior (CUB) is conceptualized not only as repeated use, but also as habitual usage and advocacy behavior, such as recommending the service to others.

2.6. Identified Research Gap

Collaborative Consumption (CC) is an emerging field that has been gaining significant scholarly attention, although its foundations have been fragmented, making it difficult to integrate theory and compare studies across various contexts (Ferreira & Fernandes, 2023). There is also an emerging trend in the Mobility-as-a-Service (MaaS) domain, where most of the previous research focused on the initial adoption of the service. There is little research on perceptions following initial adoption and how they affect continuance behavior. To contribute to the body of knowledge in this domain, this study aims to integrate technology acceptance and belief-based approaches in analyzing continuance behavior following initial adoption. Although the collaborative consumption model has been extensively developed as theory (Benoit et al., 2017), its application as empirical research has failed to sufficiently capture its triadic nature, including platforms, service providers, and consumers. The existing research has mostly followed a dyadic approach, focusing on either consumer-platform or consumer-provider relationships, while downplaying the role of platform governance and peer service providers. Likewise, a similar research gap has been observed within the MaaS research domain pertaining to the impact of shared mobility services on consumer trust, which has remained largely ignored by researchers. However, it has been found that the results pertaining to shared mobility services might be context-dependent rather than being absolute, as observed within more recent research studies. For instance, changes in travel behavior pertaining to ride-sharing services have been found to be contingent upon market conditions and perceptions (Paundra et al., 2020). Similarly, results pertaining to the overall adoption of access-based services have also been found to be context-dependent (Oliveira et al., 2022). Recent research further suggests that the institutional logic embedded in system design can substantially influence consumer perception and intention formation in sharing systems, highlighting the importance of governance and structural configurations in shaping user engagement (Clemens et al., 2022).

Moreover, it is recognized that motivation is a factor that plays an important role in the adoption and usage of sharing-based services, although the nature of this motivation is not yet fully clear. For example, in their research on this issue, Choi and Kim (2021) argued that “self-norms” and “attitude” are critical determinants of users' behavior, while other determinants such as “technology readiness” might only play a small role, perhaps due to the greater convenience that technology use offers to users. However, it is clear that further research is needed to determine which perceptions are the most effective in stimulating the adoption and usage of Mobility-as-a-Service (MaaS). Thus, although the literature offers some valuable insights on this issue, it does not yet offer a complete understanding of how cognitive perceptions interact to support the usage of MaaS services. Thus, this research aims to make a contribution to this understanding by examining the role of perceived usefulness, trust, and behavioral intention in stimulating the usage of MaaS services.

Table 1. Summary of Identified Research Gaps and Study Contributions

Research area	Identified gap in literature	Representative references	Contribution of this study
1. Continuance behavior in MaaS	Most studies focus on adoption; continuance behavior is largely overlooked	Fota et al., 2019a; Shao et al., 2023	Investigates continuance use behavior through perceived usefulness, trust, and behavioral intention
2. Role of usefulness and trust	Mediating role of intention between perceptions and behavior is insufficiently explored	Dabbous & Tarhini, 2019; Möhlmann, 2015	Tests the mediating role of intention between usefulness/trust and continuance behavior
3. Triadic platform structure in sharing economy	Most research adopts dyadic view; platform governance is rarely addressed	Benoit et al., 2017	Considers platform-mediated trust and coordination in a MaaS-specific triadic structure
4. Contextual variability of MaaS effects	Empirical findings vary across contexts, yet user perceptions under such conditions remain underexplored	Paundra et al., 2020; Oliveira et al., 2022	Examines how contextual conditions relate to users' perceptions shaping continuance use
5. Diversity in user motivations	Self-norms and attitudes studied; less emphasis on declining role of tech readiness	Choi & Kim, 2021	Explores user perceptions and their behavioral effects through intention in MaaS systems

Source: Table created by the author.

As summarized in Table 1, this study responds to these research gaps by integrating perceived usefulness, perceived trust and security, and intention to use within a model of continuance use behavior in MaaS systems. The proposed framework posits both direct effects of perceived usefulness (PU) and perceived trust and security (PT) on continuance use behavior (CUB), as well as indirect effects mediated by intention to use (IT).

3. Hypotheses Development

3.1. Perceived Usefulness and Intention to Use

The strongest behavioral influencer is perceived usefulness (PU), which is characterized as “the degree to which a user believes that making use of access-based sharing services can improve his or her performance in terms of efficiency, comfort, and costs.” Needless to say, this notion is at the very center of the entire discussion and model. As such, the literature reveals that accessibility and convenience are two driving influencer factors which impact users' intentions to make use of the mobility solutions provided by the access-based sharing services (Fota et al., 2019a, 2019b; Shao et al., 2023). However, it is important to note that perceived usefulness is not an objective measure only but includes an emotional component as well. The literature reveals that both instrumental and hedonic benefits derived from making use of platform-based services positively relate to users' intentions to make use of such services (Lang et al., 2020; Fota et al., 2019b; Minami et al., 2021). Thus, it is noted that perceived usefulness is a multiple-dimensional influencer component. This means that the design that values sustainability creates the much-required connection between what the users value and what the platform values. This argument is reinforced across multiple cultural groups. For example, in Turkish culture, Ecevit (2023) discovered that users' expectations of performance drive their intention towards adopting new transport technologies. In summary, perceived usefulness is mainly a multidimensional driver of users towards the mobility platform. Drawing from the conclusions of prior research, the following hypothesis is proposed:

H1. Perceived usefulness has a positive effect on users' intention to use MaaS.

3.2. Perceived Trust and Security and Intention to Use

A critical psychological dimension influencing users' adoption intentions regarding Mobility-as-a-Service (MaaS) platforms centers on confidence and safety perceptions. In this framework, confidence and safety considerations serve as foundational elements of the research model. Within the digital mobility ecosystem, user confidence levels are determined by infrastructure stability, operational transparency, and data protection measures (Gao et al., 2017). When assurances regarding personal information safeguarding, financial transaction security, and service quality standards are established, user confidence increases correspondingly, thereby positively shaping their propensity to utilize such services (Benoit et al., 2017; Fota et al., 2019a). Confidence functions as a pivotal element particularly in consumption models where multiple parties share resources and services; in such contexts, mutual accountability and safety perceptions directly influence user behavioral choices (Guyader, 2018; Cherry & Pidgeon, 2018). Research findings demonstrate that confidence constitutes a determining factor in the proliferation of access-based service models; accordingly, platform operational quality and social credibility are viewed as integral components of MaaS solution adoption (Lang et al., 2020). Conversely, user concerns regarding potential threats and technological vulnerabilities negatively influence their decisions to embrace such services (Avcı et al., 2022; Oliveira et al., 2022). Fundamentally, confidence and safety dimensions function to minimize user uncertainties and strengthen user perceptions of platform governance, thereby shaping adoption intentions toward Mobility-as-a-Service models. Consequently, MaaS service providers must offer multiple protection levels, transparency mechanisms, and credibility indicators to enhance user adoption intentions. Research evidence validates that confidence and safety perceptions constitute central components of MaaS adoption. Accordingly, the following hypothesis can be advanced:

H2. Perceived Trust and Security has a positive effect on users' intention to use MaaS.

3.3. Intention to Use and Continuance Use Behavior

In shared mobility, behavioral intention connects user evaluation to long-term service usage. Shao et al. (2023) found that both perceived value and social suitability positively influence user engagement and behavioral usage. Lang et al. (2020) found that confidence and satisfaction can account for a significant portion of long-term usage. Gao et al. (2017) found that when service functionality matches user expectation, behavioral intention is more likely to be translated into observable behavior. When service delivery matches service characteristics, both behavioral intention and behavior remain strong (Küper & Edinger-Schons, 2020). Satisfaction and perceived reliability can also indirectly influence long-term behavioral intention and behavior. Möhlmann (2015) found that satisfaction derived from service functionality and reliability is a prerequisite to behavioral intention turning into observable behavior. Strong behavioral intention is a major driver for long-term MaaS usage. Grounded in the preceding evidence, the subsequent hypothesis is formulated:

H3. Intention to use has a positive effect on users' continuance use behavior of MaaS.

3.4. Perceived Usefulness and Continuance Use Behavior

While perceived usefulness is conventionally positioned as a foundational antecedent of service adoption intentions, this dimension may simultaneously generate direct effects on extended-term usage patterns. When individuals recognize that Mobility-as-a-Service (MaaS) frameworks deliver functional advantages and augment their experiences regarding personal convenience, operational productivity, and transportation management, their propensity for maintaining service engagement beyond the initial adoption phase strengthens substantially (Arteaga-Sánchez et al., 2018; Lang et al., 2020). Investigations conducted within technology and transportation sectors demonstrate that perceived usefulness transcends its role in elevating user satisfaction, simultaneously reinforcing the durability of behavioral persistence (Möhlmann, 2015; Shao et al., 2023). Employing an expectation-confirmation theoretical lens, it becomes defensible to argue that individuals encountering functional advantages through repeated interactions will exhibit elevated inclinations toward sustained MaaS engagement, as they

substantiate their foundational expectations through recognition of service value (Bhattacharjee, 2001; Minami et al., 2021). Consequently, perceived usefulness may generate direct effects on extended-term usage patterns through its influence on user satisfaction dimensions and the interconnections between sustained participation and behavioral intention. Synthesizing the reviewed scholarly sources, the subsequent hypothesis is advanced:

H4. Perceived usefulness has a positive effect on continuance use behavior.

3.5. Perceived Trust and Security and Continuance Use Behavior

Credibility and safety perceptions constitute foundational structural dimensions influencing prolonged user participation with access-based service frameworks. Although these dimensions occupy paramount significance during service initiation phases, they are recognized as determinative factors in extended-duration participation inclinations through uninterrupted assessments of service stability and structural integrity (Cherry & Pidgeon, 2018; Gao et al., 2017). Credibility dimensions can attenuate perceived threat variables and facilitate transaction execution processes; consequently, they reinforce extended-duration participation (Jerónimo, 2017; Dabbous & Tarhini, 2019). Within access-based shared transportation service domains, user credibility assessments regarding transaction safety and service relationship security demonstrate correlations with prolonged behavioral patterns (Avcı et al., 2022; Wang et al., 2022). Consequently, credibility and safety perceptions can be conceptualized as direct antecedent factors of prolonged user behavior through their indirect influences on user psychological security sensations and platform reputation dimensions. In essence, scholarly sources substantiate that the subsequent hypothesis can be formulated:

H5. Perceived trust and security have a positive effect on continuance use behavior.

3.6. Mediation Effects of Intention to Use

In shared transport settings, what people intend to do acts as a bridge between how they think and feel and how long they actually keep using the service. The basic pillars of usefulness, trust, and security shape this longer-term usage, guiding behavior directly through the path of intention. Research supports such a setup. Dabbous and Tarhini (2019) demonstrate that attitudes and reliability mediate perceived benefits and sustainable consumption, hence intention being the key link in translating mental assessments into actual behavior. Similarly, Arteaga-Sánchez et al. (2018) and Möhlmann (2015) confirm that usefulness and trust affect extended use indirectly through influencing satisfaction and the forming of intentions. Wang et al. (2022) add that perceived advantages and reliability guide long-term use through aligning user preferences with system features again via their impact on intentions. Put together, these studies confirm that usefulness and reliability achieve their influence on usage patterns through an impact on intention as the mechanism translating mental and emotional evaluations into actual behavior. Proceeding from this conceptual framework, the subsequent hypotheses are formulated:

H6. Intention to use mediates the relationship between perceived usefulness and continuance use behavior.

H7. Intention to use mediates the relationship between perceived trust and security and continuance use behavior.

Within the structural framework demonstrated in Figure 1, perceived usefulness (PU) and perceived trust and security (PT) undergo designation as independent dimensional factors, intention to use (IT) undergoes positioning as an intermediary dimensional factor, and continuance use behavior (CUB) undergoes assignment as the terminal dependent dimensional factor. Explicitly, perceived usefulness (PU) and perceived trust and security (PT) undergo hypothesization as influencing user populations' intention to use (IT), which subsequently activates continuance use behavior (CUB). Furthermore, PU and PT undergo anticipation as generating both direct configurative influences and indirect configurative influences on CUB through the intermediary operational function of IT.

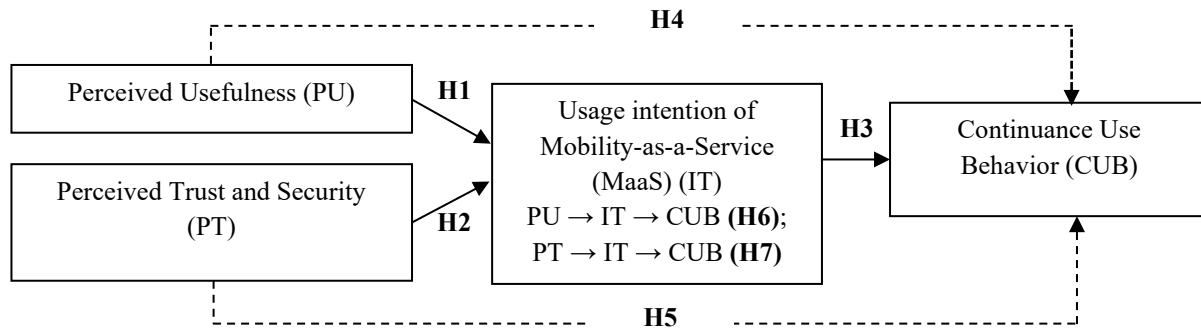


Figure 1. Proposed Research Model.

Source: Figure created by the author.

4. Materials and methods

Grounded in a structural equation model that integrates the Technology Acceptance Model (Davis, 1989) with the Expectation–Confirmation Theory (Bhattacharjee, 2001), this study enables a simultaneous assessment of how user perceptions (PU and PT) influence both intention and continuance behavior.

Sampling and Data Collection

The investigative design framework maintains an exploratory dimensional character, pursuing the objective of delineating and comprehending the reciprocal interconnections among perceived usefulness, perceived trust and security, intention to use, and continuance use behavior operating within MaaS infrastructural contexts. Data were gathered using a web-based questionnaire spread on Prolific Academic, a commercial research site of wide usage among behavioral and social science researchers (Palan & Schitter, 2018). For relevance, the respondents were filtered such that those with experience using at least a shared or multimodal transport service (e.g., ride-hailing, public transport apps, bike- or scooter-sharing, or car-sharing) were considered at least once in the past six months. Therefore, the sample size employed in this study is considered sufficient for the applied analytical approach. The sample size underwent calculation employing G*Power 3.1 (multiple linear regression; $\alpha = .05$, $1-\beta = .80$, $f^2 = .15$, number of predictors = 2), and it was established that a minimum of 68 participants would suffice for model testing (Faul et al., 2009). This demonstrates that the sample size obtained in the investigation adequately supports model testing procedures. Following removal of inadequate or substandard responses (for instance, duplicate submissions, unusually brief completion durations), the final sample comprises $N = 205$. The sample encompassed participants exhibiting diverse demographic profiles. The preponderance of respondents identified as male (58.5%), followed by female participants (40.5%), while a small proportion identified as other (1.0%). In terms of age, participants were primarily between 25–34 years (26.8%), 35–44 years (23.4%), and 45–55 years (24.9%), with smaller proportions aged 18–24 (6.3%) and 55 years or older (18.5%). Regarding education, most respondents held an undergraduate degree (33.7%), followed by A-levels or equivalent education (27.3%), vocational or technical qualifications (21.5%), and postgraduate degrees (15.6%). With respect to monthly household income, the largest group reported an income between £3,000 and £4,499 (37.1%), followed by £1,500–£2,999 (22.4%) and £4,500–£5,999 (21.0%).

Contextual Framework

Instead of employing a detailed experimental scenario or vignette, the survey began with a brief contextual introduction designed to familiarize respondents with the concept of Mobility-as-a-Service (MaaS). This text described MaaS as an integrated digital platform combining multiple transport modes (e.g., public transport, ride-hailing, and micromobility services) within a single application. Respondents were then asked to answer all questionnaire items by considering their own city and their personal experience with similar mobility services.

Measurement

The survey instrument comprised three distinct sections. The initial section incorporated a concise contextual introduction designed to acquaint respondents with the Mobility-as-a-Service (MaaS) concept. The subsequent section encompassed measurement items derived from well-validated scales in preceding investigations, adapted to the MaaS context. The primary constructs assessed included Perceived Usefulness (PU) (Davis, 1989), Perceived Trust and Security (PT) (Gefen et al., 2003), Intention to Use (IT) (Venkatesh & Davis, 2000), and Continuance Use Behavior (CUB) (Bhattacharjee, 2001). To establish semantic equivalence, Turkish translations underwent review by two bilingual researchers possessing expertise in technology acceptance and transportation research domains, and a circumscribed back-translation verification was executed on designated items. Minor linguistic refinements were implemented where appropriate to enhance clarity and contextual applicability. Each construct underwent operationalization utilizing three or four items assessed on a five-point Likert scale extending from 1 (strongly disagree) to 5 (strongly agree): PU was assessed using four items, PT using four items, IT using three items, and CUB using three items as documented in Table 2.

Table 2. Measurement Items

Construct and source	Item code	Measurement item (English)
Perceived Usefulness (PU) Davis (1989)	PU1	Using a MaaS application helps me save time by integrating different transport modes into a single platform.
	PU2	Using a MaaS application helps reduce my travel costs.
	PU3	MaaS makes my journeys more efficient by finding the best route and comparing alternatives.
	PU4	MaaS facilitates my trip planning by integrating public transport, taxis, and bikes.
Perceived Trust & Security (PT) Kim et al. (2008)	PT1	The MaaS application protects the privacy and security of my personal data.
	PT2	I believe that payments made through this platform are completely secure.
	PT3	The MaaS application reliably integrates different service providers.
	PT4	Overall, I trust the MaaS platform.
Intention to Use (IT) Ajzen (1991)	IT1	I intend to use a MaaS application for my future trips.
	IT2	If a MaaS application were available, I would plan to use it regularly.
	IT3	When I need transportation, I would prioritize using a MaaS application.
Continuance Use Behavior (CUB) Shao et al. (2023)	CUB1	If a MaaS application were available, I would continue to use this service.
	CUB2	I would recommend the MaaS application to my friends and family.
	CUB3	MaaS would become an indispensable transportation service for me.

Note: Measurement items were adapted from Davis (1989), Kim et al. (2008), Ajzen (1991), and Shao et al. (2023) to fit the MaaS context.

The concluding section of the questionnaire encompassed demographic inquiries including gender, age category, educational attainment, and monthly household income. These variables were incorporated to facilitate contextual interpretation of findings while ensuring consistency with preceding MaaS adoption investigations (Becker et al., 2017; Kamargianni et al., 2016).

Common Method Bias Control

To mitigate potential common method variance (CMV) that could influence findings, multiple procedural safeguards were implemented consistent with recommendations by Podsakoff et al. (2003). These safeguards encompassed ensuring respondent anonymity, randomizing item sequencing, and maintaining separation between predictor and criterion measurement instruments. Additionally, Harman's single-factor test was administered. In this analytical procedure, all items from measurement instruments underwent inclusion in exploratory factor analysis. Analytical results demonstrated that the initially extracted factor accounted for 58.81% of total variance. While this percentage marginally exceeds the frequently cited 50% threshold in academic literature (Podsakoff et al., 2003), contemporary

methodological investigations have established that this threshold demonstrates arbitrary characteristics and that 58% represents an acceptable figure (Fuller et al., 2016; Andersen et al., 2025). Regardless, Harman's test is recognized as an inadequate and oversimplified methodology for addressing common method variance. Consequently, common method variance appears unlikely to constitute a substantial concern.

Ethical Considerations

The research was approved by the Gaziantep University Scientific Research and Publication Ethics Committee for Social and Human Sciences (Approval No: 13, Date: 02.10.2025). All procedures were conducted in accordance with the institutional ethical standards for research involving human participants. Informed consent was obtained electronically before the research, and the participants were rewarded fairly according to Prolific's wage policies, which have been proven to encourage quality in online experiments (Peer et al., 2017).

5. Findings and Results

Measurement Model

To ensure measurement model reliability and validity, construct reliability, convergent validity, and discriminant validity were evaluated according to guidelines established by Hair et al. (2019). Composite Reliability (CR) indices for all constructs exceeded the recommended threshold of 0.70, confirming internal consistency. Average Variance Extracted (AVE) values surpassed 0.50, establishing convergent validity. The Fornell-Larcker criterion, combined with HTMT ratios, demonstrated adequate discriminant validity, confirming that constructs maintain distinctiveness from one another. The measurement model underwent evaluation utilizing a partial least squares structural equation modeling (PLS-SEM) methodology. To evaluate the statistical significance of indicator loadings, a bootstrapping procedure employing 5,000 resamples was executed. Indicator reliability was validated when outer loadings demonstrated statistical significance, as evidenced by t-values exceeding 1.96 and p-values below 0.05. This analytical procedure adheres to established protocols for PLS-SEM analysis (Hair et al., 2019).

Construct Reliability and Convergent Validity

Construct reliability and convergent validity underwent assessment utilizing Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). As documented in Table 3, all constructs demonstrated robust internal consistency, with Cronbach's alpha values ranging from 0.863 (Perceived Trust – PT) to 0.932 (Intention to Use – IT). Similarly, composite reliability values surpassed the recommended 0.70 threshold across all constructs, ranging between 0.907 and 0.957. AVE values similarly exceeded the recommended 0.50 threshold, demonstrating adequate convergent validity.

Table 3. Reliability and Validity Statistics of the Measurement Model

Construct	Cronbach's Alpha	Composite Reliability (rho_a)	Composite reliability (rho_c)	AVE
CUB	0.891	0.897	0.932	0.821
IT	0.932	0.932	0.957	0.880
PT	0.863	0.873	0.907	0.709
PU	0.873	0.882	0.914	0.726

Discriminant Validity

Two methodological approaches were employed for assessing discriminant validity: the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio of correlations. Adhering to the methodology proposed by Fornell and Larcker (1981), discriminant validity receives support when the square root of

the Average Variance Extracted (AVE) for each construct exceeds the correlation coefficients between construct pairs. As demonstrated in Table 4, the diagonal elements represent the square roots of Average Variance Extracted for each construct and exceed correlations with other constructs, thereby substantiating discriminant validity according to criteria established by investigations emphasizing consumer and technology-related domains (Hair et al., 2017; Sarstedt et al., 2020).

Table 4. Discriminant Validity Results (Fornell-Larcker Criterion)

	CUB	IT	PT	PU
CUB	0.906			
IT	0.882	0.938		
PT	0.711	0.682	0.842	
PU	0.663	0.658	0.515	0.852

To conduct more rigorous discriminant validity assessment, the Heterotrait-Monotrait (HTMT) ratio methodology proposed by Henseler et al. (2015) was implemented. HTMT ratios of 0.85 and below indicate strict discriminant validity, whereas HTMT ratios of 0.90 and below indicate acceptable discriminant validity for conceptually related constructs (Voorhees et al., 2016; Henseler et al., 2015). However, the preponderance of HTMT ratios presented in Table 5 fall below both thresholds.

Table 5. Discriminant Validity Results (HTMT)

	CUB	IT	PT
IT	0.963		
PT	0.803	0.755	
PU	0.746	0.725	0.591

The HTMT ratio between Intention to Use and Continuance Use Behavior constructs represents an exception; the HTMT value is reported as 0.963, exceeding the 0.85 threshold. Research has established that elevated HTMT ratios between conceptually related constructs frequently manifest in exploratory investigations (Sarstedt et al., 2020; Nitzl et al., 2016). It may be anticipated that high HTMT ratios between concept-related constructs will emerge in exploratory studies where the constructs are indicative of successive elements of a model, as is the case with the present study. However, the evaluation of discriminant validity in contemporary studies in consumer and information systems research relies on the combination of several diagnostics rather than on individual measures (Hair et al., 2022; Henseler et al., 2015; Cheung et al., 2024). Recent methodological reviews emphasize the importance of combining several diagnostics in evaluating discriminant validity in exploratory studies with concept-related constructs (Cheung et al., 2024; Pereira, 2024). Thus, although one HTMT value exceeds the conservative cutoff, the convergence of evidence from the Fornell–Larcker criterion, the theoretical distinction between behavioral intention and post-adoption continuance, and the exploratory nature of the study suggests that the constructs can reasonably be treated as conceptually distinct for the purposes of this analysis.

Model Fit

As presented in Table 6, the Standardized Root Mean Square Residual (SRMR) for the saturated (0.060) and estimated (0.069) models fell below the 0.08 threshold, indicating adequate model fit (Henseler et al., 2016). Additionally, Normed Fit Index (NFI) values were 0.870 and 0.861 for the saturated and estimated models, respectively, exceeding the 0.80 threshold.

Table 6. Model Fit Indices for the Structural Model

Fit Measure	Saturated Model	Estimated Model
SRMR	0.060	0.069
d_ULS	0.376	0.494
d_G	0.256	0.286
Chi-square	311.019	332.088
NFI	0.870	0.861

Model Explanation

As documented in Table 7, the model accounts for 77.8% of variance in Continuance Use Behavior (CUB) and 59.4% in Intention to Use (IT), with adjusted R² values of 0.777 and 0.590 respectively, demonstrating substantial explanatory capacity regarding user intention and sustained behavior within MaaS systems.

Table 7. Coefficient of Determination Results

Construct	R ²	Adjusted R ²
CUB	0.778	0.777
IT	0.594	0.590

Hypothesis Testing

The significance of structural pathways and indirect (mediation) effects underwent examination through a bootstrapping procedure employing 5,000 resamples, utilizing SmartPLS 4.0 software. The predictive accuracy of the structural model underwent evaluation based on the coefficient of determination (R²), with results documented in Tables 8 and 9.

Direct Effects

Table 8 presents the findings of direct effects analysis. All hypothesized structural pathways demonstrated statistical significance, with four relationships significant at the 0.001 level and one relationship between perceived usefulness and continuance use behavior significant at the 0.05 level.

Table 8. Direct Effects Results

Hypothesis	Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
H1	PU -> IT	0.417	0.416	0.062	6.766	0.000
H2	PT -> IT	0.468	0.470	0.062	7.554	0.000
H3	IT -> CUB	0.670	0.669	0.052	12.819	0.000
H4	PU -> CUB	0.125	0.127	0.052	2.393	0.017
H5	PT -> CUB	0.190	0.187	0.045	4.245	0.000

Perceived usefulness ($\beta = 0.417$, $p < 0.001$) and perceived trust and security ($\beta = 0.468$, $p < 0.001$) both have significant positive effects on intention to use. Intention to use strongly predicts continuance use behavior ($\beta = 0.670$, $p < 0.001$). In addition, perceived usefulness ($\beta = 0.125$, $p = 0.017$) and perceived trust and security ($\beta = 0.190$, $p < 0.001$) directly and positively affect continuance use behavior. These results confirm hypotheses H1–H5.

Mediating Effects

Mediation analysis was conducted to investigate the indirect effects of perceived trust and security and perceived usefulness on continuance use behavior through intention to use, representing users' behavioral intentions. Results demonstrate that intention to use partially mediates the relationships between both antecedent variables and continuance use behavior. The indirect effect of perceived trust and security on continuance use behavior through intention to use demonstrated statistical significance ($\beta = 0.313$, $p < 0.001$). Similarly, the indirect effect of perceived usefulness on continuance use behavior through intention to use proved significant ($\beta = 0.279$, $p < 0.001$). These findings provide empirical substantiation for hypotheses H6 and H7, indicating that intention to use functions as a critical psychological mechanism through which user perceptions of usefulness and trust/security influence continuance use behavior in MaaS platform contexts. Table 9 documents the results of indirect effects of user perceptions on continuance use behavior through intention to use.

Table 9. Indirect Effects (Mediation Analysis)

Hypothesis		Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
H6	PU -> IT -> CUB	0.279	0.278	0.045	6.264	0.000
H7	PT -> IT -> CUB	0.313	0.315	0.053	5.909	0.000

Table 9 shows the results of the mediation analysis in investigating the indirect effect of perceived usefulness and perceived trust and security on continuance behavior through intention to use. According to the bootstrapping result, both indirect effects of perceived usefulness and perceived trust and security on continuance behavior through intention to use are positive and statistically significant ($p < 0.001$). Perceived usefulness indirectly affects continuance behavior through intention to use ($\beta = 0.279$, $t = 6.264$). Similarly, perceived trust and security indirectly affects continuance behavior through intention to use ($\beta = 0.313$, $t = 5.909$). This supports the mediating effect of intention to use on continuance behavior by implying that users' cognitive evaluation of technology in terms of perceived usefulness and perceived trust and security increases the likelihood of continuance behavior in technology adoption and continuance models (Bhattacharjee, 2001; Venkatesh et al., 2003; Hair et al., 2017).

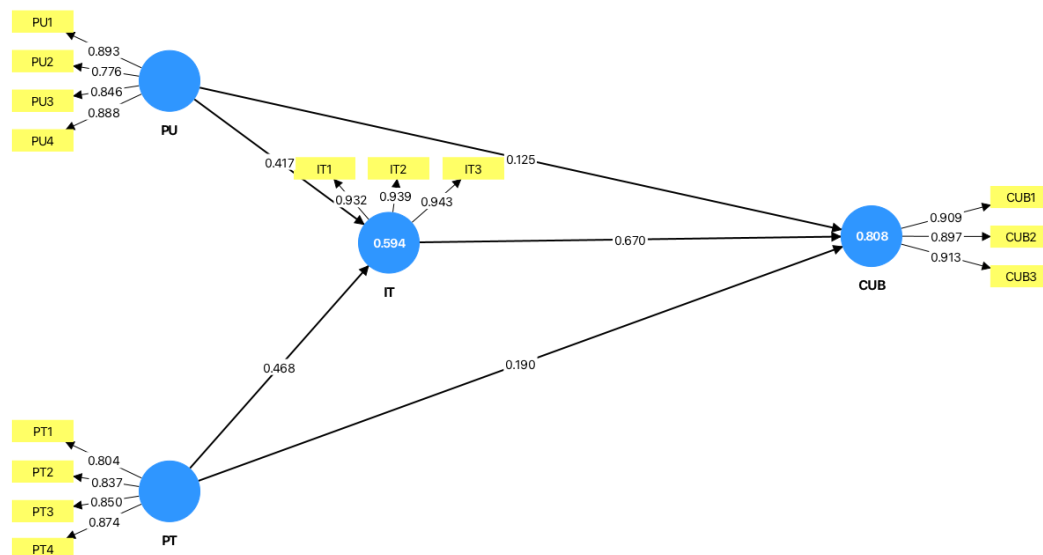


Figure 2. Structural Equation Model Results.

Note: Values on the arrows represent standardized path coefficients; R^2 values are shown within the endogenous constructs.

The structural model is illustrated in Figure 2. The figure depicts the standardized path coefficients between constructs, highlighting the mediating role of intention to use between perceived usefulness, perceived trust and security, and continuance use behavior. The model explains 59.4% of the variance in intention to use and 77.8% of the variance in continuance use behavior, indicating strong explanatory power consistent with recommended thresholds for behavioral research (Hair et al., 2022).

6. Discussion

The objective of this investigation is to analyze the roles of PU and PT in shaping IT and CUB within MaaS contexts. The results of the research provide evidence for the suggested conceptual framework and show how user cognitive and trusting evaluations jointly influence user engagement with MaaS. PU is defined as the importance of user assessment of MaaS platforms. It is important to improve efficiency, usability, and ease of use in order to promote user attitudes toward digital platforms for mobility and payments (Park et al., 2019), as suggested in previous research that focused on utilitarian aspects of user engagement with digital platforms, such as time and cost efficiency (Fota et al., 2019a; Lang et al., 2020; Shao et al., 2023). PT is also identified as an important factor in influencing user engagement with MaaS. If users rate aspects of privacy, reliability, and security as sufficient, they will have greater trust in the system (Gao et al., 2017; Avcı et al., 2022; Cherry & Pidgeon, 2018). The findings further indicate that intention to use functions as a mediating variable in the relationship between these cognitive and trust-based determinants and continuance use behavior. Perceived usefulness and perceived trust and security exert both direct and indirect influences on continuance use behavior, thereby producing partial mediation rather than complete mediation effects. This aligns with theoretical perspectives emphasizing the moderating influence of cognitive (perceived usefulness) and affective (perceived trust) determinants on behavioral outcomes (Dabbous & Tarhini, 2019; Wang et al., 2022). Consequently, it can be contended that enhancing perceived benefits associated with MaaS utilization regarding its functional attributes and trust and security mechanisms would likely strengthen users' intention to use and continuance use behavior.

Theoretical Implications

From a theoretical standpoint, the findings further support the argument that perceived usefulness (PU) and perceived trust and security (PT and IT) are important antecedents of behavioral intention and continuance usage behavior (CUB) in the context of Mobility-as-a-Service (MaaS). The high and significant correlations between PU, PT, IT, and CUB provide further support for the validity of the proposed conceptual model, consistent with previous research (Fota et al., 2019a, 2019b; Lang et al., 2020; Shao et al., 2023). The current research contributes to theory development by concurrently emphasizing both rational (utility-based) and affective (trust-based) factors as predictors of intention to use MaaS services, as supported in previous research reported in Guyader (2018), Cherry & Pidgeon (2018), and Minami et al. (2021). The mediating effect of intention to use introduces a further dimension to theory development, as a mediator between users' cognition (PU and PT) and outcome (CUB), consistent with the conceptual arguments presented in Arteaga-Sánchez et al. (2018), Dabbous & Tarhini (2019), and Wang et al. (2022). Moreover, the high explanatory power of the model ($R^2 = 0.778$ for CUB, and $R^2 = 0.594$ for IT) suggests that the proposed model is effective in capturing the main psychological and functional determinants of technology-based participation in mobility.

Practical Implications

From a managerial standpoint, this investigation demonstrates that establishing confidence, protecting data integrity, and enhancing operational quality represent essential factors for sustaining user engagement within the Mobility-as-a-Service (MaaS) domain. Consistent with antecedent investigations (Gao et al., 2017; Avcı et al., 2022; Pan et al., 2024), Maintaining platform reliability, transparency, and effective risk management is critical in enhancing perceived trust and perceived usefulness. Therefore, it is important for MaaS to prioritize reliable service, data security, and transparent information in order to foster trust.

Recommendations for policy makers

The results emphasize the importance of regulatory mechanisms and governance structures in sustaining user satisfaction and behavioral continuity in mobility services. Evidence from metropolitan transport systems (Engin, 2022) and intelligent transport research suggests that well-defined regulatory frameworks, supported by user protection policies, significantly contribute to user confidence and long-term behavioral stability. Policymakers should therefore consider institutional frameworks promoting fairness, reliability, and data protection as integral, rather than auxiliary, components of MaaS implementation strategies. Ultimately, effective MaaS deployment depends on a dual strategy that combines technological innovation with institutional legitimacy. As argued by Cherry and Pidgeon (2018) and Jiang et al. (2021), long-term user engagement is sustained not only through functional ease and technological efficiency but also through the assurance of safety, transparency, and social credibility — transforming temporary adoption into lasting behavioral commitment.

Limitations and Future Research

The current study is subject to some limitations. First, this study was grounded in online survey research conducted within Türkiye, which may compromise the external validity of the findings. Subsequent investigations may be implemented across diverse geographic contexts to evaluate external validity. Second, although this study recruited experienced users of shared or multimodal transportation, distinguishing between exploratory and habitual usage patterns may prove challenging. Future investigations may be conducted with active MaaS users to generate more comprehensive insights. Third, this study employed cross-sectional methodology, which may constrain the capacity to detect temporal changes in user perceptions and behavioral intentions. Subsequent research may utilize longitudinal designs to address this constraint. Additionally, future investigations may incorporate supplementary variables such as perceived risk, user satisfaction, and environmental consciousness to facilitate deeper analytical understanding.

Researchers' Contribution Rate Statement

This article has been prepared by a single author. All contributions to the conception, design, data collection, analysis, and writing were made solely by the author.

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Conflict of Interest Statement

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