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School of Transportation Sciences

Master of Transportation Sciences

Master's thesis

Exploring the potential of shared micro mobility vehicles: drivers' experience and acceptance

Spyridon Triantafyllos

Thesis presented in fulfillment of the requirements for the degree of Master of Transportation Sciences

SUPERVISOR :

Prof. dr. Muhammad ADNAN

CO-SUPERVISOR :

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Abstract

The present Master Thesis investigates the user satisfaction, factors influencing adoption and necessary improvements in shared micro-mobility services in the Brussels-Capital Region, Belgium. The Thesis addresses four research questions to provide a comprehensive understanding of shared micro-mobility and its acceptability in as well as integration with the Region's urban transportation system.

First, the level of satisfaction among users of shared micro-mobility services is examined, along with their main areas of concern. Findings reveal varying levels of satisfaction, with convenience and ease of use being significant determinants. Concerns regarding safety, infrastructure and costs are expressed.

Second, the dependence between the use and non-use of shared micro-mobility services, public transport and personal vehicle ownership is explored. The results suggest a complex relationship, with shared micro-mobility services seen as complementary to public transport. However, their impact on personal vehicle ownership and modal shift remains unclear, necessitating further investigation.

Third, the factors influencing the choice of potential users not to opt for shared micro-mobility services are examined. Barriers to adoption, including safety concerns, perceived risks and infrastructure limitations are identified.

Lastly, areas for improvement in shared micro-mobility schemes are investigated, in order to increase their attractiveness and encourage a modal shift. Factors identified include costs, safety measures, infrastructure enhancements and convenience improvements.

The findings of this research provide valuable insights into user preferences, interplay between transportation modes and potential improvements in shared micro-mobility services. These conclusions can guide future research, inform policy decisions and support the development of sustainable and user-centric urban transportation system, not only in the Brussels-Capital Region but also in other geographical areas. The study serves as a foundation for further exploration and research, which can contribute to a more comprehensive understanding of shared micro-mobility, guide strategy- and policy-related dialogue and decisions while also facilitating the inclusion of shared micro-mobility services in modern cities' transportation systems.

Keywords

Brussels-Capital Region; Shared micro-mobility; Survey; User acceptance; User adoption; User experience

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List of abbreviations

BCR	Brussels Capital Region
COVID-19	Coronavirus disease 2019
GHG	Greenhouse gas (emissions)
GPS	Global Positioning System
ITF	International Transport Forum
NB	Nota bene
NGO	non-Governmental Organisation
SAE	Society of Automotive Engineers
SMMS	Shared micro-mobility services
WCAG	Web Content Accessibility Guidelines
XM	Qualtrics Experience Management

1 Introduction

1.1 Background and rationale for the study

Micro-mobility refers to the combination of different light-weight vehicles, representing different transport modes, which are at the disposal of the public and which can either replace or complement vehicles with internal combustion engines, reducing their shortcomings (Leister et al., 2018; Smith et al., 2021). Among the different modes of micro-mobility, bikes, electric bikes and electric scooters are included. These vehicles can usually be rented for relatively short periods of time, through the operation of relevant shared schemes; at the same time, they can also be owned and used individually by the user (Caspi & Noland, 2019; Shaheen & Cohen, 2020, Kazemzadeh & Sprei, 2022).

Micro-mobility has sharply risen during the last years and especially after 2017 (Caspi et al., 2020; Hosseinzadeh et al., 2021) and relevant vehicles have become increasingly available to the consumers, either through shared-mobility schemes or through individual initiative (buy for personal-only use).

In Brussels, Belgium, micro-mobility is a reality which has evolved through time: from the Villo and Blue-bike bicycle-sharing schemes which pioneered the landscape with their introduction early 2010 decade, to different shared e-scooter schemes and the rise of individual micro-mobility vehicles ownership.

The introduction of these micro-mobility modes has sparked debate and research on various associated aspects:

- How the commuters' daily habits have changed, integrating to a greater or lesser extent these micro-mobility solutions in everyday commuting patterns (Liao & Correia, 2022; Reck et al., 2021; Weschke et al., 2022)
- The adaptations and adjustments that cities have to sustain in order to facilitate the operation of these micro-mobility modes (Richter et al., 2022)
- These micro-mobility solutions have had an impact on the cities' transport systems, while at the same time they have raised concerns about public space and safety (Kamargianni & Matyas, 2017; Liao & Correia, 2022; Shaheen & Cohen, 2020)
- The emergence of shared micro-mobility schemes in parallel with the increased affordability of such devices, which renders their acquisition and use individually by the users, has reiterated the relevance of the debate between ownership and short-term rental/leasing services
- There are some parallels which can be drawn between the shared micro-mobility schemes, the Mobility-as-a-Service (MaaS) concept and the Mobility-on-Demand (MoD) concept, while, at the same time, there are significant deviations (Kamargianni & Matyas, 2017; Shaheen & Cohen, 2020).

However, in order to further understand the concept of shared micro-mobility, its and its viability, sustainability and effects of shared micro-mobility services in the Brussels-Capital Region, the opinion of the users about it should be identified, analysed and turned into action.

To assess the level of satisfaction among users of shared micro-mobility services in the Brussels-Capital Region, this thesis adopts a comprehensive approach that considers the different socio-demographic contexts and spatiotemporal constraints. This approach aims to identify the factors that influence user

satisfaction and provide insights into the potential improvements of the services. By focusing on the individual interactions with shared micro-mobility services, the study aims to enhance the understanding of travel behavior and the mechanisms that influence it.

1.2 Problem statement

The analysis of user satisfaction is critical in order to assess the viability, sustainability and effects of shared micro-mobility services in the Brussels-Capital Region. Shared micro-mobility services have the potential to offer flexible and affordable transportation options that have the potential to reduce traffic congestion and promote sustainable mobility. These services allow users to rent bicycles or electric scooters for short periods and offer several advantages, such as reducing travel times and costs, improving accessibility, and decreasing environmental impacts.

While the impact of shared mobility on different aspects (including financial, environmental and purely transport-related) has been documented through various studies globally, Shaheen et al. argue that “more research is needed on a city or regional basis and on emerging services, such as microtransit, dockless bikes and scooters, and courier network services” (S. Shaheen et al., 2020).

The evaluation of user satisfaction is crucial in order to promote the use of shared micro-mobility services and increase their acceptance among the population. The present Master’s Thesis envisages to address this issue for the Brussels Capital Region, Belgium, in order to explore the levels of acceptance and satisfaction that shared micro-mobility services achieve amongst their users. It is expected that the Master’s thesis will contribute to filling the research gap in this field and increase the collective knowledge of relevant stakeholders on the issue, giving pieces of information which could be used at various levels: the improvement of the level of service that users of shared micro-mobility services experience; the improvement of the regulatory and operational framework in which these services operate; the understanding of the mechanism behind modal choice by the users and, ultimately, the improvement of the Brussels Capital Region transport system in general, to the benefit of the greater public (whether or not users of shared micro-mobility schemes).

In conclusion, the analysis of user satisfaction is an essential aspect of shared micro-mobility services' viability and sustainability. The comprehensive approach adopted in this thesis provides a useful framework to assess the level of satisfaction among users of shared micro-mobility services in the Brussels-Capital Region and identify the factors that influence it. The study's results can inform the development of more efficient and effective shared micro-mobility services and contribute to promoting sustainable mobility in the region.

1.3 Scope and research objectives/research questions

The aim/objective of the Master Thesis is to reply to specific research questions which have arisen from the above analysis.

The following is the main research question that will be sought to be addressed through the Master Thesis:

Research Question 1: What is the level of satisfaction among users of shared micro-mobility services in the Brussels-Capital Region, Belgium, and which are their main areas of concern?

There are also secondary issues that are sought to be explored through the Master Thesis and associated survey. The first among them is the interaction and interrelation between the shared micro-mobility and the other means of transport, both in terms of ownership versus use of shared services, as well as in terms of modal choice and substitution of other modes of transport with micro-mobility. As such, the research question that will be sought to be addressed are the following:

Research Question 2: Is there any dependence between the use and non-use of shared micro-mobility services, public transport and personal vehicle ownership in the Brussels-Capital Region?

Another angle of the research concerns the factors that hinder potential users from using shared micro-mobility services in the Brussels-Capital Region and this forms the final research question:

Research Question 3: Which factors influence the choice of a potential user not to opt for shared micro-mobility services in the Brussels-Capital Region?

The latter has a tertiary level which could also be explored as a research question, as they are closely linked:

Research Question 3: What needs to be improved in shared micro-mobility schemes in the Brussels-Capital Region, in order for them to become more lucrative in comparison to other means of transport and provoke a modal shift?

1.4 Thesis Outline

As afore-mentioned, the present Master Thesis aims to investigate the drivers' acceptance and satisfaction towards shared micro-mobility services in the Brussels-Capital Region, as well as the factors that influence these perceptions. The study follows a structured approach, starting with an introduction that outlines the background of the topic under discussion and the rationale behind the Thesis. The problem statement is then defined, as is the scope and research objectives/research questions that will be sought to be answered.

Chapter 2 provides an overview of the scientific literature on shared micro-mobility, including the definition of the concept, its advantages and inconveniences, as well as a glance at the relevant market, mostly in Europe. This section also examines previous efforts which sought to gauge the users' acceptance and satisfaction levels derived from such shared micro-mobility services, both at a global level and in the context of the Brussels-Capital Region and the factors that were identified to dictate the users' perceptions and choices.

Chapter 3 offers an overview of the state of play concerning shared micro-mobility in the Brussels-Capital Region, including a brief description of the region, the available urban mobility options, as well as a more extensive description of the shared micro-mobility landscape.

Chapter 4 describes the methodology used in the study, including the relevance of the survey which was conducted in the frame of this Thesis as a research tool, the data collection procedures, the sampling and respondents' characteristics, the questionnaire design, as well as the possible sources of error.

Chapter 5 presents the results and analysis of the survey conducted, focusing on the interpretation of the results, their coherence with the findings of the literature review, and the identification of the factors that influence drivers' acceptance and satisfaction towards shared micro-mobility services in the Brussels-Capital Region.

Chapter 6 concludes the Thesis by discussing the main findings of the study, drawing conclusions, and identifying the limitations and areas for future research.

The Thesis includes a bibliography section that lists all the references used in the literature review, as well as three appendices: the full online survey questionnaire, the information mail to potential stakeholders, and the information letter/explanatory note which served as the preface of the survey.

In general, the structure of the thesis follows the standard format for academic research, providing a comprehensive and rigorous analysis of the research topic.

2 Background and scientific literature: Key findings

2.1 What is (shared) micro-mobility?

In recent years, micro-mobility has gained considerable popularity, owing to the growing use of vehicles which share common physical and operational characteristics as means of transportation.

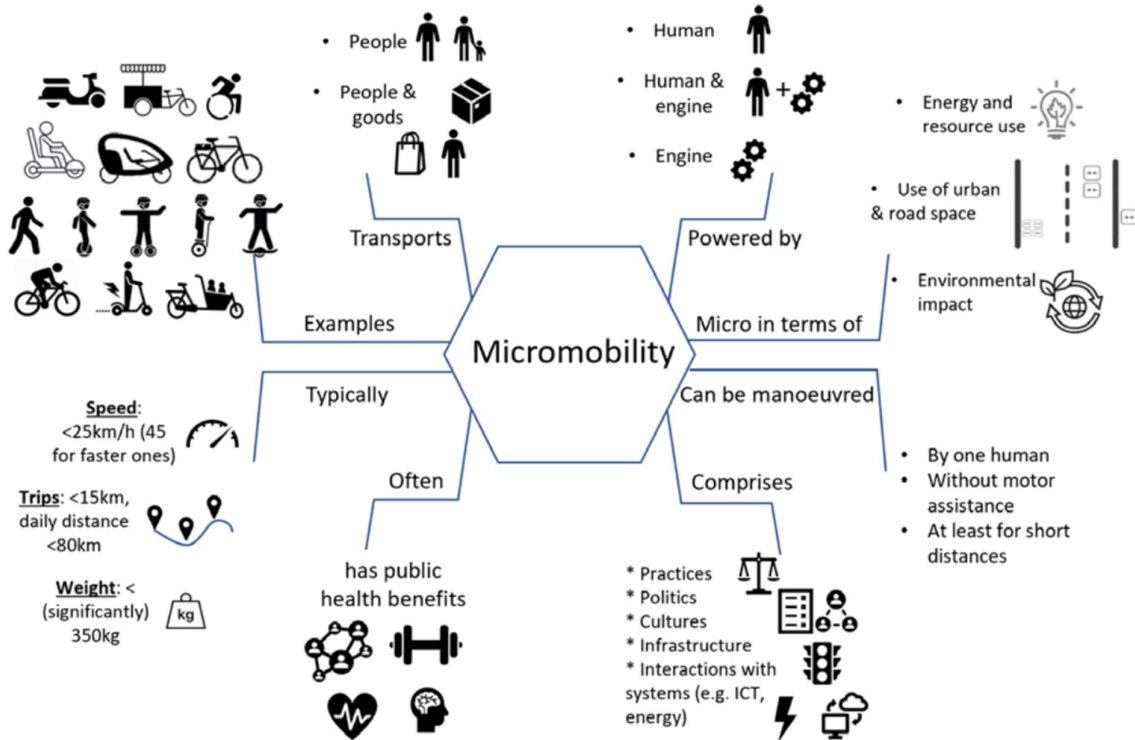
While different definitions of micro-mobility can be found in the literature (Abduljabbar et al., 2021; Aman, Zakhem, et al., 2021; Caspi & Noland, 2019b; Esztergár-Kiss & Lopez Lizarraga, 2021; Fazio et al., 2021; Felipe-Falgas et al., 2022; Kazemzadeh & Sprei, 2022b; Leister et al., 2018; Liao & Correia, 2022; Psarrou Kalakoni et al., 2022; S. Shaheen & Cohen, 2020b; I. Smith et al., 2021; Zhao et al., 2022), there is a lack of a general consensus as to what it constitutes of (Behrendt et al., 2022; Roig-Costa et al., 2021). There appear to exist two prominent definitions, though: that of the International Transport Forum (ITF) and that of the Society of Automotive Engineers (SAE). The former defines micro-mobility as “the use of micro-vehicles: vehicles with a mass of no more than 350 kilograms (771 pounds) and a design speed no higher than 45 km/h” (ITF, 2020). The latter defines micro-mobility as “an emerging travel mode that uses micro-mobility vehicles, such as e-bikes and scooters” (*SAE International*, n.d.-a), followed by a definition of powered micro-mobility vehicles, as well as their taxonomy and classification (SAE International, n.d.-b).

One of the most complete definitions is proposed by Christoforou et al. (2021) who propose that micro-mobility includes “all transportation modes that allow their users to make a hybrid usage and behave either as a pedestrian or a vehicle at their convenience (e.g. to cross a road or board on a bus) when necessary”; a terminology which was further elaborated by Psarrou Kalakoni et al. (2022) adding that “these can include a wide range of vehicles, from bicycles and electric scooters to segways, kick-scooters, single-wheel boards, and other. They can be either motorized or non-motorized modes, shared or privately owned”. This is a different approach, which does not focus on the characteristics of the micro-mobility vehicles but rather on the aspects of mobility itself (Christoforou et al., 2021; Psarrou Kalakoni et al., 2022). Further building on the multi-dimensional aspects of micro-mobility, Behrendt et al. (2022) proposed an even more inclusive concept:

Micro-mobility covers a wide range of mobility options that can typically be manoeuvred by one human without motor assistance, at least for short distances. ‘Micro’ is seen as being a relative term - in terms of energy demand, environmental impact, as well as the use of road space – vis-a-vis automobility. Micro-mobility comprises both long-standing and novel forms of mobility, including fully human-powered, partially motor-assisted and fully powered options. It can move humans, cargo, or a combination. Current examples of micro-mobility include walking, cycling, (speed) e-bikes, step-scooters, moped scooters, cargo bikes, rikshaws, wheelchairs, mobility scooters, (e)skate and hover boards. They typically do not exceed 25 km/hour (or 45 for faster ones) and weigh (often significantly) less than 350 kgs, while often providing some (public) health benefits. Trip lengths are typically less than 15 km and the daily distance travelled is less than 80 km. Micro-mobility includes the practices, policies, cultures, and infrastructures that emerge around the use of these mobility options and shape their uptake, including interaction with other systems such as energy and ICT (Behrendt et al., 2022).

While technically this is a description (and not definition) of the term “micro-mobility”, it covers a multitude of aspects, dimensions and considerations at different levels.

Figure 1: Graphical representation of the term “micro-mobility”. Source: Behrendt et al., 2022



However, despite the variations that exist, most of the definitions are based on similar building blocks. As such, micro-mobility is characterized by the use of small vehicles (usually two-wheelers, i.e. bicycles and scooters), both in terms of dimensions and weight. These vehicles, which may dispose of different propulsion systems (ranging from traditional bicycles and scooters, to power-assisted as well as fully electric ones) are used for short journeys in terms of time and short distances (usually up to 5 miles/kilometers) within urban areas. They can usually achieve speeds lower than those of conventional vehicles (typically around 25 miles/kilometers per hour) while their propulsion systems render them more environmentally friendly than other modes of transport: because of the lower production of carbon dioxide (CO₂) and other green house gas emissions, as well as because of the fact that they consume less energy, they are considered a more sustainable mode of transport.

Shared mobility originates from the sharing economy model. This is a relatively new business model, which relies on the principle that the value is generated through the sharing of goods, services or skills. In this economy model, idle assets (private but which are not being used) can be monetized and provide financial revenue by sharing them with others, exploiting one of their biggest disadvantages: underutilization (Cohen & Kietzmann, 2014; Sundararajan, 2017). This economy is applicable to multiple sectors, including that of transport. Especially in the latter, the ever-increasing congestion rates in urban environments, the unavailability of transport alternatives of sufficient quality and the unavailability of cost-controlled private “green” vehicles has led to a failure between the private and public sectors in the mobility landscape – a failure (and gap in terms of services available to the public, including the challenge of solving the first- and last-mile connectivity issues with public transit (S. Shaheen & Chan, 2016)) which the private sector seeks to exploit by offering shared mobility services, under different business models (Cohen & Kietzmann, 2014). In that sense, shared mobility can be defined as “the shared use of a vehicle, bicycle, or other mode that enables users to have short-term

access to transportation modes on an “as-needed” basis” (S. Shaheen et al., 2020). This can also be extended to shared micro-mobility services, which could be defined as the shared use of micro-mobility vehicles, for short periods of time, as and when needed, with a membership as well as a usage fee applied to each user as a compensation for these services (Cohen & Kietzmann, 2014; S. Shaheen & Chan, 2016; Sprei, 2018).

Shared micro-mobility services can be divided in two categories in terms of the way they make their fleet available to their users (how the consumers of the services can access and park the micro-vehicles): free floating and docked micro-mobility services. Free floating micro-mobility services allow users to pick up and drop vehicles (e.g., electric bicycles, electric scooters) anywhere in a specifically designated service area; similarly, these vehicles do not have to return to a specific station or dock after their use. Such vehicles can be located and activated/deactivated using smartphone apps. This gives users high flexibility and convenience as they can pick up and drop off vehicles anywhere in the service area, without being limited by infrastructure constraints. In contrast, docked micro-mobility services require users to take and return vehicles to designated docking stations, which are strategically located in specific points within the limits of the service area. The drivers must check the availability of vehicles before approaching the docking station. This type of service offers a more reliable and organized system, as vehicles are guaranteed to be available in a specific place, while they are charged and maintained at the same point of service. However, the user needs to travel longer or shorter distances in order to approach the nearest docking station, something which is less convenient in comparison to free float services. Finally, hybrid models exist as well. In such case, the users can either pick up a micro-mobility vehicle from a dock station and return it to another dock station or non-dock station location – the opposite also applies (S. Shaheen et al., 2020).

Shared micro-mobility first appeared in 1965 in the Netherlands, with the introduction of a scheme which allowed for the free use of a small number of bicycles in the city of Amsterdam (Abduljabbar et al., 2021). Despite the challenges that the programme faced and led to its failure (S. A. Shaheen et al., 2010), the cities of La Rochelle in France (1974) and Cambridge, United Kingdom (almost 30 years later than Amsterdam, in 1993) followed the same path. And while Cambridge’s experiment failed too, La Rochelle was much more successful, being able to continue the bike-sharing program until today, albeit under a different marketing name (S. A. Shaheen et al., 2010; Yélo, n.d.). One of the most precious lessons learnt during this period was the fact that the shared bikes at the disposal of the public can be easily stolen or confiscated (Abduljabbar et al., 2021; S. A. Shaheen et al., 2010). This realization led to the second generation of shared micro-mobility services: the one that introduced docking stations in an attempt to eradicate the theft problem. The Copenhagen in Denmark was the first one to introduce such schemes, with a refundable coin-deposit system, in 1995. Soon, the example was followed in other countries (S. A. Shaheen et al., 2010). And while this second generation of bike-sharing services improved on the operational aspects of the first generation, it did face challenges as well; among them, bike theft as a result of anonymous use of the bikes and low deposit fees, increased operational costs as well as inability to actually influence modal choice to users because they were still unreliable services (Abduljabbar et al., 2021; Bonnette, 2009; S. A. Shaheen et al., 2010). Again this led to a new (third) generation of shared micro-mobility services, which leveraged technological developments in order to make the systems more reliable and prone to theft: the broad use of smartphones and GPS tracking (Abduljabbar et al., 2021; S. A. Shaheen et al., 2010). It should be noted that the above historical overview mostly concerns Europe. In the North America, the first scheme to be developed was in 1994 in Portland, United States of America (S. A. Shaheen et al., 2010). This marks a 3-decades gap with Europe; however, the transition to the next two generations was much faster, with the first 3rd generation shared micro-mobility service launched in 2008 in Washington, D.C (S. A. Shaheen et al., 2010).

However, the first shared e-scooter services appeared in the scene in the United States of America in 2017, with a profound success which allowed them to surpass bikesharing in many cities (Caspi et al., 2020; Hosseinzadeh et al., 2021). Asia, on the other hand, implemented directly 3rd generation schemes, first with Singapore in 1999 which was then followed by the city of Taito, in Japan. About a decade later, Australia followed too, with the city of Melbourne as pioneer (S. A. Shaheen et al., 2010). During the last years, the use of shared micro-mobility services has expanded significantly and relevant vehicles have become increasingly available to the consumers, either through shared-mobility schemes or through individual initiative (buy for personal-only use).

The introduction of these micro-mobility modes has sparked debate and research on various associated aspects:

- How the commuters' daily habits have changed, integrating to a greater or lesser extent these micro-mobility solutions in everyday commuting patterns (Liao & Correia, 2022; Reck et al., 2021; Weschke et al., 2022)
- The adaptations and adjustments that cities have to sustain in order to facilitate the operation of these micro-mobility modes (Richter et al., 2022)
- The impact of these micro-mobility solutions on the cities' transport systems, and the concerns they have raised about public space and safety (Kamargianni & Matyas, 2017; Liao & Correia, 2022; S. Shaheen & Cohen, 2020a)
- The emergence of shared micro-mobility schemes in parallel with the increased affordability of such devices, which renders their acquisition and use individually by the users, has reiterated the relevance of the debate between ownership and short-term rental/leasing services
- The parallels which can be drawn between the shared micro-mobility schemes, the Mobility-as-a-Service (MaaS) concept and the Mobility-on-Demand (MoD) concept, as well as the (significant) deviations (Kamargianni & Matyas, 2017; S. Shaheen & Cohen, 2020a).

2.2 Advantages and inconveniences

One of the main advantages of micro-mobility is the fact that it can provide first- and last-mile mobility solutions. As evidenced earlier, there is an inefficiency and gap in the services offered to passengers in covering the need for first- and last-mile transport (S. Shaheen & Chan, 2016) – although there are cases where the latter is not applicable (Mathew et al., 2019). To that end, micro-mobility has the potential to improve door-to-door accessibility, expanding the effective radius of public transport (Caspi et al., 2020; Curtis, 2020; Hosseinzadeh et al., 2021). This fact can also have ripple effects, with the potential of reduction on car dependency being one of them (Clewlow, 2018). However, especially in the absence of studies before and after the introduction of shared micro-mobility services in cities, it is hard for this potential to be measured and, subsequently, evidenced or dismissed. Another advantage of micro-mobility is its potential to reduce traffic congestion levels and fuel consumption, especially under the possible combination of reduced car dependency and increasingly efficient traffic flows (Hamilton & Wichman, 2018). At a subsequent level, there are two other potential positive outcomes: the first is the reduction of fuel consumption (Brunner et al., 2018; Li et al., 2020) and the second the reduction of greenhouse gas emissions and air pollution (Keall et al., 2018; Olabi et al., 2023). These two factors have the potential to lead to better health levels, both at personal and society levels, together with the fact that micro-mobility appear to have the potential to improve physical benefits and well-being by promoting increased physical movement (Jones et al., 2016; Oja et al., 2011). Furthermore, micro-

mobility can be an economically affordable means of transport, which can increase the travelers' utility (Zim et al., 2018). The latter was also confirmed by other studies (Lia et al., 2014; Nocerino et al., 2016), further adding the point of easier parking. It is evident that more efficient traffic flow, easier parking space, first-/last-mile efficiency and the ability of micro-mobility to get integrated with public transport can lead to significant time savings for travelers.

At the same time, micro-mobility also has some adverse effects; some of them even mirror relevant advantages. While it is considered a form of green, sustainable mode of transport, as it does not produce any greenhouse gas (GHG) emissions during use, such emissions are indeed produced during the micro-vehicles lifecycle: manufacturing of the micro-vehicles, use, logistics operations (including both delivery from the constructions factories to the operators, as well as the servicing operations performed by other vehicles) and decommission (recycling). While, in general, the burden on the environment is lower by micro-mobility in comparison to other means of transport (for example, cars), it still exists and thus micro-mobility cannot be considered fully green and sustainable (Behrendt et al., 2022; Cazzola & Crist, 2020; de Bortoli, 2021; Hollingsworth et al., 2019). In addition, from an economic point of view, there appears to be volatility in the market: with the evolution of the sector, new elements are being developed and added in the system, including technological advancements and legal frameworks, which can alter the modus operandi of shared micro-mobility services. After heavy investment in the period before the Coronavirus disease 2019 (COVID-19) period, shared micro-mobility companies face a very challenging period from the eruption of the sanitary crisis in 2019 and onwards: there have been several corrective moves from the market, which included bankruptcies as well as mergers/acquisitions between not only minor but also major service providers, hastening the industry's consolidation rate (Heineke et al., 2020). This creates uncertainty both to users and cities, even if there is a reported willingness by potential users to increase uptake (Heineke et al., 2020): a scenario where a city is carefully planning a scenario for shared micro-mobility integration in its transport system only to find out that the main market actors expected to participate are not in position to do so can have planning and implementation implications, which are contrary to the public interest. The latter can be further hampered by the capitalistic nature of the private sector, which seeks to maximise profit rather than providing a public service, thus potentially creating inequalities, such as exclusion of areas with low profitability from being serviced or exclusion of groups of users (Sareen et al., 2021). While, in general, it is considered that micro-mobility can enhance accessibility level, relevant gains can be nullified in the case of docked micro-mobility solutions (where the docking station can be far from the potential user's point of (travel) origin or in case a specific area has a low number of available free-floating micro-vehicles (Gu et al., 2019). One major concern is the safety not only of the users of micro-mobility but also the rest of the road users: the associated risks can limit the users' experience (Olabi et al., 2023). The micro-vehicles do not possess any meaningful passive or active safety systems and thus their drivers are exposed to traffic risks – especially if the fact that the use of helmet or other protective gear is not uniformly regulated and/or mandatory. With the crashes between micro-mobility users and other motor vehicles being quite common (Fang, 2022), this is a point of concern and a potential factor of micro-mobility uptake (ITF, 2020). Finally, the growing use of free-floating shared micro-mobility services has led to the crowding of sidewalks by inactive (e-)bicycles and (e-)scooters, (Greening & Erera, 2021), which, on one hand, can pose safety risk for other road users and, at the same time, provoke the dismay of habitants because they limit the public space (Kamargianni & Matyas, 2017; Liao & Correia, 2022; S. Shaheen & Cohen, 2020a).

Overall, micro-mobility is considered a flexible, cost-effective, on-demand mode of transport, which can provide an efficient solution for first- and last-mile trips and contribute to the alleviation of challenges associated with heavy car dependence in urban environments that can solve the first- and

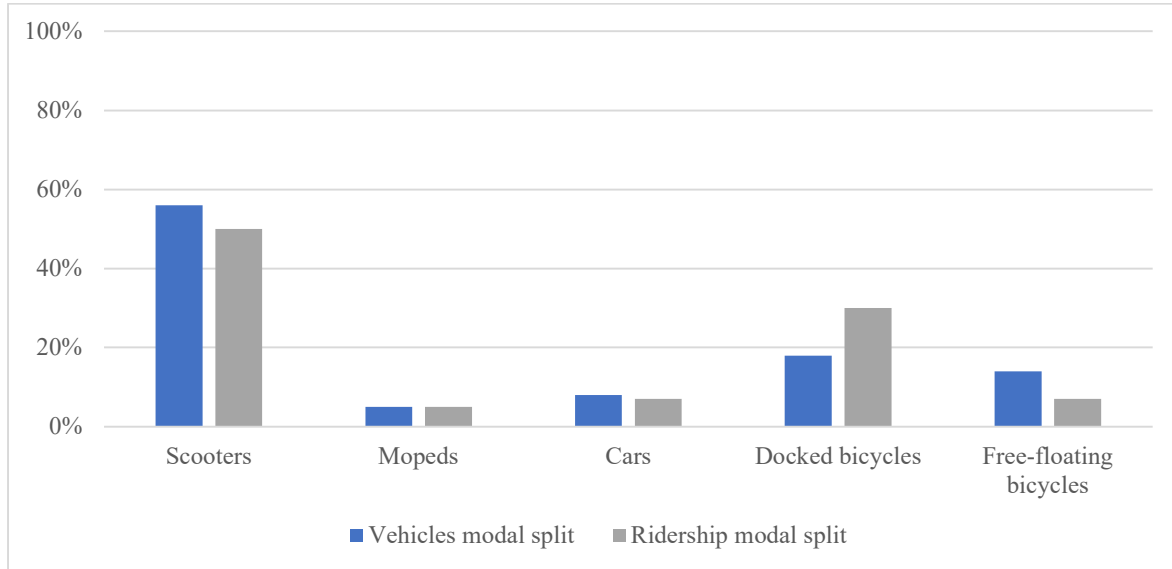
last-mile challenges and connect to public transport networks, outweighing at the same time many of the inconveniences that it introduces in the public sphere. However, the aspects of safety and public space occupancy by unattended free floating shared micro-mobility fleets have grown significantly as underlying issues, to the extent that cities have started taking drastic action. The city of Paris on the 2nd of April 2023 held a referendum, where the majority of the residents voted in favor of a ban on free floating shared e-scooters, in response to a rising number of related accidents and fatalities. The referendum saw a turnout of only 7.46% of registered voters, with just over 103,000 of the 1.38 million people on the city's electoral register taking part (Bairin & Ataman, 2023; "Paris Votes to Ban Rental E-Scooters," 2023). Of those who voted, over 91,300 were in favor of the ban, representing almost 90% of the participants. The decision to ban e-scooters was driven by growing concerns about the way they were being driven, with many users weaving through traffic, dodging pedestrians on pavements, and reaching speeds of more than 25km/h. Additionally, users often failed to wear helmets, and children as young as 12 were legally allowed to use these shared micro-mobility e-vehicles (Bairin & Ataman, 2023; "Paris Votes to Ban Rental E-Scooters," 2023). In a report issued in November of last year, the French Academy of Medicine highlighted that e-scooters were a "true public health problem" and associated with a significant number of serious injuries (Masquelet & de Saint Julien, 2022). Furthermore, the city faced criticism due to the cluttering of pavements by groups of parked e-scooters, with many dumped scooters being found in parks and squares throughout Paris. The ban is set to come into effect at the end of August, with the expiration of the contracts of the city's shared micro-mobility operators. It should be noted though that private owners of e-scooters will not be affected by the ban (Bairin & Ataman, 2023; "Paris Votes to Ban Rental E-Scooters," 2023). The decision made by Paris has generated discussions and contemplations in the public sphere, with a question arising about which city, or cities, will follow in Paris' footsteps and implement similarly drastic measures. Paris has been a pioneer in the shared micro-mobility scene, and this ban on shared e-scooters may serve as an example for other cities to prioritize public safety over other factors when considering the implementation of new forms of transportation (Bairin & Ataman, 2023; Eurocities, 2023; "Paris Votes to Ban Rental E-Scooters," 2023). Already, several cities have introduced and are enforcing stricter policies in response to unregulated parking, speed limits and micro-vehicles being used by more people than the driver only: Rome, Italy; Riga, Latvia; Helsinki, Finland; Brno, Czech Republic being amongst them (Eurocities, 2023).

2.3 A glance at the European market

Micro-mobility has sharply risen during the last years and especially after 2017 (Caspi et al., 2020; Hosseinzadeh et al., 2021) and relevant vehicles have become increasingly available to the consumers, either through shared-mobility schemes or through individual initiative (buy for personal-only use).

In Europe only, as of the end of 2022, the number of shared micro-mobility vehicles has risen to 850,000, with almost 600,000 vehicles having been deployed from 2018 to 2022. Furthermore, the year 2021 witnessed the introduction of almost 200 new shared mobility services in the continent, resulting in a staggering 550 million trips Europe-wide. This has resulted in substantial revenue for the sector, calculated to approximately €3.1 billion (Fluctuo, 2023). In comparison, in North America (United States of America and Canada), the total number of micro-vehicles is estimated at 212,000 and the number of trips at 128 million, signifying a much smaller market (Fluctuo, 2023).

Figure 2: Vehicle and ridership modal split of shared micro-mobility services in Europe in 2022. Source: Fluctuo, 2023



The availability of shared mobility vehicles is subject to fluctuations that are influenced by a variety of factors, including weather conditions, tourism, and local events. The sizes of free-floating bicycle and scooter fleets are particularly subject to change, and tend to shrink during the winter months due to the decrease in temperature and daylight hours. These fluctuations are more pronounced for shared bicycles and scooters, which are more sensitive to changes in demand, and require more meticulous management and maintenance to ensure their ongoing viability and success. As such, these shared mobility services present unique challenges that require innovative solutions in order to maintain and improve their sustainability and efficiency over time (Fluctuo, 2023). This is particularly important as these services continue to grow and play an increasingly important role in urban transportation systems.

Focusing on cycling, in the year 2022, in Europe, the shared bike industry experienced growth (+34% in comparison to 2021), with companies and manufacturers striving to improve the quality of bikes offered, by enhancing sustainability features, comfort and safety attributes. Station-based bikes demonstrated superior ridership performance, particularly in major cities. Although the number of station-based bikes remained relatively stable, the number of free-floating bikes continued to grow, increasing by more than 118% on the streets of European cities within a year (Fluctuo, 2023).

Shared scooters, which have become the most widely available shared micro-mobility mode in Europe, saw a surge in popularity in 2022 (+46% in comparison to 2021). Their strong momentum during summer months, when weather conditions are more favorable, contributed to their success. In fact, fleets of shared scooters reached almost 600,000 vehicles, with markets across Europe, except for a few in which they are banned, reporting positive results. This success was not limited by culture or geography, as both Northern and Southern European countries showed similar levels of success (Fluctuo, 2023). It is worth noting that Brussels is ranked 3rd in terms of trips per capita conducted by scooters, among 100 European cities (Fluctuo, 2023).

As to what concerns mopeds (motor scooters), they continue to thrive where scooters are banned from circulating the streets. This was the case mostly in Spain and the Netherlands, with this shared micro-mobility mode gaining a +26% bump in growth over 2021 (Fluctuo, 2023).

In terms of shared car services, the year-on-year ridership in Europe, in comparison to 2021, increased by 26%. Germany appears to be on the forefront of this trend. Car-sharing providers capitalize on the advantage of being closely linked to a major automotive industry locally, which is a fact that allows them to spearhead electric mobility, with approximately 25% of their vehicles being electric (Fluctuo, 2023). Car-sharing services not only offer a convenient means of transportation but also have the potential to play a significant role in promoting the adoption of electric vehicles (EVs) and increasing awareness of the technology. As more car-sharing operators introduce EVs into their fleets, it can lead to a greater familiarity with the technology among the public, ultimately contributing to increased demand for EVs in the future. The adoption of electric vehicles by car-sharing providers can have a positive impact on the environment by reducing the overall carbon footprint of the transportation sector. The reduction of carbon emissions from transportation is essential to mitigate the effects of climate change, and the promotion of EVs through car-sharing services can contribute to global efforts towards sustainable development. In addition to reducing carbon emissions, car-sharing services also have the potential to reduce the number of privately owned vehicles on the road, further contributing to efforts to reduce traffic congestion and air pollution (Fluctuo, 2023).

Overall, the shared mobility market in Europe is currently thriving, and is expected to continue its upward trend in the near future, with growing numbers of users and micro-vehicles. Technological advancements, such as facilitating travel over greater distances, could further enhance the user experience. Nevertheless, the increased exposure of shared mobility services to the public also invites greater political intervention and regulation, which could potentially impact the market's growth. In this context, it is crucial for user behavior to continue valuing shared mobility as an alternative and complementary form of commuting (Fluctuo, 2023).

2.4 Influencing, acceptance and satisfaction factors

There are several factors identified in the literature which influence the use or non-use of shared micro-mobility services such as bike-sharing and e-scooter programs. Among them, factors such as cost, availability of infrastructure, convenience and ease of use, health and environmental benefits, attitudes, weather conditions, and socio-demographics are considered to play a significant role in the adoption of shared micro-mobility services. Additional factors may include the regulatory framework and related policies, travel behaviors, as well as perceptions and attitudes.

In a comprehensive exercise, Kazemzadeh & Sprei (2022) proposed guidelines for the development of a Level-of-Service index for electric scooters, partially in an effort to gauge the users' satisfaction levels (and, subsequently, the level of acceptance by the users of this micro-mobility mode) (Kazemzadeh & Sprei, 2022a).

Lee et al. (2021) identified the factors that affect heterogeneity in people's intention to use shared e-scooter schemes in Seoul, Korea. Their analysis revealed two major groups of users (using e-scooters for commuting Vs. for first- and last-mile trips), with contrasting backgrounds in terms of age, financial prowess and satisfaction by public urban transport services.

In a study that covered 83 cities in Germany, Krauss et al. (2022) explored the factors that determine the utility that users enjoy from shared modes of transport (Krauss et al., 2022). The study does not only focus on micro-mobility modes, as it also included car-sharing and car-pooling, while the value of access, egress, and parking search time were used as attributes. The study, which was implemented through a stated preference experiment, concluded that the cost factor is equally important to travel time

micro-mobility modes, while for shared services, access is more important than egress time. In addition, evidence of potential modal shift from cars to micro-mobility solutions for intra-city trips was found on the basis of each mode's value of travel time (VoT). Moreover, previous findings by Reck et al. (2021) are validated, which concern the fact that docked shared micro-mobility services are more attractive to users during peak hours, with the preference shifting to dock-less services during off-peak hours (Krauss et al., 2022; Reck et al., 2021).

An interesting literature review conducted by Bretones and Marquet (2022), focused on the identification of the social and psychological factors which can affect the adoption and use of electric micro-mobility solutions. The review confirms that the users' modal choice is dictated by various factors, including not only traditional functional ones (speed, cost, time), but also non-functional ones (environmental concerns, social perception, interest for new technologies etc). Micro-mobility modes (including shared schemes) are generally considered to be "practical, easy to use, accessible, and flexible" (Bretones & Marquet, 2022).

In a different literature review, Elmashhara et al. (2022) define three categories of factors that influence the behaviour (and modal choice) of shared micro-mobility services: temporal, spatial and weather-related factors; system-related factors (such as convenience, cost, accessibility, LoS and regulatory aspects); and user-related factors, such as attitudes, socio-demographic variables, safety/security concerns, sustainability etc. The review concluded that, while specific influencing factors had been adequately studied, others, which are considered important like cultural, emotional and brand-related factors have not been deeply looked into. At the same time, the same was true for the studies' points of focus: while there is an abundance concerning the users' intention and/or use behaviour as well as satisfaction levels, there is a lack a studies concerning negative behaviours/attitudes (Elmashhara et al., 2022).

Esztergár-Kiss et al. (2022) conducted a stated preference experiment in 5 cities (Barcelona, Copenhagen, Munich, Stockholm and Tel Aviv) in order to assess the derived utility of electric scooters users. The data collected was modelled in order to estimate unobserved attributes related to electric scooters, cost and time sensitivity, as well as the probability of the selection of this mode of transport over another (Esztergár-Kiss et al., 2022).

Following a different research method, Aman et al. (2021) delved into the reviews that the users of two shared micro-mobility providers had posted on the respective app stores and, using machine-learning techniques, they identified the factors that have an impact on their levels of satisfaction. The predominant topic among the comments was the limited availability of payment options, as well as app functionality, quality of customer service, refund policies and unanticipated costs arising from the use of restricted parking areas. In addition, user safety and the regulation of e-scooter right-of-way emerged as significant areas of concern, while the analysis also suggested that user satisfaction was largely influenced by ease of use, safety (including speed and riding lane), and app functionality (Aman, Smith-Colin, et al., 2021).

Clustering the above, it can be derived that the main factors that influence the use (or non-use) of shared mobility services are the following.

1. Convenience and ease of use

Studies show that convenience, ease of use and availability of shared micro-mobility options strongly influence their adoption (Faghih-Imani et al., 2014; Nair et al., 2013). People are more

likely to use services that have a large vehicle fleet, are easily accessible and have a simple booking and payment process (Fishman, 2016; C. Smith & Schwieterman, 2018)

2. Cost

The pricing structure of shared micro-mobility services, including membership fees, usage fees and discounts appears to be a key factor affecting their use. Services with lower costs are more likely to be used, especially when they provide good value for money in comparison to other transport options (Fishman, 2016; Martin & Shaheen, 2016; Zhang et al., 2017)

3. Health and environmental benefits

One of the motivating factors for some users are the potential health and environmental benefits, since shared micro-mobility services provide an opportunity for active travel and sustainable transport (Fishman, 2016)

4. Availability of infrastructure

The availability and quality of cycling and scooter infrastructure, such as dedicated lanes, parking facilities, as well as the overall connectivity of the network can positively influence the use of shared micro-mobility services. It is obvious that the lack of such amenities is a discouraging factor for the use of such services (Fishman, 2016; S. A. Shaheen et al., 2010)

5. Attitudes

People with positive attitudes towards new technologies, environmental sustainability and active lifestyles are more inclined to adopt shared micro-mobility modes. Negative views regarding the risks and safety of micro-mobility vehicles can be deterrent factors towards the adoption of such services (Heinen et al., 2010; Ricci, 2015)

6. Safety

There appears to be a direct link between the perceived lack of safety, the risk of accidents and the micro-vehicles malfunctions with the deterrence levels for using shared mobility services (Fishman, 2016; C. Smith & Schwieterman, 2018)

7. Weather conditions

In general, weather conditions (temperature, precipitation, humidity etc) can affect the attractiveness of shared micro-mobility services. Unfavorable and adverse weather conditions (rain, snow, extreme heat) can negatively impact the use of shared mobility services, as, in such cases, the users prefer more sheltered transport options (Gebhart & Noland, 2014; C. Smith & Schwieterman, 2018; Teixeira & Lopes, 2020)

8. User demographics and individual mobility needs

Factors such as age, gender, income, and education can affect the adoption of shared micro-mobility services (Zhang et al., 2017). The use of shared mobility services is dictated or hampered by the users' individual needs (for example, traveling with children, baggage or mobility impairments, need for mobility services outside operating hours etc) (C. Smith & Schwieterman, 2018)

9. Regulations and policies

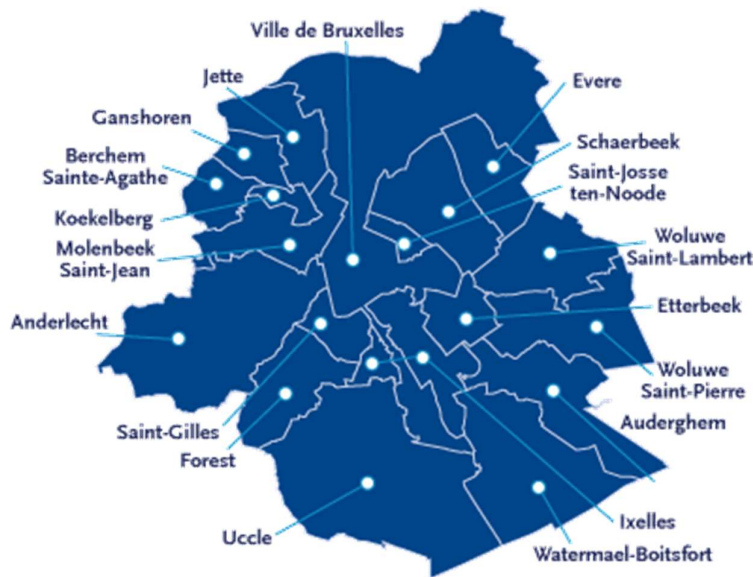
Local regulations and policies surrounding shared micro-mobility services (such as helmet requirements, age restrictions, vehicle standards etc) can impact the use of such services (Fishman, 2016).

3 State of play: (Shared) Micro-mobility in the Brussels-Capital Region

3.1.1 The Region

The Brussels-Capital Region is a region of Belgium that comprises 19 municipalities, including the city of Brussels (*The Communes of the Brussels-Capital Region*, n.d.), which is the capital of Belgium and the seat of several international institutions. The region, which is entirely surrounded by the Flemish Region and shares a border with the Walloon Region (*Brussels*, 2023), covers an area of 162 square kilometers (*Brussels-Capital Region*, 2023) and has a population of about 1.2 million people as of 2022, with a population density of 7,667 inhabitants per square kilometer, making it one of the most densely populated regions in Europe (*Structure of the Population*, n.d.). The region is bilingual, with French and Dutch as the official languages, and hosts many foreign residents and workers from various countries (*Brussels*, 2023; *Brussels-Capital Region*, 2023).

Figure 3: Map of the Brussels-Capital Region and its Municipalities (Source: The Communes of the Brussels-Capital Region, n.d.)



The region was created in 1989 as a result of the federalization of Belgium, which gave more autonomy to the three regions: Flanders, Wallonia and Brussels-Capital (*Brussels-Capital Region*, 2023). The region is separate from the Flemish and Walloon regions, but is part of both the French Community and the Flemish Community of Belgium. The Region has its own Government and Parliament, which are responsible for matters such as urban planning, environment, transport, culture, tourism and international relations (*Brussels-Capital Region*, 2023; *The Community Institutions in Brussels*, n.d.).

3.1.2 Urban mobility options

The region has a dense and modern transport network that includes metro lines, tramways, buses, trains and bicycle lanes. The region also has two international airports: Brussels Airport and Brussels South Charleroi Airport. The region is connected to other European cities by high-speed trains such as Thalys and Eurostar (*Brussels*, 2023).

More precisely, the main public transport operator in the region is STIB/MIVB, which operates a dense network of metro, tram, and bus lines. The metro system has four lines and 59 stations, providing fast and efficient connections across the region. The tram network has 17 lines and 305 stops, covering most of the municipalities in the region. The bus network complements the metro and tram services, providing connections to areas not served by the other modes of transport. STIB/MIVB also operates a night bus network, which runs on Friday and Saturday nights, providing a safe and reliable option for late-night travel (*Bruxelles Mobilité*, n.d.).

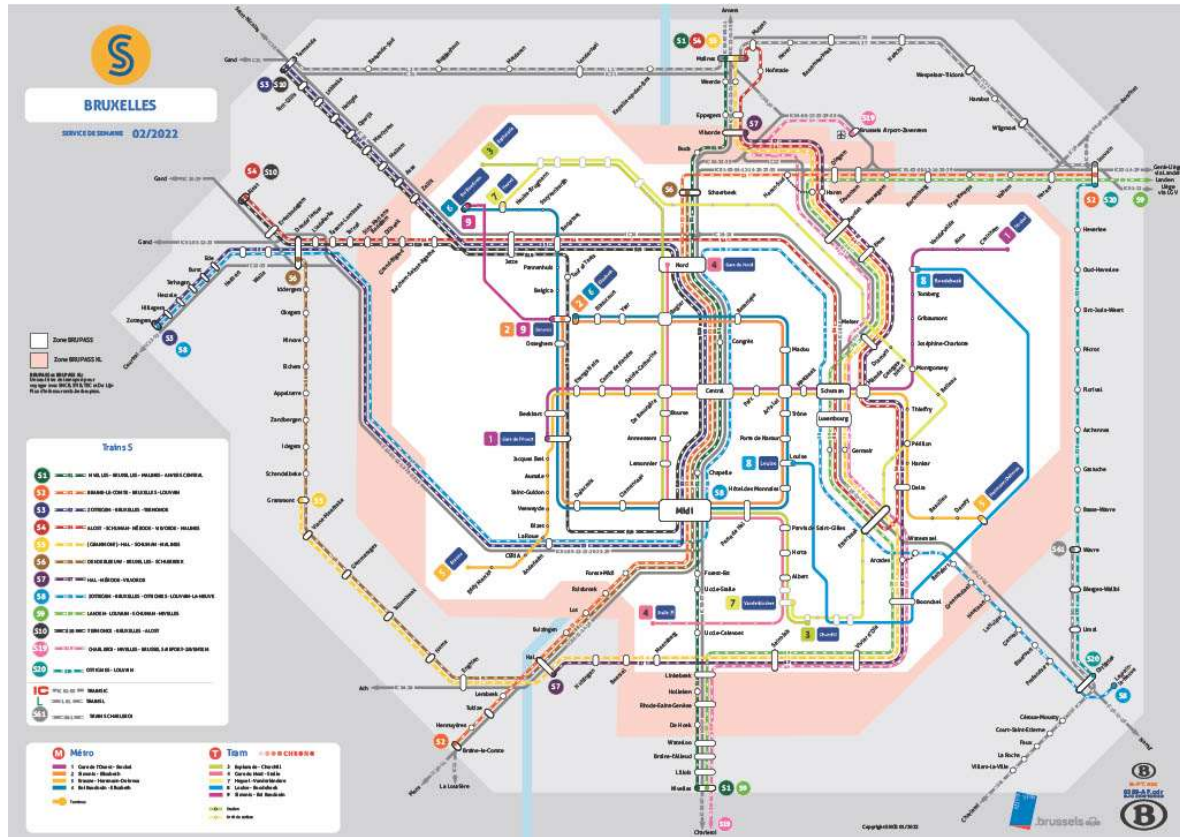
Figure 4: Map of the public transport system in the Brussels-Capital Region (Source: Network Maps, n.d.)



Additionally, there also exists the S-Train, which is essentially the commercial name of the Region's suburban train services: the railway component of the Regional Express Network (RER), as conceived as a intermodal transport solution. The S-Train transport system in Brussels, whose operator is the National Railway Company of Belgium (SNCB/NMBS), covers a radius of approximately 30 kilometers around the Capital and consists of twelve commercial services that serve the Region, through 12 suburban lines, 700 trains per week and 144 stations, including 35 in the City of Brussels itself. These stations are gateways to the TEC (acronym stands for "Transport En Commun", which is the public transport operator in the Walloon Region) (*TEC*, n.d.), De Lijn (the Flemish government-owned

enterprise that provides public bus and tram transport in Flanders) (*De Lijn*, n.d.) and STIB networks (*Le train S*, n.d.; *L'offre S*, n.d.; *Train S Zone Bruxelles*, n.d.).

Figure 5: The S-train network in the Brussels-Capital Region (Source: Train S Zone Bruxelles, n.d.).



In addition to public transport, the region has an extensive network of cycling routes and bike-, scooter- and car-sharing schemes (*Bruxelles Mobilité*, n.d.).

An interesting fact is that, according to the Deloitte City Mobility Index 2020 (Deloitte LLP, 2021), the journey modal split in the Region is heavily leaning towards car usage, which accounts for 42% of trips; public transport follows with 35%, walking with 18% while cycling comes last with a percentage of only 3%. What is intriguing is that the bicycle lanes which were added in the urban landscape during the recent have not had thus far a significant impact on the number of people choosing to cycle (Deloitte LLP, n.d.). Furthermore, Brussels is considered a top performer in terms of integrated mobility and modal diversity (which also includes different micro-mobility modes), but scoring lower in the fields of congestion, public transport reliability, innovation, transport affordability and customer satisfaction (Deloitte LLP, 2021).

3.1.3 Shared micro-mobility

In Brussels, Belgium, micro-mobility is a reality which has evolved through time: from the Villo bike-sharing scheme which pioneered the landscape to different shared e-scooter schemes and the rise of individual micro-mobility vehicles ownership. More precisely, the origins of micro-mobility in Brussels can be traced back to the early 2010 decade, when bike-sharing schemes such as Villo! and Blue-bike were launched. These services aimed to provide an alternative mode of transport for short trips within

the city, complementing public transport and reducing car dependency. However, bike-sharing faced some challenges, such as limited availability, high maintenance costs and vandalism. Free floating shared micro-mobility services (e-scooters) were introduced in Brussels in 2018. During the booming phase of this new market, ten different providers offered their services to the local population; even if most of them have now disappeared (with a common pattern between them being the non-development of their own-designed e-scooters unavailable in the free market for individual purchase), this is a testimony of the emergence and attractiveness of this market (Moreau et al., 2020).

Nowadays, several shared mobility providers exist, for different modes of transport. The two Private companies that manage carsharing in Brussels are Cambio and Getaround. Free-floating providers include Poppy, GreenMobility and Miles, while several schemes of car-sharing services among individuals also exist: Cozywheels, Getaround, Wibee and Dégage. There are also different car pooling services (BlaBlaCar, Carpool, Commuty and Kowo) (Alternative Mobility, n.d.; Mobilité Partagée, n.d.). In addition, there are electric e-moped sharing solutions, provided by Felyx and GO Sharing (Alternative Mobility, n.d.). Concerning shared micro-mobility services, these can be split into two categories: bicycle services and scooter (trottinette) services. In the first category, the service providers that operate in the Brussels-Capital Region are Blue-bike, Bolt (which offers shared electric bicycles), Cozywheels (which offers shared electric bicycles and cargo bicycles), E-bike to go, Pro Velo, Swapfiets, Tier (which offers shared electric bicycles) as well as Villo! (which offers both traditional and electric bikes – eVillo!). In the second category, that of shared scooter services, the service providers that currently operate in the Brussels-Capital Region are Bird, Bolt, Dott, Gliize, Lime, Pony, Poppy, Tier and Voi – all of which run fleets of free floating e-scooters (Alternative Mobility, n.d.).

In order to deal with the expanding landscape of shared micro-mobility, the Brussels-Capital Region has established a relevant regulatory framework, since the 1st of February 2019 (Region de bruxelles-capitale, 2018). The main elements of this framework are:

- A licensing system that requires operators to apply for a permit from the regional government and comply with certain conditions regarding fleet size, service area, quality standards and data sharing
- The maximum number of shared micro-mobility service providers is not capped
- A fee system that charges operators a fixed amount per vehicle per year plus a variable amount depending on the parking behaviour of their users (e.g., whether they park on designated zones or not)
- A monitoring system that uses data provided by operators and other sources (such as surveys or sensors) to evaluate the performance and impact of micro-mobility services on various indicators (such as modal share, safety or user satisfaction)
- A dialogue platform that involves regular meetings between operators, public authorities and other stakeholders (such as public transport providers or civil society organisations) to exchange information and feedback on micro-mobility issues.

In 2020, the Regional Mobility Plan 2020-2030 concerning the Brussels-Capital Region was approved and published (*Plan Régional de Mobilité 2020-2030: Plan Stratégique et Opérationnel*, 2020). The Plan, which was a collaborative process that began in October 2016 and involved a wide range of stakeholders from the public, private, and non-profit sectors in Brussels and Belgium, underwent public consultation for four months (from 17 June 2019 to 17 October 2019), before finally being endorsed by the Government of the Brussels-Capital Region on 5 March 2020 (*Plan Régional de Mobilité 2020-2030: Plan Stratégique et Opérationnel*, 2020). This Plan deals with different aspects of mobility in the

Brussels-Capital Region, including shared micro-mobility. With regards to the latter, the objective is to establish a network of mobility points at neighborhood level, consolidating diverse services such as shared vehicles, service stations (including tyre pumps and re-charge stations) as well as delivery services, thereby promoting extensive sharing of the provided amenities. By reinforcing the interdependence with public transportation, the program aims to provide credibility to the reduction of car ownership. The initiative also endeavors to integrate mobility access points within the centralities of the neighborhoods, relying on pre-existing urban functions, such as commercial spaces, cultural facilities, and schools. Furthermore, it seeks to develop measures aimed at endorsing the concept of vehicle-sharing among targeted audiences (*Plan Régional de Mobilité 2020-2030: Plan Stratégique et Opérationnel*, 2020). More concretely, among the actions proposed are the analysis of the existing range of shared mobility services, the identification of potential synergies and the establishment of new deployment objectives for car-sharing; the increase of visibility and credibility of shared mobility services, with targeted participatory actions aiming to encourage their use, in cooperation with sharing operators; the identification of the system's needs, including the modes, numbers, deployment programs and parking arrangements; the establishment of a framework for the deployment of shared mobility vehicles; the reinforcement of the legislative framework mainly with regards to parking and control/enforcement, in consultation with various stakeholders; and the evaluation of the feasibility of services consolidation under a unique label (*Plan Régional de Mobilité 2020-2030: Plan Stratégique et Opérationnel*, 2020).

In 2022, a new set of rules was introduced, aimed at promoting the safer use of shared e-scooters. These regulations include mandatory shared mobility parking zones (Fluctuo, 2022a), a speed limit of 20 km/h on roads and 8 km/h on pedestrian areas, as well as a prohibition on riding on sidewalks (Eurocities, 2023). The latter is particularly significant, as it serves to protect pedestrians, especially the elderly and those with limited mobility or vision, who depend on the unrestricted use of sidewalks for their mobility needs (RNIB, n.d.). These measures are motivated by the need to safeguard not only pedestrians but also e-scooter users, who are themselves vulnerable to accidents. Data collected between spring 2021 and 2022 show a tripling of the number of accidents involving e-scooters in the Brussels region over the course of a year. In addition to the new regulations, the Brussels-Capital Region government is planning to establish a network of up to 1,000 dock stations for e-scooters, in order to tackle the issue of indiscriminate parking (Eurocities, 2023).

Concerning infrastructure and micro-mobility, the Brussels-Capital Region, despite disposing of less developed cycling infrastructure compared to other European cities, has one of the highest shared bicycle and scooter usage rates in the European continent. Operators have invested significantly in these micro-mobility modes despite the infrastructural limitations and utilized the character of the city as the administrative centre of the European Union in order to promote their shared mobility models (Fluctuo, 2022b).

In the above context, there are interesting developments. The Brussels-Capital Region has been operating its bicycle sharing system through a concession with Villo, owned by JC Decaux, since its launch. However, as the concession is set to expire in 2026, the Region aims to establish a new system that better caters to the needs and desires of its residents. In order to make an informed decision about the future of bicycle sharing in Brussels, the Region has commissioned a comprehensive study of similar networks implemented by other European cities. The study consists of four phases, including the identification of five candidate cities for closer examination; the detailed analysis of these cities; consultations with relevant stakeholders (local institutions and operators); and, finally, the formulation

of recommendations to inform the development of the future Brussels bicycle sharing system. The project is expected to have a duration of 2 years (2023-2024) (Transport & Mobility Leuven, n.d.).

More importantly, though, the Brussels-Capital Region Government is ready to put into force a new legislative and operational framework governing the provision of shared micro-mobility services in its territory. During the first week of May 2023, a relevant preliminary Decree obtained governmental endorsement during its second reading. And while, prior to progressing towards the third and conclusive reading, the draft Decree is required to undergo a thorough assessment by the Council of State, it currently has the unanimous support of the Government. The provisions of the Decree (which have become stricter from the first to the second draft) foresee the capping of the total number of shared scooters circulating in the Region, from around 21.000 currently, to 8.000 for the period 2024-2027, provided only through 2 operators (down from 9 currently) (Archyde, 2023; Joris, 2023; The Brussels Times, n.d.-a). The limitation to the maximum number of shared micro-vehicles also concerns bicycles and cargo bicycles (4.000 and 500 respectively), as well as motorcycles/mopeds (500) (Archyde, 2023; Joris, 2023; The Brussels Times, n.d.-a). In an effort to address the issue of unauthorized parking, which is considered one of the biggest nuisances concerning public space, the drop zones across the entire territory of the Brussels-Capital Region are going to be increased significantly, effective from January 2024. These designated areas will serve as exclusive locations for users to park and leave their shared micro-vehicles. Currently, there exist approximately 100 drop zones along regional roads, with an additional 350 subsidized drop zones in different Municipalities across the Region. Furthermore, several other drop zones have been established or are in the final stages of implementation, including those in the Municipalities of Evere (50), Ixelles (140), Koekelberg (20), Saint-Agatha-Berchem (31), Saint-Gilles (20) and Woluwe-Saint-Lambert (75). As a result, the total number of drop zones is projected to exceed 800 in the summer of 2024 (Archyde, 2023; Joris, 2023; The Brussels Times, n.d.-a). Heavier fines are also foreseen in case Regional or Municipal services need to move or remove shared micro-vehicles left outside of the designated drop zones (Archyde, 2023; Joris, 2023; The Brussels Times, n.d.-a). Another important provision entails the expansion of designated areas with a maximum speed limit of 8 km/hour. Consequently, aside from the existing pedestrian zones situated within the heart of the Capital City and the Municipality of Ixelles, the different Municipalities will have the authority to designate further regions where this speed limit must be strictly adhered to (Archyde, 2023; Joris, 2023; The Brussels Times, n.d.-a). However, the main takeaway from the proposed reform is the commitment of the Government to impose a strict legislative and operational framework governing the provision of shared micro-mobility services, ensuring the convenience of all the residents in and visitors of the Brussels-Capital Region and not just the users of such services. And while the afore-mentioned provisions are expected to transform the way the market currently operates and the share of public space, the Government is ready to take even stricter decisions in the future, in case the current efforts are not fruitful – as much as following Paris' example and imposing a complete ban of shared e-scooters (Archyde, 2023; Joris, 2023; The Brussels Times, n.d.-a).

4 Methodology

The methodology which was followed in the context of the Master Thesis was that of literature review (covered in Chapters 2 and 3), complemented by an online survey. The survey was based on an electronic questionnaire, which respondents would need to fill in. The potential participants were invited to take part in the survey by e-mail and were provided with a specific link, through which they could access the questionnaire.

While the rationale behind the questions which were included in the survey can be found in sub-chapter “Questionnaire design”, the full questionnaire can be found in

Appendix I: Complete online survey questionnaire”.

4.1 Relevance of the survey as a tool

Data gathering through online surveys has been a practice which has been extensively used in the past in the transport sector, since they dispose of two important advantages: the first one is that they are an efficient data collection method, which is straightforward and relatively easily administered; the second reason is that they can reach a large and diverse sample of users. More importantly, this approach has already been successfully used for the identification of user perceptions of shared micro-mobility services (Fitt & Curl, 2020; Ge et al., 2020; Goralzik et al., 2022; Ko et al., 2021; Reck & Axhausen, 2021).

As a result, the relevance of an online survey as a tool in the context of the present Master Thesis was confirmed.

4.2 Data collection

4.2.1 Sampling / Respondents' characteristics

The study concerns minors above 13 years old, which is the legal limit for underage citizens to participate in surveys in Belgium, and adults whether they are or not users of shared micro-mobility services within the Brussels-Capital Region. In that context, no other restriction to the respondents' profiles was applicable. The rationale behind these two conditions is the following:

Concerning the limitation in geographical scope, it was considered that the expansion of the survey in a larger area (or multiple cities) could render the collection and analysis of data a complex and time-consuming exercise. At the same time, it would not be a given that the results obtained for each geographical area would be comparable between them and thus lead to concrete conclusions. Concerning the use of shared micro-mobility services within the Brussels-Capital Region, it was considered that the inclusion of non-users has the potential to provide a comparison basis for the inconveniences faced by existing users and the factors that prevent other potential users from utilising micro-mobility as an alternative transport mode.

It is understood that such a choice would lead to 1 data set, further distinguished into 2 sub-sets, each one concerning a different part of the population and responding to different research questions; however, this is considered an important aspect of the survey and Master Thesis, in an attempt to identify the prevailing patterns on the issue in the Brussels-Capital Region.

To that end, the ideal group of respondents would have different demographic characteristics, in order for the results to be as representative as possible of different user groups.

4.2.2 Contacting potential participants

One of the challenges during the elaboration of the Master Thesis was the design of the survey and, more particularly, sourcing a pool of potential respondents. This was overcome by the adoption of a multi-stakeholder approach, which involved different actors who had a role, interest or influence on micro-mobility in the Brussels-Capital Region. These stakeholders included 23 Belgian State Agencies,

Services and Institutes, 1 international Organisation, 5 education Institutes, 6 non-Governmental Organisations (NGOs), as well as the private sector, including the providers of shared micro-mobility services operating in the Brussels-Capital Region.

Practically, an explanatory e-mail about the Master Thesis and the survey was sent to these actors, requesting the dissemination of the survey link through their official communication channels. The relevant e-mail can be found in Appendix II: Information mail to potential stakeholders”.

One of the main reasons for the selection of this approach was the potential increase in visibility and reach of the survey through the leverage of these stakeholders’ networks. Practically, it was expected that by involving these stakeholders as intermediaries could facilitate the dissemination of the survey to a broader audience, thus increasing the relevant response rate. In addition, involving a multitude of stakeholders as points of survey dissemination could provide more opportunities for potential respondents to receive the survey and participate to it; a fact which is also supported by literature (Dillman et al., 2014).

In addition, the utilisation of existing networks and relationships that the stakeholders already dispose had the potential to increase the trust and credibility of the survey, which could in turn boost the response and completion rates, as well as data quality (Groves & Peytcheva, 2008). Finally, it facilitated the promotion of the survey to segments of users who might have otherwise been hard to reach through other methods, such as random sampling.

While this approach could not be guaranteed to yield a significant number of respondents, it had the potential for this. That fact was also backed up by literature, with similar surveys having been implemented using the same methodology in the past (Esztergár-Kiss & Lopez Lizarraga, 2021).

In more detail, the stakeholders contacted were the following:

- a. Belgian State Agencies / Services
 - 19 Municipalities of Brussels-Capital Region (Anderlecht, Auderghem / Oudergem, Berchem-Sainte-Agathe / Sint-Agatha-Berchem, Bruxelles-Ville / Stad Brussel, Etterbeek, Evere, Forest / Vorst, Ganshoren, Ixelles / Elsene, Jette, Koekelberg, Molenbeek-Saint-Jean / Sint-Jans-Molenbeek, Saint-Gilles / Sint-Gillis, Saint-Josse-ten-Noode / Sint-Joost-ten-Node, Schaerbeek, Uccle / Ukkel, Watermael-Boitsfort / Watermaal-Bosvoorde, Woluwe-Saint-Lambert / Sint-Lambrechts-Woluwe, Woluwe-Saint-Pierre / Sint-Pieters-Woluwe)
 - Agence Régionale Bruxelloise du Stationnement
 - Brussels Mobility
 - SPF Mobilité et Transports, Direction Mobilité, Service Études et Enquêtes
 - Vias institute
- b. International Organisation
 - Directorate-General for Mobility and Transport, European Commission
- c. Education Institutes
 - Ecole Saint-Jeanne de Chantal
 - Hasselt University
 - Haute Ecole Libre de Bruxelles
 - ICHEC Brussels Management school
 - Université Libre de Bruxelles

- Vrije Universiteit Brussel
- d. Non-Governmental Organisations
 - European Cyclists' Federation
 - European Transport Safety Council (ETSC)
 - International Association of Public Transport (UITP)
 - Micro-mobility for Europe
 - POLIS Network
 - Transport & Environment (T&E)
- e. Private sector
 - Shared micro-mobility service providers (Bird, Blue-bike, Bolt, Cozywheels, Dott, E-bike to go, Felyx, GO Sharing, Lime, Pony, Poppy, Pro Velo, Swapfiets, Tier, Villo!, Voi).

In total, the request was sent to 183 distinct e-mail addresses.

It should be noted that providers of car sharing services were not included in the distribution list and thus were not contacted nor requested to disseminate the survey. The main reason behind this decision was the fact that car-sharing providers, although operating according to the same commercial model to shared micro-mobility providers, they could dilute the survey's focus and reduce the quality of the responses obtained, since their client target is different and with different needs/priorities in comparison to the users of micro-mobility services.

In addition to the above, the information about the survey was also disseminated to a personal network of acquaintances.

4.2.3 Survey launch and end dates

The survey was launched on the 3rd of April 2023 and it remained active until the 30th of April 2023.

4.2.4 Questionnaire design

This sub-chapter describes the questionnaire, its sections as well as the rationale behind each question.

The tool that was used for the implementation of the survey was Qualtrics Experience Management (XM). It is a web application, which allows for the creation of comprehensive surveys, with a multitude of options including the types of questions, appearance customisation and insights. For the purposes of the Master Thesis, a new project was initiated and the questionnaire was built without the use of the pre-defined / proposed XM templates.

The first section of the online questionnaire contained questions about socio-demographics.

Question 1: Which of the below best describes your gender?

This question would indicate whether the gender distribution of the respondents was balanced or skewed, while also allowing the identification of variation patterns amongst the respondents based on their sex during the analysis of the results.

Question 2: Which age group do you belong to?

In line with the GDPR provisions, only minors above 13 years old and adults were included in the survey as respondents. As a result, all minors up to 12 years old were excluded, by the lack of an appropriate corresponding age group, with the first one including the ages from 13 to 17 years. The division of the participants in age groups would also facilitate the categorization of the data for different forms of analysis.

Question 3: Which of the below best describes your occupation?

It was expected that respondents with different occupational backgrounds would have different mobility habits and preferences. As a result, this question would allow for the identification of potential patterns among the respondents on the basis of their educational/professional routine.

Question 4: What is your education level?

This question was included in the online questionnaire in order to identify if and how the educational background of the respondents affected their views and attitudes towards shared micro-mobility.

Question 5: How many adults and minors live in your household, including yourself?

Different household compositions in terms of household members would possibly signify different transportation patterns and different habits concerning the use (or not) of shared micro-mobility services. This question was included in order to identify any possible correlation between these aspects.

Question 6: How many vehicles (if any) do you own and use in your household?

The inclusion of this specific question is drawn from the assumption that existing mobility patterns and the ownership of specific types of vehicles in a household also affect the possibility of using shared micro-mobility services. This question would allow the exploration of the relationship between owning a (micro-)vehicle and the use of shared micro-mobility services.

Question 7: What is your annual household (gross) income?

The inclusion of this specific question is drawn from the assumption that income plays a role in the selection of the transport mode by the individual user. Since micro-mobility is widely supposed to be an affordable way of transport, this question would allow the confirmation of this assumption as well as the identification of any relevant patterns between the responses received. The methodology which was used for the calculation of the classes was the following: the deciles of gross monthly income according to StatBel (Statbel, n.d.) were multiplied by 13,92 (the legal number of annual salaries in Belgium). The amounts were then rounded and simplified, forming the relevant classes.

Question 8: Do you reside in the Brussels-Capital Region?

Question 9: In which Municipality of the Brussels-Capital Region do you reside?

These two questions had a bi-fold target: first, the identification of potentially different attitudes between residents and non-residents of the Brussels-Capital area. At the same time, Question 8 acted as a leading prerequisite for Question 9, which would only appear in case the respondent had replied “Yes” to the previous question. The reason for that was to identify the different levels of acceptance and satisfaction of shared micro-mobility for each of the 19 Municipalities of the Brussels-Capital Region.

The next section of the questionnaire was expected to provide valuable general information about the acceptance, satisfaction and motivation of the respondents towards shared micro-mobility, including pieces of information concerning spatial, time-related and causal data.

Question 10: Do you possess a monthly or yearly pass to Brussels-Capital public transport system (STIB)?

The target of this question was to identify possible underlying patterns of a relation between the regular use of public transport (evidenced by the possession of a monthly or yearly pass by the respondent) and the use or non-use of shared micro-mobility services.

Question 11: How often do you use the below mobility solutions?

The purpose of this question was to identify the mobility habits of the respondents, irrespectively of the place of their occurrence. The following options were given to the respondents: walking, public transport, own car, shared car service, own motorcycle, shared motorcycle service, own micro-mobility vehicle, shared micro-mobility vehicle and “other”, where the respondents would be able to specify their reply. The frequencies that would measure the habitual use were the following: never, rarely, once per day, several times per day, few times per week and several times per week. The combination of “shared micro-mobility vehicle” and “never” was not excluded as a choice. This fact might appear odd but the logic behind it is the fact that somebody may be using shared micro-mobility services either incidentally or habitually, but not in the Brussels-Capital Region.

Question 12: How long have you been using shared micro-mobility services in Brussels?

This question was a pivotal one for the continuation of the survey at respondent level. Since the survey concerned the views and opinions of micro-mobility users, in case the respondent replied “I have not used any shared micro-mobility services in Brussels”, instead of being directed to the last slide of the questionnaire (“Thank you for your participation”) and the questionnaire being discarded, the participant would be directed to a specific sub-set of questions, which concerned the reasons behind the non-use of shared micro-mobility services. In that way, valuable conclusions were able to be drawn, especially in comparison to and in the context of the questions about demographic details and the challenges that existing users of micro-mobility services face. In addition, the replies to this question were expected to provide the data in order to identify different approaches, enabling factors and constraints among users for the adoption of shared micro-mobility: a rare user of such services would have different expectations and concerns from a casual or frequent user. As such, it would allow for the identification of attitude patterns among users. In addition, in conjunction with the rest of the data, it would be able to confirm the hypothesis that a prolonged period of use of shared micro-mobility services would be possible if the respondent was overall satisfied with the level of service and gains he enjoyed by this means of urban transportation mode.

Question 13: How often do you use shared micro-mobility services in Brussels, for each of the below purposes?

Different age groups and different needs at personal and professional levels were expected to lead to different mobility purposes at variable frequencies. This question was aiming at identifying these purposes in conjunction to their frequencies, while also allowing for an analysis at a deeper level when demographics were taken under consideration. The hypothesis tested with the previous question could be also be tested at a second level with this question.

Question 14: Which factors influence your decision to use or not use shared micro-mobility services in Brussels?

The analysis of the replies to that question was expected to reveal the strengths of the shared micro-mobility services in the Brussels-Capital Region as well as their weak points. It would act as a first step toward the identification of enablers and inhibitors of such services in the Brussels-Capital Region.

Question 15: On average, how far do you travel using shared micro-mobility services in Brussels?

Question 16: On average, how long are your shared micro-mobility trips in Brussels?

These two questions were expected to confirm the short-trip characteristic of micro-mobility and reveal possible outliers both in terms of distance and travel time. In addition, in conjunction with the question about the geographical positioning of a respondent, additional analysis concerning the facilitation of the use of shared micro-mobility services could be undertaken: for example, an increased travel time by the respondents residing in a given Municipality of the Brussels-Capital Region might indicate sub-par offered services by public transport, which is being substituted by shared micro-mobility.

Question 17: How has using shared micro-mobility services impacted your overall travel time in Brussels?

Question 18: Do you think that the shared micro-mobility services available in Brussels adequately meet the transportation needs of residents and commuters?

Question 19: How likely are you to continue using shared micro-mobility services in Brussels in the future?

These questions aimed at identifying the effectiveness and efficiency of the shared micro-mobility services, as well as the tangible perceived gain by the users. A positive reply to one of them was expected to lead to positive replies to the rest of them, too.

Question 20: How likely are you to start using shared micro-mobility services in Brussels in the future?

This question aimed at identifying the weak points of the shared micro-mobility services, as well as the of using such services by respondents who fell under the “non-user” category (only to whom this question was visible).

The next section of the questionnaire focused on the changes that the users experienced at personal level since starting using shared micro-mobility services.

Question 21: How has the use of shared micro-mobility services impacted your overall transportation habits in comparison to...? (Walking / Use of public transport / Use of own car / Use of own motorcycle / Use of own micro-mobility vehicles (bicycle / scooter))

While micro-mobility is mostly referred to as a solution for first- and last-mile transport needs, it is still part of a broader transportation system woven in the urban fabric. As a result, it was expected that a relation between micro-mobility and other means of transport existed, as it has also been found in the literature. To that end, the aim of the question was to identify the potential complementarity or antagonism between shared micro-mobility services and other modes of transport.

Question 22: How has using shared micro-mobility services impacted your transportation-related spending habits in Brussels?

Micro-mobility is considered an affordable means of transport, which can contribute to the reduction of relevant costs. This is also supported by literature findings. This question aimed at confirming the above.

Question 23: How has using shared micro-mobility services impacted your...? (Physical activity levels / Mental health & well-being / Social interactions)

The above question aimed at confirming or dismissing the applicability in the Brussels-Capital Region of the literature findings concerning the improvement of health-being amongst micro-mobility users. It was expected that positive replies could signify healthier, happier citizens who would be more open in embracing this mode of transport and who could act as its “advocates” and “ambassadors”.

The next section of the survey included a single question which had the identification of the users' level of satisfaction at its core.

Question 24: How satisfied are you with the following parameters of shared micro-mobility services in Brussels?

In total, 9 parameters were considered: Convenience; Availability of micro-vehicles; Availability of docking stations; Ease of use; Customer support services; Affordability (Cost); Integration with public transport; Available infrastructure; Regulatory Framework. The tabulated form of a single, comprehensive question was preferred over different questions for each one of the parameters included. This helped reduce the total amount of questions as well as the estimated time for the completion of the questionnaire by the respondents.

The next section of the questionnaire focused on the challenges that the users experienced.

Question 25: What kind of issues have you experienced while using shared micro-mobility services in Brussels?

In total, 7 parameters were identified: Vehicle unavailability; Parking spot/docking space unavailability; Not properly maintained vehicles (including battery level); App-related difficulties; Inadequate infrastructure (insufficient bike lanes); Unexpected fees; Unsafe traffic conditions. Again, the tabulated form of a single, comprehensive question was preferred over different questions for each one of the parameters included. This helped reduce the total amount of questions as well as the estimated time for the completion of the questionnaire by the respondents.

Question 26: How concerned are you about the safety of using shared micro-mobility services in Brussels?

Question 27: What are your biggest safety concerns when using shared micro-mobility services in Brussels?

One of the issues that has been revealed by the literature to be a point of concern about micro-mobility is road safety, especially for the drivers of micro-vehicles. Questions 25 and 26 aimed at validating or dismissing these findings. In addition, the replies to question 26 in particular could provide tangible suggestions to the City and the service providers in order to increase the perceived level of safety the users experienced. The same potential had the two questions that followed immediately after:

Question 28: What improvements would you like to see in the shared micro-mobility landscape in Brussels?

Question 29: What improvements would you like to see in the shared micro-mobility landscape in Brussels before you start using such services?

Q29 was a mirrored image of Q28, but intended to a different group of respondents: Q28 was intended to current users of micro-mobility services in the Brussels-Capital Region, while Q29 aimed non-users.

The last section of the questionnaire was dedicated to the integration of the shared micro-mobility services and the city, the adaptations the latter has both sustained and facilitated as well as the perception of both users and non-users.

Question 30: In your opinion, how well do shared micro-mobility services integrate with public transport in Brussels?

Question 31: How would you rate the city's efforts to facilitate the use of shared micro-mobility services in Brussels?

Question 32: Overall, how has the availability of shared micro-mobility services in Brussels impacted your perception of the city's transportation system?

Question 33: Overall, would you say that shared micro-mobility services in Brussels have made the city a more accessible and enjoyable place to live, work or visit?

The survey was also translated in French and Dutch languages, in order to expand the pool of potential respondents, who might not have commanded well the original English language of the questionnaire.

Overall, 33 questions were included in the survey. Out of them, 31 were visible to users of shared micro-mobility services in the Brussels-Capital Region and 17 to non-users. The section about demographics contained 9 questions, all of which would be visible to both user categories. The section about the general acceptance of shared micro-mobility services included 10 questions for users and 5 questions for non-users, while the section about the observed personal changes was visible only to users – so was the case for the single (but comprehensive) question about the overall perceived satisfaction. The section about the challenges faced included 4 questions for the users and 1 (a mirrored image of one of these 4 questions) for non-users. Finally, the section about the City and shared micro-mobility services included 4 questions for users of such services and 2 for non-users. This analysis is presented in the below table.

Table 1: Tabulated representation of the survey questionnaire

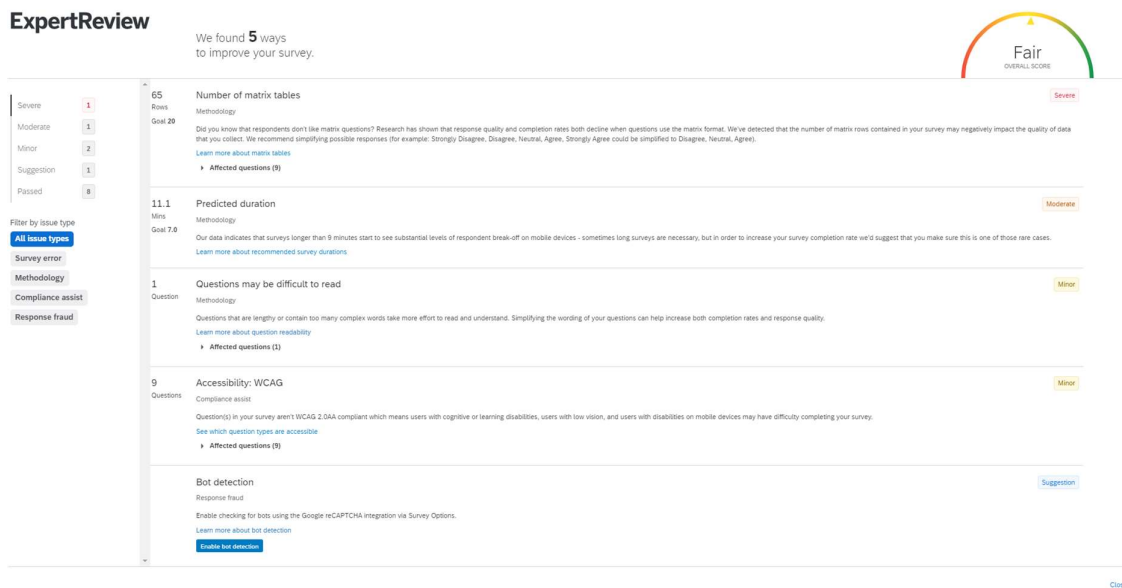
Nr.	Question	Section	User	Non-user
1	Which of the below best describes your gender?	Demographics	Yes	Yes
2	Which age group do you belong to?	Demographics	Yes	Yes
3	Which of the below best describes your occupation?	Demographics	Yes	Yes
4	What is your education level?	Demographics	Yes	Yes
5	How many adults and minors live in your household, including yourself?	Demographics	Yes	Yes
6	How many vehicles do you own and use in your household?	Demographics	Yes	Yes
7	What is your annual household (gross) income?	Demographics	Yes	Yes
8	Do you reside in the Brussels-Capital Region?	Demographics	Yes	Yes
9	In which Municipality of the Brussels-Capital Region do you reside?	Demographics	Yes	Yes
10	Do you possess a monthly or yearly pass to Brussels-Capital public transport system (STIB)?	General acceptance	Yes	Yes
11	How often do you use the below mobility solutions?	General acceptance	Yes	Yes
12	How long have you been using shared micro-mobility services in Brussels?	General acceptance	Yes	Yes
13	How often do you use shared micro-mobility services in Brussels, for each of the below purposes?	General acceptance	Yes	No
14	What factors influence your decision to use or not use shared micro-mobility services in Brussels?	General acceptance	Yes	Yes
15	On average, how far do you travel using shared micro-mobility services in Brussels?	General acceptance	Yes	No
16	On average, how long are your shared micro-mobility trips in Brussels?	General acceptance	Yes	No

17	How has using shared micro-mobility services impacted your overall travel time in Brussels?	General acceptance	Yes	No
18	Do you think that the shared micro-mobility services available in Brussels adequately meet the transportation needs of residents and commuters?	General acceptance	Yes	No
19	How likely are you to continue using shared micro-mobility services in Brussels in the future?	General acceptance	Yes	No
20	How likely are you to start using shared micro-mobility services in Brussels in the future?	General acceptance	No	Yes
21	How has the use of shared micro-mobility services impacted your overall transportation habits in comparison to...? (Walking / Use of public transport / Use of own car / Use of own motorcycle / Use of own micro-mobility vehicles (bicycle / scooter))	Personal changes	Yes	No
22	How has using shared micro-mobility services impacted your transportation-related spending habits in Brussels?	Personal changes	Yes	No
23	How has using shared micro-mobility services impacted your...? (Physical activity levels / Mental health & well-being / Social interactions)	Personal changes	Yes	No
24	How satisfied are you with the following parameters of shared micro-mobility services in Brussels?	Overall satisfaction	Yes	No
25	What kind of issues have you experienced while using shared micro-mobility services in Brussels?	Challenges	Yes	No
26	How concerned are you about the safety of using shared micro-mobility services in Brussels?	Challenges	Yes	No
27	What are your biggest safety concerns when using shared micro-mobility services in Brussels?	Challenges	Yes	No
28	What improvements would you like to see in the shared micro-mobility landscape in Brussels?	Challenges	Yes	No
29	What improvements would you like to see in the shared micro-mobility landscape in Brussels before you start using such services?	Challenges	No	Yes
30	In your opinion, how well do shared micro-mobility services integrate with public transport in Brussels?	SMMS and the City	Yes	No
31	How would you rate the city's efforts to facilitate the use of shared micro-mobility services in Brussels?	SMMS and the City	Yes	No
32	Overall, how has the availability of shared micro-mobility services in Brussels impacted your perception of the city's transportation system?	SMMS and the City	Yes	Yes
33	Overall, would you say that shared micro-mobility services in Brussels have made the city a more accessible and enjoyable place to live, work or visit?	SMMS and the City	Yes	Yes
	Total number of questions per section		31	17
	Demographics		9	9
	General acceptance		10	5
	Personal changes		3	0

	Overall satisfaction		1	0
	Challenges		4	1
	SMMS and the City		4	2
	Total number of questions per user category		31	17

The questionnaire itself had some limitations. Using the native XM “ExpertReview” tool, feedback was sought on the preliminary design of the questionnaire. After some tweaks in the questions, a “Fair” score was attributed overall. There were some trade-offs which could undermine the survey, but it was considered that such a risk was worthwhile. More precisely, the inclusion of 9 questions with matrix tables was flagged as a severe issue which could lead to a decrease in the quality of the responses as well as completion rate (Qualtrics, n.d.-b). The inclusion of the matrix tables was not issue by itself but rather the total number of 65 rows that these tables contained in comparison to a goal of 20 rows suggested by the ExpertReview. The alternative option would be to split the rows in these tables into one-by-one multiple choice questions. However, this would have significantly increased the number of total questions in the survey, with severe impact on the needed time for its completion and, subsequently, completion rate. As a result, these 9 matrix table questions remained. A moderate issue which was flagged by ExpertReview was the predicted duration of the survey, which was calculated at 11.1 minutes, with a suggested upper limit of 9 minutes. However, this was negated by the fact that not all questions in the survey would be visible to the respondents, as described above. To that end, the estimated duration for users of shared micro-mobility services in the Brussels-Capital Region was estimated at around 10 minutes, while the duration for non-users was around the 9-minute mark. Furthermore, two minor issues were flagged by ExpertReview: the length of Question 1 and 9 questions that did not meet the requirements to pass the Web Content Accessibility Guidelines (WCAG) 2 Level AA Conformance test. Concerning the first of these minor issues, Q1 is the explanatory note that describes the survey and asks for the consent (or not) of the respondents to participate. It was expected that this would be the case, so the flag was simply dismissed. Concerning the second minor issue, it was caused by the matrix tables included in the questionnaire which are not recognized as WCAG compatible (Qualtrics, n.d.-a; W3C Web Accessibility Initiative (WAI), n.d.). As a result, and since these questions could not be discarded or replaced, this flag was also dismissed. There was also a suggestion to enable the use of reCAPTCHA in order to avoid fraudulent responses by bots, but this could pose problems to the respondents who could have been unwilling to go through an additional verification process, thus lowering the response rate potential. As a result, this suggestion was also dismissed.

Figure 6: XM “ExpertReview” quality check of survey questionnaire



4.2.5 Possible sources of error

While the survey and questionnaire have been designed thoroughly, some sources of error which can affect the validity and reliability of the data collected still exist.

The first is the sample bias, which can occur in cases where the pool of respondents (“sample”) does not represent the target population. This can be attributed either to the sampling methods applied during the survey design (Couper, 2000) or a low response rate (Groves & Peytcheva, 2008) and can lead to biased results, which are not representative of the general population. This can also be viewed in a wider context of sampling frame error, which describes the cases where the methodology for the selection of the sample group is incomplete or inaccurate; something which can consequently lead to biased collected data (Lavrakas, 2008). While these errors cannot be completely excluded, a mitigation decision was taken during the survey design phase: the dissemination of the survey through the networks of relevant actors/stakeholders, as described in Section 4.2.2, which can significantly increase the number of participating respondents; an approach which is considered an efficient mitigation method (Lavrakas, 2008).

Couper (2000) identified another potential source of error which might be applicable to the designed survey: the measurement error. This describes the cases where the questionnaire fails to accurately measure the target of the survey. Poorly worded questions and unclear instructions are considered leading forces behind measurement errors. This can be closely linked to “question wording bias”, an error which can also lead to inaccurate or low quality responses (Schuman & Presser, 1996). To that end, the questionnaire was pre-tested before launch and appropriate actions for the corrections of potential measurement errors were taken.

Finally, there is the possibility of a third source of error, in the form of response bias. While this can actually be considered a type of measurement error, it is mentioned separately because it stems from different biases of the respondents rather than questionnaire flaws. In case of response bias, the participants to the survey may be self-inclined to give answers which are in line with socially acceptable

beliefs (social desirability bias); agree with statements in the questions irrespectively of their actual beliefs and opinions (acquiescence bias) or mechanically complete the survey, without actually engaging with it and putting effort in providing accurate replies (satisficing) (Dillman et al., 2014; Fan & Yan, 2010; Tourangeau et al., 2000). The mitigation strategy in that case was the testing of the questionnaire before its launch, which was considered one of the most important negating measures in the literature.

4.2.6 Information texts

During the launch of the survey, two information texts were prepared.

The first one was addressed to the stakeholders described in Section “Contacting potential participants”, in order to inform them about the context of the survey and request their support for its diffusion. It formed the main body of the e-mail that was sent and contained the link to the survey, as well as the relevant QR code.

The second information text was the explanatory note in the survey itself. At the end of the text, which appeared as the landing page once the survey link was activated or the QR code was scanned, the respondent was given the option to either participate to the survey or disregard it.

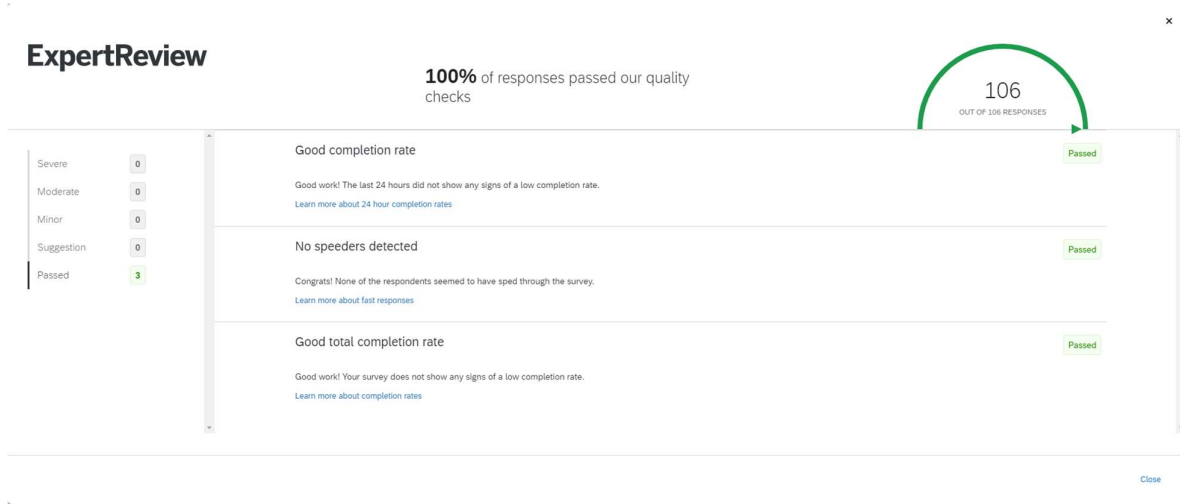
The two texts are presented in Appendices II and III respectively.

5 Survey results and analysis/interpretation

5.1 Preliminary info

During the period that the survey remained active, a total of 106 responses were collected; all of them passed successfully the quality checks of the native XM “ExpertReview” tool.

Figure 7: XM “ExpertReview” quality check of responses collected



Out of the 106 respondents, 105 accepted to participate to the survey, while 1 refused.

5.2 Socio-demographic data

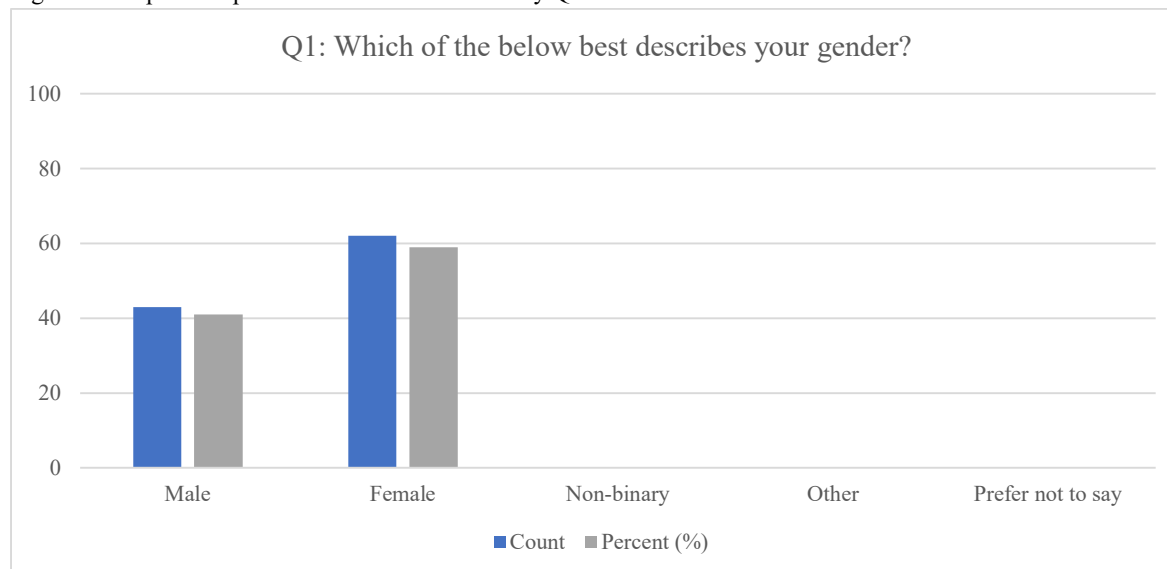
The first part of the survey included questions about socio-demographic data.

In the question about gender, 43 respondents identified themselves as male and 62 as female. No respondents selected the rest of the options (“Non-binary”, “Other” and “Prefer not to say”). This represents a difference of 18% more female respondents than male, leading to a (partially) unbalanced sample.

Table 2: Tabulated results - Survey Question 1
Q1: Which of the below best describes your gender?

	Count	Percent (%)
Male	43	41,0
Female	62	59,0
Non-binary	0	0,0
Other	0	0,0
Prefer not to say	0	0,0

Figure 8: Graphical representation of results - Survey Question 1



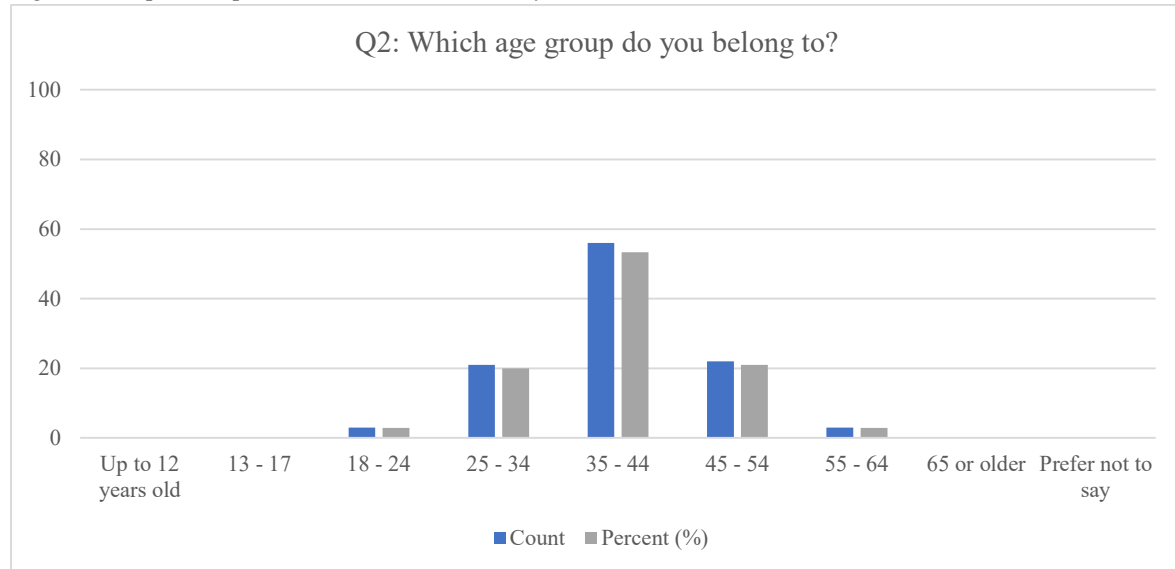
The second question concerned the age group of the respondents. It is interesting that no minors participated to the survey, while the participation of younger people aged 18-24 was extremely low (3 in absolute numbers, representing a 2,9% of the total). Similarly, no people above 65 years old participated to the survey, with the age group 55-64 being represented by only 3 respondents, representing 2,9% of the total sample. This leads to a perfect normal distribution for age groups from 13-17 to 65 and above. It is believed that this fact is an outcome of the methodology for the distribution of the survey. On one hand, by default, there was no restriction in the profiles of the potential respondents, as described in Section “Sampling / Respondents’ characteristics”. On the other hand, the potential participants to the survey were contacted through different actors who had a role, interest or influence on micro-mobility in the Brussels-Capital Region. Groups of younger people (13-17, 18-24) were expected to be contacted through different educational institutes – however, coinciding periods of decreased educational activity is believed to have led to a significantly lower participation and representation rate. At the same time, older age groups do not appear to be representing a significant proportion of shared micro-mobility users, according to literature findings. As a result, it is considered that the overall distribution is adequately representative, with the exception of age group 18-24.

Table 3: Tabulated results - Survey Question 2

Q2: Which age group do you belong to?

	Count	Percent (%)
Up to 12 years old	0	0,0
13 - 17	0	0,0
18 - 24	3	2,9
25 - 34	21	20,0
35 - 44	56	53,3
45 - 54	22	21,0
55 - 64	3	2,9
65 or older	0	0,0
Prefer not to say	0	0,0

Figure 9: Graphical representation of results - Survey Question 2

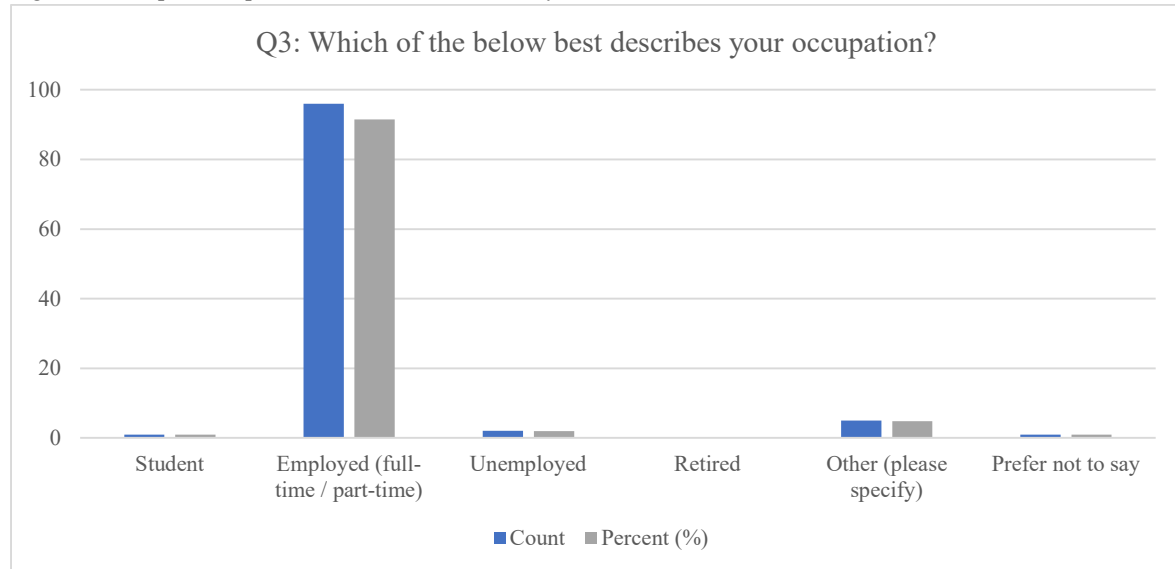


Question 3 concerned the occupation of the respondents, the vast majority of whom are employed, either part- or full-time, turning in a staggering 91,4% among all responses. The other occupations scored extremely low, while the 5 “Other” responses concerned 2 stay-at-home mothers and three other occupations that would be best included in the “Employed” group. Despite these facts, this result was somewhat expected after the analysis of Question 2 concerning the age groups.

Table 4: Tabulated results - Survey Question 3

	Count	Percent (%)
Student	1	1,0
Employed (full-time / part-time)	96	91,4
Unemployed	2	1,9
Retired	0	0,0
Other (please specify)	5	4,8
Prefer not to say	1	1,0

Figure 10: Graphical representation of results - Survey Question 3

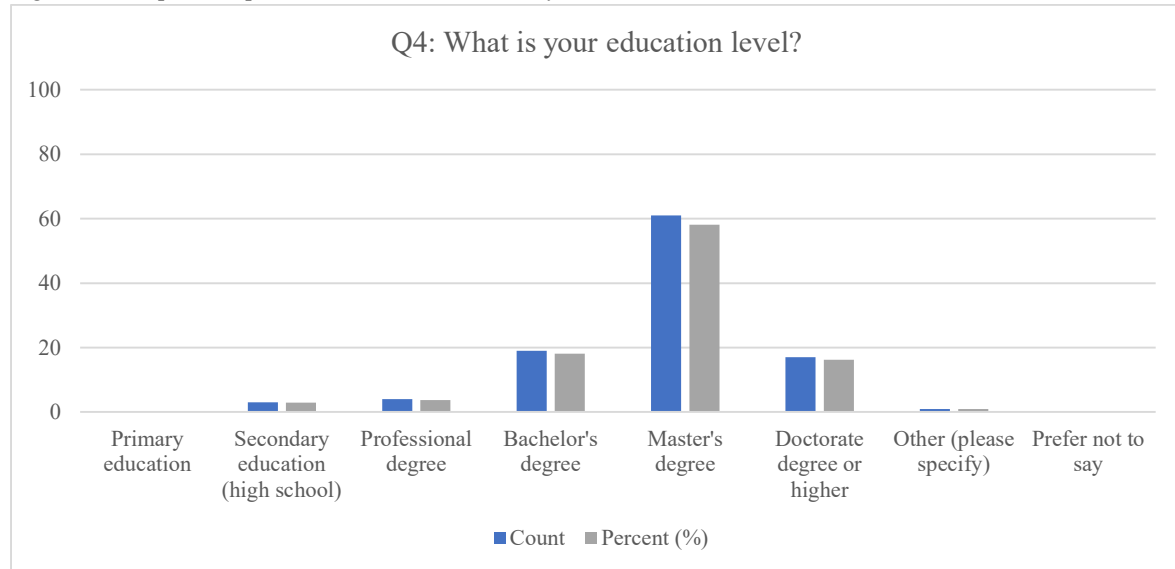


Question 4 concerned the educational level of the participants. Out of the 105 respondents who participated to the survey, no one reported having primary education. Three participants (2.9%) reported having secondary education or high school diplomas, while 4 (3.8%) reported having professional degrees. A significant number of respondents, 19 (18.1%), reported having earned a Bachelor's degree, while the highest number of respondents, 61 (58.1%), reported having completed a Master's degree. Additionally, 17 respondents (16.2%) reported having completed a Doctorate degree or higher, demonstrating a relatively high level of academic achievement among the surveyed population. Only one respondent (1.0%) reported having "Other" educational qualifications (Master's degree plus post-Master's specialization), while none of the respondents preferred not to disclose their educational background. Overall, the findings suggest that a majority of the respondents had at least a Bachelor's degree or higher, highlighting a highly educated population sample.

Table 5: Tabulated results - Survey Question 4
Q4: What is your education level?

	Count	Percent (%)
Primary education	0	0,0
Secondary education (high school)	3	2,9
Professional degree	4	3,8
Bachelor's degree	19	18,1
Master's degree	61	58,1
Doctorate degree or higher	17	16,2
Other (please specify)	1	1,0
Prefer not to say	0	0,0

Figure 11: Graphical representation of results - Survey Question 4



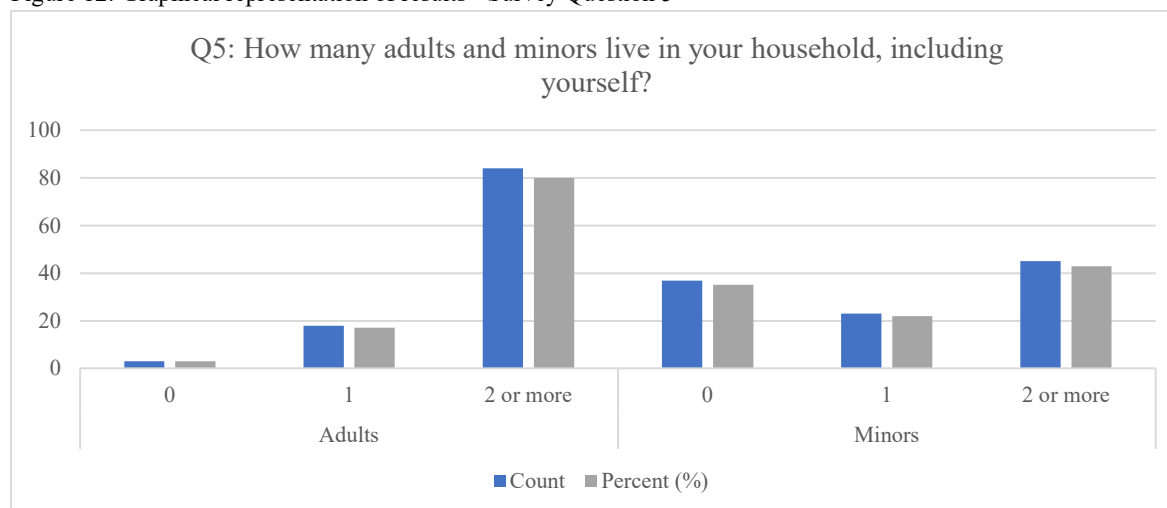
Question number 5 sought to gather information about the household composition of the respondents and more specifically the number of adults and minors. Among the respondents, 17.1% reported having only one adult in their household, while 80% reported having two or more adults. In terms of the number of minors living in the household, 35.2% reported not having any minors, 21.9% reported having one minor, and 42.9% reported having two or more minors. Interestingly, out of the 105 total respondents, 3% reported that there was no adult living in the household. This is considered a rather improbable scenario, especially given the fact that all of the respondents were aged 18 or older and as such, by default, adults.

Table 6: Tabulated results - Survey Question 5

Q5: How many adults and minors live in your household, including yourself?

		Count	Percent (%)
Adults	0	3	2,9
	1	18	17,1
	2 or more	84	80,0
Minors	0	37	35,2
	1	23	21,9
	2 or more	45	42,9

Figure 12: Graphical representation of results - Survey Question 5



Question 6 aimed at identifying the vehicles owned and used in the households of the respondents.

Table 7: Tabulated results - Survey Question 6 (Count)

Q6: How many vehicles (if any) do you own and use in your household?

	Count			
	0	1	2 or more	Prefer not to say
Bicycle	21	24	60	0
E-bicycle	74	25	6	0
Scooter	79	11	15	0
E-scooter	97	6	1	1
Hoverboard / Unicycle	100	4	0	1
Motorcycle	97	8	0	0
Petrol/Diesel car	40	43	22	0
Hybrid car	88	16	1	0
Electric car	103	2	0	0
Other (please specify)	97	3	2	3

Table 8: Tabulated results - Survey Question 6 (Percentage)

Q6: How many vehicles (if any) do you own and use in your household?

	Percent (%)			
	0	1	2 or more	Prefer not to say
Bicycle	20,0	22,9	57,1	0,0
E-bicycle	70,5	23,8	5,7	0,0
Scooter	75,2	10,5	14,3	0,0
E-scooter	92,4	5,7	1,0	1,0
Hoverboard / Unicycle	95,2	3,8	0,0	1,0
Motorcycle	92,4	7,6	0,0	0,0
Petrol/Diesel car	38,1	41,0	21,0	0,0
Hybrid car	83,8	15,2	1,0	0,0
Electric car	98,1	1,9	0,0	0,0
Other (please specify)	92,4	2,9	1,9	2,9

Figure 13: Graphical representation of results - Survey Question 6 (Count)

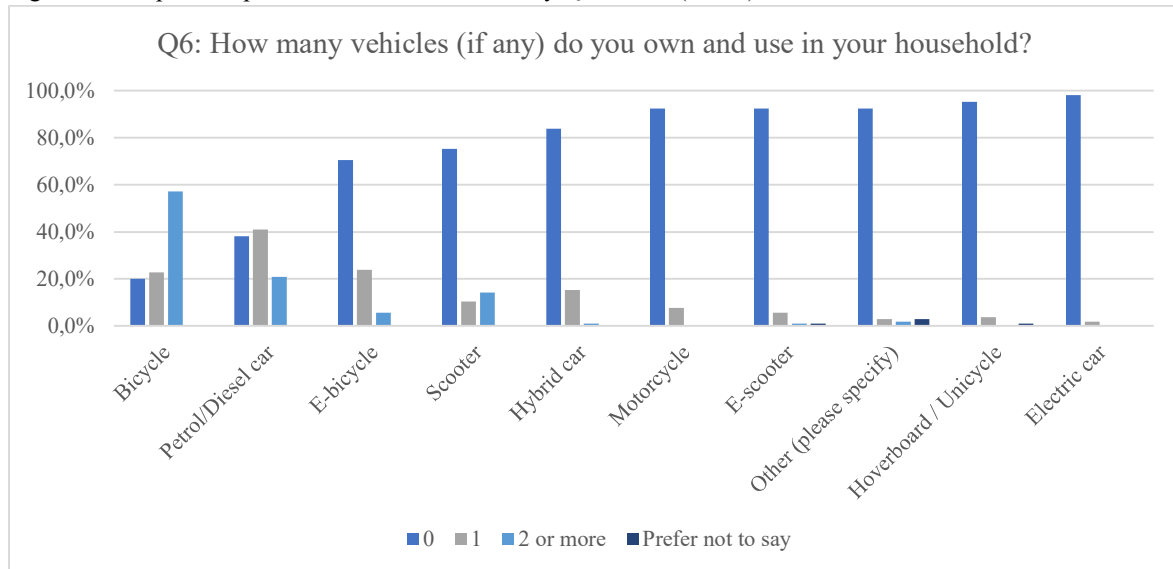
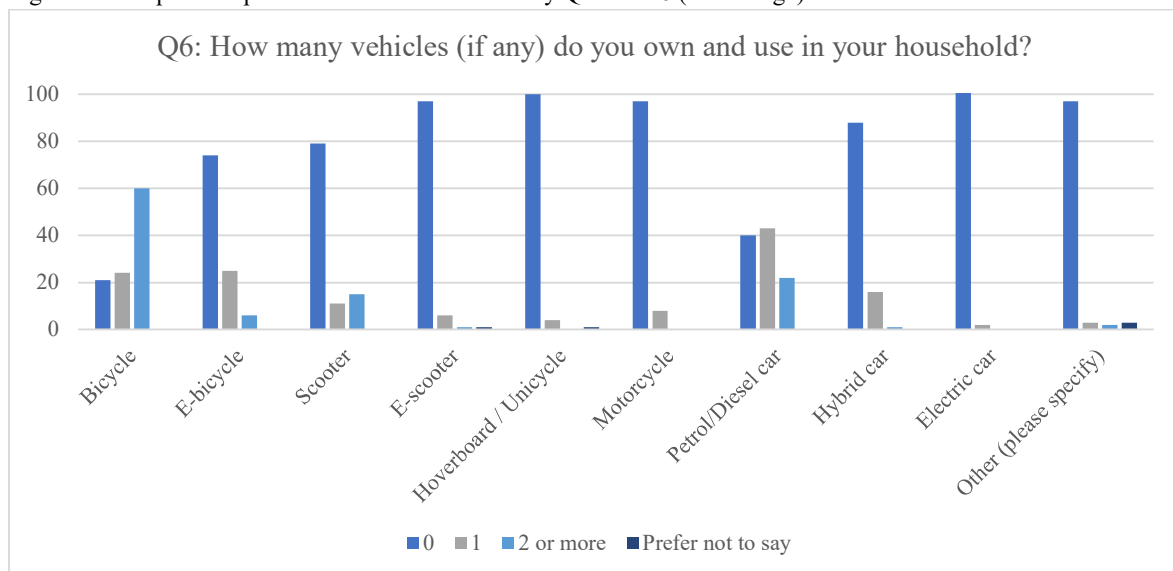
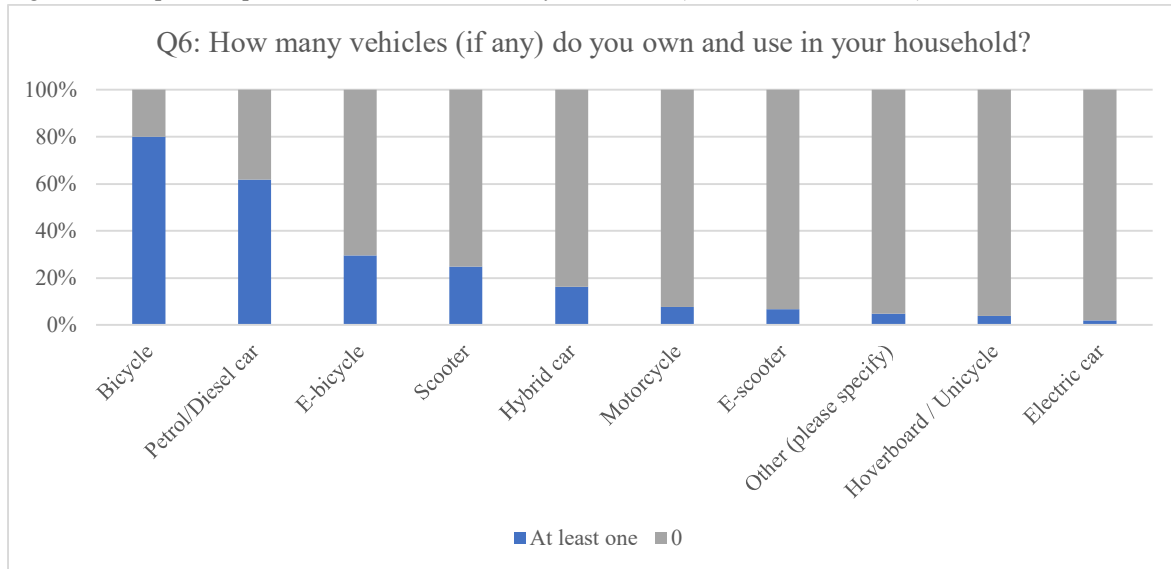


Figure 14: Graphical representation of results - Survey Question 6 (Percentage)



From the above analysis, interesting outcomes arise. The results indicate that the most commonly owned and used vehicle is the bicycle, with 80% and 29,5% of the households owning at least 1 bicycle or e-bicycle respectively. The fact that almost 60% of the households own 2 or more bicycles is impressive. Ownership of petrol/diesel cars comes at second place, with 41% of respondents owning one and 21% owning 2 or more. The percentages for hybrid and electric cars were 16,2 and 1,9% respectively. The latter is an interesting finding: it is speculated that their relatively high acquisition cost and limited charging network play a significant role. Another interesting finding is the very low ownership rate of e-scooters: only 6,7% of the households in question owned at least one of these micro-vehicles. The chart that follows uses 100% stacked columns in order to visualize the above findings.

Figure 15: Graphical representation of results - Survey Question 6 (100% stacked columns)



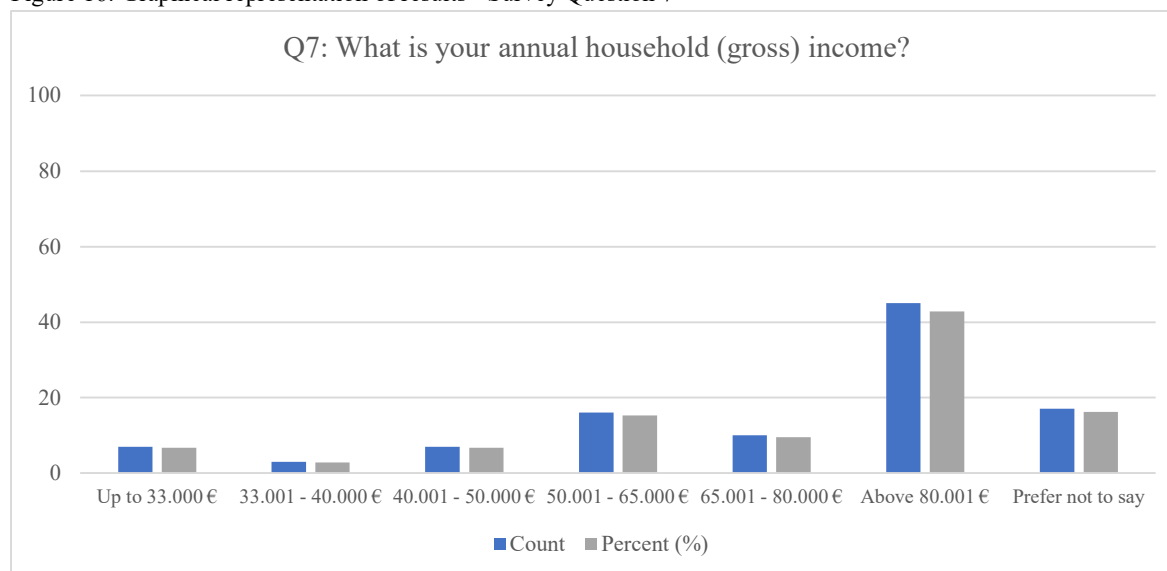
In general, the results suggest that there is a trend towards using alternative modes of transportation, such as e-bicycles and scooters, as well as hybrid cars, with the electric parts being left for the time being out of the equation. In terms of micro-mobility, it seems that there is a significant interest in owning and using bicycles and scooters, with a smaller but still notable interest in electric-powered versions of these micro-vehicles.

Question 7 concerned the annual household income in gross terms. This was a question that raised some concerns and controversy, given the fact that 16,2% of the respondents preferred not to reply. This can be attributed to different reasons, with the main one being the fact that respondents may feel uncomfortable disclosing such information, especially if it is considered to be intrusive or irrelevant to the survey's purpose. Due to the high percentage of the “Prefer not to say” option, there is a flag raised here about possible non-response bias. Statistically, almost 43% of the respondents reported a gross household income of more than 80.000,00 Euros. This can be attributed to various reasons. The first and foremost is the sample of respondents itself. The age groups represented in the survey play a crucial role in the reported income levels and, as previously mentioned, a sample bias does exist. As a result, the absence of respondents from age groups 13-17 and 18-24 eventually leads to under-representation of individuals who are typically not employed or have limited income-generating opportunities. As such, the sample tends to skew towards older age groups, which are more likely to have higher incomes due to their active participation in the workforce. Additionally, the level of education among the survey respondents could influence the reported income levels. Higher levels of education are often associated with higher-paying occupations and income potential and, among the survey participants, more than 60% reported having a Master’s Degree and another 16% a Doctorate (or higher) degree (Q4), confirming the assumption. Finally, the fact that the survey focused on the Brussels-Capital Region may have introduced another potential explanation for the higher reported income levels. Capital regions often attract higher salary-earning job opportunities, businesses and industries, which can contribute to an overall higher average income among residents. Therefore, the concentration of respondents in the Brussels-Capital Region may reflect the economic realities of the area, where higher average salaries are more prevalent compared to other regions (Wallonia and Flanders).

Table 9: Tabulated results - Survey Question 7
 Q7: What is your annual household (gross) income?

	Count	Percent (%)
Up to 33.000 €	7	6,7
33.001 - 40.000 €	3	2,9
40.001 - 50.000 €	7	6,7
50.001 - 65.000 €	16	15,2
65.001 - 80.000 €	10	9,5
Above 80.001 €	45	42,9
Prefer not to say	17	16,2

Figure 16: Graphical representation of results - Survey Question 7



The next two questions (Q8 and Q9) sought to identify the geographical dispersion of the respondents: whether they reside in the Brussels-Capital Region and, if yes, in which Municipality. The analysis showed that 77,1% of the respondents are indeed residents of the Brussels-Capital Region, with the vast majority of them (46,9%) residing in the Municipality of Woluwe-Saint-Lambert, followed by Bruxelles-Ville/Stad Brussel with 8 and Ixelles/Elsene with 7. While the sample is relatively small, such a high concentration in a single Municipality is considered abnormal and the results probably skewed.

Table 10: Tabulated results - Survey Question 8
 Q8: Do you reside in the Brussels-Capital Region?

	Count	Percent (%)
Yes	81	77,1
No	24	22,9

Figure 17: Graphical representation of results - Survey Question 8

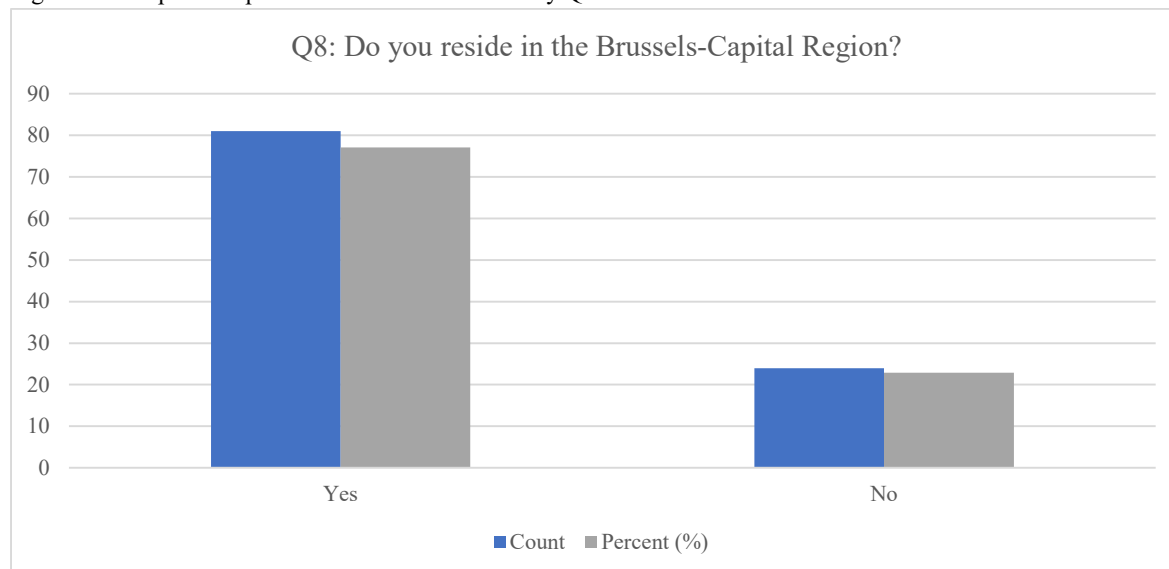
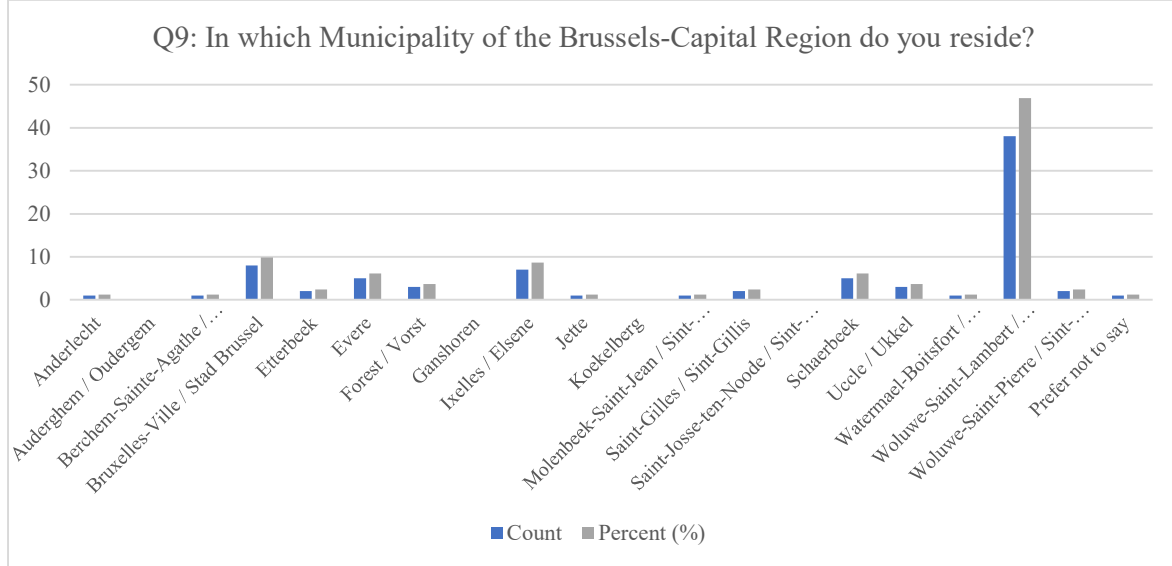


Table 11: Tabulated results - Survey Question 9

Q9: In which Municipality of the Brussels-Capital Region do you reside?

	Count	Percent (%)
Anderlecht	1	1,2
Auderghem / Oudergem	0	0,0
Berchem-Sainte-Agathe / Sint-Agatha-Berchem	1	1,2
Bruxelles-Ville / Stad Brussel	8	9,9
Etterbeek	2	2,5
Evere	5	6,2
Forest / Vorst	3	3,7
Ganshoren	0	0,0
Ixelles / Elsene	7	8,6
Jette	1	1,2
Koekelberg	0	0,0
Molenbeek-Saint-Jean / Sint-Jans-Molenbeek	1	1,2
Saint-Gilles / Sint-Gillis	2	2,5
Saint-Josse-ten-Noode / Sint-Joost-ten-Node	0	0,0
Schaerbeek	5	6,2
Uccle / Ukkel	3	3,7
Watermael-Boitsfort / Watermaal-Bosvoorde	1	1,2
Woluwe-Saint-Lambert / Sint-Lambrechts-Woluwe	38	46,9
Woluwe-Saint-Pierre / Sint-Pieters-Woluwe	2	2,5
Prefer not to say	1	1,2

Figure 18: Graphical representation of results - Survey Question 9



5.3 Adoption and motivation

Question 9 concluded the first part of the questionnaire about socio-demographics. The second part of the questionnaire was expected to provide valuable general information about the adoption by and motivation of the respondents towards shared micro-mobility, including pieces of information concerning spatial, time-related and causal data.

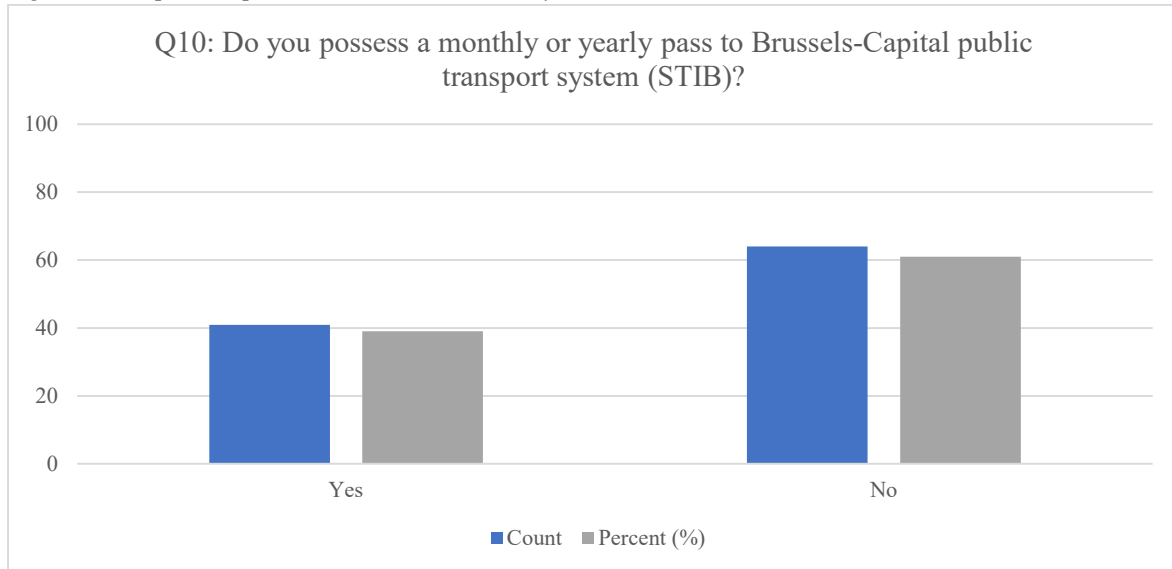
Question 10, which concerned the possession of a monthly or annual pass to Brussels-Capital public transport system (STIB), was the first question of the afore-mentioned second part. Almost 40% of the respondents answered positively, meaning that the importance of the public transport system is significant.

Table 12: Tabulated results - Survey Question 10

Q10: Do you possess a monthly or yearly pass to Brussels-Capital public transport system (STIB)?

	Count	Percent (%)
Yes	41	39
No	64	61

Figure 19: Graphical representation of results - Survey Question 10



A secondary analysis was run in order to identify whether there was a relation between Q10 and previous questions: more specifically Q7 (annual gross household income) and Q8 (the respondent being a resident of the Brussels-Capital Region). In none of the cases a statistically significant relationship was detected. In the first case (Q7), an ANOVA analysis revealed a P-value of 0.333, whereas in the second case (Q8) a ranked correlation analysis and Fisher's Exact Test showed a P-value of 0,0376 and 0,0555 respectively.

Question 11 concerned the frequency of use of various mobility solutions by the respondents for specific scenarios. It can be observed that the majority of respondents use walking and public transport on a daily basis, with 63.8% and 22.9%, respectively. In contrast, the use of own car and shared car service is more infrequent, with 27.6% and 14.3% of respondents reporting rarely using them, respectively. Own motorcycle and shared motorcycle service are the least used modes of transportation, with 94.3% and 94.3% of respondents indicating that they never use them, respectively. Interestingly, the use of micro-mobility vehicles (including own and shared) is gaining popularity, with a relatively high proportion of respondents reporting using them daily or a few times per week. Specifically, 6.7% of respondents reported using their own micro-mobility vehicle on a daily basis, and an additional 6.7% reported using a shared micro-mobility service daily. The use of these vehicles is less frequent among respondents, with 81% and 80% of respondents indicating that they never use their own and shared micro-mobility vehicles, respectively. Overall, the findings suggest that walking and public transport are the most frequently used modes of transportation among the respondents, while the use of personal vehicles such as cars and motorcycles is less frequent. The increasing popularity of micro-mobility vehicles may have implications for urban transportation policies and infrastructure development.

Table 13: Tabulated results - Survey Question 11 (Count)
 Q11: How often do you use the below mobility solutions?

	Count			
	Never	Rarely	On a daily basis	Few times per week
Walking	1	18	67	19
Public transport	8	38	24	35
Own car	29	16	37	23
Shared car service	87	15	1	2
Own motorcycle	99	2	3	1
Shared motorcycle service	99	5	0	1
Own micro-mobility vehicle	85	7	7	6
Shared micro-mobility service	84	16	3	2
Other (please specify)	93	3	7	2

Table 14: Tabulated results - Survey Question 11 (Percentage)
 Q11: How often do you use the below mobility solutions?

	Percent (%)			
	Never	Rarely	On a daily basis	Few times per week
Walking	1,0	17,1	63,8	18,1
Public transport	7,6	36,2	22,9	33,3
Own car	27,6	15,2	35,2	21,9
Shared car service	82,9	14,3	1,0	1,9
Own motorcycle	94,3	1,9	2,9	1,0
Shared motorcycle service	94,3	4,8	0,0	1,0
Own micro-mobility vehicle	81,0	6,7	6,7	5,7
Shared micro-mobility service	80,0	15,2	2,9	1,9
Other (please specify)	88,6	2,9	6,7	1,9

Figure 20: Graphical representation of results - Survey Question 11 (Count)

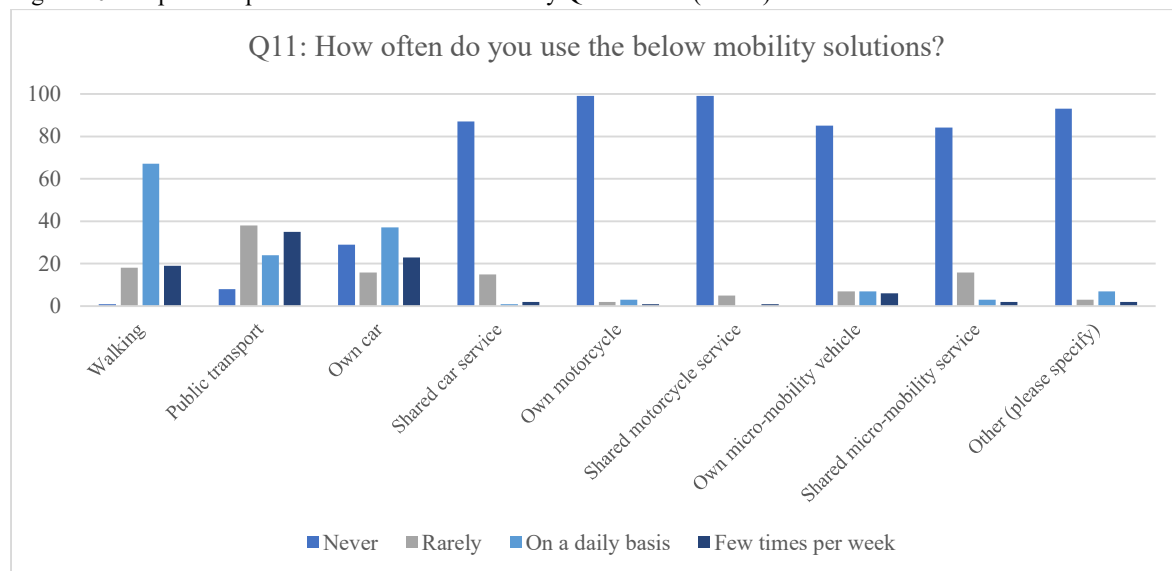
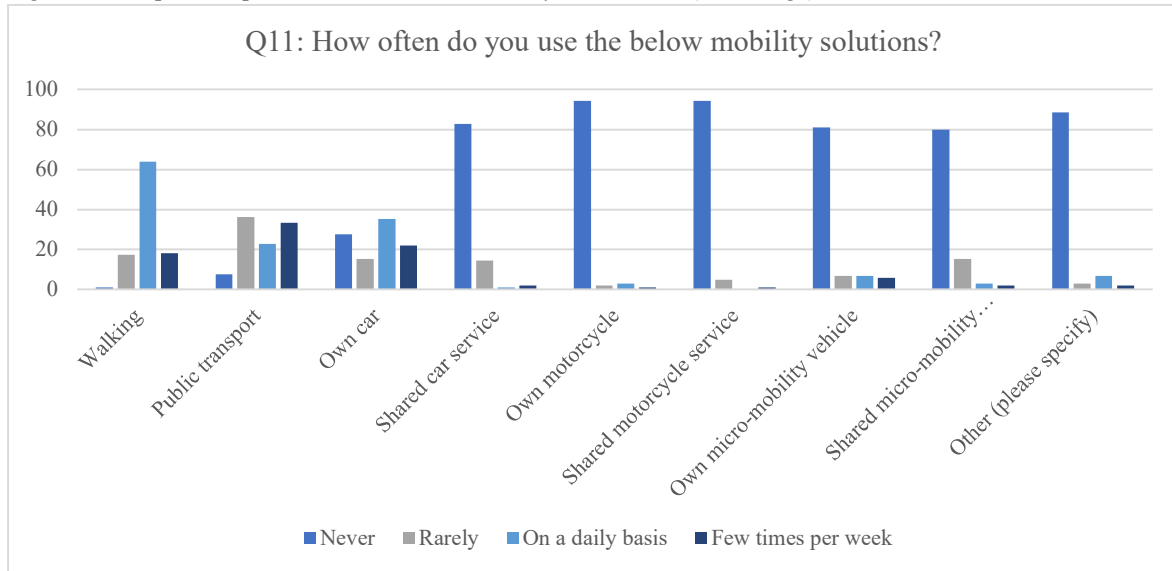


Figure 21: Graphical representation of results - Survey Question 11 (Percentage)



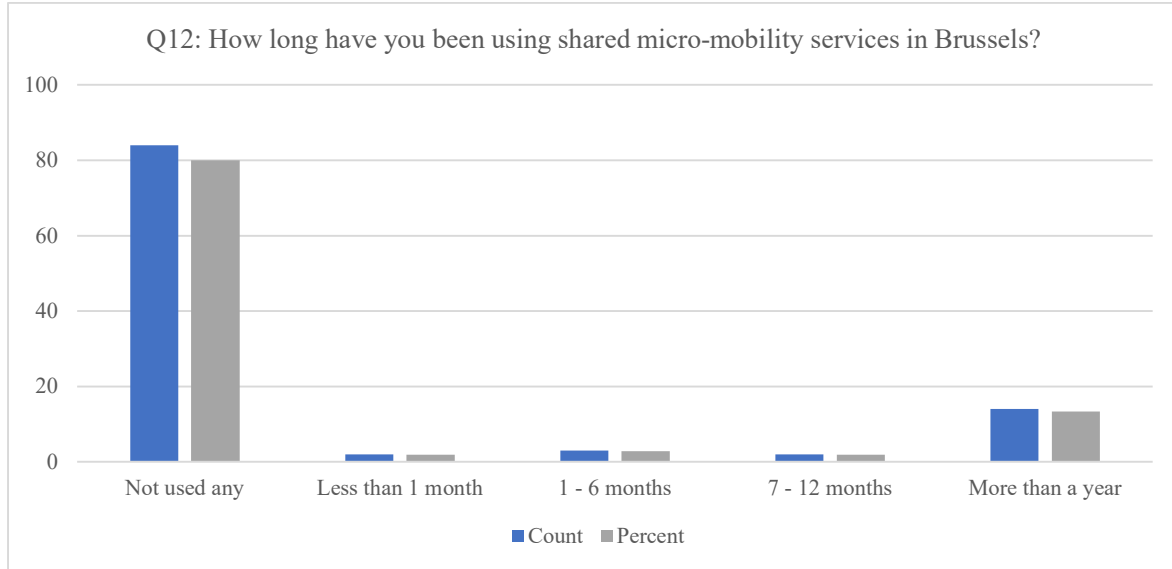
As previously suggested, Question 12, which concerned the period of use of shared micro-mobility services by the respondent, was a pivotal one for the continuation of the survey at respondent level, because depending on the reply the respondent would be presented with a different set of questions. While the sample was relatively small, it was astonishing that only 20% of the respondents had used or were using shared micro-mobility services in the Brussels-Capital Region. More importantly though, out of that 20%, 2 out of 3 respondents had been using such services for more than a year. In comparison, 9,5% of the users (almost 2% in the total sample) had been using such services either less than a month or between 7 and 12 months, while 14,3% (almost 3% in the total sample) were using shared micro-mobility services between 1 and 6 months.

Table 15: Tabulated results - Survey Question 12

Q12: How long have you been using shared micro-mobility services in Brussels?

	Count	Percent (%)
I have not used any shared micro-mobility services in brussels	84	80,0
Less than 1 month	2	1,9
1 - 6 months	3	2,9
7 - 12 months	2	1,9
More than a year	14	13,3

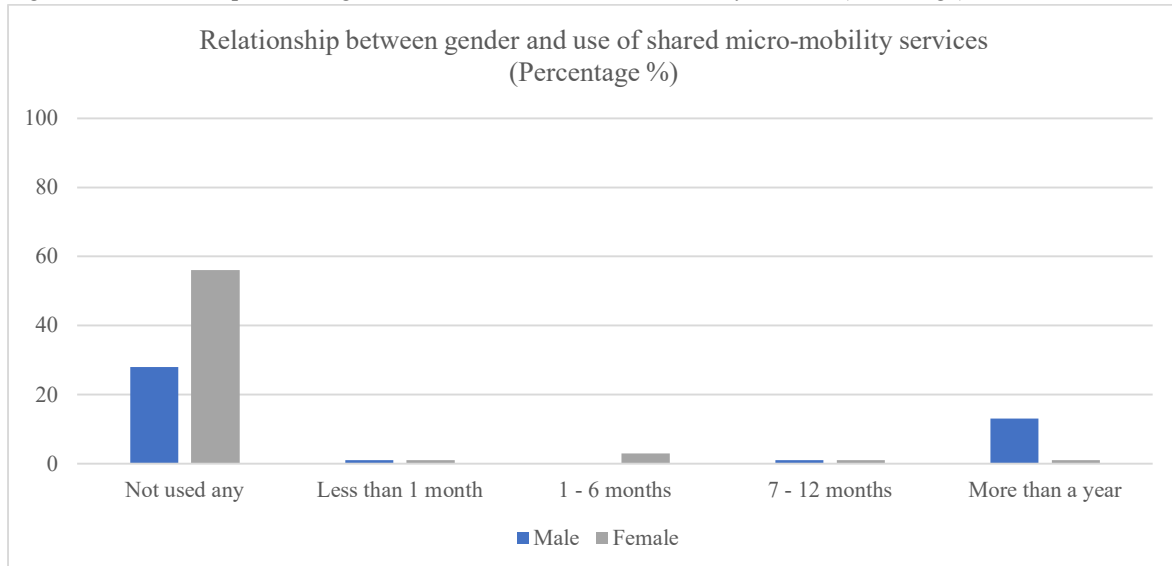
Figure 22: Graphical representation of results - Survey Question 12



The immediate question is if there is any factor among the elements unveiled through the survey’s previous questions which affects the choice of use or non-use. The findings are as follows:

There is a statistically significant relationship between the gender and the use of shared micro-mobility services, with the Chi-Squared Test resulting in a P-value of 0,000539. Among the respondents, 65% of males had never used such services, with the percentage rising over 90% for females. At the same time, 30% of males had been using shared micro-mobility services in the Brussels-Capital Region for more than a year, in contrast to females, whose percentage was only 1,6%.

Figure 23: Relationship between gender and use of shared micro-mobility services (Percentage)

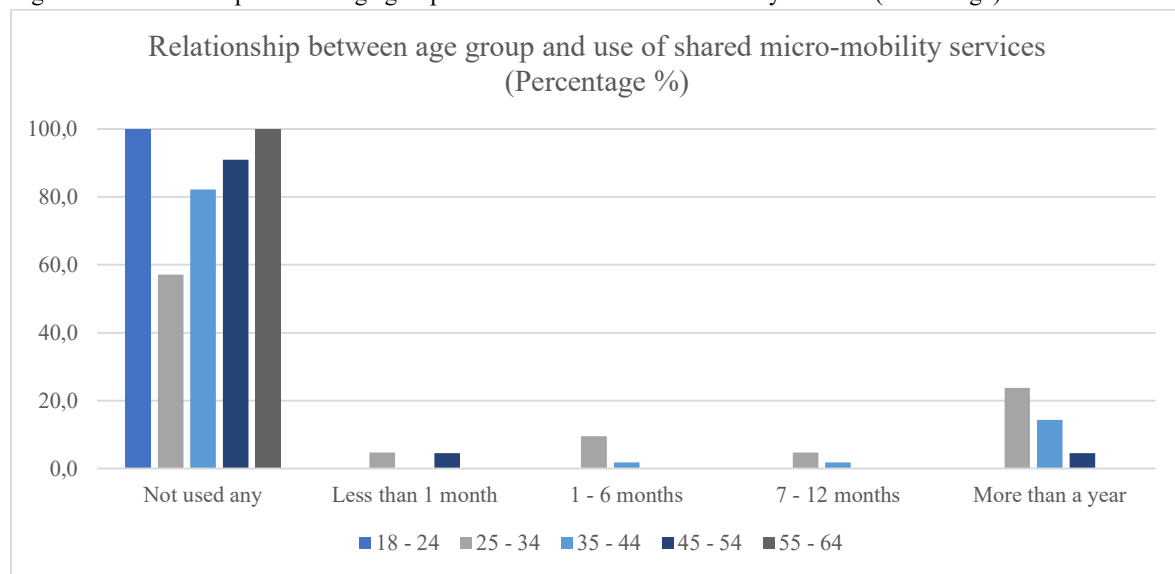


There was no statistically significant relationship between age groups and the use of shared micro-mobility services, with the Chi-Squared Test resulting in a P-value of 0,562. However, at a secondary level, the analysis revealed that, among those who had been using such services, the vast majority belonged in the age group 25-34.

Table 16: Relationship between age group and use of shared micro-mobility services (Percentage)
 Relationship between age group and use of shared micro-mobility services (Percentage %)

Age group	Period of use				
	Not used any	Less than 1 month	1 - 6 months	7 - 12 months	More than a year
18 - 24	100,0	0,0	0,0	0,0	0,0
25 - 34	57,1	4,8	9,5	4,8	23,8
35 - 44	82,1	0,0	1,8	1,8	14,3
45 - 54	90,9	4,5	0,0	0,0	4,5
55 - 64	100,0	0,0	0,0	0,0	0,0

Figure 24: Relationship between age group and use of shared micro-mobility services (Percentage)

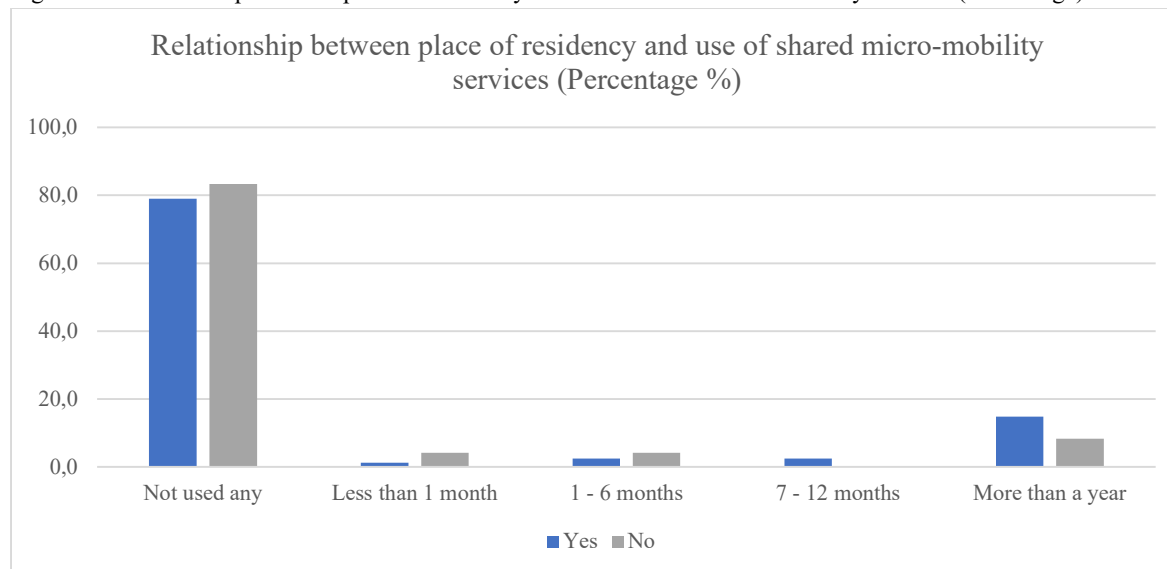


There was no statistically significant relationship between occupation and the use of shared micro-mobility services, with the Chi-Squared Test resulting in a P-value of 0,637. The same was true for the level of education, with the Chi-Squared Test resulting in a P-value of 0,992. The same appears to be the case depending on the possession of different means of transport by the users, as well as in conjunction with the annual gross household income, for which the Chi-Squared Test resulted in a P-value of 0,117. Interestingly, there appeared not to be a statistically significant relationship between the place of residency (in or out of the Brussels-Capital Region) and the use of shared micro-mobility services, with the Ranked ANOVA resulting in a P-value of 0,835. This was an interesting finding, as that it was expected that residents within the Brussels-Capital Region would use more frequently shared micro-mobility services within this perimeter. Similarly, there was no statistically significant relationship between the place of residency (Municipality of the Brussels-Capital Region) and the use of shared micro-mobility services, with the Chi-Squared Test resulting in a P-value of 0,352.

Table 17: Relationship between place of residency and use of shared micro-mobility services (Percentage)
 Relationship between place of residency and use of shared micro-mobility services (Percentage %)

Residence in BCR	Period of use				
	Not used any	Less than 1 month	1 - 6 months	7 - 12 months	More than a year
18 - 24	79,0	1,2	2,5	2,5	14,8
25 - 34	83,3	4,2	4,2	0,0	8,3

Figure 25: Relationship between place of residency and use of shared micro-mobility services (Percentage)



Finally, no statistically significant relationship between the possession of a monthly/annual pass for public transport and use of shared micro-mobility services was observed, with both the ANOVA and the Ranked ANOVA resulting in a P-value of 0,977.

The next question (Q13) aimed at identifying the reason for which shared micro-mobility services are used within the Brussels-Capital Region. The analysis showed that the majority of users (57,1%) never use shared micro-mobility services for commuting to work. On the other hand, 42,9% of users use these services rarely for social activities, and 38,1% use them a few times per week for the same purpose. Running errands is the most common reason for using shared micro-mobility services, with 52,4% of users using them for this purpose at least occasionally. Finally, for leisure, 28,6% of users use these services rarely, while 28,6% use them a few times per week.

Table 18: Tabulated results - Survey Question 13 (Count)

	Count					
	Commuting to work	Commuting to school / University	Social activities	Running errands	Leisure	Other
Never	12	21	3	11	6	16
Rarely	5	0	9	6	8	5
On a daily basis	2	0	1	0	1	0
A few times per week	2	0	8	4	6	0

Table 19: Tabulated results - Survey Question 13 (Percentage)

Q13: How often do you use shared micro-mobility services in Brussels, for each of the below purposes?

	Percentage (%)					
	Commuting to work	Commuting to school / University	Social activities	Running errands	Leisure	Other
Never	57,1	100,0	14,3	52,4	28,6	76,2
Rarely	23,8	0,0	42,9	28,6	38,1	23,8
On a daily basis	9,5	0,0	4,8	0,0	4,8	0,0
A few times per week	9,5	0,0	38,1	19,0	28,6	0,0

Figure 26: Graphical representation of results - Survey Question 13 (Count)

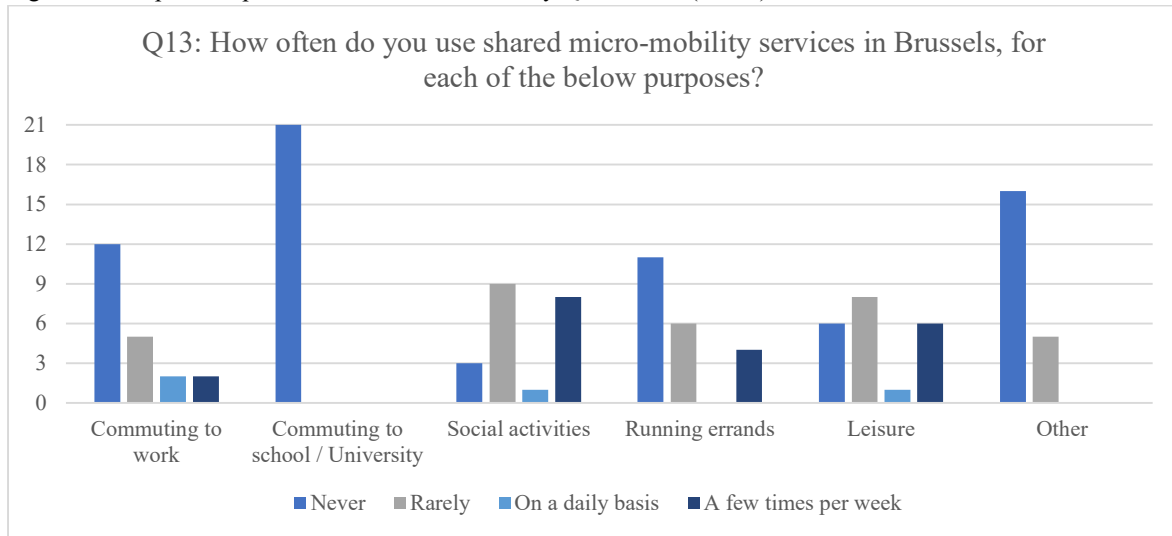
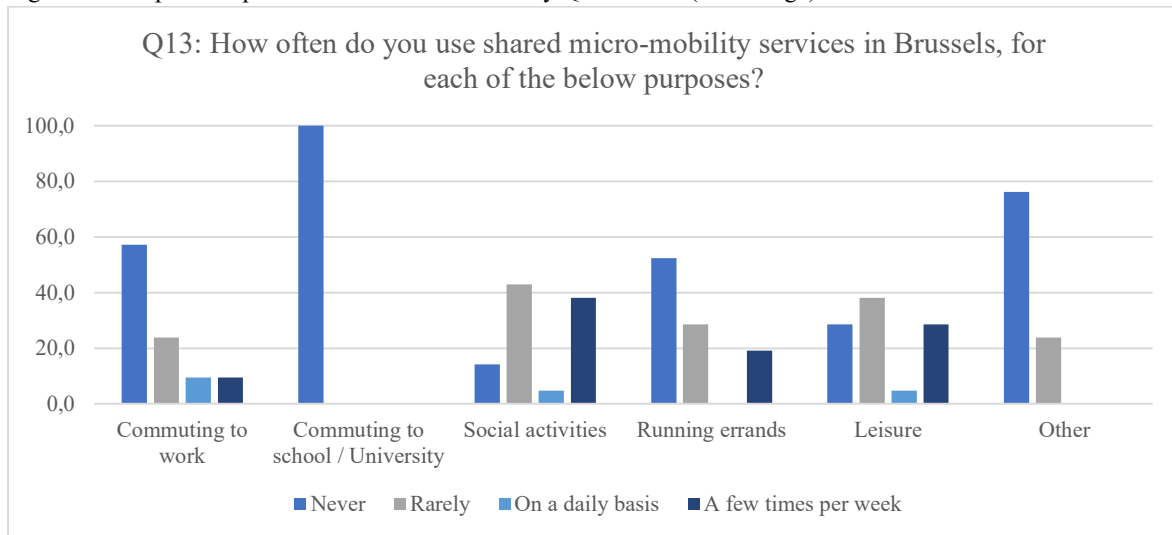


Figure 27: Graphical representation of results - Survey Question 13 (Percentage)



While the previous question (Q13) was aimed only at users of shared micro-mobility services, Question 14 was addressed to all respondents, aiming to identify the factors that influenced their decision to use (or not use) such services. The analysis shows that the convenience (33.3%), the availability of relevant

vehicles (35.2%), as well as the quality of service of other means of transport (37.1%) were the key drivers for using shared micro-mobility services. On the contrary, safety concerns and weather conditions were the major negative influences on the adoption of shared micro-mobility services. The availability of shared micro-mobility vehicles was reported as a positive influence by 35.2% of respondents, whereas only 8.6% considered it a negative influence. This suggests that the availability of shared micro-mobility services is an important factor in encouraging their adoption. Similarly, the convenience of shared micro-mobility services was positively perceived by 33.3% of respondents, while only 10.5% saw it as a negative influence. In terms of negative influences, safety concerns were the most commonly reported issue, with 44.8% of respondents identifying it as a negative influence. This highlights the importance of ensuring that shared micro-mobility services are safe for users. Weather conditions were also a significant negative influence, with 43.8% of respondents reporting it as such. This explains the seasonality patterns that are inherently characterize shared micro-mobility services. Concerning the influence of factors such as the quality of service, cost, and environmental concerns, it was found that the quality of service of other means of transport was seen as a positive influence by 37.1% of respondents, whereas the cost of other means of transport was identified as a negative influence by 27.6% of respondents. This suggests that shared micro-mobility services may need to be competitive in terms of cost and quality to encourage their adoption.

Table 20: Tabulated results - Survey Question 14 (Count)

Q14: Which factors influence your decision to use or not use shared micro-mobility services in Brussels?

	Count			
	Negative influence	No influence	Positive influence	Prefer not to say
Availability of shared micro-mobility vehicles	9	50	37	9
Quality of service of other means of transport	18	42	39	6
Convenience of shared micro-mobility services	11	51	35	8
Convenience of other means of transport	21	37	42	5
Cost of shared micro-mobility services	25	50	18	12
Cost of other means of transport	13	56	29	7
Environmental concerns	9	52	39	5
Traffic congestion	11	45	43	6
Lack of parking options	13	51	34	7
Safety concerns	47	37	16	5
Weather conditions	46	40	14	5
Health and exercise benefits	10	61	27	7
Other	8	67	2	28

Table 21: Tabulated results - Survey Question 14 (Percentage)

Q14: Which factors influence your decision to use or not use shared micro-mobility services in Brussels?

	Percentage (%)			
	Negative influence	No influence	Positive influence	Prefer not to say
Availability of shared micro-mobility vehicles	8,6	47,6	35,2	8,6
Quality of service of other means of transport	17,1	40,0	37,1	5,7
Convenience of shared micro-mobility services	10,5	48,6	33,3	7,6
Convenience of other means of transport	20,0	35,2	40,0	4,8
Cost of shared micro-mobility services	23,8	47,6	17,1	11,4
Cost of other means of transport	12,4	53,3	27,6	6,7
Environmental concerns	8,6	49,5	37,1	4,8
Traffic congestion	10,5	42,9	41,0	5,7
Lack of parking options	12,4	48,6	32,4	6,7
Safety concerns	44,8	35,2	15,2	4,8
Weather conditions	43,8	38,1	13,3	4,8
Health and exercise benefits	9,5	58,1	25,7	6,7
Other	7,6	63,8	1,9	26,7

Figure 28: Graphical representation of results - Survey Question 14 (Count)

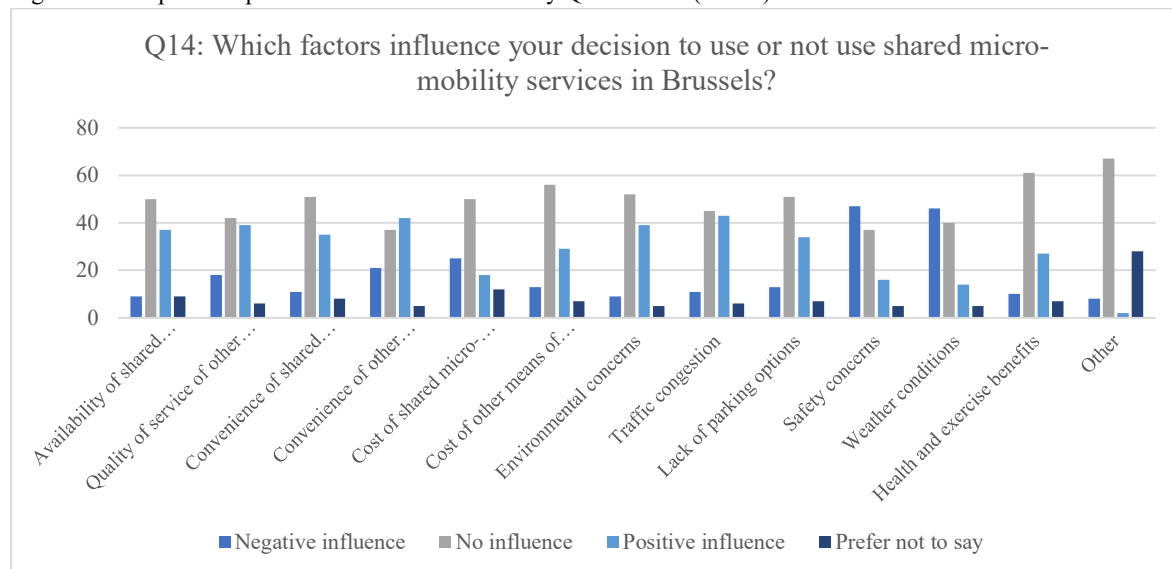
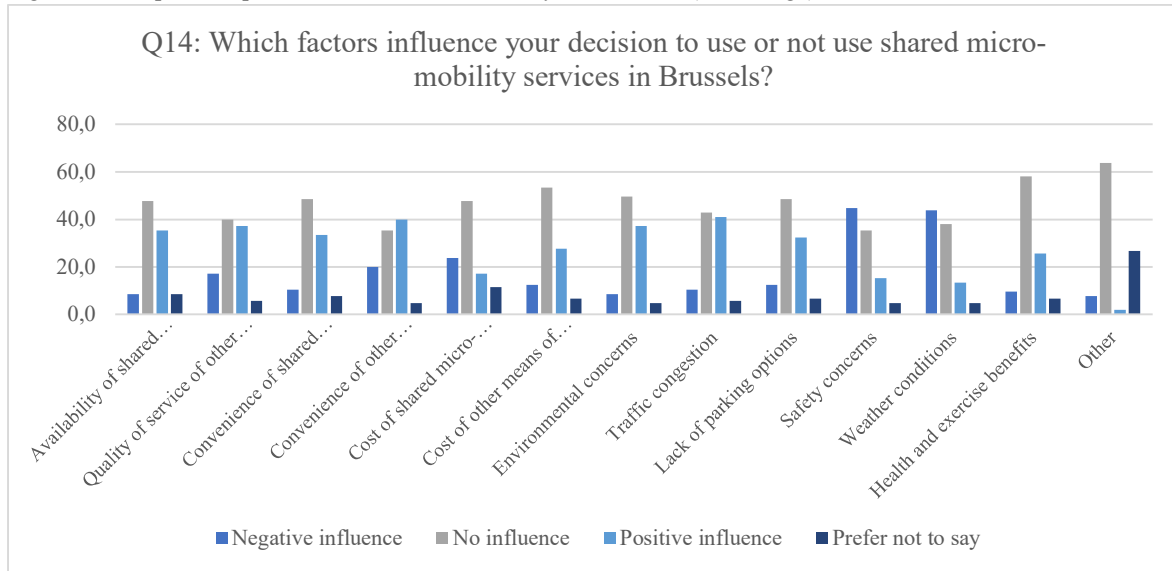


Figure 29: Graphical representation of results - Survey Question 14 (Percentage)



Since the question was addressed to both users and non-users of shared micro-mobility services, further analysis was undertaken, in order to identify the factors that influence each of the two distinct groups.

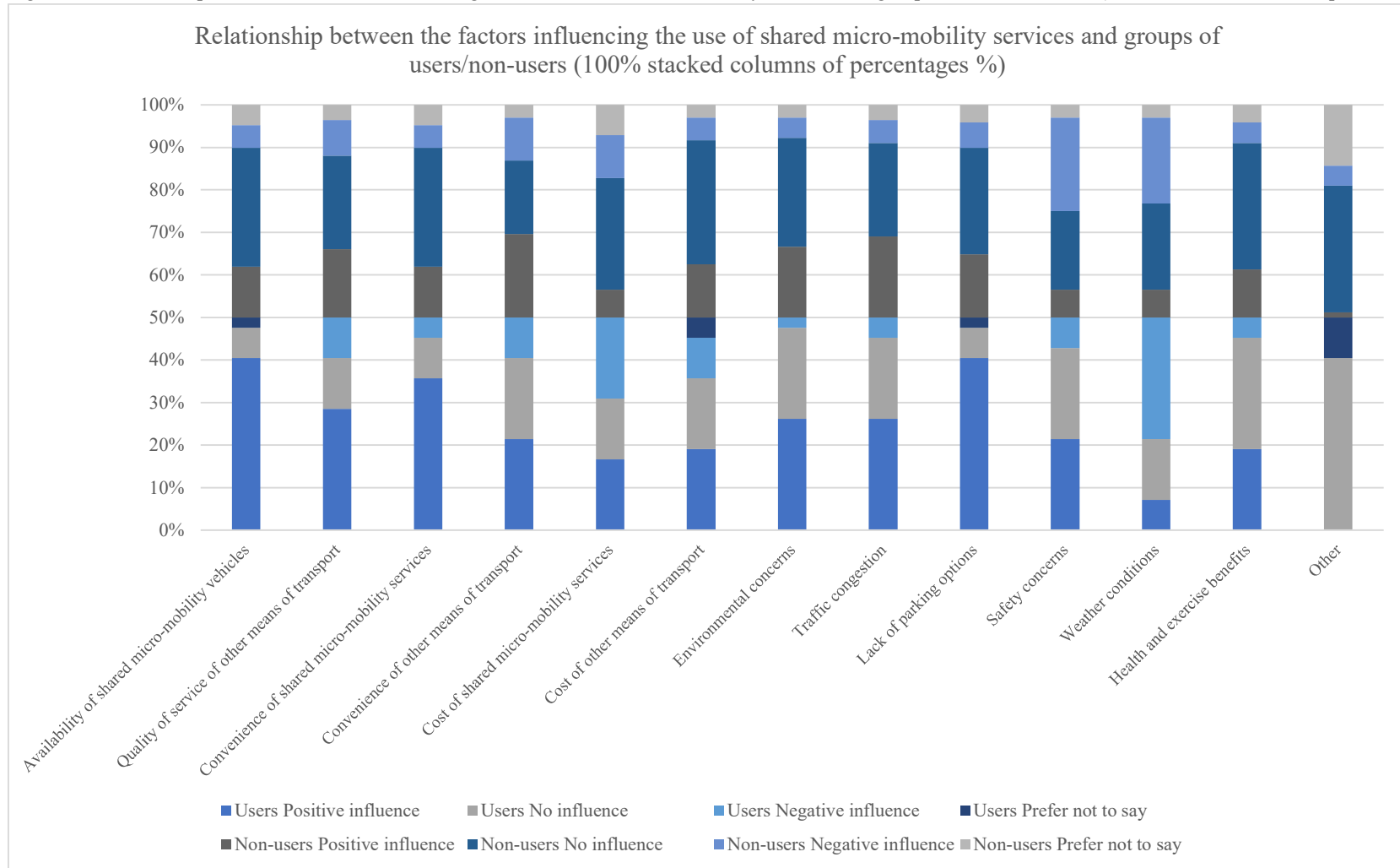
Table 22: Relationship between the factors influencing the use of shared micro-mobility services and groups of users/non-users (Count)

	Users				Non-users			
	Positive influence	No influence	Negative influence	Prefer not to say	Positive influence	No influence	Negative influence	Prefer not to say
Availability of shared micro-mobility vehicles	17	3	0	1	20	47	9	8
Quality of service of other means of transport	12	5	4	0	27	37	14	6
Convenience of shared micro-mobility services	15	4	2	0	20	47	9	8
Convenience of other means of transport	9	8	4	0	33	29	17	5
Cost of shared micro-mobility services	7	6	8	0	11	44	17	12
Cost of other means of transport	8	7	4	2	21	49	9	5
Environmental concerns	11	9	1	0	28	43	8	5
Traffic congestion	11	8	2	0	32	37	9	6
Lack of parking options	17	3	0	1	25	42	10	7
Safety concerns	9	9	3	0	11	31	37	5
Weather conditions	3	6	12	0	11	34	34	5
Health and exercise benefits	8	11	2	0	19	50	8	7
Other	0	17	0	4	2	50	8	24

Table 23: Relationship between the factors influencing the use of shared micro-mobility services and groups of users/non-users (Percentage %)

	Users				Non-users			
	Positive influence	No influence	Negative influence	Prefer not to say	Positive influence	No influence	Negative influence	Prefer not to say
Availability of shared micro-mobility vehicles	81,0	14,3	0,0	4,8	23,8	56,0	10,7	9,5
Quality of service of other means of transport	57,1	23,8	19,0	0,0	32,1	44,0	16,7	7,1
Convenience of shared micro-mobility services	71,4	19,0	9,5	0,0	23,8	56,0	10,7	9,5
Convenience of other means of transport	42,9	38,1	19,0	0,0	39,3	34,5	20,2	6,0
Cost of shared micro-mobility services	33,3	28,6	38,1	0,0	13,1	52,4	20,2	14,3
Cost of other means of transport	38,1	33,3	19,0	9,5	25,0	58,3	10,7	6,0
Environmental concerns	52,4	42,9	4,8	0,0	33,3	51,2	9,5	6,0
Traffic congestion	52,4	38,1	9,5	0,0	38,1	44,0	10,7	7,1
Lack of parking options	81,0	14,3	0,0	4,8	29,8	50,0	11,9	8,3
Safety concerns	42,9	42,9	14,3	0,0	13,1	36,9	44,0	6,0
Weather conditions	14,3	28,6	57,1	0,0	13,1	40,5	40,5	6,0
Health and exercise benefits	38,1	52,4	9,5	0,0	22,6	59,5	9,5	8,3
Other	0,0	81,0	0,0	19,0	2,4	59,5	9,5	28,6

Figure 30: Relationship between the factors influencing the use of shared micro-mobility services and groups of users/non-users (100% stacked columns of percentages %)



The analysis of the results revealed that the availability of shared micro-mobility vehicles was considered a positive influence by 81% of users, whereas only 23,8% of non-users considered it as a positive factor. In contrast, 56% of non-users reported no influence of vehicle availability, compared to only 14,3% of users. Regarding the quality of service of other means of transport, 57,1% of users and 32,1% of non-users saw it as a positive influence. In contrast, 19% of non-users reported negative influence, compared to 0% of users. The convenience of shared micro-mobility services was seen as a positive influence by 71,4% of users and only 23,8% of non-users. In contrast, 56% of non-users reported no influence of convenience, compared to only 19% of users. The convenience of other means of transport was considered a positive influence by 42,9% of users and 39,3% of non-users. However, 38,1% of users and 34,5% of non-users reported no influence of this factor. In terms of cost, only 33,3% of users saw the cost of shared micro-mobility services as a positive influence, compared to 13,1% of non-users. On the other hand, 52,4% of non-users reported no influence of cost, compared to 28,6% of users. Similarly, 38,1% of users and 25% of non-users reported no influence of the cost of other means of transport. Environmental concerns were a positive influence for 52,4% of users and 33,3% of non-users, with 42,9% of users and 51,2% of non-users reporting no influence of this factor. Traffic congestion was considered a positive influence by 52,4% of users and 38,1% of non-users, with 44% of non-users reporting no influence. The lack of parking options was a positive influence for 81% of users and 29,8% of non-users, with 50% of non-users reporting no influence. Regarding safety concerns, 42,9% of users and 13,1% of non-users saw this as a positive influence, while 44% of non-users reported negative influence. Weather conditions were a negative influence for both groups, with 57,1% of non-users reporting negative influence, compared to 28,6% of users. Finally, health and exercise benefits were reported as a positive influence by 38,1% of users and 22,6% of non-users, with 59,5% of non-users reporting no influence. In addition, the results of the analysis indicate that a significant proportion (81%) of non-users reported no influence of other factors, while 42,9% of users and 59,5% of non-users reported no influence of health and exercise benefits and 14,3% of users and 40,5% of non-users reported no influence of weather conditions. Overall, the results indicate that availability of shared micro-mobility vehicles, convenience of shared micro-mobility services, and lack of parking options are more positively perceived by users compared to non-users. On the other hand, non-users are less affected by the cost of shared micro-mobility services compared to users. Quality of service of other means of transport, convenience of other means of transport, cost of other means of transport, environmental concerns, traffic congestion, safety concerns, weather conditions, and health and exercise benefits are factors that appear to have no significant difference in perception between users and non-users. The above observations are also confirmed by the Chi-Squared Test (significance level of 0,05) which was used in order to determine if there is a significant difference between the responses of users and non-users of shared micro-mobility services. The Null Hypothesis is that there is no significant association between the factors influencing the use of shared micro-mobility services and the status of the respondents, while the Alternative Hypothesis is that there is a significant association between the factors influencing the use of shared micro-mobility services and the status of the respondents.

Table 24: Tabulated results – P-values of Chi-Squared Test results concerning the factors influencing the use of shared micro-mobility services and groups of users/non-users

P-values of Chi-Squared Test results concerning the factors influencing the use of shared micro-mobility services and groups of users/non-users

	Users	Non-users
Availability of shared micro-mobility vehicles	<0,001	0,002
Quality of service of other means of transport	0,027	0,005
Convenience of shared micro-mobility services	0,001	0,592
Convenience of other means of transport	0,124	0,367
Cost of shared micro-mobility services	0,025	0,099
Cost of other means of transport	0,117	0,396
Environmental concerns	0,003	0,612
Traffic congestion	0,01	0,364
Lack of parking options	<0,001	0,011
Safety concerns	0,183	<0,001
Weather conditions	<0,001	0,329
Health and exercise benefits	0,041	0,128
Other	1.000	0,042

Based on the results of the Chi-Squared Test, it can be concluded that there is a significant association between the responses of users and non-users for most of the influencing factors. The P-value for each influencing factor is less than the chosen level of significance (0,05), indicating that the Null Hypothesis of no association can be rejected. The exceptions are convenience of other means of transport and traffic congestion, where the p-values are greater than 0,05. As a result, it is observed that there appears to be a significant association between the use of shared micro-mobility services and several influencing factors. Specifically, availability of shared micro-mobility vehicles, convenience of shared micro-mobility services, and lack of parking options were found to have a significant association with the use of these services. Furthermore, users and non-users of shared micro-mobility services differed in their responses to various influencing factors. Users were more likely to report positive influence from the availability and convenience of shared micro-mobility services, as well as from the lack of parking options. Non-users, on the other hand, were more likely to report no influence from these factors.

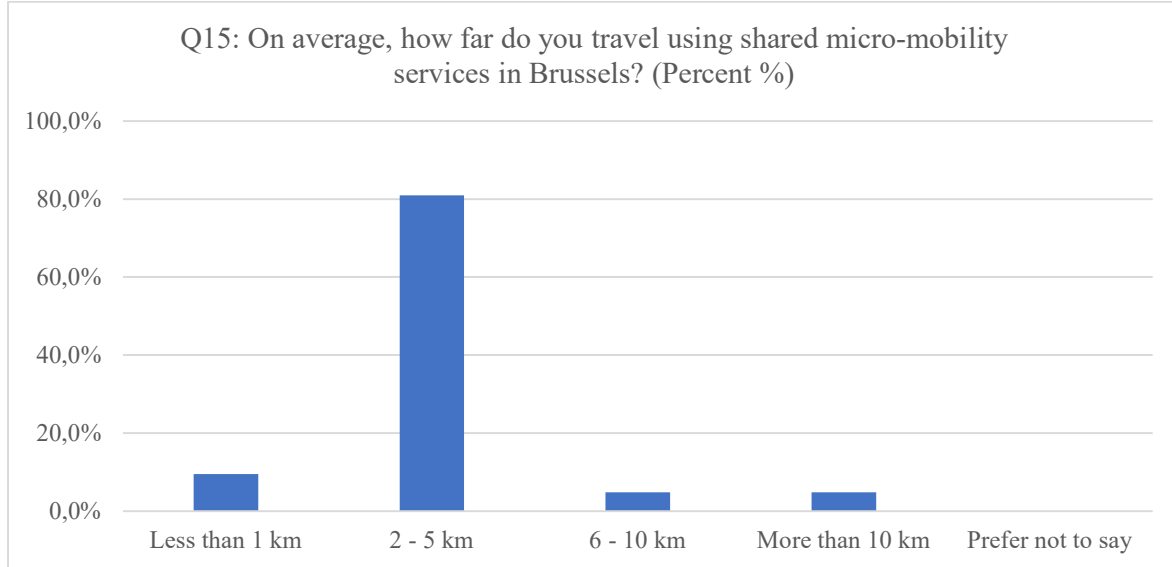
Question 15 intended to identify the usual travelling distance of the users of shared micro-mobility services. Based on the data analysis, a modest 9,5% of respondents indicated traveling distances less than 1 km when using shared micro-mobility services. In contrast, the majority, accounting for 81.0% of respondents, reported journeying distances ranging from 2 to 5 km. This range emerged as the most frequently chosen option, signifying a popular preference among users of shared micro-mobility services. Moreover, a small fraction of respondents (4,8%) stated that their typical travel distances fall within the 6-10 km range. Similarly, an equivalent proportion (4,8%) reported undertaking journeys exceeding 10 km using shared micro-mobility services. None of the respondents preferred not to disclose their distance traveled.

Table 25: Tabulated results - Survey Question 15

Q15: On average, how far do you travel using shared micro-mobility services in Brussels?

	Count	Percent (%)
Less than 1 km	2	9,5
2 - 5 km	17	81,0
6 - 10 km	1	4,8
More than 10 km	1	4,8
Prefer not to say	0	0

Figure 31: Graphical representation of results - Survey Question 15 (Percentage)



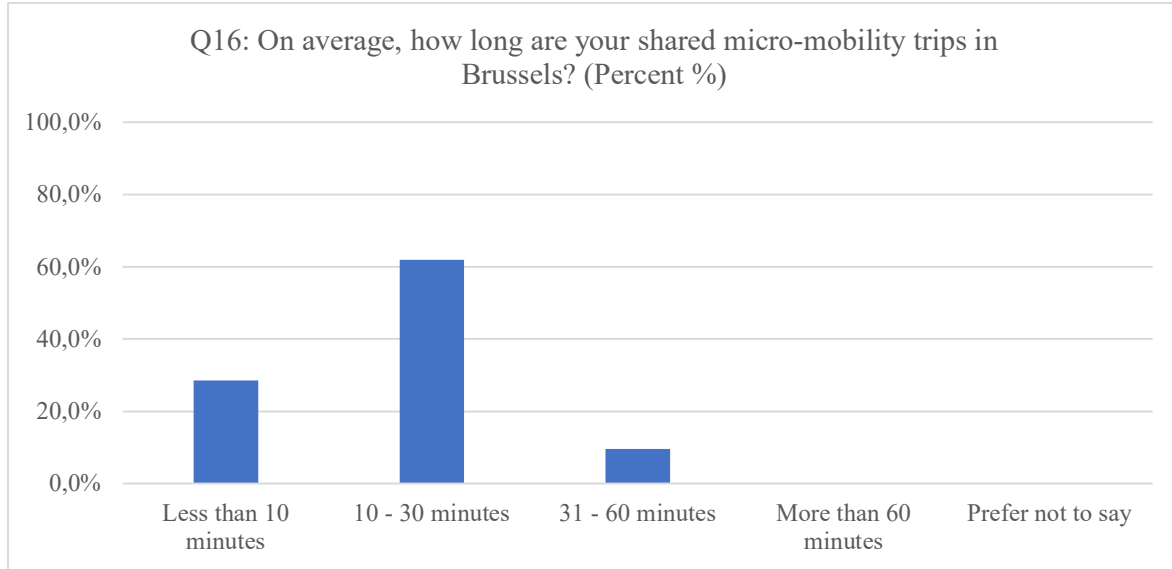
After identifying travelling distance habits, Question 16 intended to identify the usual travelling times of the users of shared micro-mobility services. Overall, the majority of respondents (61,9%) indicated travelling times between 10 and 30 minutes, while a smaller proportion (28,6%) travelling times of up to 10 minutes. The remaining respondents exhibited longer travelling times. No respondent reported travelling times of more than 60 minutes.

Table 26: Tabulated results - Survey Question 16

Q16: On average, how long are your shared micro-mobility trips in Brussels?

	Count	Percent (%)
Less than 10 minutes	6	28,6
10 - 30 minutes	13	61,9
31 - 60 minutes	2	9,5
More than 60 minutes	0	0,0
Prefer not to say	0	0,0

Figure 32: Graphical representation of results - Survey Question 16 (Percentage)

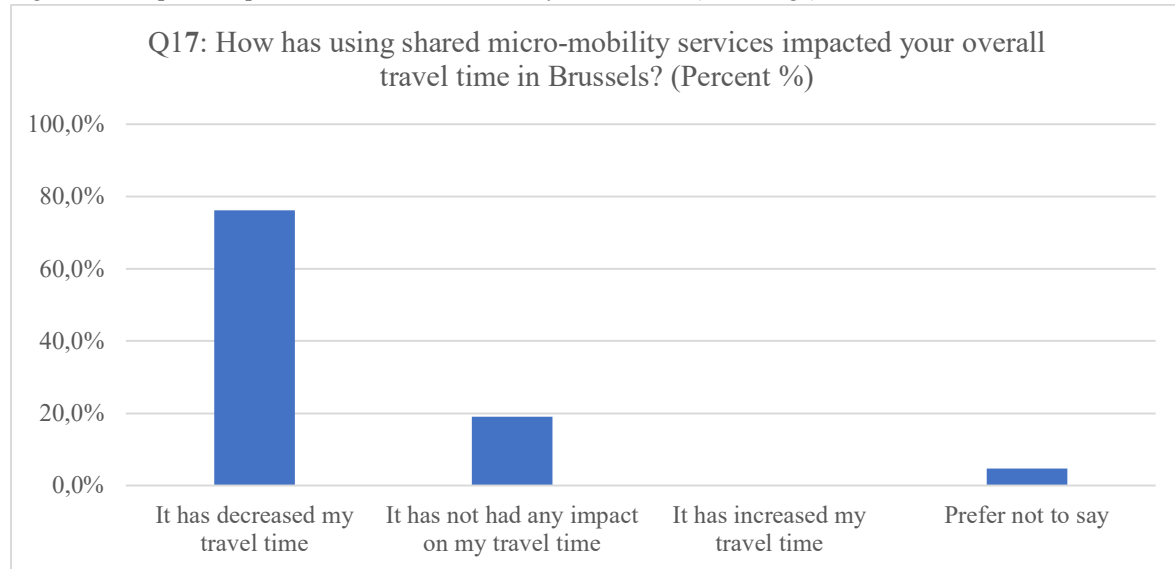


Question 17 was a follow-up to Q16, aiming to gauge the perception of the users of shared micro-mobility services concerning the impact that the use of such a transport solution had on their total travel times. According to the analysis, the majority of respondents (76,2%) reported that the use of shared micro-mobility services has decreased their travel time. A significant proportion of respondents (19,0%) stated that such use had not had any impact on their travel time. A small portion of respondents (4,8%) preferred not to disclose their response. Interestingly, no respondents indicated that the factor has increased their travel time. This finding could have several interpretations. First, it suggests that shared micro-mobility services may have positive effects on the efficiency and effectiveness of the transportation system in the Brussels-Capital Region. It could indicate that these services have led to overall improvements such as reduced congestion, more efficient use of transport infrastructure or streamlined processes, resulting in shorter travel durations for the majority of respondents. At the same time, this finding could imply that shared micro-mobility services have not caused any significant disruptions or delays in the transportation system. This could be important for ensuring the smooth operation of daily commutes, minimizing inconvenience for travelers, and maintaining the overall satisfaction levels of the users concerning the public transport services or infrastructure.

Table 27: Tabulated results - Survey Question 17

Q17: How has using shared micro-mobility services impacted your overall travel time in Brussels?		
	Count	Percent (%)
It has decreased my travel time	16	76,2
It has not had any impact on my travel time	4	19,0
It has increased my travel time	0	0,0
Prefer not to say	1	4,8

Figure 33: Graphical representation of results - Survey Question 17 (Percentage)



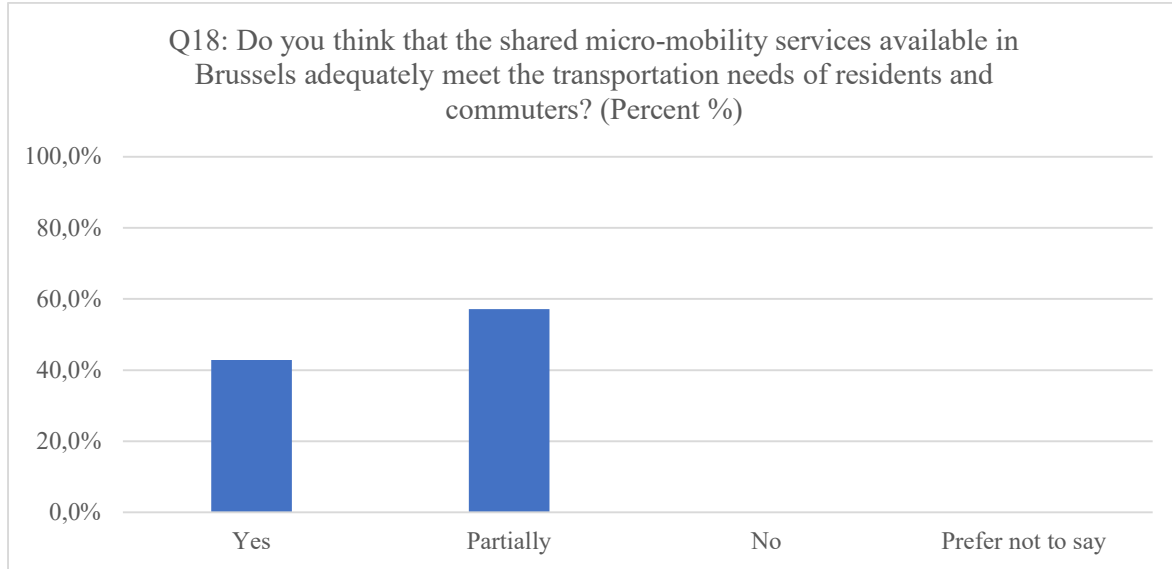
Question 18 concerned the perception of the users regarding the adequacy of shared micro-mobility services in the Brussels-Capital Region in meeting the transportation needs of residents and commuters. The findings indicate that a majority of the respondents (57,1%) expressed the opinion that the services only partially meet their transportation needs, while a significant portion (42,9%) responded affirmatively, stating that the services do adequately fulfill their requirements. The result suggesting that shared micro-mobility services partially meet the transportation needs of residents and commuters indicates that while these services offer benefits and convenience, there is room for improvement. This conclusion is further reinforced by the absence of any respondents indicating that the shared micro-mobility services do not meet their transportation needs (0,0%), which clearly suggests that the majority of participants do find utility and effectiveness in these services.

Table 28: Tabulated results - Survey Question 18

Q18: Do you think that the shared micro-mobility services available in Brussels adequately meet the transportation needs of residents and commuters?

	Count	Percent (%)
Yes	9	42,9
Partially	12	57,1
No	0	0,0
Prefer not to say	0	0,0

Figure 34: Graphical representation of results - Survey Question 18 (Percentage)



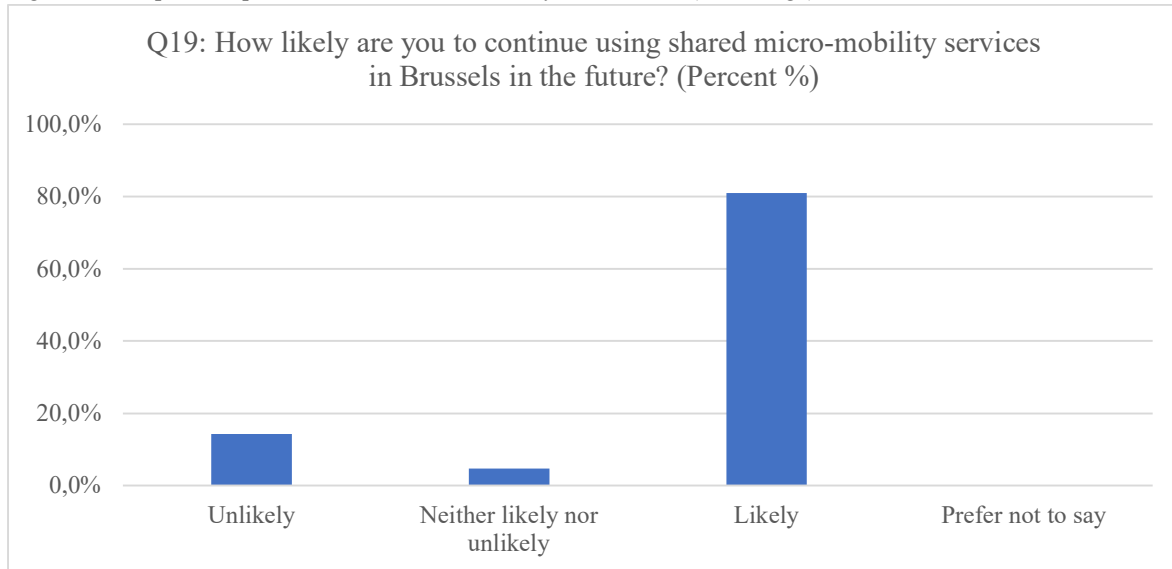
Question 20 aimed at gauging the likelihood of continued usage of shared micro-mobility services in the Brussels-Capital Region in the future. The findings indicate that a significant majority of the respondents (81,0%) expressed a positive inclination, stating that they are likely to continue using these services. A small portion of the respondents (14,3%) indicated an unlikely scenario of continued usage, while a minority (4,8%) remained neutral, neither leaning towards likelihood nor unlikelihood. The high percentage of respondents expressing a likelihood of continuing to use shared micro-mobility services in the Brussels-Capital Region suggests a positive user sentiment and satisfaction with the existing services. This result indicates that the respondents perceive value, convenience, and benefits in utilizing these services, leading them to consider incorporating them into their future transportation choices. The neutral stance of a minority of respondents (4,8%) signifies an absence of a clear inclination towards continued or discontinued usage. This may indicate a level of uncertainty or the need for further evaluation or consideration before making a definitive decision regarding future engagement with shared micro-mobility services. The presence of a small percentage of respondents (14,3%) indicating an unlikely scenario for future usage suggests the existence of certain factors or concerns that may hinder their continued engagement with shared micro-mobility services. However, overall, the high percentage of respondents expressing a likelihood of continued usage reflects a positive outlook for the future adoption and utilization of shared micro-mobility services in the Brussels-Capital Region.

Table 29: Tabulated results - Survey Question 19

Q19: How likely are you to continue using shared micro-mobility services in Brussels in the future?

	Count	Percent (%)
Unlikely	3	14,3
Neither likely nor unlikely	1	4,8
Likely	17	81,0
Prefer not to say	0	0,0

Figure 35: Graphical representation of results - Survey Question 19 (Percentage)

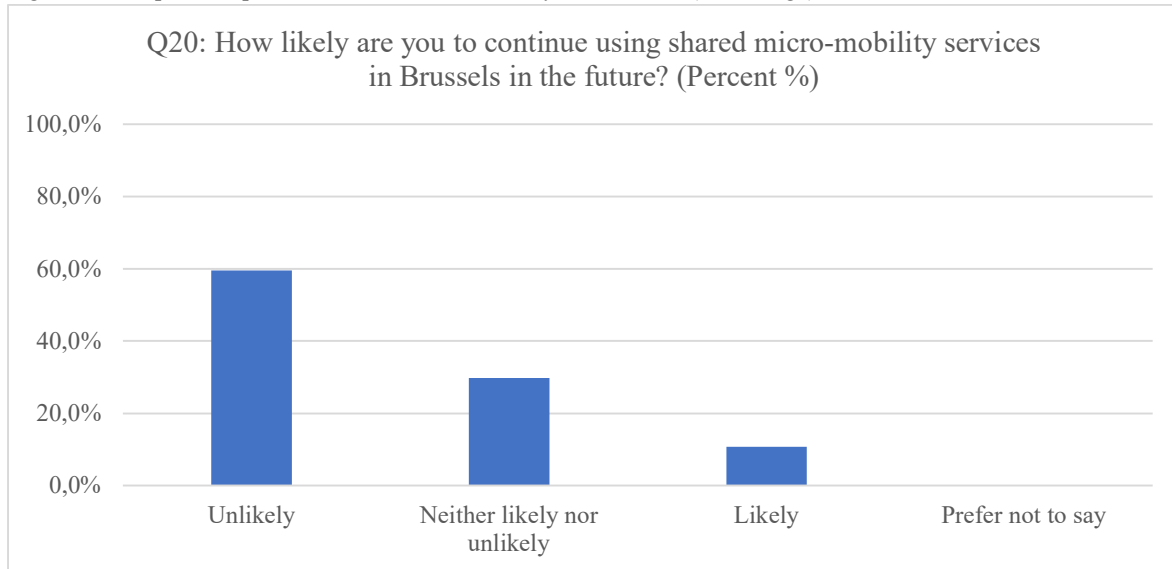


A similar question as Q19 was asked to non-users of shared micro-mobility services in the Brussels-Capital Region, aiming to identify the likelihood of starting to use such services in the future. The findings indicate that the majority of the respondents (59,5%) expressed an unlikely stance, stating that they are unlikely to start using these services. A significant portion of the respondents (29,8%) remained neutral, neither leaning towards likelihood nor unlikely. A small percentage of respondents (10,7%) expressed a positive inclination, stating that they are likely to start using shared micro-mobility services in the future. The high percentage of respondents expressing an unlikely scenario for future usage suggests underlying concerns that may hinder their adoption of shared micro-mobility services. The neutral stance of a substantial portion of respondents (29,8%) signifies an absence of a clear inclination towards starting or not starting to use shared micro-mobility services. This may indicate a level of uncertainty or the need for further evaluation before making a definitive decision regarding the adoption of these services. The presence of a small percentage of respondents (10,7%) indicating a likelihood of starting to use shared micro-mobility services in the future suggests a potential market segment that shows interest and openness to incorporating these services into their habitual transportation choices. However, it is important to note that this segment constitutes a minority of the respondents. Overall, the high percentage of respondents expressing an unlikely scenario for future usage indicates that there may be significant barriers or challenges to a wider adoption of shared micro-mobility services in Brussels.

Table 30: Tabulated results - Survey Question 20

	Count	Percent (%)
Unlikely	50	59,5
Neither likely nor unlikely	25	29,8
Likely	9	10,7
Prefer not to say	0	0,0

Figure 36: Graphical representation of results - Survey Question 20 (Percentage)



5.4 Habitual changes

Question 21 aimed at identifying how the use of shared micro-mobility services has influenced the respondents' transportation habits in relation to various modes of transportation. In terms of walking, 38,1% of respondents reported a decrease in walking since using shared micro-mobility services, while 52,4% stated that it had no impact. A small percentage (9,5%) mentioned an increase in their walking habits. Regarding the use of public transport, 38,1% reported a decrease, 42,9% reported no impact and 19,0% reported an increase in their use of public transport since adopting shared micro-mobility services. Concerning personal vehicles, 33,3% of the respondents indicated a decrease in using their own cars, while the majority (66,7%) reported no impact. Interestingly, none of the respondents reported an increase in car usage. As far as motorcycles are concerned, 9,5% of the respondents reported a decrease in motorcycle usage, while the vast majority (90,5%) stated that it had no impact. As it was also the case with cars, no respondents reported an increase in motorcycle usage. Regarding the use of personal micro-mobility vehicles like (e-)bicycles and (e-)scooters, 23,8% of the respondents reported a decrease, 71,4% reported no impact, while 4,8% reported an increase in their usage since adopting shared micro-mobility services. Overall, the findings suggest that the use of shared micro-mobility services has had varying effects on different modes of transportation. While some respondents reported decreased use of walking, public transport, and personal vehicles (cars and motorcycles), the majority indicated no significant impact on these modes. Notably, a small proportion of respondents reported increased use of public transport and personal micro-mobility vehicles. These findings suggest that shared micro-mobility services serve as a complementary transportation option and an alternative to personal vehicles for certain individuals. The decreased use of personal vehicles and the increased use of public transport indicate potential benefits in reducing traffic congestion and promoting more sustainable transportation choices. However, there is an alarming trend, in which the adoption of shared micro-mobility services has led to decrease of walking. This is worrying because it effectively suggests a decrease of habits beneficial for health and the substitution of the physical exercise provided by walking by less active modes of transport, such as scooters.

Table 31: Tabulated results - Survey Question 21 (Count)

Q21: How has the use of shared micro-mobility services impacted your overall transportation habits in comparison to...?

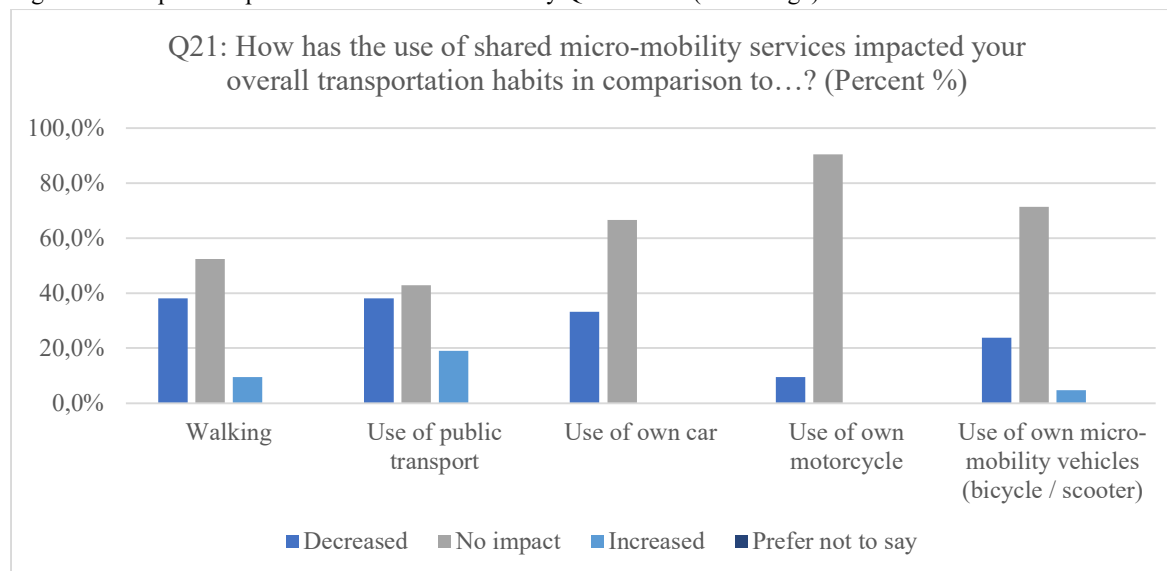
	Count			
	Decreased	No impact	Increased	Prefer not to say
Walking	8	11	2	0
Use of public transport	8	9	4	0
Use of own car	7	14	0	0
Use of own motorcycle	2	19	0	0
Use of own micro-mobility vehicles (bicycle / scooter)	5	15	1	0

Table 32: Tabulated results - Survey Question 21 (Percentage)

Q21: How has the use of shared micro-mobility services impacted your overall transportation habits in comparison to...?

	Percentage (%)			
	Decreased	No impact	Increased	Prefer not to say
Walking	38,1	52,4	9,5	0,0
Use of public transport	38,1	42,9	19,0	0,0
Use of own car	33,3	66,7	0,0	0,0
Use of own motorcycle	9,5	90,5	0,0	0,0
Use of own micro-mobility vehicles (bicycle / scooter)	23,8	71,4	4,8	0,0

Figure 37: Graphical representation of results - Survey Question 21 (Percentage)



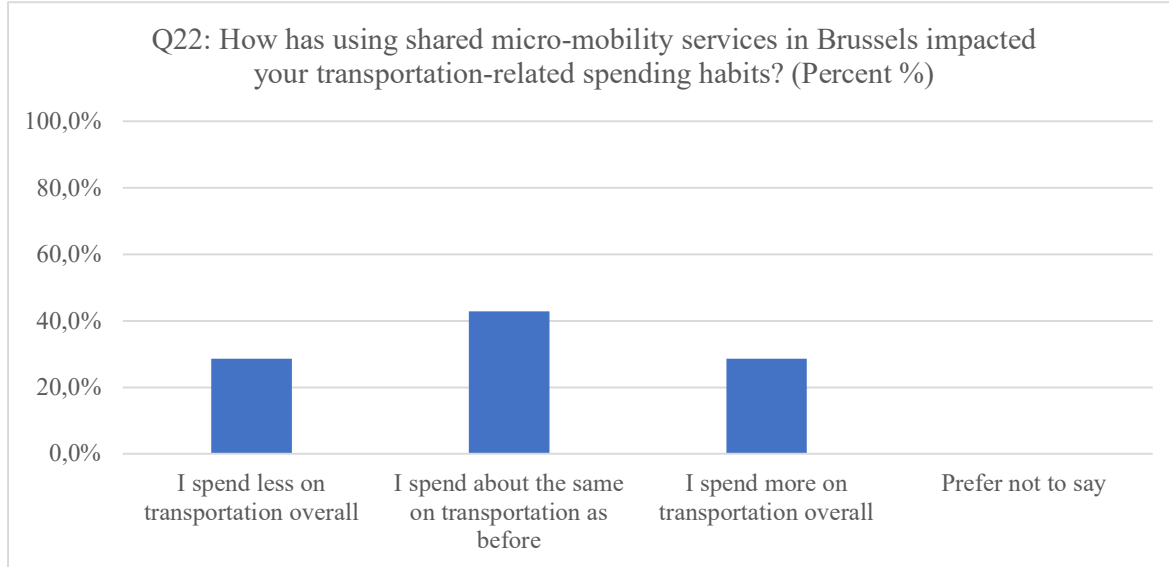
Question 22 concerned the cost-related aspect of using shared micro-mobility services in the Brussels-Capital Region; more particularly, whether the use of such services has had an impact on the participants' transport-related spending habits.

Table 33: Tabulated results - Survey Question 22

Q22: How has using shared micro-mobility services in Brussels impacted your transportation-related spending habits?

	Count	Percent (%)
I spend less on transportation overall	6	28,6
I spend about the same on transportation as before	9	42,9
I spend more on transportation overall	6	28,6
Prefer not to say	0	0,0

Figure 38: Graphical representation of results - Survey Question 22 (Percentage)



The analysis reveals that approximately 28,6% of respondents reported spending less on transportation overall since started using shared micro-mobility services. This suggests that, for a notable portion of individuals, utilizing shared micro-mobility options has resulted in cost savings in their transportation expenditures. A possible reason for this could include the relatively lower cost of shared micro-mobility services compared to other modes of transportation, especially in comparison to private car ownership. On the other hand, an equal proportion of 28,6% of respondents reported spending more on transportation overall since adopting shared micro-mobility services. A contributing factor to this could include the frequent usage of shared micro-mobility services, which are actually paid services – effectively leading to higher costs compared to their previous transportation choices. On the other hand, a significant proportion of respondents (42,9%) reported that their transportation spending habits remained the same as before started using shared micro-mobility services. This suggests that for these individuals, the introduction of shared micro-mobility options did not have a substantial impact on their overall transportation-related expenses. It is worth noting that various factors can contribute to this outcome, including a balanced usage pattern of shared micro-mobility services alongside existing transportation modes or the substitution of other forms of transportation without significant cost differences. Overall, the findings indicate a mixed impact of shared micro-mobility services on respondents' transportation-related spending habits. While some individuals reported cost savings, others experienced increased expenditures, and a significant portion observed no significant change. However, it should be noted that individual preferences and travel behaviors can greatly influence transportation-related spending habits. Factors such as trip frequency and trip length, as well as and the

overall transportation system of the city (including public transport) can play a significant role in determining the financial implications for users.

Question 23 aimed at identifying the impact that the use of shared micro-mobility services has in different aspects of the respondents' lives; notably, their physical activity levels, their mental health and well-being, as well as their social interactions.

Table 34: Tabulated results - Survey Question 23 (Count)

Q23: How has using shared micro-mobility services impacted your...?

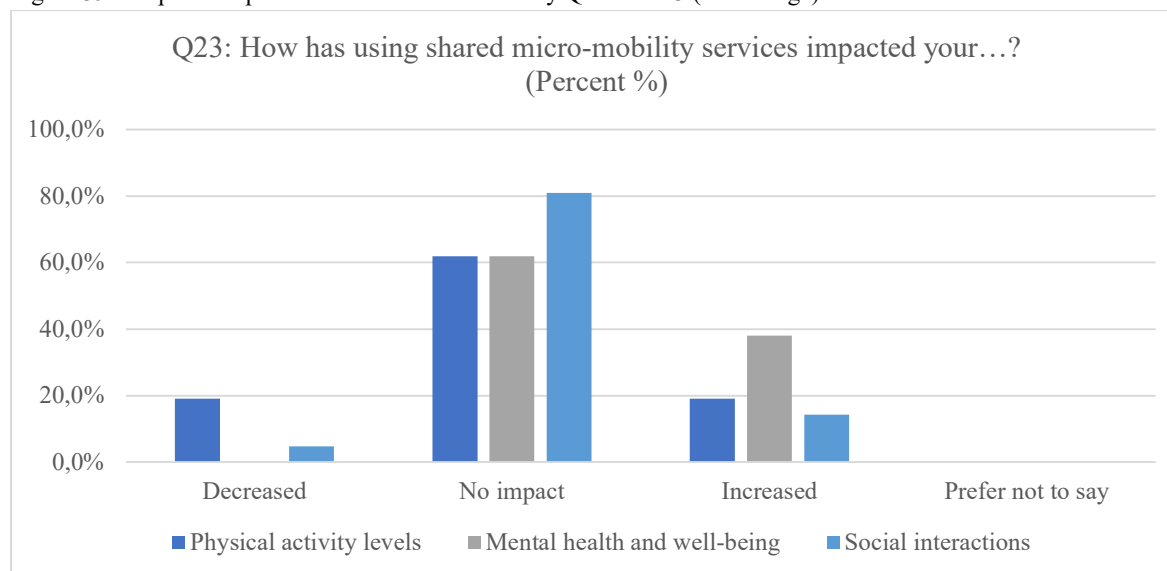
	Count			
	Decreased	No impact	Increased	Prefer not to say
Physical activity levels	4	13	4	0
Mental health and well-being	0	13	8	0
Social interactions	1	17	3	0

Table 35: Tabulated results - Survey Question 23 (Percentage)

Q23: How has using shared micro-mobility services impacted your...?

	Percentage (%)			
	Decreased	No impact	Increased	Prefer not to say
Physical activity levels	19,0	61,9	19,0	0,0
Mental health and well-being	0,0	61,9	38,1	0,0
Social interactions	4,8	81,0	14,3	0,0

Figure 39: Graphical representation of results - Survey Question 23 (Percentage)



The analysis indicates that, regarding the physical activity levels, a small proportion of respondents (19,0%) reported a decrease in their physical activity since adopting shared micro-mobility services. This fact suggests that, for some individuals, relying on shared micro-mobility options may have led to reduced physical activity. This is also in line with the replies in Question 21, which implied a decrease

of walking. On the other hand, the majority of respondents (61,9%) indicated no significant change in their physical activity levels. In terms of mental health and well-being, none of the respondents reported a decrease, while 38,1% reported an increase. Potential factors contributing to this positive impact could include the sense of freedom and independence associated with using such services, the reduction of travel-related stress, or the enjoyment derived from driving micro-mobility vehicles. Regarding social interactions, a small minority (4,8%) reported a decrease, while the majority (81,0%) reported no significant change. This suggests that the small minority of individuals who have experienced a decline in their social interactions, potentially results from a shift in their transport patterns that reduced their exposure to social opportunities or altered their commuting habits. These findings suggest that the impact of shared micro-mobility services on social interactions is relatively minor. Overall, the findings suggest that the impact of using shared micro-mobility services on physical activity levels, mental health and well-being, and social interactions varies among individuals.

5.5 Overall satisfaction levels

Question 24 concerned the parameters that affect the level of satisfaction of shared micro-mobility users in the Brussels-Capital Region. More particularly, it aimed to identify the impact that those factors had on the user experience.

Table 36: Tabulated results - Survey Question 24 (Count)

Q24: How satisfied are you with the following parameters of shared micro-mobility services in Brussels?

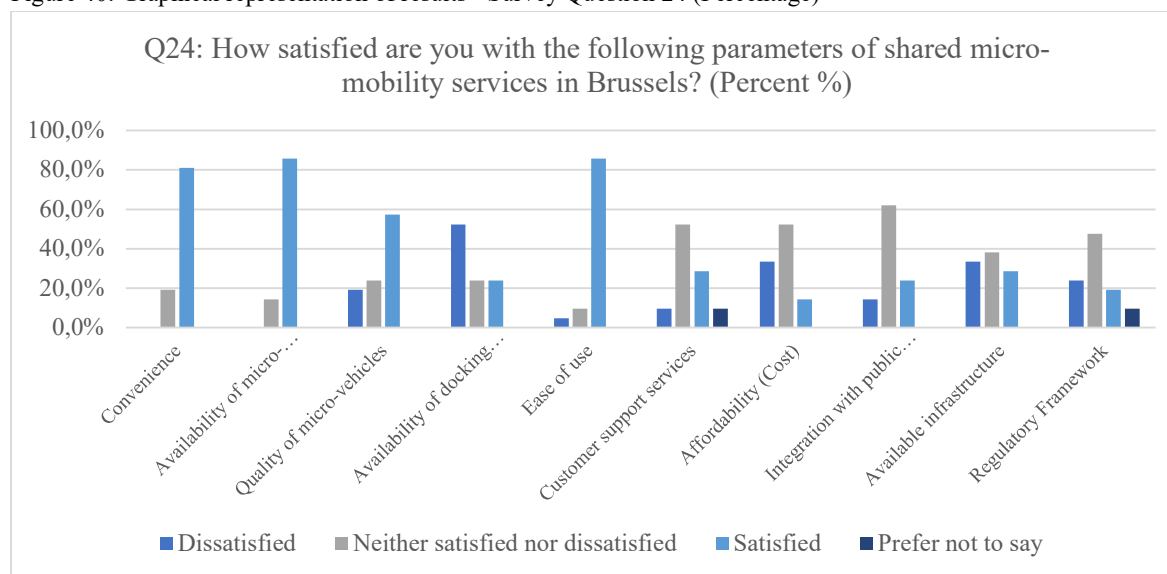
	Count			
	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Prefer not to say
Convenience	0	4	17	0
Availability of micro-vehicles	0	3	18	0
Quality of micro-vehicles	4	5	12	0
Availability of docking stations / parking spaces	11	5	5	0
Ease of use	1	2	18	0
Customer support services	2	11	6	2
Affordability (Cost)	7	11	3	0
Integration with public transport	3	13	5	0
Available infrastructure	7	8	6	0
Regulatory Framework	5	10	4	2

Table 37: Tabulated results - Survey Question 24 (Percentage)

Q24: How satisfied are you with the following parameters of shared micro-mobility services in Brussels?

	Percentage (%)			
	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Prefer not to say
Convenience	0,0	19,0	81,0	0,0
Availability of micro-vehicles	0,0	14,3	85,7	0,0
Quality of micro-vehicles	19,0	23,8	57,1	0,0
Availability of docking stations / parking spaces	52,4	23,8	23,8	0,0
Ease of use	4,8	9,5	85,7	0,0
Customer support services	9,5	52,4	28,6	9,5
Affordability (Cost)	33,3	52,4	14,3	0,0
Integration with public transport	14,3	61,9	23,8	0,0
Available infrastructure	33,3	38,1	28,6	0,0
Regulatory Framework	23,8	47,6	19,0	9,5

Figure 40: Graphical representation of results - Survey Question 24 (Percentage)



The analysis of the data suggests that, in terms of convenience, the majority of respondents (81,0%) expressed satisfaction, indicating that shared micro-mobility services are considered convenient. Similarly, a significant proportion of users (85,7%) reported satisfaction with the availability of micro-vehicles, suggesting that these vehicles are easily accessible. Regarding the quality of the alter, the findings reveal a more balanced distribution of responses. While the majority of users (57,1%) reported satisfaction, a notable proportion (19,0%) expressed dissatisfaction. This indicates that there is room for improvement in ensuring consistent quality across the micro-vehicle fleet. The availability of docking stations or parking spaces received mixed feedback. A majority of users (23,8%) expressed neither satisfaction nor dissatisfaction, while a significant percentage (52,4%) reported dissatisfaction. Regarding the ease of use of such services, a large majority of users (85,7%) reported satisfaction, indicating that the shared micro-mobility services in the Brussels-Capital Region are perceived as user-friendly and easy to navigate. Concerning customer support services, responses varied more. While a

substantial proportion of respondents (52,4%) expressed dissatisfaction, a significant percentage (28,6%) reported satisfaction. This indicates that, while it has been technology and new business models that have supported the booming era of shared micro-mobility services, traditional customer values such as customer support remains high in the users' interest. In this particular case, the percentages each response received indicate that, from the side of the service providers, this is a topic where opportunities for enhancement exist. In terms of affordability, the findings indicate that a third of the users (33,3%) expressed dissatisfaction with the cost of shared micro-mobility services. On the contrary, the majority (52,4%) reported being satisfied, suggesting that the services are generally perceived as affordable. The integration of shared micro-mobility services with public transport received mixed feedback, with a significant proportion of users (61,9%) expressing neither satisfaction nor dissatisfaction. This suggests the need for further efforts to enhance the integration and seamless connectivity between different modes of transportation. Regarding the available infrastructure (bicycle lanes in particular), responses were fairly balanced, with no single response class dominating. The findings suggest that there is room for improvement in terms of providing adequate infrastructure to support shared micro-mobility services. Lastly, the regulatory framework received mixed feedback, with almost half of the users (47,6%) expressing neither satisfaction nor dissatisfaction. This suggests that further attention should be given to addressing any regulatory concerns or gaps that users may have identified. Overall, despite the variations in satisfaction levels across different parameters, it is notable that the majority of users express satisfaction in several aspects of shared micro-mobility services. This indicates that the system has generally been successful in meeting the transportation needs of the users. In addition, the high level of satisfaction regarding convenience, ease of use, and affordability could contribute to increased adoption and continued usage of these services.

5.6 Challenges and concerns

The next question (Q25) targeted the identification of the factors that hamper the user experience of shared micro-mobility users and the frequency that these factors appear.

Table 38: Tabulated results - Survey Question 24 (Count)

Q25: What kind of issues have you experienced while using shared micro-mobility services in Brussels?

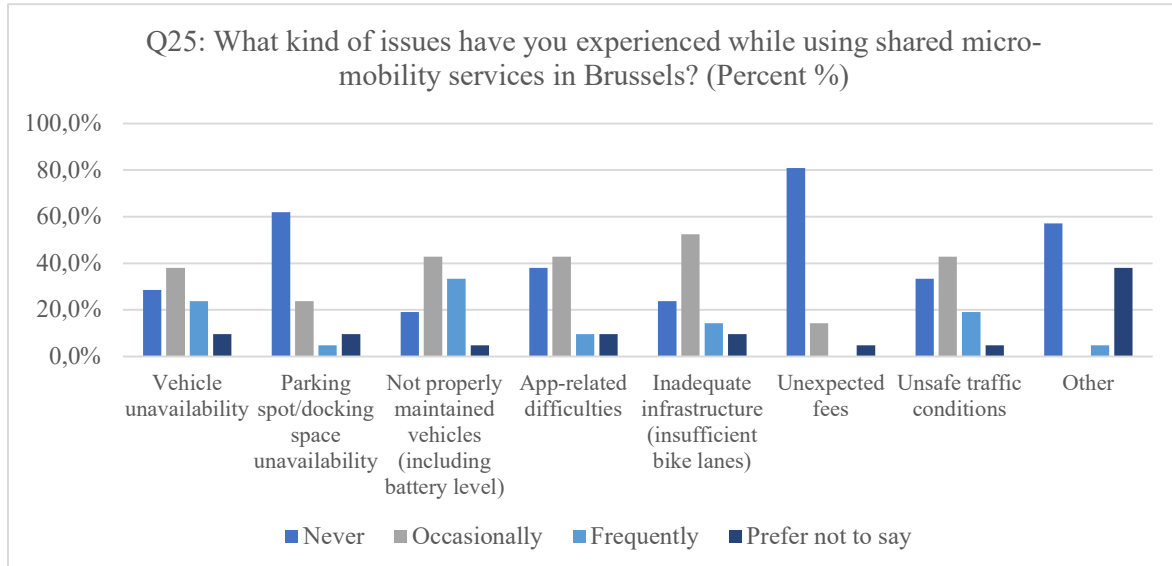
	Count			
	Never	Occasionally	Frequently	Prefer not to say
Vehicle unavailability	6	8	5	2
Parking spot/docking space unavailability	13	5	1	2
Not properly maintained vehicles (including battery level)	4	9	7	1
App-related difficulties	8	9	2	2
Inadequate infrastructure (insufficient bike lanes)	5	11	3	2
Unexpected fees	17	3	0	1
Unsafe traffic conditions	7	9	4	1
Other	12	0	1	8

Table 39: Tabulated results - Survey Question 24 (Percentage)

Q25: What kind of issues have you experienced while using shared micro-mobility services in Brussels?

	Percentage (%)			
	Never	Occasionally	Frequently	Prefer not to say
Vehicle unavailability	28,6	38,1	23,8	9,5
Parking spot/docking space unavailability	61,9	23,8	4,8	9,5
Not properly maintained vehicles (including battery level)	19,0	42,9	33,3	4,8
App-related difficulties	38,1	42,9	9,5	9,5
Inadequate infrastructure (insufficient bike lanes)	23,8	52,4	14,3	9,5
Unexpected fees	81,0	14,3	0,0	4,8
Unsafe traffic conditions	33,3	42,9	19,0	4,8
Other	57,1	0,0	4,8	38,1

Figure 41: Graphical representation of results - Survey Question 25 (Percentage)



The analysis suggest that, concerning vehicle unavailability, a considerable portion of users have experienced vehicle unavailability to varying degrees. This issue was reported occasionally by 38,1% of respondents, frequently by 23,8%, and never by 28,6%. It is worth noting that a small percentage (9,5%) chose not to disclose their response. These results indicate that a significant number of users have encountered challenges related to the availability of shared micro-mobility vehicles. Regarding the unavailability of parking spots/docking spaces, the majority of respondents (61,9%) experienced occasional unavailability of such amenities. Conversely, a smaller percentage (4,8%) reported frequent unavailability, while 23,8% indicated that they never faced this issue. A small proportion (9,5%) chose not to disclose their response. From the results, it can be deduced that addressing the availability of parking spots or docking spaces could improve the user experience and reduce inconvenience. Concerning the factor vehicle maintenance, the data indicates that a significant portion of users have encountered issues with the maintenance of shared micro-mobility vehicles, including their battery levels. Among the respondents, 42,9% reported occasional problems, with another 33,3% reported

frequent issues. On the other hand, 19,0% of the respondents denied that they have been confronted with such concerns. A small fraction (4.8%) preferred not to disclose their response. The development of the relevant smartphone/mobile applications which facilitate the use of shared micro-mobility services can be considered partially satisfactory: while a substantial number of users (42,9%) occasionally encountered difficulties related to the mobile application used for accessing and using shared micro-mobility services, an almost equal proportion (38,1%) reported total lack of such concerns – only 9,5% of the respondents stated that they faced app-related challenges frequently. As to what concerns infrastructure and its adequacy, the data demonstrates that a significant proportion of users have experienced issues related to such concerns – specifically, insufficient bike lanes. Among the respondents, 52,4% reported occasional challenges, while 14,3% encountered such issues frequently. In contrast, 23,8% stated that they never experienced this problem. A small percentage (9,5%) chose not to disclose their response. These findings suggest the need for improvements in infrastructure planning and development, including the provision of adequate bike lanes. Regarding the application of unexpected fees by the service providers, the substantial majority of respondents (81,0%) reported that they never had instances of encountering unexpected fees while using shared micro-mobility services. Conversely, 14,3% stated that they occasionally faced this issue, while a very low percentage (4.8%) preferred not to disclose their response. These findings are reassuring, especially in what concerns hidden costs or charges that have not been adequately communicated to the users prior to their engagement. At the same time, this fact highlights the importance of transparent pricing structures and clear communication – factors which have the potential to positively affect user satisfaction, thus leading to higher acceptance of shared micro-mobility services among the public. Concerning potentially unsafe traffic conditions, the data reveals that a significant proportion of respondents (42,9%) occasionally experienced unsafe traffic conditions while using shared micro-mobility services in Brussels. Additionally, 19,0% reported frequent encounters with unsafe traffic conditions, while one out of three respondents (33,3%) stated that they never faced such issues. A small fraction (4.8%) chose not to disclose their response. These findings, and especially the cumulative percentage of respondents with occasional and frequent confrontations with unsafe traffic conditions, are alarming. They imply a low level of user safety, which can have detrimental effects in the acceptance of shared micro-mobility services in the Brussels-Capital Region.

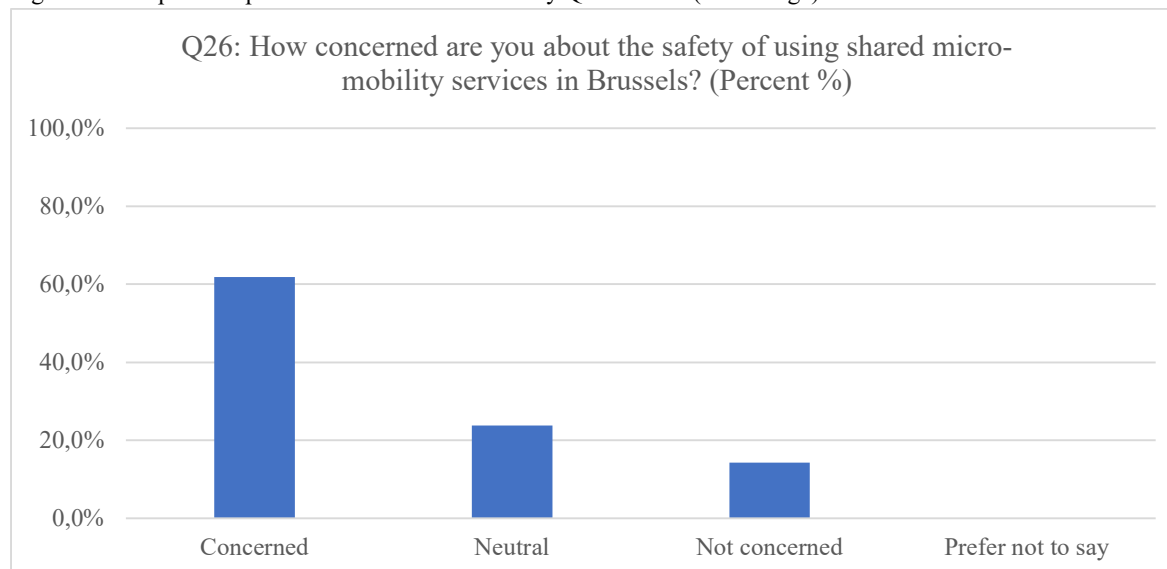
These safety concerns were further aimed to be identified with Question 26.

Table 40: Tabulated results - Survey Question 26

Q26: How concerned are you about the safety of using shared micro-mobility services in Brussels?

	Count	Percentage (%)
Concerned	13	61,9
Neutral	5	23,8
Not concerned	3	14,3
Prefer not to say	0	0,0

Figure 42: Graphical representation of results - Survey Question 26 (Percentage)



The data analysis reveals that the majority of the respondents (61,9%) appeared to be concern by the level of safety of shared micro-mobility services. This indicates that a significant proportion of users have apprehensions or reservations regarding the safety aspects associated with utilizing these services. On the other hand, a notable proportion of respondents (23,8%) indicated a neutral stance towards safety concerns. Interestingly, a smaller percentage of respondents (14,3%) reported being not concerned about the safety of using shared micro-mobility services. This suggests that some users perceive these services as relatively safe and may have confidence in the existing safety measures, infrastructure, or regulatory frameworks in place to ensure their well-being while using such modes of transportation.

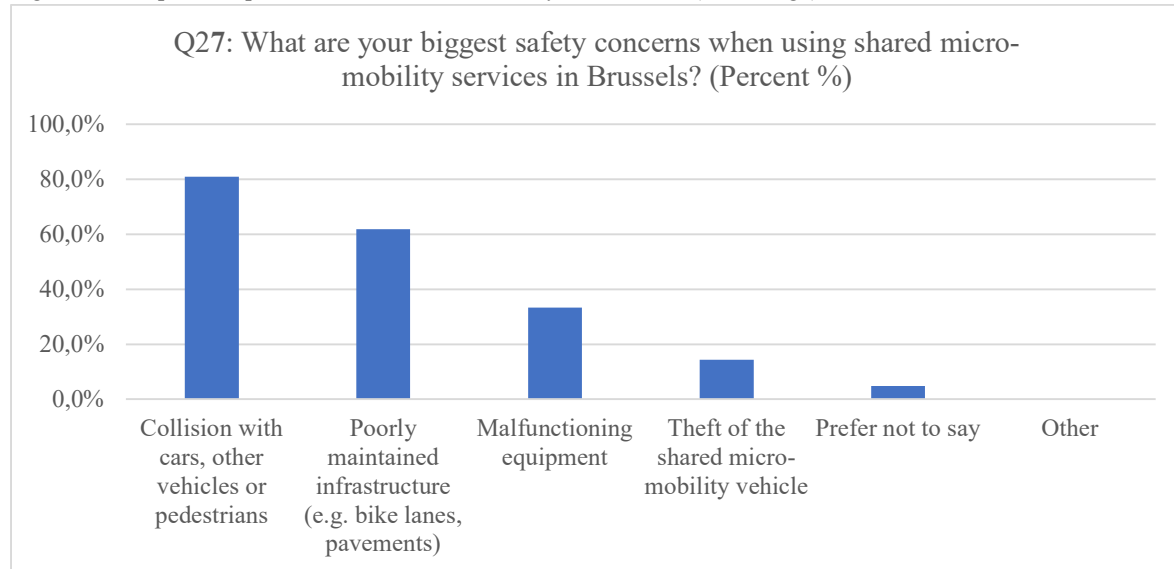
Further elaborating on the safety concerns, Question 27 aimed at identifying the factors that cause such distress.

Table 41: Tabulated results - Survey Question 27

Q27: What are your biggest safety concerns when using shared micro-mobility services in Brussels?

	Count	Percentage (%)
Collision with cars, other vehicles or pedestrians	17	81,0
Poorly maintained infrastructure (e.g. Bike lanes, pavements)	13	61,9
Malfunctioning equipment	7	33,3
Theft of the shared micro-mobility vehicle	3	14,3
Prefer not to say	1	4,8
Other (please specify)	0	0,0

Figure 43: Graphical representation of results - Survey Question 27 (Percentage)



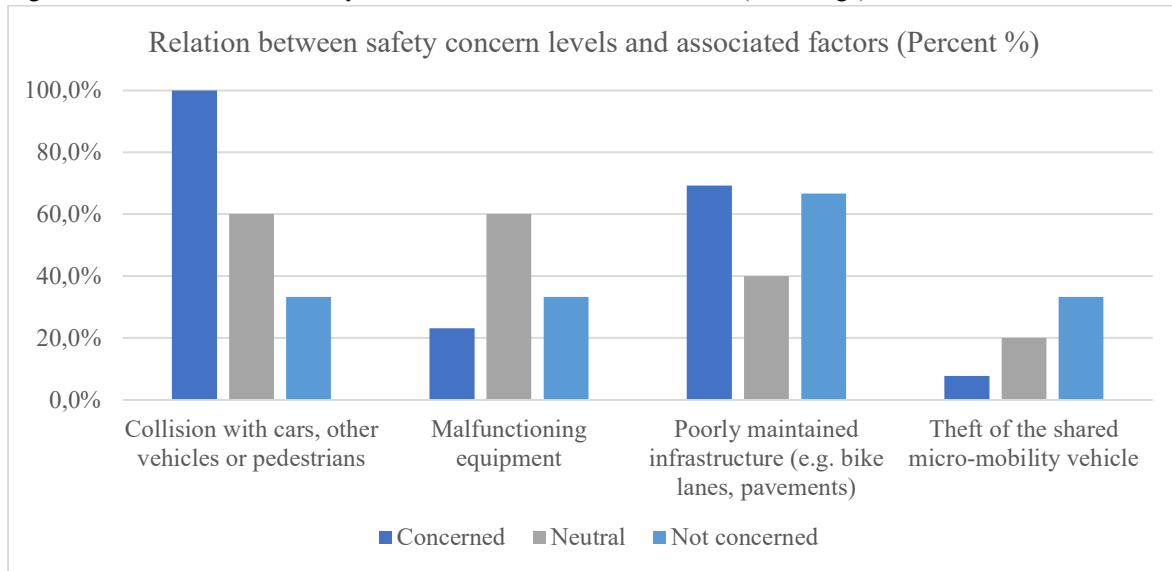
The analysis of the results revealed that the vast majority of respondents (81,0%) expressed concerns about the possibility of collisions with cars, other vehicles or pedestrians. The crowded urban environment and potential conflicts with motorized vehicles or pedestrians could contribute to this apprehension. Furthermore, a substantial number of respondents (61,9%) identified poorly maintained infrastructure, such as inadequate bike lanes or pavements, as a significant safety concern. This suggests that users are not only conscious of the importance of well-maintained and safe infrastructure to ensure their safety while using shared micro-mobility services but are also aware of defects and shortcomings in the network. A notable percentage of respondents (33,3%) reported concerns related to malfunctioning equipment. This highlights the importance of reliable and well-maintained micro-mobility vehicles to ensure a safe and smooth riding experience. Issues such as faulty brakes, lights, or electrical systems can pose risks and compromise the safety of users. In contrast, a smaller percentage of respondents (14,3%) expressed concerns about theft of the shared micro-mobility vehicles. While not as prominent as collision or infrastructure concerns, it still represents a valid apprehension among a portion of users. The fear of theft may be influenced by factors such as the value of the vehicles, perceived vulnerability when leaving them unattended, or the potential impact on user experience and convenience. This is a concern that has been hampering shared micro-mobility services since the infancy of their existence and even reason of failure for specific schemes, such as the White Bikes in the Netherlands, in the decade of 1960 (Abduljabbar et al., 2021; S. A. Shaheen et al., 2010). A small proportion of respondents (4,8%) preferred not to disclose their safety concerns, which does not significantly impact the overall interpretation of the data. The data highlights that collision risks, poorly maintained infrastructure, malfunctioning equipment and vehicle theft are among the prominent safety concerns associated with using shared micro-mobility services in Brussels. These findings underscore the importance of addressing these concerns, potentially through comprehensive safety measures, infrastructure improvements, revised regulatory framework which could include regular maintenance protocols, as well as awareness campaigns.

A secondary level analysis was run, in order to identify the factors that influence the concern levels in each category, effectively combining the results of Q26 and Q27.

Table 42: Relation between safety concern levels and associated factors (Percentage)

Relation between safety concern levels and associated factors (Percent %)			
	Concerned	Neutral	Not concerned
Collision with cars, other vehicles or pedestrians	100,0	60,0	33,3
Poorly maintained infrastructure (e.g. Bike lanes, pavements)	23,1	60,0	33,3
Malfunctioning equipment	69,2	40,0	66,7
Theft of the shared micro-mobility vehicle	7,7	20,0	33,3
Prefer not to say	0,0	0,0	0,0
Other (please specify)	0,0	20,0	0,0

Figure 44: Relation between safety concern levels and associated factors (Percentage)



Interestingly, when considering the factor of collisions with cars, other vehicles or pedestrians, all respondents in the "Concerned" group expressed apprehension, indicating an unanimous concern. At the same time, 60,0% of respondents in the "Neutral" group and 33,3% in the "Not concerned" group demonstrated their concern. Even if the latter concerned a smaller percentage, it is undeniable that the risk of collisions is a factor that instills serious concerns among users. Regarding malfunctioning equipment, 23,1% of the respondents in the "Concerned" group expressed their skepticism, while 60,0% of the users who belonged in the "Neutral" group and 33,3% in the "Not concerned" group also acknowledged this safety factor. For the factor of poorly maintained infrastructure, 69,2% of the respondents in the "Concerned" group expressed their apprehension, whereas 40,0% in the "Neutral" group and 66,7% in the "Not concerned" group also acknowledged this as a safety factor. This indicates that a significant proportion of respondents across all groups recognize the potential risks associated with inadequate infrastructure, such as poorly designed or maintained bike lanes and pavements. Finally, the relatively low percentages concerning the risk of theft of shared micro-mobility vehicles indicate that this is generally a factor that causes less distress in comparison to the others. However, it is worth noting that a portion of respondents in all groups still recognized it as a potential issue.

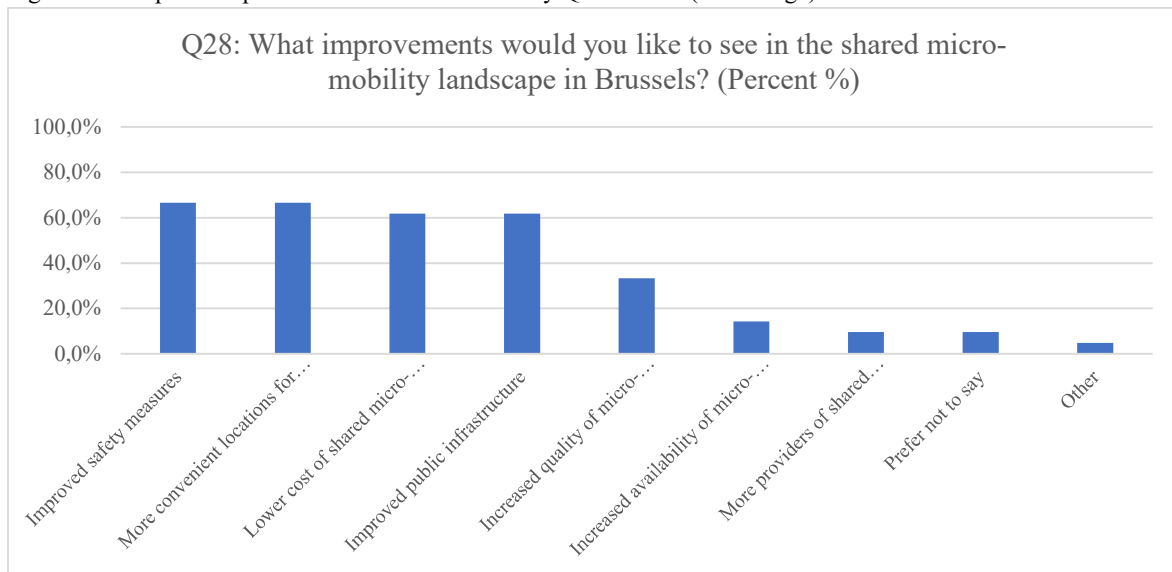
Question 28 aimed at identifying the aspects of the shared micro-mobility services system that the users perceived could be improved and thus ameliorate their experience.

Table 43: Tabulated results - Survey Question 28

Q28: What improvements would you like to see in the shared micro-mobility landscape in Brussels?

	Count	Percentage (%)
Improved safety measures	14	66,67
More convenient locations for shared micro-mobility services	14	66,67
Lower cost of shared micro-mobility services	13	61,90
Improved public infrastructure	13	61,90
Increased quality of micro-mobility vehicles	7	33,33
Increased availability of micro-mobility vehicles	3	14,29
More providers of shared micro-mobility services	2	9,52
Prefer not to say	2	9,52
Other	1	4,76

Figure 45: Graphical representation of results - Survey Question 28 (Percentage)



The analysis shows that the highest-ranked improvement, with 66,7% of respondents indicating a desire for it, is improved safety measures. This is in line with the findings of the analysis for Questions 26 and 27 and reiterates the strong concern for safety among the respondents, further highlighting the importance of implementing measures to enhance the safety of shared micro-mobility services in Brussels. Additionally, an equal percentage of respondents (66,7%) expressed a need for more convenient locations for shared micro-mobility services. This suggests that the accessibility and availability of micro-mobility services play a crucial role in meeting the demands of users and that the system has not yet lived up to the expectations of the users. It is believed that, by providing conveniently located pick-up and drop-off points, the overall usability and convenience of shared micro-mobility services can be enhanced, with a subsequent positive effect on the system’s attractiveness. Lowering the cost of shared micro-mobility services is another significant improvement desired by 61,9% of the respondents. This indicates that affordability is a crucial factor for the users of these services, and a reduction in costs would make them more accessible and appealing to a wider population. This finding is also in line with what was reported in Questions 14 and 22 concerning the cost factor of the system. Improving public infrastructure also received a high preference from 61,9% of respondents. This indicates a desire for well-maintained and well-designed infrastructure such as bike lanes and pavements to support the usage of shared micro-mobility services. This reply reinforces the findings of Questions

24, 25 and 27. A lower percentage of respondents (33,3%) expressed a desire for increased quality of micro-mobility vehicles. This is relatively in line with the results reported in Questions 24 and 25 about the quality of micro-vehicles and suggests that there is room for improvement in terms of their durability, reliability, maintenance and overall quality. Respondents also indicated a need for increased availability of micro-mobility vehicles (14,3%) and more providers of shared micro-mobility services (9,5%). These preferences reflect a desire for greater options and accessibility in terms of vehicle availability and service providers, allowing users to have a wider range of choices. It is worth noting that a small percentage of respondents preferred not to specify their improvement preferences (9,5%), and a minority (4,8%) provided other suggestions: notably the desire for more bicycles than scooters. In conclusion, the analysis of the respondents' preferences for improvements in the shared micro-mobility landscape in the Brussels-Capital Region highlights the significance of safety measures, convenience, affordability, public infrastructure, and vehicle quality.

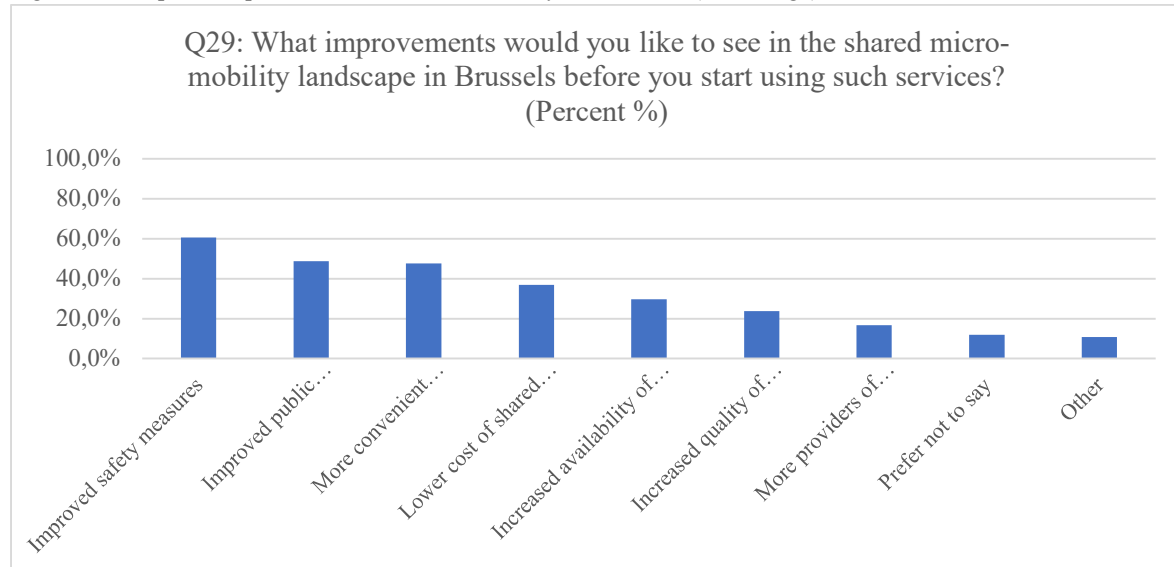
The same question was subsequently posed to non-users of shared micro-mobility services, with the aim being two-fold: on one hand, the identification of the entry barriers for new users and, on the other hand, the identification of possible relations between the views of the two groups concerning the weaknesses of the system.

Table 44: Tabulated results - Survey Question 29

Q29: What improvements would you like to see in the shared micro-mobility landscape in Brussels before you start using such services?

	Count	Percentage (%)
Improved safety measures	51	60,7
More convenient locations for shared micro-mobility services	41	48,8
Lower cost of shared micro-mobility services	40	47,6
Improved public infrastructure	31	36,9
Increased quality of micro-mobility vehicles	25	29,8
Increased availability of micro-mobility vehicles	20	23,8
More providers of shared micro-mobility services	14	16,7
Prefer not to say	10	11,9
Other	9	10,7

Figure 46: Graphical representation of results - Survey Question 29 (Percentage)



The analysis shows that the most prominent improvement factor desired by non-users is improved safety measures, with 60,7% expressing a preference for this enhancement. The second most commonly desired improvement is enhanced public infrastructure, selected by 48,8% of non-users. Furthermore, 47,6% of non-users indicated a desire for more convenient locations for shared micro-mobility services. Affordability is also an important factor, with 36,9% of respondents expressing a desire for lower costs of shared micro-mobility services. The respondents also expressed a need for increased availability of micro-mobility vehicles (29,8%) and improved quality of the vehicles (23,8%). The latter figure is trivial to decode, since non-users could not have first-hand experience of shared micro-mobility vehicles; as a result, it is considered that this is based on feedback received from existing users. Additionally, a smaller percentage of non-users indicated a preference for more providers of shared micro-mobility services (16,7%). It is worth noting that a portion of respondents preferred not to specify their improvement preferences (11,9%), while others provided additional suggestions (10,7%). These suggestions included additional operating models (spontaneous use without the need of a prior subscription, different subscription methods), more visibility on the options available to the potential users, improved regulations on parking, safety and enforcement aspects and, most importantly as it was the factor most suggested, expansion of the services beyond the Brussels-Capital Region – especially to areas where the metro and tram lines reach.

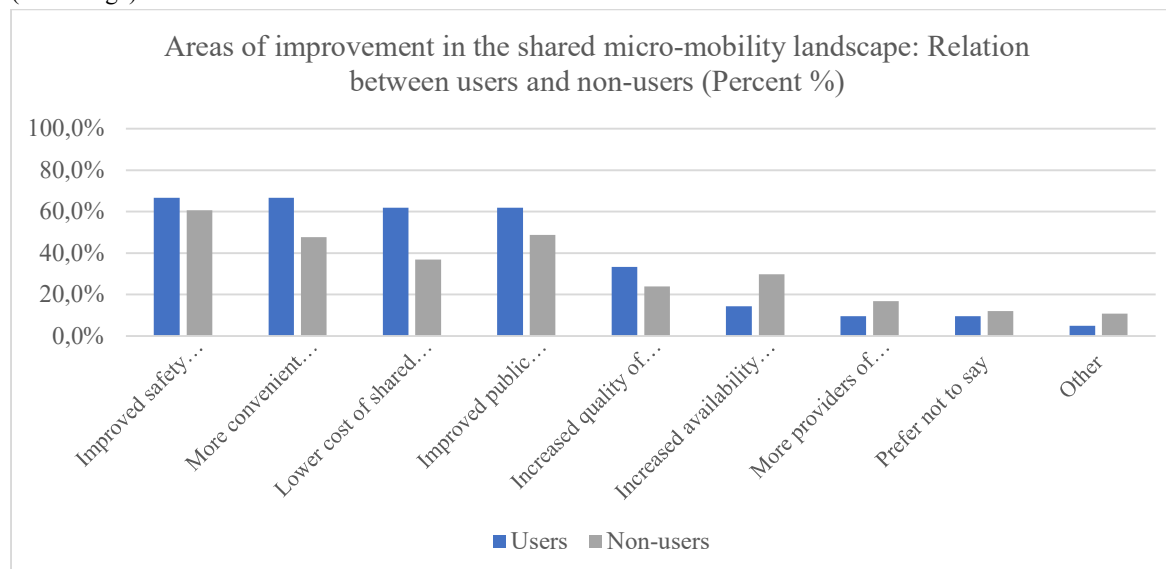
The comparison between the responses received from users and non-users of shared micro-mobility services reveals interesting insights.

Table 45: Areas of improvement in the shared micro-mobility landscape: Relation between users and non-users (Percentage)

Areas of improvement in the shared micro-mobility landscape: Relation between users and non-users (Percentage)

	Users	Non-users
Improved safety measures	66,7	60,7
More convenient locations for shared micro-mobility services	66,7	47,6
Lower cost of shared micro-mobility services	61,9	36,9
Improved public infrastructure	61,9	48,8
Increased quality of micro-mobility vehicles	33,3	23,8
Increased availability of micro-mobility vehicles	14,3	29,8
More providers of shared micro-mobility services	9,5	16,7
Prefer not to say	9,5	11,9
Other	4,8	10,7

Figure 47: Areas of improvement in the shared micro-mobility landscape: Relation between users and non-users (Percentage)



The comparison between the two groups suggests that users and non-users share common concerns and priorities when it comes to improving the shared micro-mobility landscape in Brussels. However, there are nuanced differences in the ranking and prioritization of certain factors, reflecting variations in their experiences, expectations, and barriers to adoption. More specifically, factors such as improved safety measures, more convenient locations, lower costs, as well as improved public infrastructure are important to both groups. These factors are ranked relatively high for both users and non-users, indicating a shared understanding of the key areas that require attention and enhancement in the shared micro-mobility landscape in the Brussels-Capital Region. However, there are slight variations in the ranking and prioritization of certain factors between users and non-users. The users place a higher emphasis on the increased quality of micro-mobility vehicles compared to non-users; this is understandable when taking into consideration the fact that users have a more direct experience and higher expectations regarding the performance and condition of the micro-vehicles they use. On the other hand, non-users prioritize the availability of such vehicles more than users, indicating that they may perceive limited availability as a barrier to entry and a factor influencing their decision to not use

these services. When it comes to the desire for more providers of shared micro-mobility services, non-users show a slightly higher preference compared to users. This implies that non-users may believe that having more options and competition among providers would enhance the overall quality and accessibility of the services, potentially making them more inclined to start using them.

5.7 Shared micro-mobility services and the City

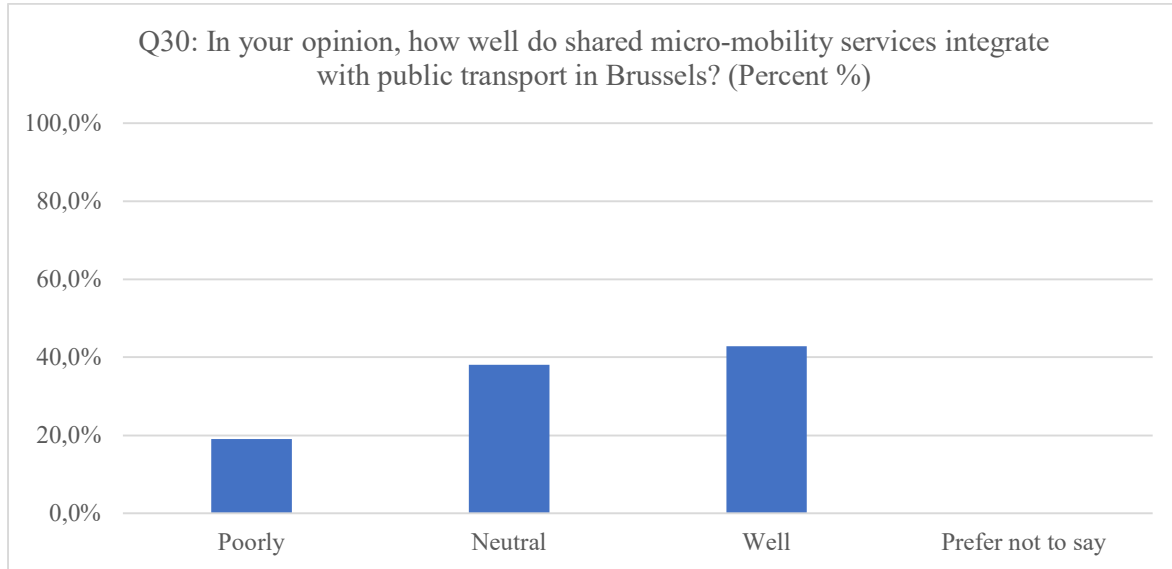
Question 30 concerned the perception of the users about the level of integration of shared micro-mobility services with the public transport in the Brussels-Capital Region.

Table 46: Tabulated results - Survey Question 30

Q30: In your opinion, how well do shared micro-mobility services integrate with public transport in Brussels?

	Count	Percentage (%)
Poorly	4	19,0
Neutral	8	38,1
Well	9	42,9
Prefer not to say	0	0,0

Figure 48: Graphical representation of results - Survey Question 30 (Percentage)



The analysis' findings indicate that a significant portion of the respondents (42,9%), perceive the integration of shared micro-mobility services with public transport as good enough. The positive perception of integration could be indicative of the inherent characteristics of such services: convenience and accessibility aiming at facilitating seamless travel experiences. On the other hand, a relatively smaller proportion of respondents (19,0%), consider the integration to be lacking. It is considered that this perspective could stem from issues such as limited availability of shared micro-mobility options near public transport hubs and inadequate level of information exchange between the different public and private transport service providers. A substantial number of respondents (38,1%) expressed a neutral stance on the issue. Overall, the analysis reveals a rather favorable opinion of the users regarding the integration of shared micro-mobility services with public transport.

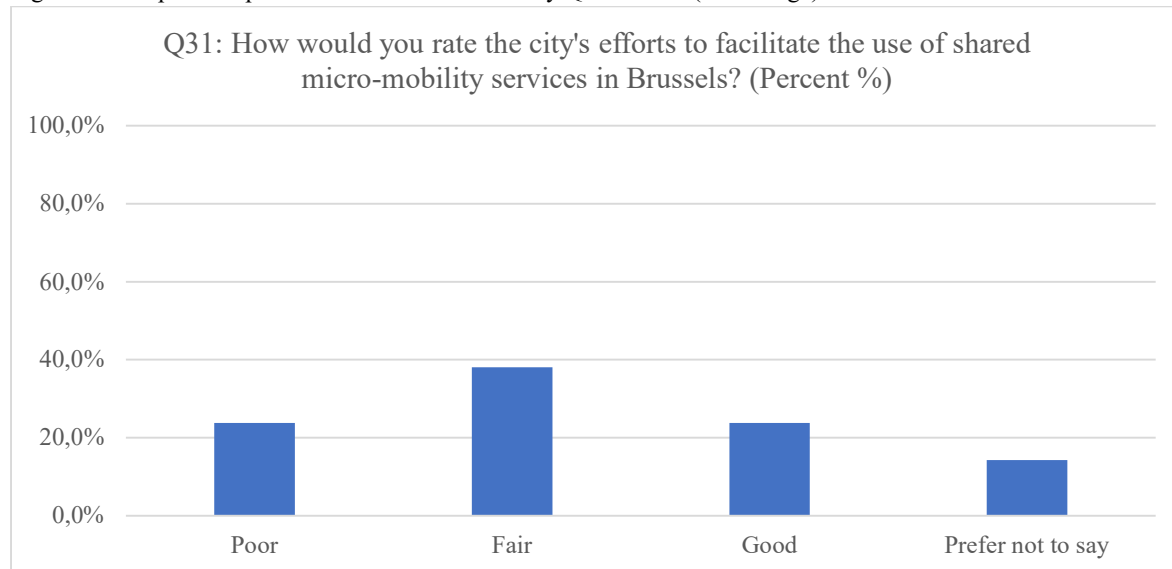
Question 31 aimed at identifying how the users of shared micro-mobility services in the Brussels-Capital Region perceived the Region's initiatives and measures aimed at supporting and promoting such services.

Table 47: Tabulated results - Survey Question 31

Q31: How would you rate the city's efforts to facilitate the use of shared micro-mobility services in Brussels?

	Count	Percentage (%)
Poor	5	23,8
Fair	8	38,1
Good	5	23,8
Prefer not to say	3	14,3

Figure 49: Graphical representation of results - Survey Question 31 (Percentage)



According to the findings, a significant proportion of respondents (38,1%), consider the Region's efforts in the matter to be encouraging. At the same time, though, this percentage indicates that there is still room for improvement. While the respondents acknowledge the existence of measures aimed at supporting the integration and accessibility of shared micro-mobility services within the Region's transportation framework, they also perceive that there are areas where further actions or enhancements are necessary in order to optimize the facilitation of these services. At the same time, a smaller percentage of respondents (23,8%), rate the city's efforts as good, while the same percentage of respondents rated the city's efforts as poor. Differentiating factors among the different groups of respondents could be the level and quality of available infrastructure (including bicycling lanes as well as amenities close to public transport hubs), the existing regulatory framework, as well as the coordination between the Region and its administrative layers (including the different Municipalities) with the relevant service providers. It is worth noting that a small percentage of respondents, comprising 14,3%, chose not to disclose their opinion by selecting "prefer not to say". Overall, while a considerable portion of respondents is favorable towards the Region's efforts, there is also a notable fraction that holds a negative perception.

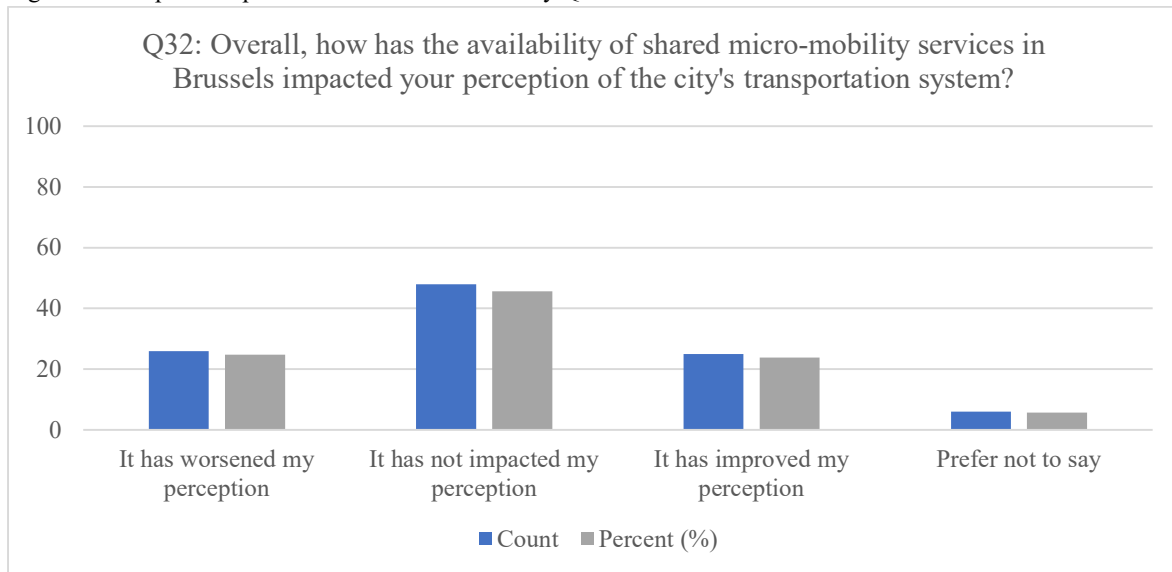
Question 32 sought to ascertain the influence of shared micro-mobility services' availability in the Brussels-Capital Region on the respondents' perception of the city's transportation system. The question was posed to both users and non-users of such services.

Table 48: Tabulated results - Survey Question 32

Q32: Overall, how has the availability of shared micro-mobility services in Brussels impacted your perception of the city's transportation system?

	Count	Percentage (%)
It has worsened my perception	26	24,8
It has not impacted my perception	48	45,7
It has improved my perception	25	23,8
Prefer not to say	6	5,7

Figure 50: Graphical representation of results - Survey Question 32



The analysis reveals that, for almost half of the respondents (45.7%), the availability of shared micro-mobility services has not had any significant impact on their perception of the Region's transportation system. Interestingly, 24,8% of the respondents reported that the availability of such services has worsened their perception of the Region's transportation system, while an almost identical proportion of respondents (23,8) reported that their perception of the Region's transportation system has improved. A small percentage (5,7%) preferred not to express their opinion on this matter. These findings suggest that while there is a portion of the respondents who perceive a negative impact, a significant number do not perceive any substantial change, and a notable proportion acknowledge a positive influence of shared micro-mobility services on their perception of the Region's transportation system. With only 1 out of 4 respondents being unfavorable, it could be deduced that the overall acceptance of shared micro-mobility services as a means of transport in the Brussels-Capital Region has been embraced by the respondents.

A second-level analysis was undertaken, in order to identify whether differences at perception exist between the users and non-users of shared micro-mobility services.

Table 49: Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region’s transport system (Count)

Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region’s transport system (Count)

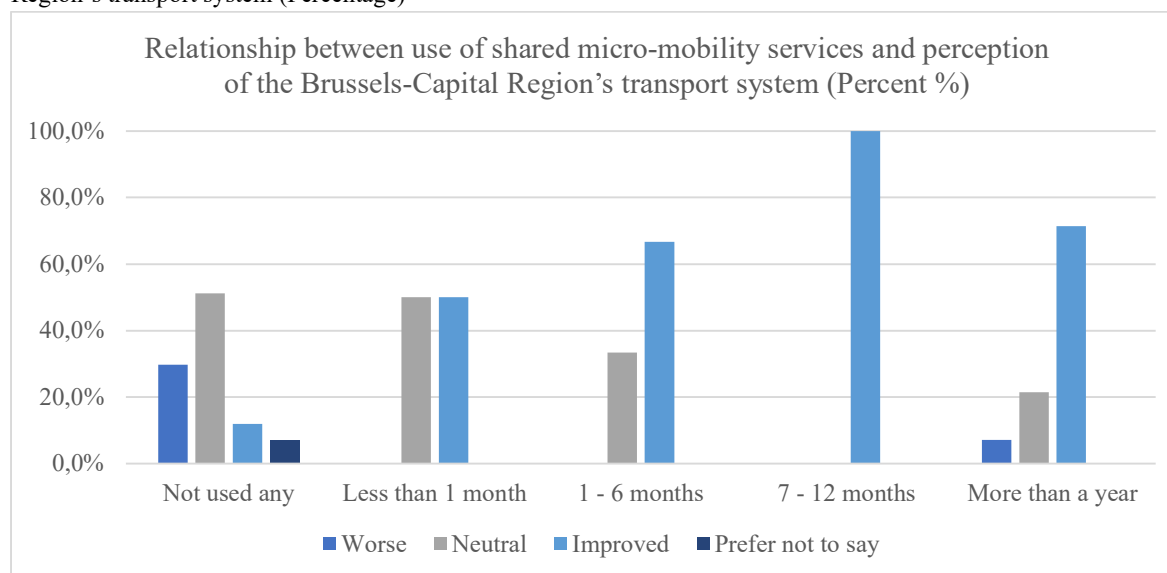
Perception	Period of use				
	Not used any	Less than 1 month	1 - 6 months	7 - 12 months	More than a year
Worse	25	0	0	0	1
Neutral	43	1	1	0	3
Improved	10	1	2	2	10
Prefer not to say	6	0	0	0	0

Table 50: Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region’s transport system (Percentage)

Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region’s transport system (Percentage)

Perception	Period of use				
	Not used any	Less than 1 month	1 - 6 months	7 - 12 months	More than a year
Worse	29,8	0,0	0,0	0,0	7,1
Neutral	51,2	50,0	33,3	0,0	21,4
Improved	11,9	50,0	66,7	100,0	71,4
Prefer not to say	7,1	0,0	0,0	0,0	0,0

Figure 51: Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region’s transport system (Percentage)



The analysis of the data suggests a strong statistically significant relationship between the perception of the respondents about the Brussels-Capital Region’s transport system and the time period during which they have been using shared micro-mobility services, with the P-value of the Chi-Squared Test being

0,000417. It is absolutely clear that the longer a respondent uses such services, the more likely this respondent is to have a positive perception of the overall transport system. More analytically, among those respondents who have not used any shared micro-mobility services, 29,8% reported a worsened perception of the transportation system. In contrast, the majority of this group, 51,2%, reported a neutral impact on their perception. Interestingly, 11,9% of non-users expressed an improved perception, suggesting that their perception may have been influenced by external factors or indirect experiences. For the respondents who have used shared micro-mobility services, the impact on their perception of the transportation system varies depending on the duration of usage. Those who have been using the services for less than 1 month are divided, with 50,0% of them reporting a neutral impact and the other 50,0% indicating an improved perception. However, this is already a vast improvement of the perception (“Improved” class) in comparison to non-users. Among the users who have been utilizing shared micro-mobility services between 1 and 6 months, a significant majority (66,7%) report an improved perception of the transportation system. This positive trend continues for users who have been using the services between 7 and 12 months and more than a year, with an astonishing 100,0% and 71,4% respectively reporting an improved perception. As a result, a strong correlation between the duration of shared micro-mobility service usage and the impact on perception of the transportation system is observed. It is suggested that, as users become more familiar with and experienced in using such services, they are more likely to perceive an improvement in the Region's transport system. This could suggest that extended usage allows individuals to better understand and appreciate the benefits of shared micro-mobility services.

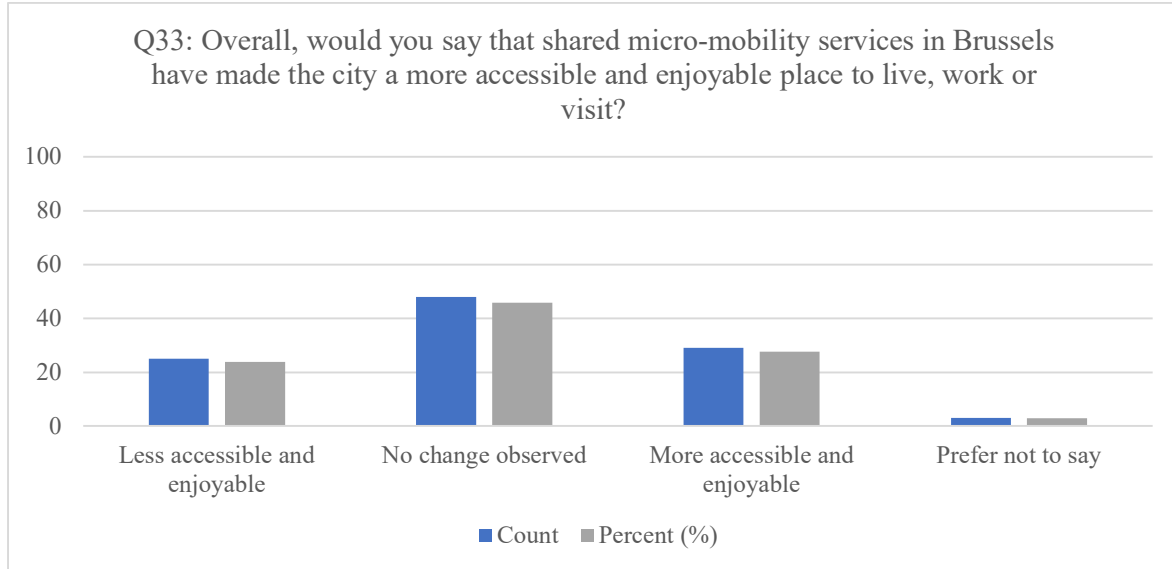
The last question (Q33) was again addressed to both users and non-users of shared micro-mobility services in the Brussels-Capital Region and concerned their perception of the attractiveness of the Region after the introduction of such services.

Table 51: Tabulated results - Survey Question 33

Q33: Overall, would you say that shared micro-mobility services in Brussels have made the city a more accessible and enjoyable place to live, work or visit?

	Count	Percentage (%)
Less accessible and enjoyable	25	23,8
No change observed	48	45,7
More accessible and enjoyable	29	27,6
Prefer not to say	3	2,9

Figure 52: Graphical representation of results - Survey Question 33



The analysis reveals that 23,8% of the respondents feel that shared micro-mobility services have made the city less accessible and enjoyable. On the other hand, a slightly higher proportion of the respondents (27.6%) reported the exact opposite, expressing a positive impact by perceiving that shared micro-mobility services have made Brussels a more accessible and enjoyable place. These individuals likely experience benefits such as improved mobility, convenience, and enhanced experiences within the city. However, the majority of respondents (45.7%) stated that they observed no change in the city's accessibility and enjoyability since the introduction of these services. A small proportion of respondents, accounting for 2.9%, preferred not to disclose their opinion on the matter. Overall, the results suggest mixed feelings regarding the impact of shared micro-mobility services on the accessibility and enjoyability of living, working, or visiting Brussels. While some individuals perceive positive changes, a notable portion feels that these services have not significantly affected the city in this regard.

Two different analyses were undertaken at this point. The first, as it was the case with Q32, aimed at identifying whether differences at perception exist between the users and non-users of shared micro-mobility services.

Table 52: Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region's attractiveness (Count)

Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region's attractiveness (Count)

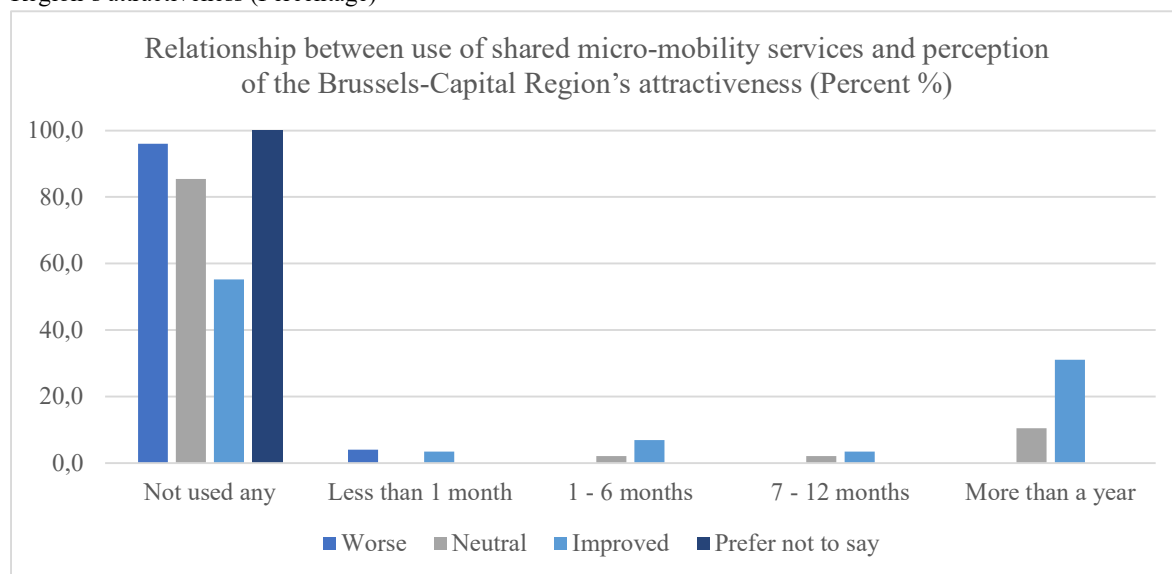
Perception	Period of use				
	Not used any	Less than 1 month	1 - 6 months	7 - 12 months	More than a year
Worse	24	1	0	0	0
Neutral	41	0	1	1	5
Improved	16	1	2	1	9
Prefer not to say	3	0	0	0	0

Table 53: Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region’s attractiveness (Percentage)

Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region’s attractiveness (Percentage)

Perception	Period of use				
	Not used any	Less than 1 month	1 - 6 months	7 - 12 months	More than a year
Worse	96,0	4,0	0,0	0,0	0,0
Neutral	85,4	0,0	2,1	2,1	10,4
Improved	55,2	3,4	6,9	3,4	31,0
Prefer not to say	100,0	0,0	0,0	0,0	0,0

Figure 53: Relationship between use of shared micro-mobility services and perception of the Brussels-Capital Region’s attractiveness (Percentage)



The analysis of the data suggests that there is no statistically significant relationship between the perception of the respondents about the Brussels-Capital Region’s attractiveness and the time period during which they have been using shared micro-mobility services, with the P-value of the Chi-Squared Test being 0,0753. More specifically, among respondents who have not used any shared micro-mobility services in the Brussels-Capital Region, the vast majority (96,0%) believe that these services have made the city less accessible and enjoyable. This perception could stem from various factors, such as limited personal experience or a general perception of inconveniences associated with these services, including the annoyance created by free floating scooters being parked at non-designated places where they limit public space and obstruct pedestrians’ easy passage. Among users, the perception of the impact varies based on the duration of usage. For respondents who have been using these services for less than one month, 4,0% share the sentiment that the city has become less accessible and enjoyable. Meanwhile, 3,4% of users in the same duration believe that the city has become more accessible and enjoyable. As the usage duration increases, a shift in perception is noticed. Among the respondents who have been using shared micro-mobility services between 1 and 6 months, 6,9% of them state that the city has become more accessible and enjoyable, while 2,1% of them report no change. In the 7-12 months duration class, 3,4% perceive increased accessibility and enjoyability, and 2,1% observe no change. Among users with more than a year of experience in using shared micro-mobility services, a substantial

proportion (31,0%) believes that shared micro-mobility services have made the city more accessible and enjoyable, with only 10,4% reporting no change. Overall, the analysis suggests a very slight correlation between the duration of shared micro-mobility service usage and the perception of the city's accessibility and enjoyability. While a higher percentage of non-users express negative views, users tend to show a more positive outlook over time, with a greater proportion perceiving increased accessibility and enjoyability as their usage duration extends. Although the variation is not significant, there is the exception of the 31% of existing users who believe that the city has become more attractive. And although this is not sufficient in order to concretely affirm a correlation between the two variables, it does signify a trend.

The second analysis which was undertaken aimed at identifying any pattern that may underpin the perception of the respondents concerning the Brussels-Capital Region's transport system and the Region's attractiveness after the introduction of shared micro-mobility services.

Table 54: Relationship between perception of the Brussels-Capital Region's transport system and attractiveness (Count)

Relationship between perception of the Brussels-Capital Region's transport system and attractiveness (Count)

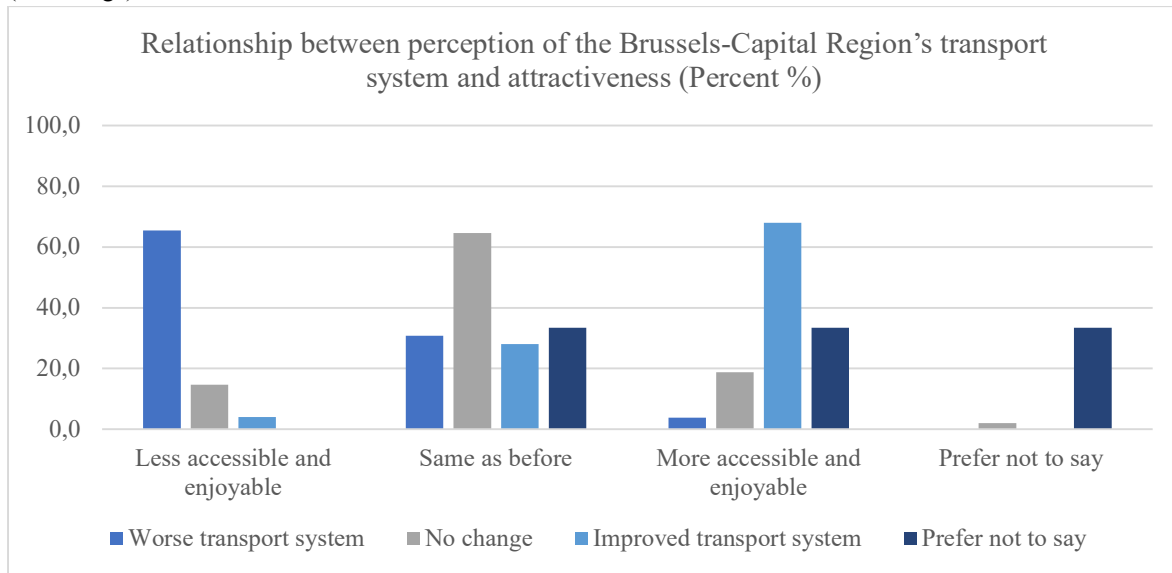
Transport system	Region attractiveness			
	Less accessible and enjoyable	Same as before	More accessible and enjoyable	Prefer not to say
Worse transport system	17	8	1	0
No change	7	31	9	1
Improved transport system	1	7	17	0
Prefer not to say	0	2	2	2

Table 55: Relationship between perception of the Brussels-Capital Region's transport system and attractiveness (Percentage)

Relationship between perception of the Brussels-Capital Region's transport system and attractiveness (Percentage)

Transport system	Region attractiveness			
	Less accessible and enjoyable	Same as before	More accessible and enjoyable	Prefer not to say
Worse transport system	65,4	30,8	3,8	0,0
No change	14,6	64,6	18,8	2,1
Improved transport system	4,0	28,0	68,0	0,0
Prefer not to say	0,0	33,3	33,3	33,3

Figure 54: Relationship between perception of the Brussels-Capital Region’s transport system and attractiveness (Percentage)



The analysis of the data suggests that there is a strong statistically significant relationship between the respondents’ perception of the Brussels-Capital Region’s attractiveness in conjunction with their perception about the Region’s transport system, with the P-value of the Chi-Squared Test being lower than 0,00001.

More specifically, among those respondents who believe that the availability of shared micro-mobility services has made the city's transportation system worse, the majority (65,4%) also perceive the city as less accessible and enjoyable. This suggests a correlation between their negative perception of the transportation system and the overall experience of the city. For those who report no change in the transportation system, the distribution of perceptions about the city's accessibility and enjoyability is more balanced. Approximately 14,6% of this group feels that the city has become less accessible and enjoyable, while 18,8% perceive it as more accessible and enjoyable. The largest proportion (64,6%) believes that the availability of shared micro-mobility services has not had a significant impact on the city's overall appeal. Among the respondents who perceive an improvement in the transportation system due to the availability of shared micro-mobility services, a significant majority (68,0%) also view the city as more accessible and enjoyable. This suggests a positive correlation between their perception of transportation improvements and the overall attractiveness of the city. A small proportion of respondents, representing one third (33,3%) in each perception category, preferred not to disclose their opinion on both the impact on the transportation system and the city's accessibility and enjoyability. In summary, the analysis reveals a strong connection between the respondents' perception of the transportation system and their perception of the city's accessibility and enjoyability: as the perception of the transport system improves (i.e., from "Worse transport system" to "Improved transport system"), there is a tendency for the perception of the city's accessibility and enjoyability to also improve (i.e., from "Less accessible and enjoyable" to "More accessible and enjoyable"). Conversely, as the perception of the transport system worsens, there is a higher likelihood of perceiving the city as less accessible and enjoyable.

6 Conclusion

6.1 Discussion / Coherence with literature findings

The findings of the survey are generally in line with the corresponding literature.

Concerning convenience and ease of use, both the literature and the survey highlighted their influence on adoption and usage of shared micro-mobility services. Previous studies (Faghieh-Imani et al., 2014; Nair et al., 2013) reported that widespread availability and distribution enhance convenience, which can in turn improve acceptance and adoption by the users. Likewise, the respondents of the survey identified the abundant availability of micro-vehicle fleets as well as more pick-up/drop-off points as factors which could render shared micro-mobility services more appealing and accessible, while the same factor of convenience is among the desired improvements of the system (Q14, Q24, Q28, Q29). This fact suggests that higher levels of adoption and acceptability of shared micro-mobility services can be achieved by increasing the corresponding convenience levels.

In terms of cost, the literature suggests that the pricing structure of shared micro-mobility services, including factors such as membership fees, usage fees and discounts, emerges as a pivotal determinant impacting their adoption and utilization. Extensive research (Fishman, 2016; Martin & Shaheen, 2016; Zhang et al., 2017) highlights that services characterized by lower costs exhibit a higher likelihood of being preferred by users. While these studies collectively emphasize the significance of pricing considerations in shaping the usage patterns and overall acceptance of shared micro-mobility services, the same was found to be true in the Brussels-Capital Region. The respondents identified cost as an important parameters of the system in the Brussels-Capital Region and put emphasis in the need for more user-friendly costs (Q28, Q29). However, the results cannot be considered fully conclusive, as a contradiction with the above exists: in Q14 cost is not considered a significant defining factor for the adoption of shared micro-mobility services, while in Q24 slightly over half of the users of such services reported that they were neither satisfied nor dissatisfied with the current costs.

In what concerns health benefits, the literature identifies them as potential motivating factors in adopting shared micro-mobility services, as they provide an opportunity for active travel and sustainable transport (Fishman, 2016). The results of the survey though are not supportive enough to completely confirm the literature findings (Q23). On one hand, there is an important proportion of respondents (current users of shared micro-mobility services in the Brussels-Capital Region) who reported improved levels of mental health and well-being. At the same time, a lower proportion of respondents reported increased physical activity levels and an even lower proportion improved social interactions. On the other hand, the vast majority of respondents did not notice any change concerning these factors, leading to the conclusion that they do not play a significant role as driving forces of adoption of shared micro-mobility services in the Brussels-Capital Region. In addition, there is an alarming findings, which concerns the reduced physical activity levels reported by almost 20% of the respondents. This is also connected to a shift from active modes of transport (walking) to shared micro-mobility services (Q21). The alarming character of that finding is that, while such services are considered to be beneficial for health reasons, they could actually lead to deterioration of physical health if walking is not equally substituted in the everyday exercising routines of the users. At a subsequent level, the increasing spread of electrically assisted micro-vehicles (e-scooters and e-bicycles) (The Brussels Times, n.d.-b) could further aggravate this trend.

Regarding attitudes, the literature suggests that people who are favorable toward emerging technologies, environmental sustainability and active lifestyles have a higher tendency to embrace shared micro-mobility modes. The inverse appears to be true in what concerns the user safety and associated risks, which are considered entry barriers (Bretones & Marquet, 2022; Fishman, 2016; Heinen et al., 2010; Ricci, 2015; C. Smith & Schwieterman, 2018). The survey was not able to confirm the former part of the literature findings, but was able to confirm the latter: road safety risks greatly affect the perception of existing and potential users of shared micro-mobility services and, subsequently, the relevant biases towards adoption or non-use of such services (Q24, Q25, Q26, Q27, Q28, Q29, Q30). In addition to that, both the literature and the survey findings highlight safety as a paramount concern for shared micro-mobility users, with the collision risk with other vehicles and pedestrians being the respondents' top safety concern – again in line with the literature (Masquelet & de Saint Julien, 2022).

In what concerns infrastructure, both the literature and the survey emphasized their importance in enhancing the safety, utility and user experience of shared micro-mobility services. Studies discussed how features like dedicated bicycle lanes, wider sidewalks, parking solutions and sidewalks can help reduce conflicts, collisions and discomfort while riding (Fishman, 2016; S. A. Shaheen et al., 2010). Correspondingly, surveyed users prioritized better maintained bike lanes and public spaces for parked vehicles as key desired improvements (Q24, Q25, Q28, Q29). In both cases, the availability of parking amenities was an important factor towards adoption of shared micro-mobility services.

Furthermore, while the literature overall identified potential benefits for city accessibility and livability from reduced car dependence and flexible mobility options enabled by shared micro-mobility, the survey revealed mixed perceptions regarding their impact on city enjoyability. Some users reported positive changes, many perceived no significant impact, and others noted reduced accessibility (Q32 and Q33). However, on that aspect, the most important takeaway is the relationship between time and the respondents' perception of the Brussels-Capital Region's attractiveness in conjunction with their perception about the Region's transport system: the users of such services tend to have a more positive outlook over time, with a greater proportion perceiving increased accessibility and enjoyability as their usage duration extends. At the same time, as the perception of the transport system improves among the population, there is a tendency for the perception of the city's accessibility and enjoyability to also improve. Ultimately, this signifies that resistance among the population towards shared micro-mobility services can be overcome through time, positively impacting the Region's attractiveness.

In summary, there are aspects of the literature findings that could be confirmed by the survey results and aspects which could not be completely backed up. It is evident though that the survey had specific limitations which should be addressed in similar future research efforts, as discussed in the following Chapter (“Limitations and future research”).

6.2 Limitations and future research

One of the main limitations of the present Thesis is the survey method and the sample that was used for the analysis; more specifically, securing an adequate pool of respondents. This was mitigated by employing a multi-stakeholder approach, engaging various actors with vested interests, roles or influence over shared micro-mobility in the Brussels-Capital Region. It was expected that the actors to whom the survey was communicated would substantially contribute to its diffusion, allowing the survey to get traction and attract a significant number of respondents. Despite these efforts, the survey yielded a rather low response rate, collecting a total of 106 valid responses, out of which 105 could be used.

This relatively small sample size raises concerns regarding the generalizability of the findings to the wider population of shared micro-mobility users in the Region. Furthermore, the sample's representativeness may be compromised due to the recruitment method reliant on email access and voluntary participation, potentially introducing response bias, stemming from self-reporting tendencies.

Moreover, the geographical scope of the study is limited to the Brussels-Capital Region. On one hand, this fact is considered to have limited the response rate, while on the other hand it raises the question the external validity of the findings beyond the pre-defined geographical context. As a result, caution should be exercised when attempting to extrapolate the results to other cities or regions.

In terms of methodology, while the literature review provides a sound theoretical background, the Thesis' comprehensiveness may be subject to inherent limitations in the selected sources. In addition, the online survey was not complemented by alternative research methods like interviews, focus groups or field work; to that end, the survey may not have captured the depth of qualitative insights obtainable through these alternative research methods.

The time constraints imposed on the research may have restricted the thoroughness of data collection and analysis, potentially limiting the investigation's depth and breadth. The survey was launched on the 3rd of April 2023 and it remained active until the 30th of April 2023. The survey period coincided with the Easter holidays, which resulted in several challenges with regards to participant availability and engagement. Many of the stakeholders who were approached in order to support the dissemination of the survey were temporarily unavailable during this period. This was particularly true for educational institutions, which were included as potential survey recipients: it is believed that their students could have significantly contributed to achieving an increased number of responses. This concerned a period of two weeks, which caused a setback in terms of momentum, overall engagement and, subsequently, survey response rate. Unfortunately, upon of normal business operations, the survey did not manage to re-establish its previous level of traction.

Based on the findings and afore-mentioned limitations, several possibilities for future research and work emerge, allowing for opportunities which could expand knowledge on the issue of shared micro-mobility in the Brussels-Capital Region and address the gaps identified in the study.

Firstly, future research endeavors could focus on increasing the sample size and improving the representativeness of respondents. A larger and more diverse sample would provide a more accurate reflection of the perspectives and experiences of shared micro-mobility users in the region, at the same time, this could add more credibility to the findings which could then be considered robust enough to enhance their potential for generalization in other geographical areas. Apart from targeted sampling techniques, such as stratified sampling based on demographic characteristics or geographic distribution, seeking the collaboration of one or more stakeholders towards the development of the questionnaire could also have additional positive results: a) the commitment of the stakeholder(s) in promoting the survey; and b) the connection of the theoretical part of the research with real-life questions and aspects which could potentially link theory and practice.

Secondly, qualitative research methods, such as in-depth interviews or focus groups, could be employed to complement the quantitative survey data. These qualitative approaches would provide a deeper understanding of the factors influencing user satisfaction, areas of concern, and barriers to adoption. They can uncover nuanced perspectives, subjective experiences, as well as contextual factors that quantitative data alone may not be able to capture.

Furthermore, future research could explore the long-term impacts of shared micro-mobility services on transportation patterns, urban mobility and sustainability (of the city's transportation system and the city itself as a whole). This could involve longitudinal studies that track changes in modal choice and travel behavior over an extended period of time. Understanding how shared micro-mobility services interact with other transportation modes, including public transport and personal vehicle ownership, could shed light on the dynamics of modal shift and the overall transportation landscape. Additionally, investigating the environmental and health-related outcomes of shared micro-mobility adoption can provide valuable insights into its potential contributions to sustainability and public health objectives.

Another fruitful direction for future research concerns the exploration of the role of technological advancements and innovation in shaping the future of shared micro-mobility services. As technology continues to evolve, studying the impact of emerging trends, such as electric micro-mobility vehicles, mobility-as-a-service platforms or integration with smart city initiatives, could provide valuable insights into the potential benefits and challenges associated with these developments and how they could influence the perceived user experience, service quality and overall adoption and effectiveness of shared micro-mobility systems.

Lastly, research efforts could be directed towards the evaluation of the economic viability and financial sustainability of shared micro-mobility schemes. Investigating the business models, revenue streams and cost structures of shared micro-mobility providers can shed light on the long-term viability and potential for profitability, allowing for information about the economic implications of supporting and scaling shared micro-mobility services, as well as integrating them into the/a Region's transport system.

In conclusion, it is believed that the present Master Thesis provides a foundation for further research and work in the field of shared micro-mobility services in the Brussels-Capital Region. Future studies should aim to address the identified limitations, expand the sample size, employ mixed-method approaches, explore long-term impacts, investigate technological advancements, and evaluate the economic viability of shared micro-mobility schemes. By pursuing these avenues, future researchers can contribute to a more comprehensive understanding of shared micro-mobility, guide policy decisions, and support the development of sustainable and user-centric urban transportation systems.

6.3 Conclusions

The present Master Thesis endeavoured to address several research questions pertaining to shared micro-mobility services in the Brussels-Capital Region, Belgium. The primary research question aimed to assess the level of satisfaction among users and identify their main areas of concern. In addition, secondary research questions investigated the relationship between shared micro-mobility services and other transportation modes, including ownership versus usage patterns, modal choice, as well as the substitution of other modes by shared micro-mobility. Furthermore, the Thesis examined the factors influencing potential users' decision not to adopt shared micro-mobility services and explored opportunities for improvement to incentivize a modal shift.

As a result, these Research Questions are considered to have been addressed, albeit to a varying degree, providing insightful findings and contributing to a deeper understanding of the shared micro-mobility services landscape in the Brussels-Capital Region.

Concerning Research Question 1, the level of satisfaction among users of shared micro-mobility services in the Brussels-Capital Region and their main areas of concern were examined. The survey results indicated varying levels of satisfaction, with convenience and ease of use being significant positive determinants. On the contrary, concerns were expressed regarding safety, infrastructure and costs. Improving these aspects would enhance user satisfaction and overall service quality.

In respect to Research Question 2, the dependence between the use and non-use of shared micro-mobility services, public transport, and personal vehicle ownership in the Brussels-Capital Region was explored. The survey results had traces that indicated a relationship between these modes of transportation. While shared micro-mobility services were seen as complementary to public transport, their impact on personal vehicle ownership and modal shift was less clear. As a result, further investigation is necessary to fully understand the dynamics between these modes and their role in achieving sustainable transportation goals.

Concerning Research Question 3, the factors that influence the choice of potential users not to opt for shared micro-mobility services in the Brussels-Capital Region were examined. The survey findings highlighted several barriers to adoption, including safety concerns, perceived risks and the need for better infrastructure and supporting amenities.

Finally, with regards to Research Question 4, the areas for improvement in shared micro-mobility services in the Brussels-Capital Region, in order to make them more lucrative and provoke a modal shift, were investigated. The survey results identified key areas of potential improvement, including cost structures, safety measures, infrastructure enhancements and increased convenience through expanded availability and pick-up/drop-off points.

In conclusion, this Master Thesis successfully answered the research questions by providing valuable insights into the satisfaction levels, areas of concern, factors influencing adoption, and necessary improvements in shared micro-mobility services in the Brussels-Capital Region. The findings contribute to the understanding of user preferences, highlight the interplay between different transportation modes, and offer recommendations for enhancing the attractiveness, usability, and sustainability of shared micro-mobility services. These conclusions can guide future research, inform policy decisions, and support the development of user-centric and sustainable urban transportation systems within and beyond the Brussels-Capital Region.

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Minors

Q6: How many vehicles (if any) do you own and use in your household?

	0	1	2 or more	Prefer not to say
Bicycle				
E-bicycle				
Scooter				
E-scooter				
Hoverboard / Unicycle				
Motorcycle				
Petrol/Diesel car				
Hybrid car				
Electric car				
Other (please specify)				

Q7: What is your annual household (gross) income?

Up to 33.000 €
33.001 - 40.000 €
40.001 - 50.000 €
50.001 - 65.000 €
65.001 - 80.000 €
Above 80.001 €
Prefer not to say

Q8: Do you reside in the Brussels-Capital Region?

Yes
No

Q9: In which Municipality of the Brussels-Capital Region do you reside?

Anderlecht
Auderghem / Oudergem
Berchem-Sainte-Agathe / Sint-Agatha-Berchem
Bruxelles-Ville / Stad Brussel
Etterbeek
Evere
Forest / Vorst
Ganshoren
Ixelles / Elsene
Jette
Koekelberg
Molenbeek-Saint-Jean / Sint-Jans-Molenbeek
Saint-Gilles / Sint-Gillis
Saint-Josse-ten-Noode / Sint-Joost-ten-Node
Schaerbeek
Uccle / Ukkel
Watermael-Boitsfort / Watermaal-Bosvoorde

Woluwe-Saint-Lambert / Sint-Lambrechts-Woluwe
 Woluwe-Saint-Pierre / Sint-Pieters-Woluwe
 Prefer not to say

Q10: Do you possess a monthly or yearly pass to Brussels-Capital public transport system (STIB)?

Yes
 No

Q11: How often do you use the below mobility solutions?

	Never	Rarely	On a daily basis	Few times per week
Walking				
Public transport				
Own car				
Shared car service				
Own motorcycle				
Shared motorcycle service				
Own micro-mobility vehicle				
Shared micro-mobility service				
Other (please specify)				

Q12: How long have you been using shared micro-mobility services in Brussels?

I have not used any shared micro-mobility services in brussels
 Less than 1 month
 1 - 6 months
 7 - 12 months
 More than a year

Q13: How often do you use shared micro-mobility services in Brussels, for each of the below purposes?

	Commuting to work	Commuting to school / University	Social activities	Running errands	Leisure	Other
Never						
Rarely						
On a daily basis						
A few times per week						

Q14: Which factors influence your decision to use or not use shared micro-mobility services in Brussels?

	Negative influence	No influence	Positive influence	Prefer not to say
Availability of shared micro-mobility vehicles				
Quality of service of other means of transport				
Convenience of shared micro-mobility services				
Convenience of other means of transport				
Cost of shared micro-mobility services				
Cost of other means of transport				
Environmental concerns				

Traffic congestion
Lack of parking options
Safety concerns
Weather conditions
Health and exercise benefits
Other

Q15: On average, how far do you travel using shared micro-mobility services in Brussels?

Less than 1 km
2 - 5 km
6 - 10 km
More than 10 km
Prefer not to say

Q16: On average, how long are your shared micro-mobility trips in Brussels?

Less than 10 minutes
10 - 30 minutes
31 - 60 minutes
More than 60 minutes
Prefer not to say

Q17: How has using shared micro-mobility services impacted your overall travel time in Brussels?

It has decreased my travel time
It has not had any impact on my travel time
It has increased my travel time
Prefer not to say

Q18: Do you think that the shared micro-mobility services available in Brussels adequately meet the transportation needs of residents and commuters?

Yes
Partially
No
Prefer not to say

Q19: How likely are you to continue using shared micro-mobility services in Brussels in the future?

Unlikely
Neither likely nor unlikely
Likely
Prefer not to say

Q20: How likely are you to continue using shared micro-mobility services in Brussels in the future?

Unlikely
Neither likely nor unlikely
Likely
Prefer not to say

Q21: How has the use of shared micro-mobility services impacted your overall transportation habits in comparison to...?

	Decreased	No impact	Increased	Prefer not to say
Walking				
Use of public transport				
Use of own car				
Use of own motorcycle				
Use of own micro-mobility vehicles (bicycle / scooter)				

Q22: How has using shared micro-mobility services in Brussels impacted your transportation-related spending habits?

I spend less on transportation overall				
I spend about the same on transportation as before				
I spend more on transportation overall				
Prefer not to say				

Q23: How has using shared micro-mobility services impacted your...?

	Decreased	No impact	Increased	Prefer not to say
Physical activity levels				
Mental health and well-being				
Social interactions				

Q24: How satisfied are you with the following parameters of shared micro-mobility services in Brussels?

	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Prefer not to say
Convenience				
Availability of micro-vehicles				
Quality of micro-vehicles				
Availability of docking stations / parking spaces				
Ease of use				
Customer support services				
Affordability (Cost)				
Integration with public transport				
Available infrastructure				
Regulatory Framework				

Q25: What kind of issues have you experienced while using shared micro-mobility services in Brussels?

	Never	Occasionally	Frequently	Prefer not to say
Vehicle unavailability				
Parking spot/docking space unavailability				
Not properly maintained vehicles (including battery level)				
App-related difficulties				
Inadequate infrastructure (insufficient bike lanes)				
Unexpected fees				

Unsafe traffic conditions

Other

Q26: How concerned are you about the safety of using shared micro-mobility services in Brussels?

Concerned

Neutral

Not concerned

Prefer not to say

Q27: What are your biggest safety concerns when using shared micro-mobility services in Brussels?

Collision with cars, other vehicles or pedestrians

Poorly maintained infrastructure (e.g. Bike lanes, pavements)

Malfunctioning equipment

Theft of the shared micro-mobility vehicle

Prefer not to say

Other (please specify)

Q28: What improvements would you like to see in the shared micro-mobility landscape in Brussels?

Improved safety measures

More convenient locations for shared micro-mobility services

Lower cost of shared micro-mobility services

Improved public infrastructure

Increased quality of micro-mobility vehicles

Increased availability of micro-mobility vehicles

More providers of shared micro-mobility services

Prefer not to say

Other

Q29: What improvements would you like to see in the shared micro-mobility landscape in Brussels before you start using such services?

Improved safety measures

More convenient locations for shared micro-mobility services

Lower cost of shared micro-mobility services

Improved public infrastructure

Increased quality of micro-mobility vehicles

Increased availability of micro-mobility vehicles

More providers of shared micro-mobility services

Prefer not to say

Other

Q30: In your opinion, how well do shared micro-mobility services integrate with public transport in Brussels?

Poorly

Neutral

Well

Prefer not to say

Q31: How would you rate the city's efforts to facilitate the use of shared micro-mobility services in Brussels?

Poor

Fair

Good

Prefer not to say

Q32: Overall, how has the availability of shared micro-mobility services in Brussels impacted your perception of the city's transportation system?

It has worsened my perception

It has not impacted my perception

It has improved my perception

Prefer not to say

Q33: Overall, would you say that shared micro-mobility services in Brussels have made the city a more accessible and enjoyable place to live, work or visit?

Less accessible and enjoyable

No change observed

More accessible and enjoyable

Prefer not to say

Appendix II: Information mail to potential stakeholders

Brussels, 03 April 2023

From: Spyridon Triantafyllos
Student, Master of Transportation Sciences Programme, Hasselt University, Belgium

Dear Sir/Madame,

My name is Spyridon Triantafyllos, student of the programme “Master of Transportation Sciences”, Hasselt University, Belgium.

In the frame of my Master Thesis about the exploration of the potential of shared micro-mobility in the Brussels-Capital Region, a relevant survey is conducted.

The purpose of this official e-mail is to request your support in disseminating the survey, in order to collect as many as possible complete questionnaires which would allow for concrete findings and conclusions based on a representative population sample.

While the impact of shared mobility on different aspects (including financial, environmental and purely transport-related) has been documented through various studies globally, “more research is needed on a city or regional basis and on emerging services,” (Shaheen et al., 2020). The Master Thesis envisages to address this issue for the Brussels-Capital Region, by exploring from the perspective of the users of shared micro-mobility services their experiences and level of acceptance of this transport mode and, from the side of non-users, the relevant impeding factors.

On this basis, in case you consider the topic of the Master Thesis to be in line with your interests, I would like to kindly ask for your support in this work, by disseminating this survey link and/or attached QR code to potential respondents through your official communication channels. Of course, the results of the survey and the Master Thesis will be shared with you, once finalized.

The survey, which is completely anonymous, is active from 01/04/2023 to 30/04/2023. Participation is voluntary and the respondents have the right to discontinue their participation at any time during the reply process, without any justification or implication.

In case of questions, you can contact me (spyridon.triantafyllos@student.uhasselt.be) or my Supervisors (Prof. dr. Muhammad Adnan: Muhammad.Adnan@uhasselt.be / Prof. dr. Wim Ectors: Wim.Ectors@uhasselt.be). For any issues or other concerns regarding the processing of personal data, you can contact the Hasselt University data protection officer (dpo@uhasselt.be).

An acknowledgement of receipt of the present communication as well as your intentions in supporting this survey would be most welcome and appreciated.

With best regards,
Spyridon Triantafyllos



Appendix III: Explanatory note in the survey

Exploring the potential of shared micro-mobility vehicles: drivers' experience and acceptance in the Brussels-Capital Region

Dear respondent,

My name is Spyridon Triantafyllos, student of the programme “Master of Transportation Sciences” at Hasselt University, Belgium.

In the frame of my Master Thesis about the exploration of the potential of shared micro-mobility vehicles and the services they are provided through in the Brussels-Capital Region, a relevant survey is being conducted.

The aim of the Thesis (and, subsequently, the present survey) is to explore from the perspective of the users of shared micro-mobility services their experiences and level of acceptance of this transport mode and, from the side of non-users, the relevant impeding factors.

The survey is anonymous and does not require more than 10 to 12 minutes to be completed. There are no right and wrong replies, but honest ones

Consent

Before starting the survey, you are kindly requested to thoroughly read the below information:

- I have read the above information about this survey
 - I understand the purpose of this survey as well as what is expected of me during this study
 - I understand that my participation in this study is voluntary and that I have the right to discontinue my participation at any time during the reply process, by closing the browser window
 - In case of aborting the process, no justification is required and no disadvantage can arise for me
 - I understand that the results of this survey may be used for scientific purposes and may be published
 - My name will not be published and the confidentiality of my data is guaranteed at every stage of the research process: survey, analysis of results and dissemination of results/publication
 - I am aware that the results of this research will be kept for 5 months, starting from April 2023, and will be deleted after this period
 - In case of questions, I am aware that I can contact the administrator of this survey (spyridon.triantafyllos@student.uhasselt.be)
 - For any complaints or other concerns regarding the processing of personal data, I am aware that I can contact the Hasselt University data protection officer (dpo@uhasselt.be)
- I agree to take part in this study/project and agree that my data/answers will be registered
- I disagree and would not like to participate to the survey