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Technologies for New Mobility Services: Opportunities and Challenges from the Perspective of Stakeholders

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Highlights

What are the main findings?

- European stakeholders identify technology in NMS as a key driver for improving modal integration, user experience, and proximity of transport services.
- Investors show higher overall optimism regarding the role of technology in NMS, yet they prioritize different NMS as the primary beneficiaries.

What is the implication of the main finding?

- Addressing regulatory and infrastructure challenges is essential to maximize technology's impact on both mobility attributes and the performance of NMS.
- Cross-sector collaboration and alignment of investment strategies are essential to ensure coordinated efforts toward sustainable and inclusive urban mobility futures.

Abstract

Technological advancements are reshaping New Mobility Services (NMS) by enhancing trip planning, booking, and payment processes, while also improving fleet management, infrastructure utilization, and data-driven decision-making. Despite these developments, challenges persist in integrating technologies into cohesive and interoperable mobility systems. This study draws insights from 163 stakeholders across the NMS ecosystem to examine both the opportunities and barriers associated with the effective integration of technology into NMS, particularly within urban and metropolitan contexts. Using statistical methods, these responses were analyzed across eight stakeholder groups to determine whether their views converge or diverge. Findings reveal a broad consensus on the technologies expected to have the greatest impact, as well as on the main challenges of integrating these technologies into NMS. Divergences arise in the perceived influence on specific mobility attributes, such as environmental sustainability, security, safety, equity, and social inclusion, and in the services considered most likely to benefit. Notably, investors express a more optimistic view across nearly all technologies, prioritizing shared vehicle services and anticipating the strongest impacts in environmental sustainability. The rest of the stakeholder groups emphasize the potential of technology to enhance modal integration and identify Mobility-as-a-Service (MaaS) as the NMS with the greatest expected benefits. These insights help identify strategic priorities and redirect efforts toward promoting investment in technologies with the highest potential to deliver transformative benefits across the NMS ecosystem.

Keywords: New Mobility Services; technology; stakeholders

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1. Introduction

The European Union (EU) is spearheading the Sustainable and Smart Mobility Strategy to promote sustainable, smart, and resilient transport systems across member states [1]. This strategy highlights the importance of making connected and automated multimodal mobility a reality, boosting data and artificial intelligence for smarter mobility, modernizing fleets, and strengthening transport safety and security. Moreover, the New EU Urban Mobility Framework emphasizes the need to prioritize active, collective, and shared mobility through a multimodal and digitalized approach [2]. The EU underscores the importance of implementing technologies such as smart ticketing systems, alternative fuels, Mobility as a Service (MaaS), and automated transport systems, along with investments in safety infrastructure. These efforts highlight the growing recognition of technology's role in shaping sustainable and integrated mobility services.

Nowadays, a wide range of emerging technologies, such as Information and Communication Technologies (ICT), play a pivotal role in achieving smart and sustainable mobility. In the transportation field, ICT refers to a broad spectrum of tools and applications that enable access, sharing, and management of information while supporting integration and connectivity between various transportation modes and stakeholders [3,4]. Examples of ICT include mobile apps/websites, display screens, navigation systems, gaming applications for mobility education and engagement, augmented reality, Mobility-as-a-Service (MaaS) platforms, dynamic speed control, and chatbots [4]. ICT solutions also encompass decision-making technologies such as data visualization tools, traffic monitoring, artificial intelligence, and machine learning techniques, which are crucial in simplifying complex transportation data, helping decision-makers interpret trends and make informed choices [5–8]. Moreover, the integration of ICT has been effective in optimizing energy efficiency by contributing to the development of smart grids, energy management systems, energy storage, and charging infrastructure, as well as the shift toward cleaner energy systems [9].

These technologies are essential to the development of New Mobility Services (NMS), which are understood as a wide range of mobility services based on ICT that have emerged in recent years or will be available soon [10]. NMS can be classified into micro-mobility services (such as bike-sharing and e-scooter sharing), car-based mobility services (such as car-sharing, ride-sharing, ride-hailing, demand-responsive transport (DRT), and shared autonomous vehicles), and digital platforms (such as MaaS) [10,11]. ICT can act as a prerequisite to enable a NMS or add additional value to increase operational efficiency, fleet management, and data transactions, as well as improve the user experience in an existing NMS [10]. The correct integration between ICT and energy solutions with NMS offers greater opportunities, promoting environmental sustainability, facilitating the optimization of transport resources, enabling a diverse range of services, and transforming traditional transport models into more adaptable mobility systems.

Despite the rapid growth of NMS in recent years and the wide range of technologies available, there is a limited body of research identifying which technologies should be prioritized to enhance the performance of NMS. Understanding these relationships is crucial to focusing efforts towards achieving a more efficient and sustainable mobility. This study, conducted within the framework of the EU-funded GEMINI project (Greening European Mobility through Cascading Innovation Initiatives), addresses this gap by exploring two key research questions: (i) What are stakeholders' expectations regarding emerging technologies to enhance NMS? (ii) What barriers do stakeholders perceive as major obstacles to integrating emerging technologies into NMS? The findings aim to prioritize efforts toward solutions that improve the performance of NMS and support the sustainability and resilience of mobility systems, contributing to the broader goal of climate neutrality through modal shift and integration with public transport.

The remainder of this paper is organized as follows. Section 2 delves into the existing literature on the technological framework and stakeholders of NMS. Section 3 provides an overview of the methodology and data used to analyze the research questions. Section 4 presents and discusses the results of the study. Finally, Section 5 summarizes the key insights derived from this analysis and highlights the most significant policy implications.

2. Review of Technologies and Stakeholders in NMS

The transportation industry has witnessed a revolution driven by new technologies, which opens a wide range of possibilities for providing efficient solutions to people's travel needs. However, technological advancements on their own are not enough to ensure progress toward sustainable mobility. It is essential to identify and prioritize innovations with the greatest potential to generate the greatest impact. Achieving this requires strategic alignment and the concerted efforts of the stakeholders involved, each contributing from their respective areas of expertise. Therefore, understanding both the technological innovations and the roles and perspectives of key stakeholders is essential to support informed decision-making and guide the adoption of solutions with the highest potential to advance smart mobility.

In this context, this literature review examines the technologies with the greatest potential to enhance the performance of NMS, as well as the stakeholders influencing their development and implementation.

2.1. Technologies of NMS

ICT play a central role in enabling significant advancements in transportation, such as smart transportation infrastructure, mobility hubs, and intelligent vehicles [12], through supporting systems such as Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V). In the case of V2I communication, collaboration with infrastructure elements—such as traffic lights and parking systems within the smart city framework—enhances the operational efficiency of NMS and increases overall road capacity [13,14]. For V2V, technological vehicle advancements—such as sensors, cameras, and communication systems—enhance security measures and ensure a connected and interactive experience for users [4].

By enabling connectivity among vehicles, users, infrastructure, and a centralized platform where all data is collected and managed, ICT improve the overall efficiency and responsiveness of the transportation network [15]. An example of the benefits of connectivity and automation is car platooning, where vehicles travel closely together, showing potential traffic efficiency and fuel optimization [16,17]. The development and implementation of these technologies enable real-time data exchange, vehicle tracking, traffic flow optimization, route planning, smooth navigation, and enhancement of the overall driving experience [18–20].

The combination of intelligent infrastructures and vehicle technology represents a significant step towards smart, integrated, and energy-efficient solutions, where all components work harmoniously. Geolocation and mapping data from NMS allows locating of facilities [21], identification of mobility patterns [22], and optimization of services [23], among other applications. Moreover, ICT optimize the use of alternative fuels by supporting the development of smart grids, energy management systems, and charging infrastructure [9]. These applications can be extended to other emerging energy sources, such as biodiesel, renewable fuels, and hydrogen fuel cells, which are currently being explored because of their environmental benefits, energy efficiency, and potential for widespread adoption [24,25].

By leveraging real-time data, these technologies streamline coordination among users and service providers, enhance decision-making, and improve overall efficiency in urban mobility [26], while simultaneously generating large volumes of data that must be processed and analyzed to be effectively used. Big data solutions can capture, manage, and analyze huge volumes of structured or unstructured data to address existing mobility challenges and support decision-making solutions [27,28]. With processing, it is possible to simplify complex transportation data in visualization tools and dashboards, helping decision-makers interpret trends and make informed decisions. For example, Bachechi et al. [5] discuss the visualization of traffic monitoring; Yamamoto [7] presents a tool to assess the completeness of streets; and Zuo et al. [8] examine mobility trends during COVID-19. Leveraging big data, machine learning algorithms have been developed to predict patterns and make informed decisions, allowing service providers to optimize their efficiency and sustainability [6,28–30]. Some examples of machine learning applications include the prediction of traffic accidents, traffic flow optimization, transportation emissions, demand patterns, and user experience personalization [6,28,31].

To process these large amounts of data, there are enabling technologies that enhance computational efficiency. Cloud computing offers service models to manage computer resources over the internet, minimizing significant investment in technology infrastructure, centralizing the management of data, and enabling flexibility for users [32], which is a solution to deal with usage peaks, latency, and constrained bandwidth [33]. Similarly, quantum computing has the potential to solve problems beyond those of classical computing, offering exponential computational power and energy efficiency [34].

The data generated by mobility systems, often processed and stored in centralized platforms, frequently includes personal or sensitive information. Geolocation data and payment transactions made via credit cards, mobile wallets, or other electronic systems consistently raise concerns regarding privacy and the potential for unauthorized access [28,35–37]. In this context, blockchain has emerged as a safeguard, warranting secure and transparent transactions, preventing data tampering, preserving the privacy and integrity of communication channels, and enhancing trust in the transportation sector [38,39]. This technology operates as a decentralized and distributed storage system with linked blocks and encrypted information, making it a secure system against fraud [40].

In recent years, blockchain applications have been extended to other technologies to enable privacy, security, convenience, and personal data control. For instance, the development of smart contracts, tokenization, zero-trust architecture systems, and biometric authentication payments. Smart contracts are automatically self-executing codes with predefined conditions for all stakeholders involved, without the need for intermediaries [41]. Tokenization streamlines transactions, enhances privacy through controlled data access, incentivizes users, and increases welfare by improving pricing models [42]. Zero trust architecture systems work with continuous authentication and network micro-segmentation to quickly detect threats and generate alerts against external and internal risks [43]. Biometric authentication payments focus on verifying identities using unique physical (like facial features or fingerprints) or behavioral (such as voice patterns or handwriting) characteristics [44]. All these technological advances enable privacy, security, convenience, personal data control, and social welfare.

Other challenges persist related to people's willingness to adopt new digital services, their level of digital literacy, and the need to pre-test services before implementing NMS projects [4]. Virtual reality and augmented reality have been introduced to create virtual and interactive experiments for user studies and digital training [45]. These technologies have demonstrated significant potential to explain complex concepts quickly and intuitively, helping people better understand the use and benefits of NMS [46]. As these technological advances continue improving, the transportation ecosystem unfolds as a dynamic and interconnected network, adapting in real time to the needs and preferences of users.

Based on the literature review, a summary diagram was developed to provide an overview of how technological innovations interact within the NMS ecosystem, highlighting their applicability across multiple services (see Figure 1).

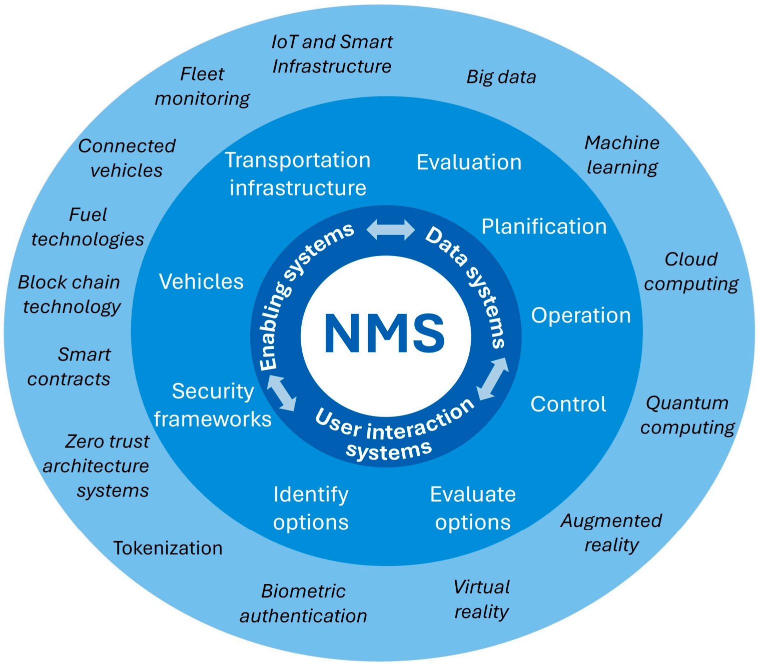

Figure 1. Overview of Enabling Technologies for NMS.

2.2. Main Stakeholders Within NMS

Prior Filipe et al. [47] emphasize the importance of determining the role, requirements, and articulation of transportation stakeholders to ensure the successful design, implementation, and adoption of sustainable mobility practices. Sobrino et al. [48] highlight the importance of identifying the perspectives of different stakeholders, leveraging commonly prioritized factors, identifying major disagreements on specific points, and implementing adjustments based on the particular knowledge of each group. For that, it is necessary to identify key groups of stakeholders. Each group is characterized by pursuing common objectives, which may not necessarily coincide with those of other groups. For NMS, Kamargianni and Matyas, Polydoropoulou et al., and Sobrino et al. [49–51] have identified different stakeholders, which may be divided as: (1) Government and Regulation Bodies, (2) Research, academia, and think tanks, (3) Consultants, (4) Infrastructure Managers and Providers, (5) Mobility Operators, (6) Ancillary services to mobility services, (7) Investors, Financial Institutions, and Insurance companies, and (8) other groups such as Neighbors/citizens/local communities, NGOs, Property developers, and Transportation and User Associations.

The first group, *Government and Regulation Bodies*, refers to governmental bodies or agencies responsible for supervising and/or regulating transport services, including NMS. They usually organize and coordinate various modes of transport in cities [52]. Their engagement is vital in addressing urban mobility challenges and advancing transportation infrastructure [53]. These entities actively collaborate with research, academia, think tanks, and consultancy firms to recognize effective planning, regulation, and harmonization in addressing mobility challenges. O'Neill [54] emphasizes that public authorities are interested in the potential economic and social benefits of NMS.

Researchers and academics delve into trends, challenges, and opportunities in the mobility sector and provide evidence-based recommendations to advance knowledge in a particular field [55]. *Think Tanks* provide expertise on specific topics and make recommendations to policymakers, public authorities, and mobility operators to help decision-making [56]. *Consultants* refer to companies that provide analysis and expertise to improve the understanding and development of projects and offer strategic advice, business, and implementation strategies [57].

The fourth to eighth groups are stakeholders who address transportation challenges and ensure the successful operation of NMS under existing regulations. *Mobility Operators* invest in vehicles and ICT systems to maximize efficiency and guarantee daily operation services [58]. They are responsible for fleet management, user experience, and technology integration to optimize mobility solutions [59]. *Infrastructure Managers and Providers* are responsible for overseeing and maintaining the physical components and cyber-urban infrastructure that support NMS [60,61]. Their duties include managing electric vehicle charging stations, maintaining parking facilities, and ensuring the virtual infrastructure to guarantee the information flow for MaaS. *Ancillary services to mobility services* are related to additional support services designed to improve the overall user experience and operational efficiency of mobility services. These services may include customer support, energy providers, maintenance services, and data analysis [62–64]. *Investors, Financial Institutions, and Insurance Companies* can provide the necessary capital to develop and expand businesses and offer risk management solutions [65], ensuring the safety and security of service providers and users within the NMS framework. Also, they facilitate transactions, payment systems, and financial planning for NMS operators [66]. *Other stakeholders* refer to additional interested parties who can influence NMS implementation and development or have a cross-sectional vision of these services, such as Neighbors/citizens/local communities, NGOs, Property developers, and Transportation and User Associations.

As described, there are several stakeholders with specific roles in the design, operation, maintenance, and control of NMS. Due to their distinct visions and responsibilities, each stakeholder may prioritize different policies, plans, and technological projects within their organizations based on their perspective. A deeper understanding of these perspectives is essential to guide the effective integration of technologies into NMS. Existing literature has primarily addressed this issue by analyzing individual technologies in isolation—such as automation, electrification, or mobility platforms—focusing on their barriers and opportunities from the perspectives of specific stakeholder groups [67–71].

However, there is a gap in evaluating the potential of the most relevant technologies applied in NMS from the perspectives of different stakeholder groups. Specifically, there remains a critical need to examine how stakeholders perceive the role of these emerging technologies in advancing passenger mobility in urban and metropolitan areas. A deeper understanding of these perspectives is essential to guide effective technology integration, align development with user and system-level needs, and overcome the practical challenges that hinder widespread adoption of NMS-enabling technologies.

3. Methodology

The methodology designed to explore the impact and integration barriers of technological innovations in NMS is structured into three main phases. Phase 1, survey definition, focuses on identifying the key technologies with current or potential application in NMS, the main challenges to their integration, the mobility attributes likely to be affected, and the stakeholders involved in NMS. Phase 2 encompasses the implementation of a structured survey aimed at capturing stakeholders' perceptions of the role of technologies in NMS. Phase 3 consists of analyzing the data to identify similarities and differences in stakeholder perspectives, providing insights into how each group perceives the potential, benefits, and challenges associated with technological integration in NMS.

3.1. Phase 1—Survey Definition

Based on the literature review presented above and with the support of the GEMINI consortium—a multidisciplinary alliance of 43 partners from 17 European countries, representing sectors such as academia, mobility operators, public administrations, and business innovators—the key elements for the research were identified.

A preliminary information package was distributed to all partners, who were invited to review and enrich the content to ensure the survey captured the most relevant and pertinent aspects. Based on the feedback received, the first version of the survey was developed and shared for further comments. The final version was then refined to strike a balance between clarity and analytical depth, while aiming to ensure a high response rate. As a result, the survey is structured into four sections, two of which are the most relevant for this research: (i) Technical Innovation Drivers, and (ii) Professional Background.

(i) Questions about Technical Innovation Drivers

The survey design encompasses a flexible approach, incorporating multiple-choice questions with both single and multiple-choice response formats. The main section—*Technical Innovation Drivers*—explores the role of technology in shaping NMS by examining four interrelated elements: technologies, challenges, mobility attributes, and the services themselves. Technologies refer to a broad range of technologies that enhance the performance of NMS and play a key role in promoting the sustainability, efficiency, and resilience of mobility systems. Challenges capture the key barriers that must be addressed to ensure the successful integration of technologies into NMS. Mobility attributes represent the dimensions through which the performance of NMS can be evaluated within the broader transport system, offering insights into how they contribute to its overall sustainability. Finally, the selection of NMS focuses on those that have become the most widely adopted services in recent years, particularly in urban and metropolitan settings.

The final selection of questions, answer options, and response format of this section is presented in Table 1.

Table 1. Technical Innovation Drivers—Survey Questions.

Question	Answer Options	Response Format
Question 1. In your opinion, please rank the following emerging technologies on their potential to boost NMS	• IoT and Smart City Infrastructure. • Advanced Fleet Monitoring and Management Solutions. • Connected, Cooperative, and Autonomous Vehicles. • Electric Vehicles. • Hydrogen Fuel Cells. • Alternative fuels (e.g., Biodiesel and Renewable fuels). • Big Data, AI, and Machine Learning Techniques. • Cloud and Edge Computing Services. • Quantum Computing. • Data Spaces (for trusted and secure data sharing). • Blockchain technology (for data integrity). • Smart Contracts. • Tokenization. • Zero Trust Architectures/Systems. • Biometric Authentication/Payments. • Augmented Reality (AR) and Virtual Reality (VR). • Computer Vision.	5-point scale Very low to Very high potential Respondents could select "I don't know this technology" if unfamiliar; in such cases, these responses were excluded from the analysis.

Table 1. *Cont.*

Question	Answer Options	Response Format
Question 2. Indicate, in your opinion, which are the greatest challenges to fostering the integration of technical innovations into NMS.	• Regulatory hurdles. • Concerns over sharing commercially sensitive data. • Technology readiness. • Infrastructure availability. • Lack of user adoption. • Lack of technical knowledge and/or human resources. • Lack of public awareness of key benefits. • Lack of political support/funding from local governments.	Multiple-choice and multiple-answer
Question 3. In your opinion, how can be the impact of cutting-edge technologies, such as the ones previously described, on the following mobility service-related attributes.	• User Experience/customer satisfaction/quality of service. • Modal integration. • Accessibility and proximity of transport services to people. • Economic efficiency. • Environmental sustainability. • Affordability. • Equity and social inclusion. • Safety. • Security.	5-point scale Very low to Very high impact
Question 4. Indicate, in your opinion, which of the following NMS you think could benefit the most from technical innovations.	• Carsharing. • Bike sharing. • Moped scooter sharing. • Kick scooter sharing. • Ride-hailing. • Ridesharing (carpooling, vanpooling, etc.). • On-demand microtransit. • MaaS.	Multiple-choice and multiple-answer

(ii) Professional Background

This research, guided by the perspectives of stakeholders, offers valuable insights into the technological landscape shaping the future of NMS. For this reason, in the professional background section, the respondents were asked to identify the categories and subcategories that best fit the activities of their organization.

Based on their responses, each respondent was classified into the following stakeholder groups: (1) *Government and Regulation bodies*—European Institutions (Commission, Parliament, EU Agency, among others), EU national governments, regional or local governments, regulators at different levels (EU, state, municipal, among others), environmental and regulatory bodies, standardization and certification bodies, city authorities, public transport authorities, and urban planners. (2) *Mobility Operators*—Public and private operators, shared mobility operators (including shared vehicles, pooling, and ride-hailing), MaaS operators, and other innovative transportation solutions operators. (3) *Infrastructure Managers and Providers*—Public and private infrastructure managers, public and private parking space owners, and charging infrastructure companies, among others. (4) *Ancillary services to mobility services*—Technology providers, energy providers, vehicle manufacturers, and vehicle renters. (5) *Investors, Financial Institutions, and Insurance*—Financial institutions (handling payments), sponsoring and partnering companies, and insurance companies. (6) *Research, academia, and think tanks*—Universities and Academic Institutions, Research Centers, and Think Tank Organizations. (7) *Consultants*—International, national, regional, and local Consulting Firms. Independent consultants also fall into this category. (8) *Others*—Neighbors/citizens/local communities, NGOs, Property developers, and Transportation and User Associations.

3.2. Phase 2—Data Collection Campaign

The survey was distributed online through the GEMINI consortium to a wide range of entities and organizations connected to NMS. To enhance data reliability, responses were collected anonymously to encourage honest and unbiased answers. This approach aims to reduce central tendency bias, where respondents may prefer safer or neutral options to avoid conflict in sensitive topics or due to a general reluctance to choose extreme responses [72,73]. Moreover, only fully completed questionnaires were considered, excluding those with incomplete or brief completion times.

The survey yielded success, gathering 280 responses, of which 163 were complete, valid, and submitted by respondents affiliated with entities located in Europe. Data are available in the repository by Vassallo and Garrido [74].

In terms of professional background, 47% of respondents work in large organizations (250 or more employees), 20% in medium-sized organizations (50–249 employees), 21% in small organizations (10–49 employees), and the rest (12%) in organizations with fewer than 10 employees. Half (50%) of the organizations operate at an international level. Respondents report an average of 14.1 years of professional experience, with a standard deviation of 10.4 years. In total, 24% of the responses come from *Research, academia, and think tanks*, 15% from *Others*, 13% from *Government and Regulation bodies*, 13% from *Mobility Operators*, 11% from *Infrastructure Managers and Providers*, 11% from *Ancillary services to mobility services*, 8% from *Investors and Financial Institutions*, and 8% from *Consultants*.

3.3. Phase 3—Data Analysis

To obtain results from the data, a two-step approach was applied, consisting of an initial exploratory phase followed by a statistical analysis. The exploratory phase aimed to identify general patterns and trends to understand stakeholders' expectations regarding the role of emerging technologies in enhancing NMS. To that end, potential and impact scores were calculated and organized to identify the technologies with the highest potential to enhance NMS (Question 1), as well as the specific attributes most influenced by these technologies (Question 3). In addition, the main challenges to technological integration with NMS (Question 2) and the NMS expected to benefit most from technological advancements (Question 4) were ranked according to the percentage of responses, from highest to lowest.

Subsequently, a statistical analysis was conducted to assess whether stakeholder groups held significantly different views. For the 5-point scale questions, and given the non-normal distribution of the data, a non-parametric test was employed. The Wilcoxon–Mann–Whitney test (U-test) was used to compare medians between groups and evaluate whether their responses differ significantly [75]. This approach helps determine whether stakeholder perceptions converge or diverge regarding the potential of emerging technologies to reshape NMS and the NMS attributes most impacted by these technologies.

In contrast, for multiple-choice questions, each response option—representing a specific challenge or a particular NMS—was treated as a binary categorical dependent variable (coded as 1 if selected, 0 otherwise). Binary logistic regression—a method commonly used for categorical data that estimates the probability of a binary outcome based on one or more predictor variables [76]—was applied to explore variations in stakeholder perceptions. Each stakeholder group was included as a categorical predictor to assess its influence on the likelihood of selecting specific integration challenges or identifying specific NMS as likely to benefit from technological innovation. This approach enables an understanding of stakeholders' priorities and expectations regarding the challenges posed by technology integration, and the NMS that could benefit most from these technologies.

All exploratory and statistical analyses were performed using R 4.4.2 [77].

4. Findings and Discussion

4.1. Potential of Technologies to Boost NMS

The ranking of technologies, according to their potential to enhance NMS, provides valuable insights into industry priorities for innovation. Each technology is assessed by different stakeholder groups, as indicated by distinct symbols and colors (see Figure 2). Technologies cluster around the higher and lower potential scores, indicating broad recognition of their importance in enhancing NMS.

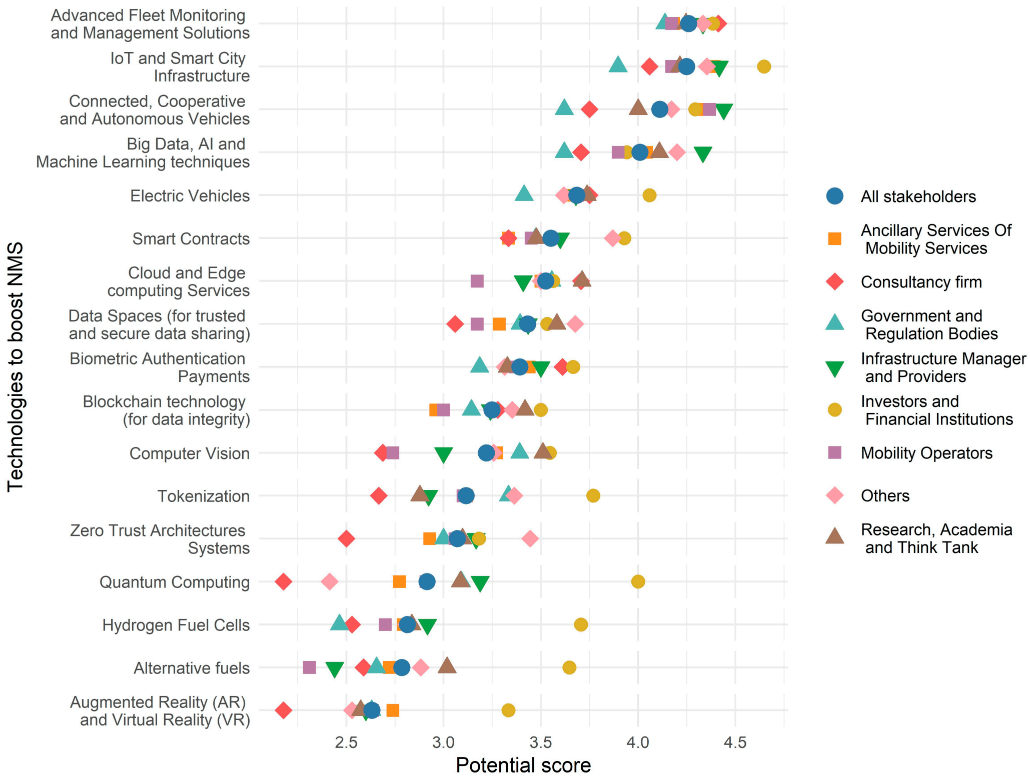

Figure 2. Potential of technologies to boost NMS by stakeholder group.

Across the board, stakeholder groups rated "Advanced Fleet Monitoring and Management Solutions", "IoT and Smart City Infrastructure", and "Connected, Cooperative, and Autonomous Vehicles" as the technologies with the highest potential to boost NMS. Nearly all groups assigned scores above 4, indicating a perception of "Very High Potential". That highlights the expected benefits of achieving fully connected systems capable of real-time monitoring across both infrastructure and fleet operations. Stakeholders perceived the integration of V2I and V2V communication, alongside smart urban technologies, as a key factor for improving the capacity and coordination of transport networks. Such connectivity facilitates the operation of diverse NMS by enabling systems to respond dynamically to changing network conditions. As a result, decision-makers can act quickly and accurately in response to real-time events, leading to more efficient operations, reduced maintenance and operational costs, and ensuring quality standards. Simultaneously, greater access to real-time information empowers users to make more informed travel choices. This, in turn, could enhance the attractiveness and competitiveness of NMS.

Although there is general agreement among stakeholder groups concerning the technologies with the greatest potential to boost NMS, statistical analysis using the U-test identified significant differences (see results in Appendix A). *Government and Regulatory Bodies* showed distinct evaluations of "*IoT and Smart City Infrastructure*" as well as "*Big Data, AI, and Machine Learning techniques*" compared to the rest of the groups. Additionally, Consultancy firms differ in their assessment of "*Connected, Cooperative, and Autonomous Vehicles*" compared to the other groups. While these stakeholders assign lower scores, these technologies remain among the most impactful for fostering innovation in NMS. This suggests that, although government and consultancy firms may adopt a more cautious or conservative stance toward these technologies, they nonetheless recognize their strategic relevance and transformative potential.

Moreover, "*Big Data, AI, and Machine Learning techniques*" were ranked fourth in overall potential across all stakeholder groups. *Infrastructure Managers and Providers* assigned significantly higher scores to these technologies compared to other groups, as confirmed by the U-test results. This likely reflects their direct involvement with V2I applications, where real-time data processing and predictive maintenance are crucial for optimizing system performance. Considering the vast data generated by fleets and infrastructure facilities, these technologies are essential for enabling fast and accurate decision-making processes.

Additionally, the optimistic outlook of *Investors and Financial Institutions* stands out across almost all technologies. This group consistently rated every technology above a score of 3, suggesting that each of them has at least moderate potential to enhance NMS. The U-test further confirmed that this group has a significantly more optimistic view regarding a wider range of technologies—such as "*Quantum computing*", "*Hydrogen Fuel Cells*", "*Alternative Fuels*", "*Augmented Reality and Virtual Reality (AR/VR)*"—compared with the rest of the stakeholders. Although some of these technologies are still in stages of development and face specific technical challenges [34,45], the positive expectations from investors may indicate a willingness to support further research, innovation, and development, which could help accelerate their integration into the mobility landscape.

4.2. Challenges to Fostering the Integration of Technical Innovations into NMS

The survey results on perceived barriers and challenges to fostering the integration of technical innovations into NMS reveal a multifaceted landscape (see Figure 3). "*Lack of technical knowledge and/or human resources*" and "*technology readiness*" are not considered high barriers, suggesting that the foundational expertise and capabilities for integrating technology into NMS are no longer the main concern. Instead, the focus shifts to external factors, with "*Regulatory hurdles*" and "*Infrastructure availability*" standing out as the most significant challenges. This underscores the critical role of regulatory frameworks in ensuring the proper implementation of NMS and highlights the importance of a robust infrastructure for the successful deployment of NMS.

Although the "*lack of political support or funding from local governments*" was identified as the third most important challenge overall, the binary logistic regression analysis indicates that *Investors and Financial Institutions*, *Government and Regulation Bodies*, as well as *Research, Academia, and Think Tanks* are less likely to identify this challenge compared to the rest of the stakeholders (see Table 2). This difference can be attributed to the distinct roles and perspectives of these stakeholders. For instance, *Investors and Financial Institutions* often focus on financial viability and risk diversification, relying on alternative funding mechanisms beyond local government support. *Research, Academia, and Think Tanks* typically obtain funding from national or international programs, rather than from local governments. *Government and Regulatory Bodies*, on the other hand, may not perceive this as a barrier given their direct involvement in policy formulation rather than operational implementation.

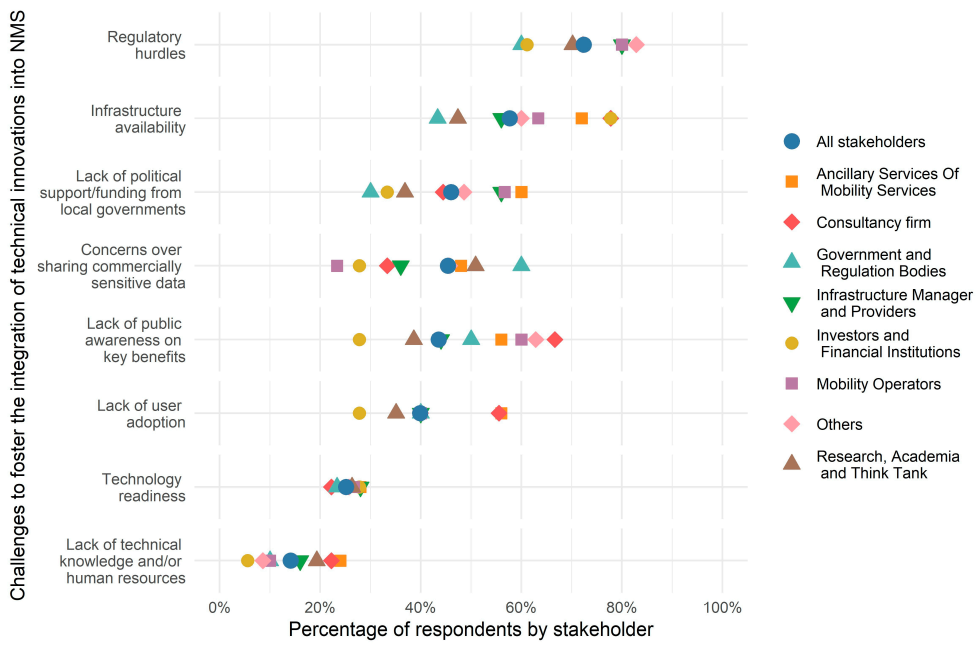

Figure 3. Challenges to foster the integration of technical innovations into NMS.

Table 2. Binary logistic regression results. Challenges to foster the integration of technical innovations into NMS.

Challenges	Intercept Coeff (sd.)	Government Coeff (sd.)	Researchers Coeff (sd.)	Consultancy Coeff (sd.)	Investors Coeff (sd.)	Operators Coeff (sd.)	Infrastructure Coeff (sd.)	Ancillary Services Coeff (sd.)	Others Coeff (sd.)
Regulatory hurdles	1.145 ** (0.47)	−0.888 * (0.51)	−0.272 (0.45)	−0.374 (0.62)	−0.693 (0.67)	0.195 (0.61)	0.069 (0.67)	0.345 (0.57)	0.756 (0.52)
Infrastructure availability	0.156 (0.42)	−0.491 (0.47)	−0.427 (0.41)	1.067 * (0.63)	1.097 (0.70)	0.451 (0.52)	−0.281 (0.56)	0.671 (0.51)	0.241 (0.44)
Lack of political support/funding from local governments	0.599 (0.42)	−1.259 ** (0.51)	−0.917 ** (0.42)	−0.520 (0.56)	−1.292 ** (0.65)	−0.025 (0.51)	−0.294 (0.56)	0.343 (0.49)	−0.114 (0.44)
Concerns over sharing commercially sensitive data	0.295 (0.42)	0.255 (0.47)	−0.025 (0.41)	−0.956 * (0.57)	−1.251 * (0.67)	−1.615 *** (0.56)	0.048 (0.59)	0.349 (0.50)	−0.317 (0.43)
Lack of public awareness on key benefits	−1.188 *** (0.43)	0.745 (0.48)	0.036 (0.41)	1.430 ** (0.60)	0.233 (0.68)	1.439 *** (0.55)	−0.170 (0.59)	0.447 (0.50)	1.254 *** (0.46)
Lack of user adoption	−0.240 (0.41)	−0.083 (0.47)	−0.427 (0.40)	0.562 (0.55)	−0.716 (0.67)	−0.217 (0.51)	−0.097 (0.56)	0.603 (0.47)	−0.186 (0.43)
Technology readiness	−1.361 *** (0.46)	0.002 (0.53)	0.272 (0.45)	−0.142 (0.64)	0.406 (0.70)	0.040 (0.57)	0.289 (0.62)	0.288 (0.52)	0.199 (0.48)
Lack of technical knowledge and/or human resources	−1.973 *** (0.58)	−0.405 (0.73)	0.586 (0.56)	0.434 (0.69)	−0.860 (1.18)	−1.070 (0.82)	0.667 (0.80)	1.009 * (0.61)	−0.733 (0.70)

Note: ***, **, * represent the statistical significance at 0.01, 0.05, and 0.1 levels.

Additionally, some groups highlight different challenges that must be addressed to promote technological integration with NMS. For example, *Consultants* and *Others* identified the "*lack of public awareness of key benefits*" as the second most important challenge, while *Mobility Operators* ranked it third. This perception is further supported by the binary logistic regression analysis, which shows that being part of the *Consultants*, *Mobility Operators*, or *Others* is associated with a significantly higher probability of selecting this challenge (see Table 2). This may reflect the broader, cross-cutting perspective of these stakeholders, who often act as intermediaries between innovation and implementation and are thus more attuned to social acceptance and communication gaps that can hinder the adoption of technological solutions.

Furthermore, while "*concerns over sharing commercially sensitive data*" were considered by some stakeholder groups as an intermediate barrier, binary logistic regression results indicate that *Mobility Operators* are significantly less likely to identify this issue as a major challenge. This may suggest that mobility operators consider data sharing a necessary practice to support operations, user-centered service design, and customer acquisition and retention, rather than a potential issue. However, this lower level of concern could also reflect a possible underestimation of the privacy and ethical implications. Overlooking the risks associated with data sharing could reduce users' trust in the mobility services provided.

Finally, when asked about additional challenges not indicated in the survey, some interesting aspects pointed out by the respondents included adopting policies for transit reorganization, integrating NMS with public transport, and finding the right balance between the financial operation of NMS and users' needs.

4.3. Impact of Cutting-Edge Technologies on Mobility Attributes of NMS

Anticipating the impacts of cutting-edge technologies on mobility attributes of NMS provides valuable insights into the perceived benefits of implementing these technologies, as shown in Figure 4. Notably, "*Modal Integration*", "*User Experience, Customer Satisfaction, and Quality of Service*", and "*Accessibility and Proximity of Transport Services to People*" stand out as the top three attributes expected to be most impacted by cutting-edge technologies. This underscores the transformative potential of emerging technologies in seamlessly integrating different transportation modes to improve accessibility and proximity and enhance the overall user experience.

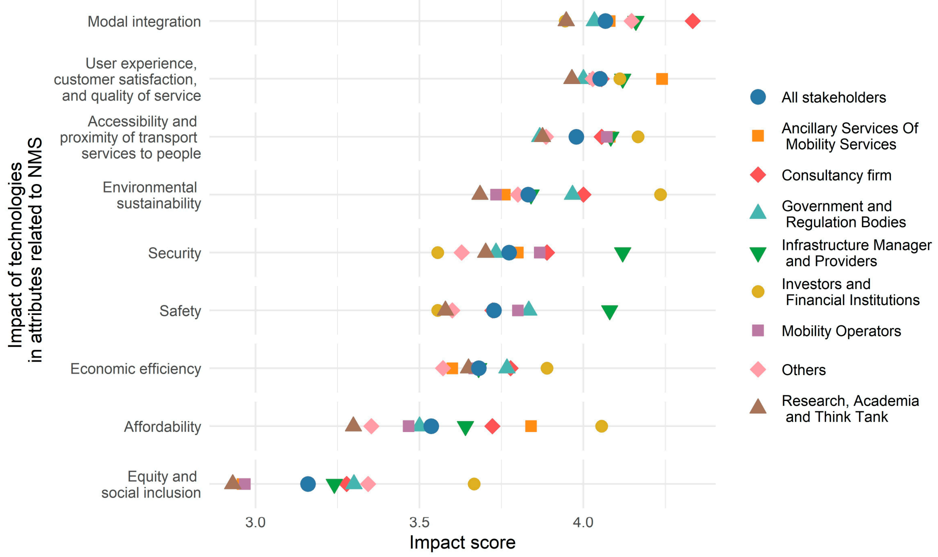

Figure 4. Impact of technologies on mobility attributes of NMS.

Nonetheless, the U-test revealed significant differences among the groups' opinions (see Appendix A). *Investors and Financial Institutions* report a more optimistic view regarding the impact of emerging technologies on "*Environmental sustainability*". This optimism may reflect a less comprehensive understanding of the full scope of environmental impacts. In contrast, stakeholders such as *Researchers, Academia, and Think Tanks*, as well as *Mobility Operators*, adopt a more critical perspective on "*Environmental sustainability*". These stakeholders tend to possess a broader and more up-to-date understanding of NMS, recognizing that they are not necessarily environmentally friendly. They acknowledge the full range of life cycle assessment, including material production, operation, maintenance, vehicle lifespan, and the analysis of journeys previously made using more sustainable modes.

Additionally, *Infrastructure Managers and Providers* have higher expectations regarding the impact of technology on "*Security*" and "*Safety*". These two attributes were rated as having a "*High Impact*". This higher rating is attributed to the potential of technological advancements to significantly reduce road accidents and cyberattacks, which may enable direct infrastructure maintenance and operation providers to carry out their roles more efficiently.

"*Equity and Social Inclusion*" was rated as having the lowest impact across all evaluated attributes, followed by "*affordability*" as the second lowest. Notably, *Researchers, Academia, and Think Tanks* expressed a significantly less optimistic outlook concerning these mobility attributes, as confirmed by the U-test. This perception may reflect their understanding that outcomes related to equity and affordability are not solely driven by technological advancements, but are instead shaped by broader societal dynamics, public policies, and social inclusion strategies.

4.4. NMS Most Benefited from Technical Innovations

As shown in Figure 5, "*MaaS*" and "*On-demand micro-transit*" emerge as the services that are expected to benefit most from technical innovations. These results align with the attributes most impacted by cutting-edge technologies, which focus on modal integration, mobility user experiences, and accessibility and proximity of services, especially for long first-mile and last-mile journeys with low public transportation availability, in line with Bowden and Hellen, Casquero et al., Lopez-Carreiro et al., and Shaheen et al. [78–81].

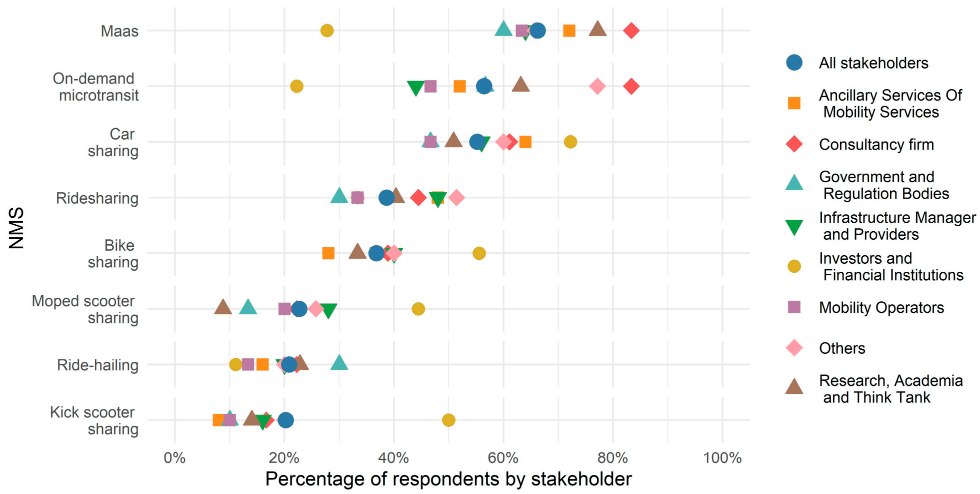

Figure 5. NMS that most benefited from technical innovations.

Although most stakeholder groups share similar views on which NMS could benefit most from new technologies, *Investors and Financial Institutions* exhibit a distinct outlook. This group assigns significantly lower priority to "*MaaS*" and "*On-demand micro-transit*", while giving higher priority to "*bike sharing*", as confirmed by the binary logistic regression analysis (see Table 3). They show stronger confidence in shared mobility services, ranking "*car sharing*", "*bike sharing*", "*kick scooter sharing*", and "*moped scooter sharing*" as the NMS segments most likely to benefit from technological advancements. The lower prioritization of MaaS may stem from persistent challenges in achieving full-service integration, as difficulties in coordinating trip planning, booking, and payments across multiple transport operators remain unresolved, posing considerable risks from an investment perspective. Meanwhile, the implementation of technologies in specific shared mobility services is generally viewed as less risky by investors. Nevertheless, MaaS remains a promising approach for integrating diverse mobility services, requiring collaborative governance and alternative financing to realize its full potential and ensure efficient NMS operation.

Table 3. Binary logistic regression results. NMS that benefited from technical innovations.

Challenges	Intercept Coeff (sd.)	Government Coeff (sd.)	Researchers Coeff (sd.)	Consultancy Coeff (sd.)	Investors Coeff (sd.)	Operators Coeff (sd.)	Infrastructure Coeff (sd.)	Ancillary Services Coeff (sd.)	Others Coeff (sd.)
Maas	1.199 *** (0.45)	−0.720 (0.49)	0.246 (0.44)	0.481 (0.70)	−2.155 *** (0.69)	−0.442 (0.53)	−0.366 (0.59)	0.110 (0.52)	−0.509 (0.46)
On-demand microtransit	0.371 (0.43)	−0.229 (0.48)	0.041 (0.42)	1.080 (0.70)	−1.624 ** (0.71)	−0.202 (0.50)	−0.451 (0.56)	−0.362 (0.49)	0.811 * (0.48)
Car sharing	0.032 (0.40)	−0.284 (0.46)	−0.061 (0.39)	0.192 (0.56)	0.923 (0.66)	−0.610 (0.51)	0.469 (0.56)	0.646 (0.48)	0.372 (0.43)
Ridesharing	−0.926 ** (0.42)	−0.326 (0.49)	0.365 (0.41)	0.097 (0.56)	0.233 (0.65)	−0.754 (0.56)	1.102 (0.59)	0.734 (0.49)	0.860 ** (0.43)
Bike sharing	−0.854 ** (0.42)	0.098 (0.49)	0.020 (0.41)	0.345 (0.56)	1.077 * (0.63)	0.165 (0.52)	0.399 (0.57)	−0.380 (0.51)	0.384 (0.43)
Moped scooter sharing	−0.608 (0.53)	−0.934 (0.68)	−1.583 *** (0.60)	−0.157 (0.69)	0.384 (0.71)	−0.575 (0.63)	0.202 (0.65)	−0.335 (0.59)	0.092 (0.55)
Ride-hailing	−1.167 ** (0.49)	0.481 (0.53)	−0.027 (0.47)	0.083 (0.66)	−0.912 (0.89)	−0.804 (0.68)	0.322 (0.69)	−0.365 (0.61)	−0.273 (0.51)
Kick scooter sharing	−0.595 (0.59)	−1.214 (0.75)	−0.896 (0.60)	−0.499 (0.75)	0.595 (0.75)	−1.001 (0.76)	−0.280 (0.76)	−1.160 (0.83)	−0.207 (0.60)

Note: ***, **, * represent the statistical significance at 0.01, 0.05, and 0.1 levels.

On the other hand, *Researchers*, *Academia*, *and Think Tanks* perceive particularly low benefits for “*moped scooter sharing*”, with a significantly lower likelihood of selecting this NMS compared to the rest of the stakeholder groups, as supported by binary logistic regression analysis. This perspective may stem from the challenges and social concerns associated with this type of service, including safety issues, environmental impacts, and regulatory issues that have notably affected the deployment of this service.

5. Conclusions

This study delved into key drivers shaping the landscape of NMS in urban and metropolitan areas, addressing questions related to stakeholders’ perceptions of potential technology enablers, the challenges hindering the integration of technical innovations, the impact of emerging technologies on NMS attributes, and the types of NMS expected to yield the greatest benefits from these technologies. Employing a methodology that includes a literature review, a comprehensive survey, and analysis using non-parametric methods and binary logistic regressions, the study captures valuable insights into European stakeholders’ expectations regarding the role of technology in the NMS landscape.

Overall, stakeholders hold broadly aligned perspectives, recognizing that there is great confidence in the role of enabling technologies to boost NMS. However, regulatory barriers and the lack of supporting infrastructure remain critical challenges that must be addressed to achieve effective integration. Once these hurdles are overcome, technologies such as *Advanced fleet monitoring, IoT and smart city infrastructure, Connected, cooperative, and autonomous vehicles*, and *Big Data, AI, and Machine Learning techniques* are expected to play a central role in driving the future development of NMS. These technologies are crucial to enhance *modal integration*, *user experience*, *customer satisfaction*, *quality of service*, and *accessibility and proximity of transport services to people*. Among the NMS most likely to benefit from these advancements are *MaaS* platforms and *on-demand micro transit*.

However, some stakeholder groups express divergent priorities regarding technological integration. *Infrastructure Managers and Providers* place greater emphasis on the potential of technology to enhance *safety* and *security*. *Consultants and Mobility Operators* identify the *lack of public awareness of key benefits* as a critical challenge that must be addressed. By contrast, there are challenges that certain stakeholders consider a lower priority. *Investors*, *Researchers*, and *Government and Regulation Bodies* do not view the “*lack of political support or funding from local governments*” as a principal issue. *Mobility Operators* do not consider *concerns over sharing commercially sensitive data* as a moderate challenge, whereas other stakeholder groups consider it a more significant issue. These contrasting perspectives underscore the need for strengthened cross-sector collaboration and the development of coordinated strategies to ensure the effective integration of emerging technologies into NMS.

Furthermore, *Investors and Financial Institutions* show an optimistic outlook regarding all emerging technologies. Additionally, investors have higher expectations for the integration of technology in shared vehicle services compared to *MaaS*. These findings underscore the importance of aligning investors' priorities with those of other stakeholders to ensure that investments and strategic efforts are directed toward the NMS and technologies with the greatest potential impact. In this regard, it becomes essential to develop business models and strategies that make MaaS more attractive to investors by reducing the perceived risks associated with its implementation as a viable business model.

Additionally, it is important to highlight specific areas where technology may have a more limited impact. Stakeholders indicate that aspects such as *affordability, equity, and social inclusion* are less likely to be influenced by technological solutions. This suggests that addressing these challenges requires efforts beyond technological advancement—specifically, coordinated social, economic, and regulatory initiatives—to build mobility systems that are affordable and inclusive.

Future research on NMS could explore several avenues. First, examining the long-term impacts of emerging technologies on NMS could yield valuable insights into their broader implications for urban life, environmental sustainability, and social equity. Second, analyzing the synergies and potential conflicts among stakeholder perspectives—particularly in the context of MaaS—may reveal opportunities and challenges critical to the successful implementation of such platforms across varying urban scales and sociodemographic contexts. Third, conducting a comprehensive analysis to ensure the technological integration of NMS with public transport systems is essential to fostering a cohesive mobility ecosystem that effectively supports modal integration. Finally, future studies could employ advanced approaches to capture individual-level heterogeneity within stakeholder groups, thereby helping to uncover preference patterns that shape decision-making and facilitate the successful implementation of emerging technologies in NMS.

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Abbreviations

The following abbreviations are used in this manuscript:

NMS	New Mobility Services
MaaS	Mobility as a Service
ICT	Information and Communication Technologies
DRT	Demand-responsive transport
EU	European Union
AR	Augmented Reality
VR	Virtual Reality
GEMINI	Greening European Mobility through Cascading Innovation Initiatives
U-test	Wilcoxon–Mann–Whitney test

Appendix A. Wilcoxon–Mann–Whitney Test Results (U-Test)

Table A1. *p*-value results. Comparison of stakeholders' perspectives on the potential technologies to boost NMS.

Stake-holder 1	Stakeholder 2	1. IoT and Smart City Infrastructure	2. Advanced Fleet Monitoring and Management Solutions	3. Connected, Cooperative and Autonomous Vehicles	4. Electric Vehicles	5. Hydrogen Fuel Cells	6. Alternative Fuels	7. Big Data, AI and Machine Learning Techniques	8. Cloud and Edge Computing Services	9. Quantum Computing	10. Augmented Reality (AR) and Virtual Reality (VR)	11. Computer Vision	12. Biometric Authentication Payments	13. Blockchain Technology (for Data Integrity)	14. Data Spaces (for Trusted and Secure Data Sharing)	15. Smart Contracts	16. Tokenization	17. Zero Trust Architectures Systems
Ancillary Services of Mobility Services	Consultancy firm	0.39	0.55	0.03 **	0.51	0.62	0.96	0.78	0.58	0.16	0.18	0.07 *	0.52	0.41	0.76	1.00	0.67	0.13
	Government and Regulation Bodies	0.07 *	0.92	0.06 *	0.79	0.70	0.62	0.16	0.70	0.63	0.36	0.24	0.69	0.76	0.40	0.54	0.22	0.93
	Infrastructure Manager and Providers	0.91	0.50	1.00	0.73	0.59	0.23	0.04 **	0.63	0.68	0.40	0.46	0.65	0.05 *	0.10 *	0.02 **	0.21	0.36
	Investors and Financial Institutions	0.41	1.00	0.56	0.15	0.13	0.03 **	0.80	0.71	0.04 **	0.52	0.66	0.76	0.19	0.42	0.17	0.09 *	0.90
	Mobility Operators	0.98	0.80	0.62	0.65	0.59	0.21	0.83	0.39	0.45	0.25	0.02 **	0.87	0.95	0.85	0.76	0.92	0.58
	Others	0.63	0.84	0.67	0.72	0.99	0.40	0.29	0.87	0.25	0.76	0.25	0.95	0.28	0.08 *	0.24	0.42	0.62
	Research, Academia and Think Tank	0.99	0.97	0.50	0.43	0.73	0.12	0.13	0.34	0.60	0.51	0.44	0.86	0.31	0.37	0.56	0.86	0.66

Table A1. *Cont.*

Stakeholder 1	Stakeholder 2	1. IoT and Smart City Infrastructure	2. Advanced Fleet Monitoring and Management Solutions	3. Connected, Cooperative and Autonomous Vehicles	4. Electric Vehicles	5. Hydrogen Fuel Cells	6. Alternative Fuels	7. Big Data, AI and Machine Learning Techniques	8. Cloud and Edge Computing Services	9. Quantum Computing	10. Augmented Reality (AR) and Virtual Reality (VR)	11. Computer Vision	12. Biometric Authentication Payments	13. Blockchain Technology (for Data Integrity)	14. Data Spaces (for Trusted and Secure Data Sharing)	15. Smart Contracts	16. Tokenization	17. Zero Trust Architectures Systems
Consultancy firm	Government and Regulation Bodies	0.46	0.63	0.48	0.31	0.76	0.75	0.41	0.75	0.08 *	0.43	0.26	0.34	0.63	0.36	0.64	0.16	0.16
	Infrastructure Manager and Providers	0.33	0.93	0.02 **	0.77	0.24	0.28	0.04 **	0.93	0.17	0.70	0.52	0.88	0.44	0.09 *	0.05 **	0.21	0.03 **
	Investors and Financial Institutions	0.08 *	0.51	0.04 **	0.42	0.02 **	0.04 **	0.96	0.77	0.00 ***	0.03 **	0.22	0.70	0.70	0.33	0.24	0.06 *	0.11
	Mobility Operators	0.39	0.38	0.05 **	0.85	1.00	0.30	0.91	0.16	0.77	0.70	0.84	0.35	0.53	0.91	0.84	0.77	0.52
	Others	0.14	0.64	0.03 **	0.73	0.41	0.47	0.23	0.45	0.97	0.26	0.41	0.43	0.90	0.06 *	0.36	0.32	0.04 **
	Research, Academia and Think Tank	0.33	0.42	0.06 *	0.98	0.33	0.13	0.12	0.91	0.05 **	0.30	0.01 **	0.41	0.97	0.20	0.64	0.59	0.04 **
Government and Regulation Bodies	Infrastructure Manager and Providers	0.05 **	0.58	0.04 **	0.47	0.19	0.17	0.00 ***	0.89	0.91	0.83	0.96	0.49	0.11	0.19	0.10 *	0.68	0.31
	Investors and Financial Institutions	0.00 ***	0.86	0.12	0.07 *	0.00 ***	0.00 ***	0.22	0.92	0.03 **	0.05 **	0.54	0.49	0.32	0.88	0.44	0.58	0.84
	Mobility Operators	0.06 *	0.66	0.11	0.45	0.81	0.06 *	0.31	0.12	0.31	0.69	0.10 *	0.95	0.71	0.37	0.77	0.20	0.61
	Others	0.01 ***	0.95	0.07 *	0.47	0.34	0.35	0.01 ***	0.46	0.11	0.56	0.99	0.82	0.45	0.14	0.64	0.63	0.54
	Research, Academia and Think Tank	0.03 **	0.79	0.12	0.23	0.33	0.06 *	0.00 ***	0.48	0.72	0.72	0.02 **	0.81	0.50	0.65	1.00	0.32	0.63

Table A1. *Cont.*

Stakeholder 1	Stakeholder 2	1. IoT and Smart City Infrastructure	2. Advanced Fleet Monitoring and Management Solutions	3. Connected, Cooperative and Autonomous Vehicles	4. Electric Vehicles	5. Hydrogen Fuel Cells	6. Alternative Fuels	7. Big Data, AI and Machine Learning Techniques	8. Cloud and Edge Computing Services	9. Quantum Computing	10. Augmented Reality (AR) and Virtual Reality (VR)	11. Computer Vision	12. Biometric Authentication Payments	13. Blockchain Technology (for Data Integrity)	14. Data Spaces (for Trusted and Secure Data Sharing)	15. Smart Contracts	16. Tokenization	17. Zero Trust Architectures Systems
Infrastructure Manager and Providers	Investors and Financial Institutions	0.50	0.43	0.48	0.28	0.33	0.26	0.01 **	0.98	0.05 *	0.11	0.83	0.83	0.60	0.39	0.30	1.00	0.48
	Mobility Operators	0.88	0.33	0.57	0.97	0.24	0.03 **	0.04 **	0.11	0.44	0.94	0.34	0.43	0.14	0.07 *	0.05 **	0.21	0.23
	Others	0.75	0.57	0.61	0.99	0.43	0.57	0.25	0.39	0.25	0.54	0.84	0.56	0.41	0.86	0.19	0.44	0.64
	Research, Academia and Think Tank	0.87	0.35	0.46	0.74	0.75	0.70	0.32	0.63	0.75	0.65	0.19	0.58	0.33	0.59	0.12	0.31	0.61
Investors and Financial Institutions	Mobility Operators	0.37	0.82	0.93	0.31	0.02 **	0.00 ***	1.00	0.18	0.03 **	0.04 **	0.08 *	0.59	0.26	0.33	0.28	0.08 *	0.49
	Others	0.66	0.82	0.85	0.23	0.02 **	0.05 **	0.15	0.47	0.00 ***	0.27	0.56	0.69	0.78	0.32	0.77	0.33	0.76
	Research, Academia and Think Tank	0.34	0.99	0.95	0.38	0.13	0.51	0.05 *	0.66	0.14	0.10 *	0.16	0.62	0.68	0.88	0.42	0.12	0.79
Mobility Operators	Others	0.60	0.61	0.93	0.92	0.47	0.05 **	0.23	0.38	0.80	0.38	0.17	0.86	0.36	0.04 **	0.42	0.40	0.32
	Research, Academia and Think Tank	0.97	0.80	0.89	0.78	0.30	0.01 **	0.11	0.02 **	0.20	0.49	0.00 ***	0.86	0.39	0.18	0.77	0.78	0.31
Others	Research, Academia and Think Tank	0.56	0.74	0.79	0.66	0.67	0.25	0.76	0.14	0.05 **	0.76	0.02 **	1.00	0.90	0.40	0.64	0.62	0.97

Note: ***, **, * represent *p*-value at 0.01, 0.05, and 0.1 levels.

Table A2. *p*-value results. Comparison of stakeholders' perspectives on the impact of technology on mobility attributes in NMS.

Stakeholder 1	Stakeholder 2	1. User experience, Customer Satisfaction, and Quality of Service	2. Modal Integration	3. Accessibility and Proximity of Transport Services to People	4. Economic Efficiency	5. Environmental Sustainability	6. Affordability	7. Equity and Social Inclusion	8. Safety	9. Security
Ancillary Services of Mobility Services	Consultancy firm	0.74	0.23	0.54	0.74	0.18	0.60	0.29	0.49	0.50
	Government and Regulation Bodies	0.56	0.55	0.99	0.59	0.18	0.46	0.19	0.27	0.28
	Infrastructure Manager and Providers	0.74	0.50	0.83	0.66	0.48	1.00	0.48	0.04 **	0.01 ***
	Investors and Financial Institutions	0.89	0.99	0.66	0.43	0.06 *	0.38	0.07 *	0.91	0.81
	Mobility Operators	0.94	0.23	0.47	0.99	0.83	0.46	0.83	0.81	0.51
	Others	0.76	0.19	0.60	0.54	0.86	0.04 **	0.70	0.63	0.63
	Research, Academia and Think Tank	0.25	0.62	0.47	0.80	0.97	0.05 *	0.43	0.58	0.44
Consultancy firm	Government and Regulation Bodies	0.95	0.39	0.55	0.82	0.64	0.22	0.92	0.81	0.80
	Infrastructure Manager and Providers	0.58	0.42	0.74	0.96	0.50	0.61	0.75	0.69	0.41
	Investors and Financial Institutions	0.85	0.21	0.82	0.86	0.79	0.92	0.42	0.48	0.56
	Mobility Operators	0.84	0.82	0.98	0.71	0.13	0.20	0.41	0.59	0.78
	Others	0.93	0.55	0.24	0.38	0.13	0.06 *	0.54	0.29	0.55
	Research, Academia and Think Tank	0.57	0.09 *	0.22	0.79	0.08 *	0.05 *	0.05 *	0.32	0.70
Government and Regulation Bodies	Infrastructure Manager and Providers	0.33	0.92	0.85	0.89	0.67	0.47	0.81	0.25	0.05 *
	Investors and Financial Institutions	0.66	0.54	0.69	0.57	0.33	0.08 *	0.24	0.35	0.53
	Mobility Operators	0.64	0.43	0.49	0.64	0.20	0.92	0.38	0.61	0.89
	Others	0.78	0.52	0.58	0.22	0.13	0.12	0.48	0.15	0.73
	Research, Academia and Think Tank	0.47	0.22	0.51	0.81	0.08 *	0.18	0.01 **	0.09 *	0.80

Table A2. *Cont.*

Stakeholder 1	Stakeholder 2	1. User experience, Customer Satisfaction, and Quality of Service	2. Modal Integration	3. Accessibility and Proximity of Transport Services to People	4. Economic Efficiency	5. Environmental Sustainability	6. Affordability	7. Equity and Social Inclusion	8. Safety	9. Security
Infrastructure Manager and Providers	Investors and Financial Institutions	0.62	0.48	0.91	0.76	0.26	0.43	0.26	0.09 *	0.03 **
	Mobility Operators	0.70	0.47	0.70	0.67	0.54	0.45	0.61	0.18	0.09 *
	Others	0.50	0.67	0.47	0.31	0.39	0.07 *	0.81	0.02 **	0.05 **
	Research, Academia and Think Tank	0.16	0.26	0.52	0.78	0.36	0.09 *	0.12	0.01 **	0.04 **
Investors and Financial Institutions	Mobility Operators	0.96	0.20	0.76	0.43	0.03 **	0.11	0.10	0.78	0.69
	Others	0.88	0.17	0.28	0.16	0.05 **	0.01 ***	0.16	0.76	0.84
	Research, Academia and Think Tank	0.31	0.58	0.25	0.49	0.02 **	0.01 ***	0.01 ***	0.81	0.67
Mobility Operators	Others	0.84	0.64	0.17	0.52	0.77	0.35	0.80	0.51	0.81
	Research, Academia and Think Tank	0.32	0.08 *	0.17	0.82	0.79	0.43	0.30	0.54	0.96
Others	Research, Academia and Think Tank	0.35	0.06 *	0.70	0.32	0.92	0.69	0.19	0.91	0.85

Note: ***, **, * represent *p*-value at 0.01, 0.05, and 0.1 levels.

References

1. European Commission. Sustainable and Smart Mobility Strategy—Putting European Transport on Track for the Future. Available online: https://transport.ec.europa.eu/system/files/2021-04/2021-mobility-strategy-and-action-plan.pdf (accessed on 8 June 2025).
2. European Commission. Sustainable Transport—New Urban Mobility Framework. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52021DC0811 (accessed on 8 June 2025).
3. Gössling, S. ICT and Transport Behavior: A Conceptual Review. *Int. J. Sustain. Transp.* **2018**, *12*, 153–164. [CrossRef]
4. Yigitcanlar, T.; Downie, A.T.; Mathews, S.; Fatima, S.; MacPherson, J.; Behara, K.N.S.; Paz, A. Digital Technologies of Transportation-Related Communication: Review and the State-of-the-Art. *Transp. Res. Interdiscip. Perspect.* **2024**, *23*, 100987. [CrossRef]
5. Bachechi, C.; Po, L.; Rollo, F. Big Data Analytics and Visualization in Traffic Monitoring. *Big Data Res.* **2022**, *27*, 100292. [CrossRef]
6. Silveira-Santos, T.; Manuel Vassallo, J.; Torres, E. Using Machine Learning Models to Predict the Willingness to Carry Lightweight Goods by Bike and Kick-Scooter. *Transp. Res. Interdiscip. Perspect.* **2022**, *13*, 100568. [CrossRef]
7. Yamamoto, S.; Mori, H. Human Interface and the Management of Information. Designing Information. In Proceedings of the Thematic Area, HIMI 2020 Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, 19–24 July 2020.

8. Bian, Z.; Zuo, F.; Gao, J.; Chen, Y.; Chandra, S.S.; Venkata, P.; Bernardes, S.D.; Ozbay, K.; Ban, X.; Wang, J. Time Lag Effects of COVID-19 Policies on Transportation Systems: A Comparative Study of New York City and Seattle. *Transp. Res. Part A Policy Pract.* **2021**, *145*, 269–283. [CrossRef]
9. Murshed, M. An Empirical Analysis of the Non-Linear Impacts of ICT-Trade Openness on Renewable Energy Transition, Energy Efficiency, Clean Cooking Fuel Access and Environmental Sustainability in South Asia. *Environ. Sci. Pollut. Res.* **2020**, *27*, 36254–36281. [CrossRef]
10. Shibayama, T.; Emberger, G. New Mobility Services: Taxonomy, Innovation and the Role of ICTs. *Transp. Policy* **2020**, *98*, 79–90. [CrossRef]
11. Mubiru, I.; Westerholt, R. A Scoping Review on the Conceptualisation and Impacts of New Mobility Services. *Eur. Transp. Res. Rev.* **2024**, *16*, 12. [CrossRef]
12. Agarwal, P.; Alam, M.A. Use of ICT for Sustainable Transportation. *IOP Conf. Ser. Earth Environ. Sci.* **2018**, *150*, 012032. [CrossRef]
13. Gioldasis, C.; Christoforou, Z. Smart Infrastructure for Shared Mobility. In *Advances in Mobility-as-a-Service Systems, Proceedings of the 5th Conference on Sustainable Urban Mobility, CSUM2020, Virtual, 17–19 June 2020*; Springer: Berlin/Heidelberg, Germany, 2020.
14. Trubia, S.; Severino, A.; Curto, S.; Arena, F.; Pau, G. Smart Roads: An Overview of What Future Mobility Will Look Like. *Infrastructures* **2020**, *5*, 107. [CrossRef]
15. Ibáñez, J.A.G.; Zeadally, S.; Contreras-Castillo, J. Integration Challenges of Intelligent Transportation Systems with Connected Vehicle, Cloud Computing, and Internet of Things Technologies. *IEEE Wirel. Commun.* **2015**, *22*, 122–128. [CrossRef]
16. Nikolayev, N.N. The Internet of Things in Transport Technology Improvement and Project Learning. *IOP Conf. Ser. Mater. Sci. Eng.* **2021**, *1083*, 012068. [CrossRef]
17. Khalifa, A.; Kermorgant, O.; Dominguez, S.; Martinet, P. Platooning of Car-Like Vehicles in Urban Environments: An Observer-Based Approach Considering Actuator Dynamics and Time Delays. *IEEE Trans. Intell. Transp. Syst.* **2021**, *22*, 5684–5696. [CrossRef]
18. Anwar, N.; Among Praja, A.K.; Akbar, H.; Adhikara, M.F.A.; Rasjidin, R.; Adhy, D.R. Review Literature Performance: Quality of Service from Internet of Things for Transportation System. In Proceedings of the 2021 1st International Conference on Computer Science and Artificial Intelligence, ICCSAI 2021, Jakarta, Indonesia, 28 October 2021; Volume 1, pp. 444–450. [CrossRef]
19. Khan, A.R.; Jamlos, M.F.; Osman, N.; Ishak, M.I.; Dzaharudin, F.; Yeow, Y.K.; Khairi, K.A. DSRC Technology in Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) IoT System for Intelligent Transportation System (ITS): A Review. In *Recent Trends in Mechatronics Towards Industry 4.0: Selected Articles from IM3F 2020, Malaysia*; Springer: Berlin/Heidelberg, Germany, 2020; pp. 97–106.
20. Dikshit, S.; Atiq, A.; Shahid, M.; Dwivedi, V.; Thusu, A. The Use of Artificial Intelligence to Optimize the Routing of Vehicles and Reduce Traffic Congestion in Urban Areas. *EAI Endorsed Trans. Energy Web* **2023**, *10*, 1–13. [CrossRef]
21. Pérez-Fernández, O.; García-Palomares, J.C. Parking Places to Moped-Style Scooter Sharing Services Using GIS Location-Allocation Models and GPS Data. *ISPRS Int. J. Geo-Inf.* **2021**, *10*, 230. [CrossRef]
22. Arias-Molinares, D.; García-Palomares, J.C.; Gutiérrez, J. Micromobility Services before and after a Global Pandemic: Impact on Spatio-Temporal Travel Patterns. *Int. J. Sustain. Transp.* **2023**, *17*, 1058–1073. [CrossRef]
23. Zheng, Z.; Chen, Y.; Zhu, D.; Sun, H.; Wu, J.; Pan, X.; Li, D. Extreme Unbalanced Mobility Network in Bike Sharing System. *Phys. A Stat. Mech. Its Appl.* **2021**, *563*, 125444. [CrossRef]
24. Baldinelli, A.; Francesconi, M.; Antonelli, M. Hydrogen, E-Fuels, Biofuels: What Is the Most Viable Alternative to Diesel for Heavy-Duty Internal Combustion Engine Vehicles? *Energies* **2024**, *17*, 4728. [CrossRef]
25. Turner, J.W.G.; Leach, F.C.P. *The Role of Alternative and Renewable Liquid Fuels in Environmentally Sustainable Transport*; Woodhead Publishing: Cambridge, UK, 2022.
26. Golalikhani, M.; Oliveira, B.B.; Carravilla, M.A.; Oliveira, J.F.; Antunes, A.P. Carsharing: A Review of Academic Literature and Business Practices toward an Integrated Decision-Support Framework. *Transp. Res. Part E Logist. Transp. Rev.* **2021**, *149*, 102280. [CrossRef]
27. Torre-Bastida, A.I.; Del Ser, J.; Laña, I.; Ilardia, M.; Bilbao, M.N.; Campos-Cordobés, S. Big Data for Transportation and Mobility: Recent Advances, Trends and Challenges. *IET Intell. Transp. Syst.* **2018**, *12*, 742–755. [CrossRef]
28. Lee, D.; Camacho, D.; Jung, J.J. Smart Mobility with Big Data: Approaches, Applications, and Challenges. *Appl. Sci.* **2023**, *13*, 7244. [CrossRef]
29. Rosário, A.T.; Dias, J.C. How Has Data-Driven Marketing Evolved: Challenges and Opportunities with Emerging Technologies. *Int. J. Inf. Manag. Data Insights* **2023**, *3*, 100203. [CrossRef]
30. Wu, Q.; Zhang, G.; Cheng, W. The Key Technologies and Challenges of Mobility as a Service. In Proceedings of the IEEE Conference on Intelligent Transportation Systems, ITSC, Macau, China, 8–12 October 2022; pp. 767–772. [CrossRef]
31. Nikitas, A.; Michalakopoulou, K.; Njoya, E.T.; Karampatzakis, D. Artificial Intelligence, Transport and the Smart City: Definitions and Dimensions of a New Mobility Era. *Sustainability* **2020**, *12*, 2789. [CrossRef]

32. Harris, I.; Wang, Y.; Wang, H. ICT in Multimodal Transport and Technological Trends: Unleashing Potential for the Future. *Int. J. Prod. Econ.* **2015**, *159*, 88–103. [CrossRef]
33. Arthurs, P.; Gillam, L.; Krause, P.; Wang, N.; Halder, K.; Mouzakitis, A. A Taxonomy and Survey of Edge Cloud Computing for Intelligent Transportation Systems and Connected Vehicles. *IEEE Trans. Intell. Transp. Syst.* **2022**, *23*, 6206–6221. [CrossRef]
34. Gill, S.S.; Kumar, A.; Singh, H.; Singh, M.; Kaur, K.; Usman, M.; Buyya, R. Quantum Computing: A Taxonomy, Systematic Review and Future Directions. *Softw.-Pract. Exp.* **2022**, *52*, 66–114. [CrossRef]
35. Affia, A.A.O.; Matulevicius, R. Security Risk Management in Shared Mobility Integration. In Proceedings of the ACM International Conference Proceeding Series, Vienna, Austria, 23–26 August 2022. [CrossRef]
36. Dypvik Landmark, A.; Arnesen, P.; Södersten, C.J.; Hjelkrem, O.A. Mobile Phone Data in Transportation Research: Methods for Benchmarking against Other Data Sources. *Transportation* **2021**, *48*, 2883–2905. [CrossRef]
37. Ranchordás, S. *Smart Mobility, Transport Poverty and the Legal Framework of Inclusive Mobility*; Springer: Berlin/Heidelberg, Germany, 2020; pp. 61–80.
38. Jabbar, R.; Dhib, E.; Said, A.B.; Krichen, M.; Fetais, N.; Zaidan, E.; Barkaoui, K. Blockchain Technology for Intelligent Transportation Systems: A Systematic Literature Review. *IEEE Access* **2022**, *10*, 20995–21031. [CrossRef]
39. Martelli, F.; Renda, M.E.; Zhao, J. The Price of Privacy Control in Mobility Sharing. *J. Urban Technol.* **2021**, *28*, 237–262. [CrossRef]
40. Auer, S.; Nagler, S.; Mazumdar, S.; Mukkamala, R.R. Towards Blockchain-IoT Based Shared Mobility: Car-Sharing and Leasing as a Case Study. *J. Netw. Comput. Appl.* **2022**, *200*, 103316. [CrossRef]
41. Hawlitschek, F.; Notheisen, B.; Teubner, T. The Limits of Trust-Free Systems: A Literature Review on Blockchain Technology and Trust in the Sharing Economy. *Electron. Commer. Res. Appl.* **2018**, *29*, 50–63. [CrossRef]
42. Sun, L.; Hua, G.; Teunter, R.H.; Cheng, T.C.E.; Shen, Z.J.M. The Effects of Tokenization on Ride-Hailing Blockchain Platforms. *Prod. Oper. Manag.* **2023**, 1–18. [CrossRef]
43. Annabi, M.; Zeroual, A.; Messai, N. Towards Zero Trust Security in Connected Vehicles: A Comprehensive Survey. *Comput. Secur.* **2024**, *145*, 104018. [CrossRef]
44. Vadim, S.; Firdaus, M.; Rhee, K.-H. Privacy-Preserving Decentralized Biometric Identity Verification in Car-Sharing System. *J. Multimed. Inf. Syst.* **2024**, *11*, 17–34. [CrossRef]
45. Li, F.; Trappey, A.J.C.; Lee, C.H.; Li, L. Immersive Technology-Enabled Digital Transformation in Transportation Fields: A Literature Overview. *Expert Syst. Appl.* **2022**, *202*, 117459. [CrossRef]
46. Yildirim, O.; Pidel, C.; West, M. Future Mobility Solutions: A Use Case for Understanding How VR Influences User Perception. In Proceedings of the 2020 IEEE International Conference on Artificial Intelligence and Virtual Reality, AIVR 2020, Utrecht, The Netherlands, 14–18 December 2020; pp. 184–187. [CrossRef]
47. Prior Filipe, R.; Heath, A.; McCullen, N. The Path to Sustainable and Equitable Mobility: Defining a Stakeholder-Informed Transportation System. *Sustainability* **2022**, *14*, 15950. [CrossRef]
48. Sobrino, N.; Nicolas Gonzalez, J.; Manuel Vassallo, J.; de los Angeles Baeza, M. Regulation of Shared Electric Kick Scooters in Urban Areas: Key Drivers from Expert Stakeholders. *Transp. Policy* **2023**, *134*, 1–18. [CrossRef]
49. Kamargianni, M.; Matyas, M. The Business Ecosystem of Mobility-as-a-Service. In *Transportation Research Board (TRB) Annual Meeting*; National Academies: Washington, DC, USA, 2017; Volume 96, pp. 8–12.
50. Polydoropoulou, A.; Pagoni, I.; Tsirimpa, A. Ready for Mobility as a Service? Insights from Stakeholders and End-Users. *Travel Behav. Soc.* **2020**, *21*, 295–306. [CrossRef]
51. Gonzalez, J.N.; Sobrino, N.; Vassallo, J.M. Considering the City Context in Weighting Sustainability Criteria for Last-Mile Logistics Solutions. *Int. J. Logist. Res. Appl.* **2023**, *28*, 380–400. [CrossRef]
52. Wright, S. A European Model for Public Transport Authorities in Small and Medium Urban Areas. *J. Public Transp.* **2015**, *18*, 45–60. [CrossRef]
53. Linde, L.B.A.; Witte, P.A.; Spit, T.J.M. Quiet acceptance vs. the 'polder model': Stakeholder involvement in strategic urban mobility plans. *Eur. Plan. Stud.* **2021**, *29*, 425–445. [CrossRef]
54. O'Neill, P. The Role of Public Authorities. *Transportation* **1990**, *17*, 313–328. [CrossRef]
55. López Carreiro, I. *MaaS Implementation Pathways: A Multi-Stakeholder Approach*; Universidad Politécnica de Madrid: Madrid, Spain, 2021.
56. McGann, J.G. Think Tanks, Foreign Policy and the Emerging Powers. In *Think Tanks, Foreign Policy and the Emerging Powers*; Palgrave Macmillan: New York, NY, USA, 2018; pp. 1–456.
57. Tavoletti, E.; Kazemargi, N.; Cerruti, C.; Grieco, C.; Appolloni, A. Business Model Innovation and Digital Transformation in Global Management Consulting Firms. *Eur. J. Innov. Manag.* **2021**, *25*, 612–636.
58. Zhang, L.; Zhang, J.; Duan, Z.Y.; Bryde, D. Sustainable Bike-Sharing Systems: Characteristics and Commonalities across Cases in Urban China. *J. Clean. Prod.* **2015**, *97*, 124–133. [CrossRef]
59. Amirnazmiafshar, E. Identifying the Gaps Between Needs, Expectations, and Views of Different Stakeholders Related to Car-Sharing, Bike-Sharing, and Scooter-Sharing Systems. Doctoral Dissertation, Politecnico di Torino, Torino, Italy, 2023.

60. Cruz, C.O.; Sarmento, J.M. "Mobility as a Service" Platforms: A Critical Path towards Increasing the Sustainability of Transportation Systems. *Sustainability* **2020**, *12*, 6368. [CrossRef]
61. Qiao, S.; Huang, G.; Yeh, A.G.-O. Mobility as a Service and Urban Infrastructure: From Concept to Practice. *Trans. Urban Data Sci. Technol.* **2022**, *1*, 16–36. [CrossRef]
62. Sevdari, K.; Calearo, L.; Andersen, P.B.; Marinelli, M. Ancillary Services and Electric Vehicles: An Overview from Charging Clusters and Chargers Technology Perspectives. *Renew. Sustain. Energy Rev.* **2022**, *167*, 112666. [CrossRef]
63. Gulotta, F.; Rancilio, G.; Blaco, A.; Bovera, F.; Merlo, M.; Moncecchi, M.; Falabretti, D. E-Mobility Scheduling for the Provision of Ancillary Services to the Power System. *Int. J. Electr. Electron. Eng. Telecommun.* **2020**, *9*, 349–355. [CrossRef]
64. Weiller, C. E-MOBILITY SERVICES. In *New Economic Models for Transport in the Digital Economy. Case Study for Research Council UK Digital Economy Theme*; University of Cambridge: Cambridge, UK, 2012.
65. McKillop, D.; French, D.; Quinn, B.; Sobiech, A.L.; Wilson, J.O.S. Cooperative Financial Institutions: A Review of the Literature. *Int. Rev. Financ. Anal.* **2020**, *71*, 101520. [CrossRef]
66. Teece, D.J. Business Models, Business Strategy and Innovation. *Long Range Plann.* **2010**, *43*, 172–194. [CrossRef]
67. Castellanos, S.; Grant-Muller, S.; Wright, K. Technology, Transport, and the Sharing Economy: Towards a Working Taxonomy for Shared Mobility. *Transp. Rev.* **2022**, *42*, 318–336. [CrossRef]
68. Koumoutsidi, A.; Pagoni, I.; Polydoropoulou, A. A New Mobility Era: Stakeholders' Insights Regarding Urban Air Mobility. *Sustainability* **2022**, *14*, 3128. [CrossRef]
69. Delaere, H.; Basu, S.; Macharis, C.; Keseru, I. Barriers and Opportunities for Developing, Implementing and Operating Inclusive Digital Mobility Services. *Eur. Transp. Res. Rev.* **2024**, *16*, 1. [CrossRef]
70. Lopez-Carreiro, I.; Monzon, A.; Lopez, E. MaaS Implications in the Smart City: A Multi-Stakeholder Approach. *Sustainability* **2023**, *15*, 10832. [CrossRef]
71. Paiva, S.; Ahad, M.A.; Tripathi, G.; Feroz, N.; Casalino, G. Enabling Technologies for Urban Smart Mobility: Recent Trends, Opportunities and Challenges. *Sensors* **2021**, *21*, 2143. [CrossRef] [PubMed]
72. Sabolić, D.; Samuelson, M.B. Mitigating Central Tendency and Acquiescence Biases in Survey Design: A Methodological Exploration with Empirical Evidence. *Stud. Humanist. AGH* **2024**, *23*, 115–138. [CrossRef]
73. South, L.; Saffo, D.; Vitek, O.; Dunne, C.; Borkin, M.A. Effective Use of Likert Scales in Visualization Evaluations: A Systematic Review. *Comput. Graph. Forum* **2022**, *41*, 43–55. [CrossRef]
74. Vassallo, J.M.; Garrido, L. GEMINI_T1.1_Market Analysis and Innovation Drivers_Survey_and_Results. Zenodo. Available online: https://zenodo.org/records/13746801 (accessed on 11 September 2024).
75. Hui, E.G.M. *Learn R for Applied Statistics*; Apress: Singapore, 2019.
76. Agresti, A. *Categorical Data Analysis*, 3rd ed.; Wiley: Gainesville, FL, USA, 2013.
77. R Core Team. R: A Language and Environment for Statistical Computing. Available online: https://www.r-project.org/ (accessed on 21 June 2025).
78. Bowden, H.; Hellen, G. A Data Driven, Segmentation Approach to Real World Travel Behaviour Change, Using Incentives and Gamification. In *Lecture Notes in Mobility*; Müller, B., Meyer, G., Eds.; Springer: Cham, Switzerland, 2018; pp. 173–182.
79. Casquero, D.; Monzon, A.; García, M.; Martínez, O. Key Elements of Mobility Apps for Improving Urban Travel Patterns: A Literature Review. *Futur. Transp.* **2022**, *2*, 1–23. [CrossRef]
80. Lopez-Carreiro, I.; Monzon, A.; Lopez, E.; Lopez-Lambas, M.E. Urban Mobility in the Digital Era: An Exploration of Travellers' Expectations of MaaS Mobile-Technologies. *Technol. Soc.* **2020**, *63*, 101392. [CrossRef]
81. Shaheen, S.; Cohen, A.; Martin, E. *Smartphone App Evolution and Early Understanding from a Multimodal App User Survey*; Springer International Publishing: Berlin/Heidelberg, Germany, 2017; pp. 149–164. [CrossRef]