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Identifying the gaps between needs, expectations, and views of different stakeholders related to car-sharing, bike-sharing, and scooter-sharing systems

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Declaration

I hereby declare that, the contents and organization of this dissertation constitute my own original work and do not compromise in any way the rights of third parties, including those relating to the security of personal data.

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I would like to dedicate this thesis to my loving parents

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Abstract

Shared mobility, such as car-sharing, bike-sharing, and scooter-sharing services, is quickly expanding in several countries, including Italy, where it was introduced a few years ago. The benefits of this type of transportation mode have been estimated and reported by many authors. However, since a shared mobility system is a type of transportation that combines the characteristics of private vehicles and transit services, policy-makers may not know how to treat it well. Moreover, although many policies have been proposed to promote shared mobility, they still have little impact in terms of aggregated market shares in urban areas. It may be because the actual requirements of the passengers regarding shared transportation services characteristics are not well understood. Hence, it is important to understand what needs to be improved in shared mobility services.

Aiming to contribute to filling this gap, two separate studies are carried out, namely the analysis of car sharing, scooter sharing, and bike sharing (separately) and the analysis of shared mobility services (as a whole, not related to a specific one). In the analysis of each shared mobility service (separately), 12 sub-criteria are compared by four different stakeholder groups (users, non-users, local authorities, and services operators) to determine their standpoints on the importance of each sub-criterion that people can consider in their decisions to use each shared mobility service. Also, in the separate analysis of each shared mobility service, each stakeholder rated the importance of specific criteria associated with their specific role. Hence, the criteria rated by government members differ from those rated by operators and users/non-users. However, users and non-users rated the same criteria in order to understand their perceptions' gaps.

This study applies Multi-Actor Multi-Criteria Analysis (MAMCA) because it is an appropriate method when different stakeholders are involved. One step of the MAMCA is to determine the main criteria and weights, which is done through a perception-based analysis that was implemented by using a Bayesian Best-Worst Method (BWM). This method is chosen because it is the only one ensuring a very high quality of the computed weights while requiring a small amount of data. The latter aspect is essential because some of the shareholders are members of the government and operators, which are few in number. Other advantages of this method include the combination of weight quality, fewer inconsistencies between criteria, fewer data required to obtain highly reliable results, low equalizing bias, and average transparency of the method.

Before calculating the optimal group weights by Bayesian BWM, the consistency of the interviewees' answers was checked using the input-based approach, and acceptable ones (their obtained global input-based consistency ratio is less than the input-based consistency ratio thresholds) were considered. After eliminating pairwise comparisons with unacceptable consistency ratios, different sample sizes can be obtained and utilized for different levels of the model. Also, it is important to note that Bayesian BWM can provide much more information than the original BWM. For example, Bayesian BWM can provide the credal ranking and

confidence level in the weight-directed graph. This helps to understand the importance perceived by stakeholders of one criterion over other criteria. From a methodological viewpoint, the experimental design proposed in the present work also helps to make some original contributions to the field of multicriteria analyses and Bayesian BWM applications.

In order to collect the required data, nine different surveys have been designed and administered in the Turin metropolitan area in Italy. Data on operators and government members were collected through phone calls to targeted contact points, while for users and non-users, a panel maintained by a survey company was used to have a representative sample of the population in the study area (using online surveys). Survey data are used to calculate criteria and sub-criteria weights to determine how the comparative criteria are rated in terms of importance by different stakeholders of different shared mobility services. Hence, surveys provide insights into how specific individuals or groups perceive certain aspects. In those surveys administered to users and non-users of each shared mobility service, in addition to BWM-related questions, questions about their routines, daily travel views, and socio-demographic characteristics were also asked.

This study helps determine the relative importance of sub-criteria and main-criteria from each stakeholder's perspective and contributes to understanding how one main-criterion/sub-criterion can be of different importance across different shared mobility services. Besides, it helps to distinguish stakeholders' views on each sub-criterion and, more specifically, to know how different stakeholders score the importance of the comparison factors associated with their role as shared mobility service stakeholders. Based on these results, suggestions for government members and each shared mobility service operator are given to attract more users and non-users and to understand which shared mobility system is most appropriate to implement in Turin, according to users' and non-users' perceptions. Also, this study contributes to presenting scenarios to determine how to increase the use of bike-sharing and scooter-sharing services compared to car-sharing services, given their larger social benefits.

Sintesi

La mobilità condivisa, come i servizi di car-sharing, bike-sharing e sharing di monopattini elettrici, si sta espandendo rapidamente in diversi paesi, tra cui l'Italia, dove è stata introdotta alcuni anni fa. I vantaggi di questo tipo di modalità di trasporto sono stati stimati e riportati da molti autori. Tuttavia, poiché un sistema di mobilità condivisa è un tipo di trasporto che combina le caratteristiche dei veicoli privati e dei servizi di trasporto pubblico, i decisori pubblici potrebbero non sapere bene come considerarlo. Inoltre, sebbene molte politiche siano state proposte per promuovere la mobilità condivisa, hanno ancora scarso impatto in termini di quote di mercato aggregate nelle aree urbane. Questo potrebbe essere dovuto al fatto che le effettive esigenze dei passeggeri in merito alle caratteristiche dei servizi di trasporto condiviso non sono ben comprese. Pertanto, è importante capire cosa deve essere migliorato nei servizi di mobilità condivisa.

Con l'obiettivo di contribuire a colmare questa lacuna, vengono condotti due studi distinti, ovvero l'analisi del car sharing, sharing di monopattini elettrici e bike sharing (separatamente) e l'analisi dei servizi di mobilità condivisa (nel loro insieme). Nell'analisi di ciascun servizio di mobilità condivisa (separatamente), 12 sottocriteri vengono confrontati da quattro diversi gruppi di stakeholder (utenti, non utenti, enti locali e operatori di servizi) per determinare il loro punto di vista sull'importanza di ciascun sottocriterio che i potenziali utenti potrebbero considerare nelle loro decisioni di utilizzare ciascun servizio di mobilità condivisa. Inoltre, nell'analisi separata di ciascun servizio di mobilità condivisa, ogni stakeholder ha valutato l'importanza di criteri specifici associati al proprio ruolo specifico. Pertanto, i criteri valutati dai membri del governo differiscono da quelli valutati dagli operatori e dagli utenti/non utenti. Tuttavia, utenti e non utenti hanno valutato gli stessi criteri per comprendere le lacune delle loro percezioni.

Questo studio applica la Multi-Actor Multi-Criteria Analysis (MAMCA) perché è un metodo appropriato quando sono coinvolti diversi stakeholder. Una fase del MAMCA è determinare i criteri e i pesi principali, che viene eseguita attraverso un'analisi basata sulla percezione che è stata implementata utilizzando un Bayesian Best-Worst Method (BWM). Questo metodo è scelto perché è l'unico che garantisce una qualità molto elevata dei pesi calcolati, pur richiedendo una piccola quantità di dati. Quest'ultimo aspetto è essenziale perché alcuni dei portatori di interesse sono membri del governo e operatori, che sono pochi di numero. Altri vantaggi di questo metodo includono la robustezza dei pesi ottenuti, meno incoerenze tra i criteri, meno dati necessari per ottenere risultati altamente affidabili, bassa distorsione di equalizzazione e trasparenza del metodo di calcolo.

Prima di calcolare i pesi di gruppo ottimali mediante Bayesian BWM, la coerenza delle risposte degli intervistati è stata verificata utilizzando l'approccio basato sull'input e sono state

selezionate quelle accettabili (il loro input-based consistency ratio è inferiore ad una predeterminata soglia). Dopo aver eliminato il rischio di effettuare confronti a coppie con rapporti di consistenza inaccettabili, è possibile ottenere e utilizzare diverse dimensioni del campione per diversi livelli del modello. Inoltre, è importante notare che il Bayesian BWM può fornire molte più informazioni rispetto al BWM originale. Ad esempio, il Bayesian BWM può fornire un credal ranking e il livello di confidenza. Questo aiuta a comprendere l'importanza percepita dalle parti interessate di un criterio rispetto ad altri criteri. Da un punto di vista metodologico, il disegno sperimentale proposto in questo lavoro contribuisce anche a fornire alcuni contributi originali nel campo delle analisi multicriteri e delle applicazioni del Bayesian BWM.

Per raccogliere i dati richiesti, sono state progettate e gestite nove diverse indagini nell'area metropolitana di Torino, in Italia. I dati su operatori e decisori pubblici sono stati raccolti contattandoli direttamente al telefono, mentre per utenti e non utenti è stato utilizzato un panel gestito da una società di indagine per avere un campione rappresentativo della popolazione nell'area di studio (tramite sondaggio online) . I dati dell'indagine vengono utilizzati per calcolare criteri e pesi dei sottocriteri, al fine di determinare in che modo i criteri comparativi sono valutati in termini di importanza dai diversi stakeholder dei diversi servizi di mobilità condivisa. Pertanto, le indagini forniscono informazioni su come individui o gruppi specifici percepiscono determinati aspetti. Nelle indagini somministrate agli utenti e ai non utenti di ciascun servizio di mobilità condivisa, oltre alle domande relative alla BWM, sono state poste anche domande sulle loro abitudini, sugli spostamenti quotidiani e sulle loro caratteristiche socio-demografiche.

Questo studio aiuta a determinare l'importanza relativa dei sottocriteri e dei criteri principali secondo il punto di vista di ciascuna parte interessata e contribuisce a far comprendere come un criterio/sottocriterio principale possa avere un'importanza diversa nei diversi servizi di mobilità condivisa. Inoltre, aiuta a distinguere le opinioni degli stakeholder su ciascun sottocriterio e, più specificamente, a sapere in che modo i diversi stakeholder valutano l'importanza dei fattori di confronto maggiormente associati al loro ruolo. Sulla base di questi risultati, vengono forniti suggerimenti ai decisori pubblici e a ciascun operatore del servizio di mobilità condivisa per attirare più utenti e non utenti e per capire quale sistema di mobilità condivisa è più appropriato implementare a Torino, secondo le percezioni di utenti e non utenti. Inoltre, questo studio contribuisce a presentare scenari per determinare come aumentare l'uso dei servizi di bike sharing e sharing di monopattini elettrici rispetto ai servizi di car sharing, dati i loro maggiori benefici social.

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Chapter 1

Introduction

Recent decades have seen changes in the way urban transportation is viewed. Initially, the rising use of private transportation in industrialized countries provided greater access. However, it has led to negative externalities such as pollution and excessive energy and time consumption in the long run because of traffic congestion. Mainly this is more likely to occur in urban areas where demand is concentrated during peak hours (Jorge and Correia, 2013). Furthermore, car ownership costs such as fuel, parking, and the cost of car insurance are rising (Mitchell et al., 2010). Public transportation could be a proper alternative, but it has several drawbacks. For example, public transport coverage does not provide door-to-door service, even in European cities with a significant public transport network. Also, public transport service lacks personalization and a flexible schedule (Jorge and Correia, 2013).

International concerns over climate change and global motorization have heightened interest in sustainable transportation strategies. These include integrated land use and transportation plans, vehicle technologies, clean fuels, and transportation demand management (Shaheen and Lipman, 2007). Urban transportation systems face challenges such as accelerating population growth, urban sprawl, congestion, and overcrowded public transportation services. The level of service provided by conventional modes of transport is affected by these problems and inevitably intensifies dependence on a private vehicle. Under these circumstances, the transportation market is fundamentally changing. It provides new opportunities for more flexible, efficient, and responsive solutions, such as introducing shared mobility modes of car-sharing systems scattered around a city (Calderón and Miller, 2020). The term 'shared mobility' contains car-sharing modes, private vehicle sharing (fractional ownership, peer-to-peer car-sharing), scooter-sharing (in Italy, it is called "Sharing di Monopattini Elettrici"), traditional ridesharing, bicycle-sharing, transport network companies (ride-sourcing), and Electronic hailing (taxis). In addition, it can encompass flexible transit services, consisting of micro transits that complement rail and fixed-track bus systems (Shaheen and Chan, 2016).

The car-sharing system consists of a small and medium fleet of cars available at several stations that can be used by a relatively large group of members (Shaheen et al., 1999). The car-sharing system is a mode of transportation that combines the freedom of a private car and the affordable cost of traditional public transit (Barth and Shaheen, 2002; Martin and Shaheen, 2011a; Habib et al., 2012; Morency et al., 2012; Uteng et al., 2019; Ceccato and Diana, 2021). Furthermore, the car-sharing system can offer privacy and flexibility as a private car and also does not have the disadvantages of public transportation (Barth and Shaheen, 2002; Zhou and Kockelman, 2011; Clewlow, 2016) without directly incurring all costs (Cooper et al., 2000; Huwer, 2004; Shaheen et al., 2006; Martin and Shaheen, 2011a; Costain et al., 2012; De Lorimier and El-Geneidy, 2013; Shaheen and Cohen, 2013; Efthymiou et al., 2013; De Luca and Di Pace, 2015; Shaheen and Chan, 2016; Efthymiou and Antoniou, 2016; Yoon et al., 2017; Wang et al., 2017; Kim et al., 2017a; Hua et al., 2019; Jones and Leibowicz, 2019) and restrictions (Coll et al., 2014), it can bridge the gap between private car and public transport (Morency et al., 2007; Efthymiou et al., 2013; Kaspi et al., 2014).

Car-sharing systems can have positive effects on the environment. Generally, the car-sharing system has positively affected urban mobility since each car is used more efficiently than private vehicles (Litman, 2000; Schuster et al., 2005). The utilization rate of shared vehicles is more than single-user private vehicles due to spending less time in the parking lot and more time on the road, leading to less sunk costs. In addition, less land is needed for car parking in the medium and long term (Mitchell et al., 2010). Hence, the car-sharing program is an opportunity to develop sustainable urban development (Costain et al., 2012; Jorge, Barnhart, and de Almeida Correia, 2015) without the obligation of passengers to relinquish the benefits of using the private car (Huwer, 2004). It is important to note that car-sharing service does not eliminate car use, but it does make individuals aware of how to use the car properly (Huwer, 2004; De Lorimier and El-Geneidy, 2013; Coll et al., 2014; Morency et al., 2015). In developed countries, many young people postpone obtaining a driver's license (Mounce and Nelson, 2019). Furthermore, it indicates that the importance of having a car is gradually diminishing (Schmöller et al., 2015). These reasons shift from car ownership to "car as demand" (Firnkorn and Müller, 2012; Kent and Dowling, 2016; Mounce and Nelson, 2019).

Global mobility challenges are omnipresent. Urban centers worldwide face challenges with a lack of space, congestion, and high emissions levels (Gössling, 2020; Maiti et al., 2020). Micro-mobility is a promising urban mobility solution (Feng et al., 2020). The term micro-mobility refers to incorporating a short trip with a small vehicle. It is called micro-mobility when transport mobility is restricted to only a limited range of travel for light vehicles (Elhenawy et al., 2020). Shared micro-mobility is those services providing short-term electric rental vehicles to the general public for a fee (McKenzie, 2019). Vehicles of light categories such as motorbikes, e-bikes, electric scooters (e-scooters), bikes, shared bikes, and some riding devices such as skateboards are considered micro-mobility vehicles (Tuncer et al., 2020).

A Bike-Sharing System (BSS) is a new flexible form of investment in contiguous bicycle infrastructure that has been theorized to encourage more bike trips (Buck and Buehler, 2012; Gleason and Miskimins, 2012). The BSS is defined as the shared utilization of a bike system in which users have access to the fleet of bikes offered in public space (Büttner and Petersen, 2011). The recent proliferation of the bike-share scheme (BSS), recognized as a public bike use program, is one of the sustainable transportation alternatives that assist in alleviating the abovementioned concerns (Bauman et al., 2017). For instance, since the BSS is an eco-friendly and emission-free transport mode, it could provide a low-carbon solution for the “last mile” problem (DeMaio, 2009; Zhang et al., 2015). The last mile is traveling the short distance between transit stations, the workplace or home, and public transport that is too far for walking (Zhang et al., 2015).

Furthermore, the other benefit is cost savings from the modal shift. It enables individuals to use bikes at an affordable cost, with fewer responsibilities compared to bike ownership. Generally, the bike-sharing mode is known as an affordable means of transportation (Hyland et al., 2018). In addition, bike-sharing as a daily mode of transportation can help alleviate fuel costs, curb traffic congestion, and increase health benefits and environmental awareness (Shahin et al., 2010, Fishman et al., 2013; Li et al., 2019). BSSs triggered 25,240 tons of carbon dioxide and 64 tons of nitrogen oxide gas emissions to fall and reduced 8358 tons of gasoline consumption, conferring improved air quality in Shanghai, China, in 2016 (Zhang and Mi, 2018). Hence, increasing the deployment and utilization of the BSS can yield notable greenhouse gas emission reductions and provide obvious environmental benefits (Bajracharya et al., 2018). Also, implementing a Public Bike-Sharing (PBS) program turned out to be effective in raising the cycling rate among people living in areas where the BSSs are available (Fuller et al., 2013; Ricci, 2015; Godavarthy and Taleqani, 2017).

Bike reservation, pick-up, and drop-off processes in this system are self-service. BSS is commonly concentrated in urban settings, with lower implementation and operational costs (e.g., in contrast to shuttle services). There are two types of bike-sharing stations. First, there is a bike-sharing service in which the Bike-Sharing Program (BSP) provides multiple dock (fixed stations that lock the bicycles and release the bike by computer control) locations that enable people to pick-up and drop-off bikes at the different docks. Another service is dockless (flex stations), where people can receive a code on their mobile phone to unlock the bike and pick-up the bike or drop-off in a public place, so there is no need for docking stations (Shaheen et al., 2010).

E-scooters are part of micro-mobility, complementing existing transport networks (Button et al.,2020). Micro-mobility may alleviate some challenges facing today's large cities and provide a sustainable urban transport path. Shared stand-up e-scooters (electric kick/standing scooters) are shared micro-mobility. It is important to note that e-scooters should not be confused with the small electric motorcycles on which motorcyclists sit, as they are sometimes called e-scooters. Standing e-scooters are similar to children's but are equipped with small motors (Button et al., 2020). They are available in many cities as short-term rental options (Hollingsworth et al., 2019). Especially with the change to the Mobility-as-a-Service paradigm, e-scooter-sharing has become a common means of transportation in cities (Ciociola et al., 2020).

E-scooters are battery-powered, motorized versions of kick-scooters and have a long and narrow platform on which users can stand. There is also a vertical pole at the front with handlebars, throttle, brake controls, and two small in-line wheels at the front and rear (Fang et al., 2018). E-scooters are small, electric, and single-occupancy vehicles that are part of the global boom in "urban micro-mobility" (Tuncer and Brown, 2020). The contribution of e-scooters can play an essential role in improving accessibility in less-connected communities and supporting transportation sustainability (Zou et al., 2020). E-scooters are better than cars in terms of ecological potential (Kazmaier et al., 2020). However, due to the limited charge of the scooters' batteries, the distance traveled by e-scooters is limited. Otherwise, if the charge falls below the use conditions, passengers must leave the shared scooter halfway to the destination (Zhu et al., 2020). E-scooters are usually dockless, meaning there is no fixed location, and they are picked-up and dropped-off from arbitrary places in the service area (Fawcett et al., 2018). With the Internet of Things (IoT), mobile payment, and location-based services, dockless e-scooter-sharing does not require fixed docking stations for users (He and Shin, 2020). The user accesses the available scooters through a special service program downloaded on their mobile device. After finding the available e-scooter, the user scans the Quick Response (QR) code on the e-scooter, opens it, and starts the trip. After reaching the destination, the user can park the e-scooter, click the mobile application's end button, and leave the e-scooter. The travel cost is charged to the credit card linked to the mobile app (McKenzie, 2019). Data connections, location data of GPS units, and mobile apps are utilized to prevent theft, help users find the e-scooter to rent, and allow companies to collect scooters for service or charging (Petersen, 2019).

People can move on city streets by e-scooters, addressing mobility problems such as congestion and the first and last mile (Bai and Jiao, 2020). The e-scooter is a competitive mode of transportation in last-mile situations (Baek et al., 2021). The advantages of e-scooters could vary significantly in geographical areas only a few blocks away because of the differential access to bus routes and transit lines (Smith and Schwieterman, 2018). E-scooters can help people who live farther away from such stations access them more quickly, thus encouraging multimodal travel. The dimensions of an e-scooter spatially take up a little more space than a pedestrian but occupy much less than a cyclist (Tubis et al., 2019). Because of the accumulation at traffic junctions, e-scooters can offer an easy solution if the destination is not appropriately connected to the public transportation network or for long distances that seem like a long walk (Allem and Majmundar, 2019). Also, e-scooter users can benefit from low travel costs due to by-the-minute e-scooter rental services and healthy competition between micro-mobility service providers (Maiti et al., 2020).

Since shared mobility systems are a mode of transportation that combines the advantages of private vehicles and transit services, policy-makers might not know how to treat these kinds of services well. Furthermore, although many policies promoting shared mobility use have been proposed, they have less impact on triggering passengers to shift mode from private vehicles to shared mobility. It might be because the real requirements of passengers towards transport mode in the shared mobility service are not well understood. Hence, it is important to figure out what should be improved in shared mobility services. Also, it is important to understand the existing different views between users and service providers. Besides, the difference between the perspectives of users and non-users should be determined to be able to not only attract users to use the service more but also induce non-users to choose this service as their transport mode. Also, the requirements for transport modes are abstracted into a set of factors, and the perceived importance is assigned to each factor. Hence, it is necessary to identify the gap between the needs, expectations, and views of different stakeholders in car-sharing, bike-sharing, and scooter-sharing systems. To do this, five research questions can be introduced as follows.

1. Do **perceptions** vary **across stakeholders regarding each criterion** in **each shared mobility system**?
2. Is there a **difference in the importance** of criteria **between** bike-sharing, car-sharing, and scooter-sharing systems?
3. How do **different** shared mobility service **stakeholders score** the importance of **different comparison factors** associated with **each stakeholder**?
4. Which **shared mobility** system is the **best suited for implementation** according to the **users' and non-users' perceptions** in the Turin metropolitan area?
5. Once having clarified the relative importance of different criteria, **how can such results** be used to **improve sustainable transportation** systems?

The present thesis work is structured to address the above questions. First, an introduction briefly explains each shared mobility service, the benefits of using these services, and the five research questions investigated in this study. Then, a literature review is conducted for each shared transportation service to determine what factors influence demand. Some factors that are important from the author's view but have not been well investigated in the literature are considered in this research. After that, in the methodology section, a suitable method is selected according to the research questions and the purpose of the research. Then, in the implementation of the method, the various stages of the performance of the selected method are explained. Next, the process of data selection and description of the obtained data is done in the experimental activities section. After this, the results obtained from the methods are given in the results section. Finally, in the end, a review of the key obtained conclusions, recommendations to government members and operators, limitations of the study, and suggestions for future studies are provided. The overall structure of the study is illustrated in Figure 1.

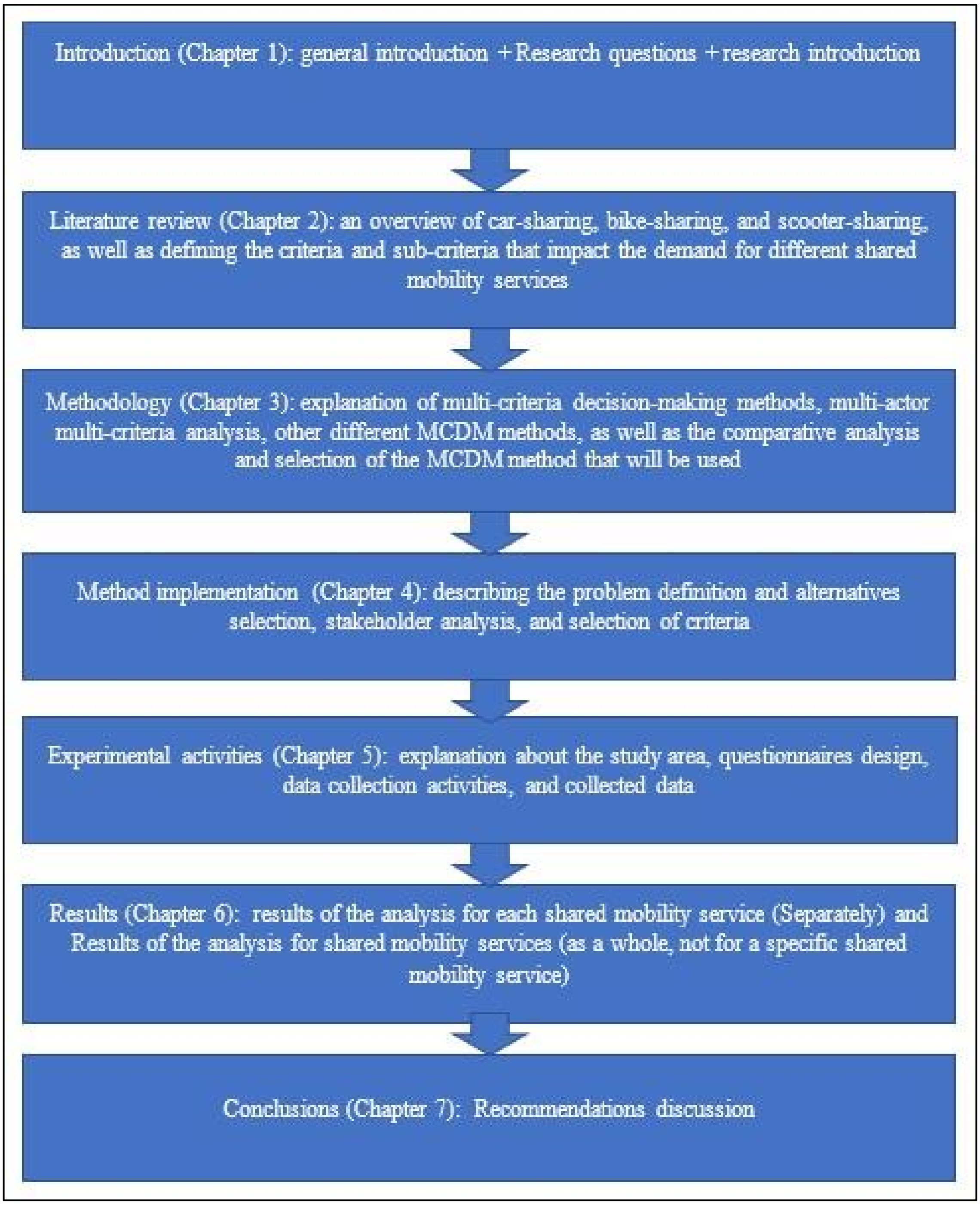

Figure 1: Structure of the study.

Chapter 2

Literature Review

According to the research questions and purposes of this study mentioned in Chapter 1, this section aims to deliver an overview of car-sharing, bike-sharing, and scooter-sharing services to understand better the important criteria and sub-criteria that can affect each of these shared mobility services. The reasons for placing the sub-criteria in each criterion are based on the literature, the author's knowledge, as well as the similar characteristics of those sub-criteria.

2.1 An overview of car-sharing

The car-sharing system and its benefit are explained in Chapter 1. This section provides an overview of car-sharing services to understand better the important criteria and sub-criteria that can affect car-sharing usage. In this regard, explanations about the history, trends, classification, interaction with other modes of transportation, factors affecting demand, interaction effects among different factors, and a summary of the description are provided as follows.

2.1.1 History and trends of car-sharing systems

Technological advances help expand the concepts of a shared economy, a developing phenomenon that favors the shift from private to service (shared mobility) (Vosooghi et al., 2017). Technologies such as social networking, location-based services, the Internet, electric vehicles, access to keyless vehicles, in-car navigation systems, and mobile GPS allow operators and users to track the location of the car (Kaspi et al., 2014; Shaheen and Chan, 2016) have played an essential role in the growth of the car-sharing system over time (Morency et al., 2015; Shaheen et al., 2016; Becker et al., 2017a; Lempert et al., 2019; Standing et al., 2019). According to Shaheen et al. (1999), the first shared vehicles were mainly created for economic reasons. These origins can be traced back to 1948, when the Sefage Cooperative launched its services in Zurich, Switzerland. Elsewhere, a series of "public car" tests were unsuccessful. Amongst these failures was the Procotip, a car-sharing initiative launched in 1971 in Montpellier, France. Another case was Witkar, which was settled in Amsterdam in 1973. However, the experience gained from failures and advances in communication technology launched several successful programs in the 1980s. These included Mobility Car-sharing in

Switzerland and Stattauto in Germany. It was initially anticipated that car-sharing would not work in the United States because, as Fishman and Wabe (1968) noted, 'American cities have, with almost no exception, become "motor" cities – adapted to the owner-driver form of transport.' Hence, car-sharing schemes only appeared under the Mobility Enterprise program in the 1980s.

Compared to early European users, those living in the United States prefer convenience to affordable prices, probably owing to inexpensive driving in the United States (Lane, 2005). In the 1990s, shared vehicles became prevalent in the United States. Several experimental programs were performed to understand how to run and operate this system. These comprise Carlink I and II at the Bay Area Rapid Transit station in Dublin-Pleasanton, ZEV.NET at the University of California, Irvine, and UCR Intellishare at the University of California, Riverside (Shaheen et al., 2000; Shaheen and Wright, 2001). These programs brought insights into user behavior in shared vehicles and assessed the feasibility of these systems as a business. Therefore, in many countries such as Japan, the United States, and Singapore, the natural progression toward commercializing this concept was predicted (Kek et al., 2006). Although the first car-sharing partnership was launched in 1948 (Shaheen et al., 1999; Shaheen and Cohen, 2007; Becker et al., 2017a), the car-sharing system has only expanded in recent years (Morency et al., 2015; Clewlow, 2016; Lempert et al., 2019), and has become a common mode of transportation around the world (Shaheen and Cohen, 2007; Costain et al., 2012), even in Italy (Rotaris et al., 2019). Ceccato's (2020) study in Turin, Italy, concluded that people who used car-sharing were satisfied with the service and wanted to use it in the future. Especially on congested streets, car-sharing appeared to be attractive for city travel.

It should be noted that car-sharing systems are different from traditional car rentals because car-sharing services can provide short-term access (Lagadic et al., 2019). Rates are measured in minutes or hours (Ciari et al., 2015), not days or weeks (Del Mar Alonso-Almeida, 2019). In addition, in the car rental process, cars are borrowed on a contract basis and are picked up from centralized and staffed locations for each rent (Stillwater et al., 2008). Conversely, in most car-sharing programs, a single contract is set up at the subscription stage (Ceccato, 2020), and shared cars are reserved and picked up directly by the user (Shaheen et al., 2006; Stillwater et al., 2008; Shaheen and Chan, 2016; Terrien et al., 2016; Juschten et al., 2017). Shaheen et al. (2015) define a car-sharing system as short-term access to a car among members who share a fleet of cars that a third-party organization maintains, operates, and ensures. In a car-sharing system, users usually have vehicle access by booking them via smartphones or simply picking up units on the street. Due to real-time vehicle tracking, service providers do not need to do the matching. Car-sharing operators provide car-sharing services, cars, and maintenance (Huwer, 2004; Shaheen et al., 2006: Kim et al., 2017a; Mounce and Nelson, 2019). The car-sharing travel cost is calculated based on the trip (Ferrero et al., 2018). It depends on the use of the car (Efthymiou et al., 2013; Jian et al., 2017), especially the distance and/or travel duration (Huwer, 2004; Stillwater et al., 2008; Efthymiou and Antoniou, 2016; Juschten et al., 2017). Depending upon the business model, the cost entails insurance, maintenance, parking, membership costs, fuel, and congestion pricing (Stillwater et al., 2008; Efthymiou et al., 2013; Shaheen and

Cohen, 2013; Ciari et al., 2015; Shaheen and Chan, 2016; Efthymiou and Antoniou, 2016; Kim et al., 2017a; Del Mar Alonso-Almeida, 2019).

2.1.2 Car-sharing classification

Car-sharing is not a univocal concept. Different systems can have widely different travel demand characteristics, ambits of application, and impacts according to their operational scheme. Therefore, it is important to consider the different variants implemented in urban areas worldwide. Car-sharing business models can include four groups: Peer-to-Peer (P2P), Business-to-Business (B2B), Business-to-Customer (B2C), and Business to Government (B2G) (Shaheen et al., 2019).

2.1.2.1 Peer-To-Peer (P2P)

Peer-to-Peer (P2P) is a car-sharing system in which car owners can rent their cars to others when they are not using them (Balac et al., 2015; Li et al., 2018; Shaheen and Cohen, 2020). It is implemented through a technology platform provided by a facilitating company to bring the user and owner together and manage the reservation and payment process (Shaheen et al., 2015, 2018; Lagadic et al., 2019). The user can access the car through a specific device or face-to-face interactions with the owner (Lagadic et al., 2019). However, Calderón and Miller (2020) believe that this mobility alternative appears to be operationally different from car-sharing systems. The P2P model is highly flexible at a lower cost than other systems (Shaheen et al., 2018; Del Mar Alonso-Almeida, 2019). The operator does not bear the cost of maintaining and purchasing the fleet. Also, car owners do not spend to make their cars attractive and accept receiving low earnings from sharing their cars because they do not expect to profit (Dill et al., 2019). Besides, P2P car-sharing systems can overcome the geographical constraints of traditional car-sharing systems. In particular, to raise revenue, car-sharing operators typically focus their cars on areas with high potential demand, reducing access to other zones (Dill et al., 2019). Conversely, the cars in P2P are widespread throughout the city. Moreover, in a P2P system, the range of cars users can access is usually more remarkable than in other services (Shaheen et al., 2018).

2.1.2.2 Business-to-Business (B2B)

Business-to-Business (B2B) is another type of car-sharing in which the companies' employees are service members. The company or a third-party operator owns and/or manages the fleet (Lagadic et al., 2019). Thus, this model is characterized by employer-based usage, for example, for business travels (Fleury et al., 2017) instead of Business-to-Customer (B2C), which has personal usage (Clark et al., 2015).

2.1.2.3 Buyer-to-Customer (B2C)

In B2C systems, the operators offer public service (Lagadic et al., 2019). This service can be One-way or Round-trip (Le Vine, Adamou, and Polak, 2014, 2014b; Namazu and Dowlatabadi, 2018; Lempert et al., 2019).

2.1.2.3.1 Round-trip car-sharing system

The Round-trip or Two-way system encompasses home zone-based and Station-based (Efthymiou and Antoniou, 2016). In Round-trip Station-based services, users pick-up and return the car in the same reserved parking lot (Ferrero et al., 2018; Del Mar Alonso-Almeida, 2019), whereas, in the Round-trip Home Zone-based system, users pick-up and drop-off the car in the same zone of the city (Firnkorn and Shaheen, 2016). Round-trip car-sharing has been documented as a strategy to decrease car ownership and mileage in urban areas (Shaheen et al., 2015). It streamlines the operators' function as demand planning is for each car-sharing station (Jorge and Correia, 2013). Although daily re-balancing is less critical for service providers in this system, long-term fleet size decision-makers should pay close attention to users' demands that car-sharing stations must meet appropriately. One of this service's pros is its reliability concerning cars and parking space availability (Glotz-Richter, 2016) because car reservations are made (Le Vine and Polak, 2019).

2.1.2.3.2 One-way car-sharing system

The One-way or point-to-point car-sharing system is station-based and Free-floating (Martin and Shaheen, 2016; Del Mar Alonso-Almeida, 2019; Lagadic et al., 2019). The One-way station-based sharing system allows users to return the vehicle to a different car-sharing station from where it was picked up (Shaheen and Cohen, 2013; Guirao et al., 2018; Ferrero et al., 2018). In Free-floating programs, users can pick-up and drop-off the car anywhere in a service area (Becker et al., 2017a, 2017b, 2018; Ferrero et al., 2018). Free-floating is the newest and most flexible car-sharing system that operates without fixed stations or Round-trip requirements (Becker et al., 2017a). It has attracted private car owners and public transport users by providing fast and convenient motorization, especially for short trips (Vosooghi et al., 2017).

2.1.2.3.3 One-way vs. Round-trip

A car-sharing program has been proposed by some authors that can work with a Round-trip system under normal conditions and a One-way system for specific locations such as airports, which can create high demand (Jorge, Barnhart, and de Almeida Correia, 2015). According to Becker et al. (2017a), Station-based car-sharing is mainly used when individuals require a car. However, the Free-floating car-sharing system is chosen when it saves time compared to other alternative modes. The Free-floating car-sharing system is used for a much wider variety of trips than the Station-based car-sharing system. The Free-floating car-sharing system opens up car-sharing to One-way travel, i.e., to the airport or commute (Ciari et al., 2014; Le Vine, Lee-Gosselin, Sivakumar, and Polak, 2015; Becker et al., 2017a). Kaspi et al. (2014) mentioned that the total excess time users spend in the system can be decreased by 14% to 34% by incorporating the parking reservation policies in the One-way car-sharing system. Because of the added flexibility in the One-way car-sharing system, the number of trips generated by One-way car-sharing systems is three times greater than that of Round-trip systems in Zurich, Switzerland (Balac et al., 2015). Students also prefer the Free-floating sharing system to the station in Italy (Rotaris et al., 2019). Moreover, as the One-way system can make commuting more feasible, it increases service attractiveness (Ciari et al., 2014; Jorge, Molnar, and de Almeida Correia, 2015).

Accordingly, the Round-trip car-sharing market is relatively small and is mainly used for leisure, shopping, and sporadic trips (Barth and Shaheen, 2002; Martínez et al., 2017). A survey performed by Firnkorn and Müller (2011) in Germany confirmed this. The market share of

Car2go, a One-way car-sharing company, was approximately 0.37%, which is 25 times more than that of Round-trip car-sharing. Note, however, that this figure was counted based on the member subscriptions, not the number of active members. Moreover, in a study by Costain et al. (2012) in Toronto, Canada, the behavior of a Round-trip car-sharing company was examined. The results identified that the majority of trip purposes were shopping trips. The result endorsed the belief that the reasons for travel are limited.

2.1.2.3.4 Re-balancing issue

Notwithstanding that the Free-floating car-sharing service can entice more people, the uneven demand for this system raises re-balancing challenges for suppliers (Li et al., 2018). Intuitively, One-way trips inevitably cause some stations to be empty and others to become saturated, especially during peak hours. In order to overcome the imbalance problem, the dynamic pricing strategy has been explored as a potential solution (Ciari et al., 2015; Jorge, Molnar, and de Almeida Correia, 2015). Martínez et al. (2017) proposed a multimodal agent-based microsimulation for Lisbon, Portugal, and showed that 20% of travel requests were not made due to a lack of vehicle access. Correspondingly, the re-balancing problems are attributed to the demand for services during peak hours being three times higher than during off-peak hours. Hence, a One-way car-sharing system has brought about important operational challenges, such as parking management and car re-balancing (Shaheen et al., 2015; Brandstätter et al., 2016).

The Free-floating model can include a broader range of trip purposes than the Round-trip (Jorge and Correia, 2013; Jorge, Barnhart, and de Almeida Correia, 2015). However, due to the higher flexibility, the re-balancing vehicles for the Free-floating systems are more acute than their counterparts (Jorge and Correia, 2013; Jorge, Molnar, and de Almeida Correia, 2015; Terrien et al., 2016). Spatial imbalances are exacerbated because there are no restrictions on picking-up and dropping-off cars at stations. Spieser et al. (2016) proposed a policy re-balancing guide for operators, stating that re-balancing-added costs create a trade-off between financial viability and service quality. Weikl and Bogenberger (2013) mentioned that consumer-based re-balancing strategies are more prevalent than operator-based approaches in Free-floating services.

Concerning agent-based microsimulation, Li et al. (2018) presented a supply model of Free-floating car-sharing by considering the stock of cars in certain places. While it was assumed that users behave in a First-In, First-Out manner when faced with an under-supply situation, and individuals park their cars in determined locations. Likewise, in research by Ciari et al. (2014) in Berlin, Germany, it was determined that the Free-floating service operates well in complementing Station-based car-sharing systems. Also, a 30% shift from car to Free-floating car-sharing systems was observed.

Brendel et al. (2018) proposed a decision support system for vehicle relocation, containing forecasting, relocation, and communication components in the field of re-balancing. The Econophysics Method was applied to develop a System Energy Relocation Algorithm (SERA) that first detects cars located in places with low demand and places with a low supply of cars and afterward comes to the relocation decisions. Also, Wagner et al. (2016) proposed a method based on demand forecasting. A zero-inflated regression describes changes in demand levels by analyzing the key points of high activity across the city.

2.1.2.4 Business to Government (B2G)

In a B2G model, car-sharing operators provide transportation services to a government agency. Pricing may include pricing models, such as the per-transaction cost or a fee-for-service contract. It is important to note that B2G car-sharing services are usually offered by B2C service operators (Shaheen et al., 2019). Also, since the B2G model is rarely considered in the literature compared to other business models, it is not reviewed in this study.

2.1.3 Interaction with other modes of transport

Because of the increasing expansion of car-sharing programs, one of the main aspects of forecasting models is understanding the relationship between car-sharing systems and other means of transportation (Dias et al., 2017). The ability to demonstrate the nature of this relationship is significant, given the growing uncertainty of financial resources for transportation services and the lack of meaningful data presented by private ride-hailing services. Also, the analysis of complementary and alternative models can contribute to examining whether the car-sharing system complements or expands existing transport modes or competes with them for ridership. It can assist policymakers and urban planners in managing a wide range of mobility alternatives (Welch et al., 2018). Therefore, it is required to gain more in-depth insight into the relationship between car-sharing and other modes, especially public transport and private cars.

2.1.3.1 Public transportation and private cars

The Station-based car-sharing system appears to trigger more efficient car usage by gradually shifting away from private cars to active modes or public transport (Sioui et al., 2013; Becker et al., 2017a). In contrast, the Free-floating car-sharing system may decline public transport or active modes in favor of car trips (Firnkorn, 2012; Le Vine, Lee-Gosselin, Sivakumar, and Polak, 2015; Becker et al., 2017a). This change starts at a high level as the members of the Free-floating car-sharing system are frequent public transport users. Therefore, this system can complement public transport (shaheen and Wright, 2001; Huwer, 2004; Shaheen and Martin, 2010; Murphy, 2016; Clewlow, 2016; Becker et al., 2017a; Kim et al., 2017a). Ceccato's (2020) study in Turin, Italy, confirmed that the car-sharing service could complement public transportation services. Moreover, the car-sharing system raises public transport usage (Lempert et al., 2019). Also, the results of some other studies exhibited that there is a complementary relationship between car-sharing and public transportation systems (Cervero,2009; Zoepf and Keith, 2016), as they can provide both mobilities for individuals who do not own a private car (Douma et al.,2008).

From another standpoint, Kortum and Machemehl (2012) noted that high use of transit is one feature that raises the probability of the city supporting a successful car-sharing scheme. Car-sharing can respond to the first-mile/last-mile mobility demand (Shaheen and Chan, 2016; Lagadic et al., 2019). For instance, a Free-floating car-sharing system can be used as a last-mile connection as part of multi-leg multimodal trips and connect the public transport station and users' final destination (Shaheen and Chan, 2016; Le Vine and Polak, 2019). Also, the Free-floating car-sharing systems could fill the service gap left by public transport (Becker et al., 2017a). The car-sharing system can provide access to transit stations in areas where public transportation is not sufficiently developed, such as rural areas (Cooper et al., 2000; Rotaris and Danielis, 2018). Also, it can fill a mobility gap for places and times of day that are not served adequately by transit, such as in off-peak periods or on weekends (Millard-Ball, 2005). Correspondingly, De Luca and Di Pace (2015) revealed that when public transportation services are not efficient or guaranteed, the intercity car-sharing plan can complement the transportation systems.

Acheampong and Siiba (2019) found that dissatisfaction with public transport services lays the groundwork for car-sharing systems. It means relying on car-sharing systems alone to meet travel needs without having a comprehensive strategy to provide quality and cost-effective public transportation services can lead to unsustainable results. Moreover, Efthymiou and Antoniou (2014) indicated that people who use buses for social trips and those who spend much time traveling are not satisfied with the car-sharing scheme. Hu et al. (2018) stated that the car-sharing system appears to have more demand between 1.2 km and 2.4 km from the bus station. In a different light, Millard-Ball (2005) noted that public transportation could provide easy access to shared vehicles for passengers away from car-sharing locations. Flexibility in scheduling and destinations provided by the car-sharing system may be used as a service that supports the transit by car-sharing users, especially for discretionary trips (Cooper, 2000, Wang et al., 2017). In a study in Beijing, Yoon et al. (2017) found that individuals who use the buses or those traveling in a group are more likely to select the Round-trip car-sharing system. Morsche et al. (2019) found that public transport users were more likely to use flexible public transport options, while private car drivers were more likely to utilize car-sharing services in the Netherlands.

Wagner et al. (2015) found that short-distance transport complements car-sharing activities, while long-distance trains seem to be a substitution. Rotaris et al. (2019) mentioned that the car-sharing system mainly replaces private cars and, to some extent, public transport. Ceccato (2020) noted that the car-sharing system might replace trips made by employees and students on non-working days and weekdays in Turin, Italy. In addition, if the in-vehicle travel time factor in the car-sharing system is shorter than in public transportation, there may be a deviation from public transportation to the car-sharing system. Also, it was suggested that to prevent shifting from public transportation to the car-sharing system; policies should be considered to maintain short waiting times and low rates, such as raising transportation frequencies. In addition, public transportation speeds must be enhanced to compete with car-sharing speeds to reduce potential switches. In a study by Le Vine, Lee-Gosselin, Sivakumar, and Polak (2015), the P2P car-sharing system was identified as an alternative to public transportation. In contrast, the Round-trip car-sharing system complemented public transportation in London.

Furthermore, Ceccato (2020) pointed out a substitution relationship between the car-sharing system and subway or private cars in Turin, Italy. However, there was no relationship between the car-sharing system and the train, company, or school bus. On the other hand, waiting time is a factor that affects the shifting from public transportation to car-sharing systems. If the waiting time for public transportation is more than 3 minutes, favorable switch rates are expected in Turin, Italy. In addition, potential users are inclined to pay € 0.8 to avoid 4 min wait. In public transportation, a potentially low shift rate was observed for urban travel, i.e., for short and long distances, especially for less than 10-18 km. In addition, the cost of public transportation should be lower to avoid switching from public transport to car-sharing systems. Interestingly, Cervero (2003) mentioned that car-sharing systems are mainly not attractive in congested areas where transits provide services adequately, such as downtown.

According to Ceccato (2020), car-sharing programs can significantly decrease the number of car travels in Turin, Italy. Also, decreasing the cost of a car-sharing system could shift from private cars to a car-sharing program. In addition, the same impact could be enhanced by raising the cost of driving a private car, decreasing trip time by at least 3 minutes, or declining walking time to reach a shared car. Also, car-sharing can replace personal car trips less than 14 kilometers, even from outside the city and to destinations within the city. Nevertheless, potential users are inclined to walk 6 minutes to reach the shared car. Therefore, in order to increase car-sharing usage, the cost of a car-sharing scheme should not change, but parking fares should be raised.

2.1.3.2 Walking and bike

Lane (2005) noted that users of car-sharing systems that decreased their car ownership since joining the car-sharing system drive less (77%), ride bicycles, walk, transit, and use more taxis. It was also noted that members did not simply replace car trips with trips in car-sharing systems. Instead, users replaced car travel with a combination of transit, foot, taxi, and to some extent, bikes. Hence, it was concluded that the car-sharing system could complement walking and cycling trips, especially for inconvenient activities, by walk and cycling modes, such as night trips or carrying heavy loads (Cooper et al., 2000). Martínez et al. (2017) noticed that the car-sharing system is slightly faster on short trips (less than 3 km) than the walking mode. However, car-sharing has a significantly more significant advantage as the distance traveled increases. Approximately it is six times faster on long journeys (more than 15 km) than on foot. On the contrary, due to the attractiveness of the new car-sharing service in San Francisco, people were more inclined to use the car-sharing system in the first (Cervero, 2003) and second (Cervero and Tsai, 2004) years instead of walking and cycling. However, members of the car-sharing system were more likely to use walking and cycling than non-members in the fourth year (Cervero et al., 2006).

According to Ceccato (2020), the car-sharing system is not appropriate for very short trips, especially for a distance of fewer than two km and a trip time of fewer than 30 minutes. These trip types are usually carried out by cycle or on foot. In particular, trips up to 300 meters are made on foot, while the maximum trip distance by bike is 1.4 kilometers. Moreover, decreasing the cost of car-sharing trips and walking distance to reach the shared car may induce shifts from personal cars, cycling, and walking transport modes to the car-sharing system. Nonetheless, cyclists tend to walk up to 9 min, and they may decide to shift if they could decrease this travel time by at least 5 min compared to the walking time to reach their bicycles.

2.1.3.3 Taxi

Ciari et al. (2015) mentioned a negligible impact of car sharing on taxis in Zurich, Switzerland. However, Murphy (2016) showed that the car-sharing system is more likely to be substituted by taxi or car travel than transit travel. Martínez et al. (2017) mentioned that private cars are more cost-effective than the car-sharing program. Nonetheless, car-sharing systems outdo taxis in terms of travel costs. Because taxis are subject to night tariffs, but car-sharing systems are not. A study conducted in five North American cities by Martin and Shaheen (2016) figured out that members of the car-sharing system reduced taxi use by 42% to 64% after joining the car-sharing program. Also, Yoon et al. (2017) observed a considerable correlation between taxi and trip costs, indicating that the car-sharing system can be a competitive alternative mode of transportation for taxi users, especially when taxi fares are high.

On the other hand, some studies mentioned that the car-sharing system could complement taxis, which are more suitable for One-way travel and offer an option for individuals who cannot drive. Also, it can complement the cheaper rental car for long-distance travel (Millard-Ball, 2005). Efthymiou and Antoniou (2014) found that people who use taxis for social activities are more likely to use the car-sharing system in Greece.

2.1.4 Factors influencing demand for car-sharing system

As previously mentioned, five factors influencing car-sharing demand can be considered: socio-demographic characteristics of the traveler, trip-related features, car-sharing characteristics, built environment and land use characteristics, and attitudinal effects. These are separately considered in the following subheads. The previous work and methodology of examining socio-demographic factors for the car-sharing study are described in Appendix 1 as an example of the review process used in this study.

2.1.4.1 Socio-demographic characteristics influencing the demand for different car-sharing systems[1]

Socio-demographics refer to a combination of socio-demographic factors that define individuals in a particular group or population. The main socio-demographic factors mentioned in the literature and considered in this study include gender, age, educational level, occupation and economic status, household size, marital status, presence of children, and vehicle ownership status. These are, in fact, the most frequently investigated characteristics in the reviewed literature. These different social and demographic characteristics can help understand group members' commonalities (Burghard and Dütschke, 2019). The importance of socio-demographic factors is that they can be considered key drivers of mobility patterns and travel modes and can ascertain the diffusion of car-sharing services in the urban population (Prieto et al., 2017). Generally, a proper understanding of key demographic factors may help increase the

[1] Most of the contents of the present section/appendix have been published in Amirnazmiafshar, E., & Diana, M. (2022). A review of the socio-demographic characteristics affecting the demand for different car-sharing operational schemes. Transportation Research Interdisciplinary Perspectives, 14, 100616.

diffusion of car-sharing services (Millard-Ball, 2005). Focusing on the effect of users' socio-demographic factors on the choices of different car-sharing operational schemes can help offer suggestions for the planning and increasing demand for car-sharing operational schemes.

Car-sharing users appear to be a particular group concerning socio-demographics (Burghard and Dütschke, 2019). People's features, such as age and gender, can impact member behavior (Morency et al., 2012). The impact of the main socio-demographic characteristics on choosing different shared car systems is examined in the following subheads.

Some tables show the impact of the socio-demographic characteristics on the membership of shared cars, usage, or attitudes in each section. Also, the type of car-sharing services and any study-specific conditions are shown in the tables to identify the relationship between socio-economic characteristics and car-sharing demand. Besides, in some tables, the percentage of members belonging to a particular group or level in each study is specified, as the definitions in studies are different.

The tables are arranged according to the types of car-sharing services to make them easier to read. In the row of tables, first, studies on free-floating car-sharing are listed. Then, studies that have reviewed more than one type of car-sharing service are listed. Finally, studies examined other car-sharing services, including station-based (service type is not specified), one-way station-based, P2P, and round-trip station-based are listed.

2.1.4.1.1 Gender

One of the important factors that have been stressed in the previous literature is the gender factor. Table 1 lists the studies that concluded that either males or females tend to use car-sharing more consistently.

Table 1: The positive relationship of being a man or a woman with car membership, usage, or attitude.

Gender groups	% of members in this group	Car-sharing service type	Studied impact	Specific conditions	Geographic area	References
Male	63.6	Free-floating	Membership	-	Germany	Firnkorn and Müller, 2012
	70.0	Free-floating	Membership	-	Munich and Berlin, Germany	Kopp et al., 2015
	80.0	Free-floating	Membership		Zurich, Switzerland	Ciari et al., 2015
	70.0	Free-floating	Adoption	-	Based, Switzerland	Becker et al., 2017a
	60.0	Station-based				
	58.1	One-way station-based and free-floating	Switch from existing transport mode to car-sharing	-	Turin, Italy	Ceccato and Diana, 2021
	Unspecified	Station-based and free-floating	Switch from existing transport mode to car-sharing	-	Ghana, Sub-Saharan Africa.	Acheampong and Siiba, 2020
	84.6	Round-trip, free-floating	Membership	-	Berlin, Germany	Kawgan-Kagan, 2015
	Unspecified	Station-based	Frequency of use	-	North America	Morency et al., 2012
	74.2	Station-Based	Switch from existing transport mode to car-sharing	-	Shanghai, China	Hu et al., 2018
	Unspecified	One-way Station-based	Usage	-	Salerno, Italy	Cartenì et al., 2016

Gender groups	% of members in this group	Car-sharing service type	Studied impact	Specific conditions	Geographic area	References
	55.7	Round-trip	Switch from existing transport mode to car-sharing	-	Beijing, China	Yoon et al., 2017
	About 55.0%	P2P	Membership	-	Portland, USA	Shaheen et al., 2018
Female	63.0	Free-floating	Membership	-	Montreal, Canada	Wielinski et al., 2015
	51.0	Station-based				
	57.0	Round-trip	Membership	-	North America	Martin and Shaheen, 2011a
	Unspecified	Round-trip	Membership	New service	San Francisco, USA	Cervero, 2003

It can be seen that different studies led to different conclusions. It indicates that the gender dimension is intertwined with other elements that must be considered to clarify how gender affects car-sharing demand. The first group of studies showed that car-sharing members are predominantly male (Ciari et al., 2015; Firnkorn and Müller, 2012; Kawgan-Kagan, 2015; Kopp et al., 2015; Shaheen et al., 2018). Males are more likely to change from their existed mode of transportation to car-sharing (Acheampong and Siiba, 2020; Cartenì et al., 2016; Ceccato and Diana, 2021; Hu et al., 2018). Males are more receptive to shared car services, especially free-floating shared car schemes (Becker et al., 2017a). About 79% of free-floating service members were male in Turin, Italy (Perboli et al., 2017). In general, males are more interested in cars, technology, and innovation, of which the car-sharing system is an example (Kawgan-Kagan, 2020).

Similarly, in Zurich, Switzerland, males accounted for 80% of the free-floating service members (Ciari et al., 2015). Although males have a higher frequency of use, their trips are shorter (Habib et al., 2012). Moving from actual behaviors to attitudes, 84% of male users expressed interest in using car-sharing in a stated preferences survey conducted in Salerno, Italy. In addition, they raised their utility of switching from personal cars to shared cars (Cartenì et al., 2016). Morency et al. (2012) indicated that males are more inclined to choose station-based car-sharing than females in monthly usage. However, although the gender variable was significant in their study, this parameter's coefficient was somewhat minor. This reflects the significant but small impact of gender on station-based car-sharing demand. In Beijing, although males were more inclined to replace their current mode of transport with round trips, males and females did not exhibit markedly different behavior on the car-sharing choice for one-way trips (Yoon et al., 2017).

On the other hand, a handful of papers from North America reported higher membership rates for females. However, the observed gap was minimal in Martin and Shaheen (2011a). They focus on round-trip services only, compared to most previously mentioned studies, which often focused on the correlation between being male and more extensive free-floating services. In this regard, a study on the willingness to join the round-trip system found no gender differences (Kim et al., 2017). Cervero (2003) reported a much larger membership rate of females for a round-trip service in San Francisco, but this could result from the survey being conducted only one month after the service launch. In addition, this study is significantly older than the average and therefore refers to services whose features differ somewhat from the contemporary standard practice.

Only one study (Wielinski et al., 2015) reported an over-representation of female members of the free-floating system in Montreal, which is even more surprising since the gender distribution in the same city is usually almost the same for different services. Apart from this exception, about 75% of females chose free-floating services in Berlin, while about 80% of males did. However, there is a significant gap between females and males for round-trip car-sharing, while 35% of females chose round-trip car-sharing; this figure was almost 60% for males. Also, males and females have a similar interest in using e-car sharing. Approximately 80% of females chose Battery Electric Vehicles (BEVs), while 65% chose Internal Combustion Engine Vehicles (ICEVs) (Kawgan-Kagan, 2015). It indicates that females who chose car-sharing are more likely to use BEVs instead of ICEVs. However, males chose more ICEVs than BEVs (Kawgan-Kagan, 2015). Therefore, females seem more attracted to the more specific BEV systems than the ICEV system (Kawgan-Kagan, 2015; Kim et al., 2015). Del Mar Alonso-Almeida (2019) offered additional insights into the perceived value role in increasing female car-sharing demand.

To sum up, males positively correlated with the demand for car-sharing, especially the free-floating variant, while results are more mixed for round-trip services. However, females seem keener to choosing e-car-sharing systems. Besides, female car-sharing members in North American countries appear more inclined to choose car-sharing than female members in Europe.

2.1.4.1.2 Age

Many studies stated that car-sharing attracted more attention from younger members (Burkhardt and Millard-Ball, 2006; Ceccato and Diana, 2021; Ceccato, 2020; Firnkorn and Müller, 2012; Martin and Shaheen, 2011a; Vinayak et al., 2018). Table 2 lists studies stating that youngsters are more inclined to choose shared cars. Because different articles consider different definitions of youth, for each study, the age range with the highest percentage of membership distribution is presented in the first column of Table 2.

Table 2: The positive correlation between young age groups and car-sharing membership, usage, or attitudes.

Age groups (brackets or mean)	% of members in this group	Car-sharing service type	Studied impact	Specific conditions	Geographic area	References
25-54	77.0	Free-floating	Membership	-	Turin, Italy	Ceccato, 2020
18-34	93.0	Free-floating	Membership	New Service	Turin, Italy	Perboli et al., 2017
Mean age of 38.7	-	Free-floating	Usage	E-car-sharing	Germany	Burghard and Dütschke, 2019
Under 35	56.0	Free-floating	Membership	-	Germany	Firnkorn and Müller, 2012
Under 36	60.0	Free-floating	Membership	-	Austin, USA	Kortum and Machemehl, 2012
Under 36	50.0	Free-floating	Membership	-	Based, Switzerland	Becker et al., 2017a
25-44	73.8	Free-floating	Membership	-		

Age groups (brackets or mean)	% of members in this group	Car-sharing service type	Studied impact	Specific conditions	Geographic area	References
25-49	71.1	Station-based			Montreal, Canada	Wielinski et al., 2015
35-44	25.4	One-way station-based and free-floating	Membership, switch from existing transport mode to car-sharing	-	Turin, Italy	Ceccato and Diana, 2021
18-24	Unspecified	One-way station-based and free-floating	Membership	-	Seattle. USA	Vinayak et al., 2018
20-39	About 62.0	Station-based and free-floating	Membership	-	Montreal, Canada	Sioui et al., 2013
The 30s or 40s	Unspecified	Round-trip, one-way station-based	Membership	-	North America	Millard-Ball, 2005
18-25	Unspecified	Round-trip, one-way station-based, free-floating, P2P	Usage	In rural areas	Friuli-Venezia Giulia, Italy	Rotaris and Danielis, 2018
The Mid-30s	Unspecified	Round-trip and one-way station-based, B2B	Membership	-	North America	Brook, 2004
31-50	50.0	Station-based	Membership	-	San Francisco Bay Area, USA	Clewlow, 2016
25–39	55.0	Station-based	Membership	-	Philadelphia, USA	Lane, 2005
The 20s and 30s	77.9	Station-based	Membership, willingness to continue membership	BEV service	Seoul, South Korea	Kim et al., 2015
25-45	Unspecified	One-way station-based	Switch from existing transport mode to car-sharing	E-car-sharing	Salerno, Italy	Cartenì et al., 2016
20-35	56.0	One-way station-based	Interested in car-sharing	-	Beijing, China	Shaheen and Martin, 2010
20-40	67.0	Round-trip	Membership	-	North America	Martin et al., 2010
30-60	55.0	Round-trip	Membership	-	North American	Martin and Shaheen, 2011a
Mean age of 37.7	-	Round-trip	Membership	-	USA and Canada	Burkhardt and Millard-Ball, 2006
25-34	55.0	P2P	Membership	-	Portland, USA	Shaheen et al., 2018

A personal car is no longer a priority for adults, which can be considered a reason to attract young members to shared cars (Ceccato and Diana, 2021). This shift from car ownership to “cars as demand” is reinforced by the preference for more sustainable mobility practices (Ceccato and Diana, 2021; Kortum and Machemehl, 2012). For instance, 67% of car-sharing members in North America were between 20 and 40 years old (Martin et al., 2010). Also, in the San Francisco Bay Area, USA, the car-sharing system members are significantly younger than non-members. About 50% of members are in the age group of 31 to 50 years. However, this figure is around 37% for non-members (Clewlow, 2016). This may be because the employment rate among members is higher than among non-members, associated with a lower average age (Becker et al., 2017a). This is more the case in free-floating car-sharing than in station-based car-sharing (Becker et al., 2017a; Wielinski et al., 2015). For example, 73.8% of free-floating members were between 25 and 44 years old in Montreal, Canada. However, the 25 to 49 age group accounted for 71.1% of the members of station-based car-sharing, slightly less than free-floating. Approximately 93% of the members of free-floating car-sharing were between 18 and 34 years old in Turin, Italy (Perboli et al., 2017). Similarly, half of the free-floating car-sharing members in Basel, Switzerland, and 56% of members of the system in Germany were under 36 and 35 years old, respectively (Becker et al., 2017a; Firnkorn and Müller, 2012).

Car-sharing with Evs has a special added attraction for young couples with no private car. The same is true for young people who start a family and use car-sharing to complement their private car trips (Burghard and Dütschke, 2019). In rural areas, similar to urban areas, car-sharing users are young (Rotaris and Danielis, 2018). In Beijing, China, people encouraged to use car-sharing belonged to the younger age group of 20 to 35 years (Shaheen and Martin, 2010). Furthermore, 85% of 25–45-year-old people were satisfied using the car-sharing system in Salerno, Italy (Cartenì et al., 2016). Analogously, some research has shown that members of shared cars are in their late 20s and mid-30s (Brook, 2004; Lane, 2005) or are 20 to 39 years old (Kortum and Machemehl, 2012; Sioui et al., 2013) or in their 30s or 40s (Millard-Ball, 2005), or are 25 to 45 years old (Kopp et al., 2015). In Portland, USA, P2P service members are between 25 and 34 years old. In Switzerland, the effect of age in increasing car-sharing demand is maximized at age 35 (Juschten et al., 2017). Besides, the older age (55 years or older) in households without high income negatively affects the willingness to join a car-sharing program (Dias et al., 2017).

However, Cervero et al. (2007) mentioned that round-trip car-sharing usage increased with age in San Francisco, USA. Nevertheless, it is significant to stress that this study used the age factor as a numerical variable. However, in most other studies, age has been used as a class variable, making it possible to identify potential non-linear relationships. For instance, a study by Kim et al. (2015) found that 77.9% of e-car-sharing members were within the age group of the 20s and 30s in Seoul. Interestingly, the probability of switching from private cars to e-car-sharing among elders is higher than among younger ones. However, this seems to have happened because the survey is aimed at members of the electric vehicle-sharing program who have a strong will to change their transportation mode, not the general public. In essence, it can be indicated that most car-sharing users are young people, typically in their mid-20s to mid-30s. In addition, free-floating members appear to be slightly younger than station-based members. Also, it appears that in North America, the age of car-sharing members is a little older than the age of car-sharing members in other countries.

2.1.4.1.3 Education level

The most prominent feature of car-sharing members is their high education level (Burkhardt and Millard-Ball, 2006; Becker et al., 2017a; Ceccato, 2020; Firnkorn and Müller, 2012; Juschten et al., 2017; Kawgan-Kagan, 2015; Shaheen et al., 2018; Shaheen and Martin, 2010). Table 3 lists the papers that showed that well-educated background raises car-sharing demand. Different articles have different definitions of well-educated people. For each study, the educational background of the well-educated people with the highest percentage of membership distribution is specified in the first column of Table 3.

Table 3: The positive correlation between well-educated background and car-sharing membership, usage, or attitudes.

Education level	% distribution of the members	Car-sharing service type	Studied impact	Specific conditions	Geographic area	References
Master's degree or PhD	52.9	Free-floating	Membership	-	Turin, Italy	Ceccato, 2020
University degree or PhD	70.0	Free-floating	Usage	-	Munich and Berlin, Germany	Kopp et al., 2015
University or technical college	46.3	Free-floating	Membership	-	Germany	Firnkorn and Müller, 2012
Graduate degree	Unspecified	One-way station-based and free-floating	Frequency of use	-	Seattle. USA	Vinayak et al., 2018
Bachelor’s degree or higher	Unspecified	One-way station-based and free-floating	Usage	-	Seattle. USA	Dias et al., 2017
University degree (or equivalent)	75.0 70.0	Station-based Free-floating	Membership	-	Based, Switzerland	Becker et al., 2017a
Graduated from a university or technical college	66.7	Round-trip, free-floating	Membership, trip frequency	-	Berlin, Germany	Kawgan-Kagan, 2015
Bachelor’s degree **Postgraduate or advanced degree**	35.0 48.0	Round-trip One-way station-based	Membership	-	North America	Millard-Ball, 2005
Upper secondary education or higher	71.1	Round-trip, free-floating, and P2P	Membership	-	Switzerland	Juschten et al., 2017
Four-year or advanced college graduates	66.7	Round-trip and one-way station-based, B2B	Membership	-	North America	Brook, 2004
Bachelor's degree or higher	87.0	Station-based	Membership	-	Portland, USA	Cooper et al., 2000
Bachelor's degree or higher	Unspecified	Station-based	Membership	-	Quebec City, Canada	Coll et al., 2014
Above high school diploma	60.0	One-way station-based	Membership	-	Beijing, China	Shaheen and Martin, 2010
University education	Unspecified	Round-trip	Interested in car-sharing	-	Dublin, Ireland	Carroll et al., 2017
Bachelor's degree or higher	84.0	Round-trip	Membership	-	North America	Martin et al., 2010
Bachelor’s degree **Graduate or professional degree**	43.0 41.0	Round-trip	Membership	-	North America	Martin and Shaheen, 2011a
Bachelor’s degree **Postgraduate or advanced degree**	35.0 48.0	Round-trip	Membership	-	USA and Canada	Burkhardt and Millard-Ball, 2006
Bachelor's degree or higher	Unspecified	Round-trip	Interested in car-sharing	-	Shanghai, China	Wang et al., 2012
Postgraduate degree	Unspecified	P2P	Adoption	-	Paris, France; Madrid, Spain; Tokyo, Japan; and London, England	Prieto et al., 2017
Bachelor’s degree or higher	86.0	P2P	Membership	-	Portland, USA	Shaheen et al., 2018

A typical figure is that more than sixty-seven percent of members had a bachelor’s or advanced degree in North America. This rate is remarkably above the average education level of people living in the neighborhoods where the services are provided (Brook, 2004). Also, more than 80% of round-trip car-sharing members had a four-year college or advanced degree, while around 28% of all US citizens had a bachelor’s degree (Martin and Shaheen, 2011a).

Similarly, about 87% of station-based car-sharing members had a bachelor's degree or higher, while only 31% of Portlanders had a bachelor's degree (Cooper et al., 2000). This significant education gap may be because educated people are more adapted to using the internet, such as booking car-sharing, than others. In addition, these people are usually more prepared to adapt to a new lifestyle. It is also essential to state that well-educated individuals are associated with environmental awareness and calculate the car's actual costs rather than car-sharing (Coll et al., 2014). Besides, the education level is higher among frequent users of shared transport (Vinayak et al., 2018). The reason may be that educated decision-makers are more environmentally friendly and favor a new urban lifestyle. Millard-Ball (2005) suggested that more than one-third of members in North America have a four-year college degree, and about half possess a postgraduate or advanced degree. It is noteworthy that an online survey of shared car members was employed in this study. This survey results primarily represented well-educated members because they are likelier to use a personal computer. Round-trip car-sharing members are mostly highly educated (84% have a four-year college or advanced degree) in North America (Martin et al., 2010).

Beyond car-sharing membership, a high level of education can also increase car-sharing demand (Coll et al., 2014; Dias et al., 2017; Kopp et al., 2015). It is likely that highly educated people are more aware of this service and can leverage it through technology (Dias et al., 2017). This may show that being attracted to car-sharing may be based on a certain level of social awareness, not strictly an economic decision. Wang et al. (2012) noted that the tendency to use shared cars is directly related to the level of education. However, this study's distribution of academic achievement indicates that this sample had a higher level of education than the Shanghai population. This may be because the head of the household had filled out the mail survey, and they probably have the highest education in the household.

Shaheen et al., 2018 found that 86% of the P2P members had bachelor's degrees or higher. This may be because P2P car-sharing, like other shared mobilities, operates mainly in urban areas and larger cities where people with higher education live. However, surprisingly, Prieto et al. (2017) mentioned that having a higher education level, such as a postgraduate degree, had no impact on joining P2P car-sharing. This study noted that this is normal because P2P car-sharing is more compatible with many users. However, it should be noted that the education factor in this research is insignificant. Most people are looking to choose car-sharing to have a four-year college degree or higher, especially a postgraduate or advanced degree. Also, it appears that the education level of round-trip shared car users is less than that of other car-sharing service users.

2.1.4.1.4 Occupation and economic status

People's economic and social views can be an important factor influencing their attitudes in choosing a car-sharing program (Becker et al., 2017a). Most car-sharing members earn more than non-members, and most are employed. This may mean that the employee may choose car-sharing for work-related activities (Ceccato and Diana, 2021; Ceccato, 2020; Clewlow, 2016; Dias et al., 2017; Juschten et al., 2017; Kawgan-Kagan, 2015; Vinayak et al., 2018; Winter et al., 2017; Yoon et al., 2017). Table 4 lists studies that examined the impact of income levels on the membership and usage of car-sharing. It should be stated that there is a different perception of low, middle, or high income, and there are subgroups with distinct behaviors/preferences. Therefore, for each study, the income range for the designated income level (Low- or Moderate and Above-average or high), which has the largest share in the distribution of members, is specified in the second column of Table 4. The unit currencies of the countries listed in Table 4 have been converted to Euros per year for comparative purposes, although incomes in different countries have different purchasing powers.

Table 4: The positive relationship of occupation and economic status groups on car-sharing membership, usage, or attitudes.

Occupation and economic status groups	Average household income) (euro/year)	% distribution of the members	Car-sharing service type	Studied impact	Specific conditions	Geographic area	References
Above-average or high-income level	≥30000.0	77.0	Free-floating	Membership	-	Netherlands	Winter et al., 2017
	≥30000.0	About 48.0	Free-floating	Membership	-	Turin, Italy	Ceccato, 2020
	≥30000.0	About 48.0	One-way station-based and Free-floating	Membership	-	Turin, Italy	Ceccato and Diana, 2021
	≥82836.0	Unspecified	One-way station-based and free-floating	Membership	-	Seattle. USA	Vinayak et al., 2018
	≥82836.0	Unspecified	One-way station-based and free-floating	Membership	-	Seattle. USA	Dias et al., 2017
	Net household income ≥ 24000.0	About 50.0	Round-trip and free-floating	Membership	-	Berlin, Germany	Kawgan-Kagan, 2015
	Canada: ≥ 39767.0 USA: ≥ 82836.0	50.0	Round-trip, one-way station-based	Membership	-	North America	Millard-Ball, 2005
	≥ 82836.0	59.0	Station-based	Membership	-	San Francisco Bay Area, USA	Clewlow, 2016
	15000.0-25000.0	Unspecified	One-way station-based	Willingness to join	-	Greece	Efthymiou et al., 2013
	13255.0-26512.0	19.0	Round-trip	Membership	-	North America	Martin et al., 2010
	≥ 12240.0	About 16.0	Round-trip	Membership	-	Beijing, China	Yoon et al., 2017
	41420.0-62130.0	18.0	P2P	Membership	-	Portland, USA	Shaheen et al., 2018
Low- or moderate-income level	17800.0-44520.0	58.2	Station-based	Willingness to continue membership	BEV service	Seoul, South Korea	Kim et al., 2015
	15000.0-25000.0	Unspecified	Station-based	Willingness to join	-	Athens, Greece	Efthymiou and Antoniou, 2014
	Median Household income: 42420.0	Unspecified	Round-trip	Membership	-	San Francisco, USA	Cervero et al., 2007
	≤ 82840.0	68.0	Round-trip	Membership	-	North America	Martin and Shaheen, 2011a

Results from previous studies are somewhat mixed. In Salerno, Italy, nearly 80% of employed users were inclined to use the e-car-sharing service (Cartenì et al., 2016). Car-sharing members generally are from families where the number of employed people is above average, and they are from high-income households in Turin, Italy (Ceccato and Diana, 2021). Nonetheless, Martin and Shaheen (2011a) figured out that shared cars primarily served the middle class in North America. Nevertheless, in the latter study, more than 20% of the members of the shared cars earned $100,000 or more. In San Francisco, USA, the average annual income of round-trip car-sharing members was $ 57,000, higher than the city average, primarily since more than 90% worked in professional fields (Cervero and Tsai, 2004).

Similarly, some studies showed that members are mostly middle-to-higher-income in North America (Brook, 2004; Martin et al., 2010; Millard-Ball, 2005). However, it should be noted that Millard-Ball (2005) conducted an online survey of shared car members. The results of this survey are likely to over-represent the individuals with a high-income level because they are more inclined to use their personal computers. Shaheen et al. (2018) mentioned that P2P shared car members generally earned slightly more than the US population. For the most part, this result is general since P2P car-sharing, like many shared mobility systems, is built in large, higher-income cities. Similarly, in a study by Winter et al. (2017), this sample shows more educated people than the national average. The geographical limitations of this study could explain this problem in a sample of selected cities located in the metropolis of the Randstad region, which is more prosperous.

On the other hand, Kortum and Machemehl (2012) mentioned that families with higher income levels are less inclined to choose shared cars. They probably prefer their vehicles. Importantly, in this study income variable is insignificant. Hence, the direct relationship between membership and income may not be between the mode share and income.

The probability of using e-car-sharing is higher among lower-income groups than high-income individuals in Seoul. It may imply that the current economic advantages are unsatisfactory for this group (Kim et al., 2015). Also, in San Francisco, car-sharing trips declined as income levels raised (Cervero et al., 2007). It is significant to highlight that this study used the income factor as a numerical variable. Nevertheless, income has been used as a categorical variable in most other studies to make it more informative. This can help us identify which income group most members belong to, compare income groups, and discover potential non-linear relationships.

Similarly, Efthymiou and Antoniou (2014) suggested that low-to-middle-income individuals are more willing to join the car-sharing program in Greece. In this study, median-income respondents earning between € 15,000 and € 25,000 per year are more inclined to join the car. This may show that lower-income individuals find station-based car-sharing more expensive and prefer public transport or walking. Also, high-income individuals prefer to use their vehicles. It should be noted that the presence of children seems to decrease car-sharing use among families with low and middle earning levels (Dias et al., 2017). This could be because of financial hardship and the complexity of children's activities and travel patterns.

Overall, the income of people who want to use a car subscription is above-average, especially in a free-floating system. Indeed, it may not be easy to offer shared vehicles such as free-floating car-sharing in low-income neighborhoods because it may not be profitable for commercial operators. However, for people with lower-than-average incomes, car-sharing is attractive. These people seem to think purchasing and maintaining a personal car is expensive. However, they do require it for their causal travels. Therefore, it is likely that certain local circumstances, such as the availability and attractiveness of other travel means like public transport, may determine which social group tends to use shared cars.

Furthermore, it should be noted that the reasons high-income people are attracted to car-sharing can differ from those of low-income people. In this regard, Millard-Ball (2005) noted that individuals with various earnings stated various causes for utilizing shared cars. For instance, people who earned between $ 10,000 and $ 20,000 a year (4% of the sample) looked for trip comfort. People with incomes between $20,000 and $30,000 a year (7.7% of the sample) demanded acceptable trip costs, needed to carry their belongings, and were reluctant to use public transportation. People with income between $30,000 and $40,000 a year (11.3% of the sample) looked for acceptable trip costs. Finally, people earning more than $ 75,000 a year (35% of the sample) need a car for their destination and are looking for a low-cost means of transport. This shows that middle- to upper-income members can also be cost-sensitive people. Further, it is necessary to emphasize that their neighborhood's shared car system may not be conveniently provided.

2.1.4.1.5 Household size

Car-sharing users are in smaller households than the average (Ceccato and Diana, 2021; Ceccato, 2020; Kortum and Machemehl, 2012; Millard-Ball, 2005). Table 5 lists studies that showed a positive correlation between small household size and car-sharing use. In order to clarify the meaning of small household size, for each study, the household size considered to be small is specified in the first column of Table 5.

Table 5: The positive correlation between small household size and car-sharing membership, usage, or attitudes.

Average household size	Car-sharing service type	Studied impact	Specific conditions	Geographic area	References
About 2.5	Free-floating	Usage	-	Austin, USA	Kortum and Machemehl, 2012
About 2.4	Free-floating	Membership		Turin, Italy	Ceccato, 2020
Around 2.5	One-way station-based and free-floating	Membership	-	Turin, Italy	Ceccato and Diana, 2021
About 2.0	Round-trip, one-way Station-based	Membership	-	North America	Millard-Ball, 2005
1.8	Station-based	Membership	-	Portland, USA	Cooper et al., 2000

It is worth mentioning that if household income rises, the likelihood of buying a car-sharing subscription increases (Clewlow, 2016; Dias et al., 2017); this is associated with the number of employees in the house, a similar trend. However, the number of household members negatively impacts shared car use (Ceccato and Diana, 2021). This can indicate that shared car is utilized by employees living in low-size families. For example, in Portland, Oregon, the household size of station-based car-sharing members was 1.8 people per household, while the average city household was 2.23 people per household (Cooper et al., 2000). In Canada, the probability of car-sharing members living with someone else was 71%. However, that figure was 61% for US car-sharing members. Also, in North America, about 64% of members live with at least another individual, with a household mean of 2.02. In addition, about a quarter of families have children (Millard-Ball, 2005). Therefore, the car-sharing decline due to the average household size increase is probably due to the more significant number of children in larger families (Kortum and Machemehl, 2012). Because sometimes, the presence of children, especially among low-and-middle-income households, can be accompanied by decreased shared car membership. It is worth expressing that these results are based on only a few articles. Therefore, more research is required to add strength to the results.

2.1.4.1.6 Marital status

Many single-person households use car-sharing systems in Austin, USA (Celsor and Millard-Ball, 2007). Generally, the shared car is more appealing in places where the ratio of single-parent households is high (Carroll et al., 2017; Coll et al., 2014). Table 6 lists studies on the impact of being single on car use.

Table 6: The positive correlation between being single and car-sharing membership, usage, or attitudes.

Car-sharing service type	Studied impact	Specific conditions	Geographic area	References
Station-based	Intention to join car-sharing	-	Athens, Greece	Efthymiou and Antoniou, 2014
Round-trip	Membership	-	Dublin, Ireland	Carroll et al., 2017
Round-trip	Usage	-	USA	Celsor and Millard-Ball, 2007

Generally, married people are less inclined to utilize shared cars in Athens, Greece (Efthymiou and Antoniou, 2014). This may be because a married couple may commute to different workplaces, and both may use a personal car. Because using two shared cars or a private car and car-sharing can be very costly for them. For example, the husband/wife can take the wife/husband to the nearest public transport or workplace instead of the shared car.

It should be mentioned that only a few articles examine the impact of marital status on car-sharing demand. Therefore, more studies are needed to understand its effects on car-sharing demand, especially in free-floating and P2P services.

2.1.4.1.7 Presence of children

Some studies suggest that families with children are more inclined to opt for shared car schemes (Carroll et al., 2017; Coll et al., 2014; Rotaris and Danielis, 2018; Sioui et al., 2013). Depending on local conditions, this could be due to child seats in car-sharing vehicles. Indeed, some other studies have suggested that the presence of children may be associated with reduced car-sharing use (Kim et al., 2017; Kopp et al., 2015; Vinayak et al., 2018), especially among low- and middle-income households (Dias et al., 2017). This may occur because of the more complex travel-activity patterns created by children and also budget constraints. For instance, in Munich and Berlin, Germany, most car-sharing members did not have children (Kopp et al., 2015). Table 7 indicates a list of studies on the effect of the presence of children on car-sharing use.

Table 7: Effect of the presence of children on car-sharing membership, usage, or attitudes.

Presence of Children	Car-Sharing Service Type	Studied Impact	Specific Conditions	Geographic area	References
Positive	Round-trip, one-way station-based, free-floating, P2P	Interested in car-sharing	In rural areas	Friuli-Venezia Giulia, Italy	Rotaris and Danielis, 2018
	Station-based and free-floating	Membership	-	Montreal, Canada	Sioui et al., 2013
	Station-based	Membership	-	Quebec City, Canada	Coll et al., 2014
	Round-trip	Interested in car-sharing	-	Dublin, Ireland	Carroll et al., 2017
Negative	Free-floating	Membership	-	Munich and Berlin, Germany	Kopp et al., 2015
	One-way station-based and free-floating	Usage	-	Seattle. USA	Dias et al., 2017
	One-way station-based and free-floating	Usage	-	Seattle. USA	Vinayak et al., 2018
	Round-trip	Usage	-	Netherlands	Kim et al., 2017

Namazu et al. (2018) reported that the probability of being in the early stages of family formation among the early users of one-way car-sharing is higher than among round-trip car-sharing users. However, the survey data from this study is not enough to clarify whether users of one-way shared cars become round-trip shared car users when they have children.

2.1.4.1.8 Vehicle ownership

In most cases, the mean number of cars in each family among the members of the car-sharing systems is less than among non-members (Becker et al., 2017a; Catalano et al., 2008; Ceccato and Diana, 2021; Ceccato, 2020; Cervero et al., 2007; Clewlow, 2016; De Luca and Di Pace, 2015; Efthymiou and Antoniou, 2014; Habib et al., 2012; Juschten et al., 2017; Namazu et al., 2018; Nobis, 2006; Wang et al., 2012; Wang et al., 2017). Table 8 shows a list of studies showing the positive correlation between the low level of vehicle ownership and the use of shared cars.

Table 8: Positive correlation between low vehicle ownership and car-sharing membership, usage, or attitudes.

Average household vehicle ownership (vehicle/household)	Car-sharing service type	Studied impact	Direction of causation	Specific conditions	Geographic area	References
1.4	Free-floating	Membership	Exogenous	-	Turin, Italy	Ceccato, 2020
1.0	Free-floating	Usage	Exogenous	E-car-sharing	Germany	Burghard and Dütschke, 2019
Average car per adult: about 0.4	Free-floating	Membership	Exogenous, Endogenous	-	Munich and Berlin, Germany	Kopp et al., 2015
1.1	Station-based and free-floating	Membership	Exogenous, Endogenous	-	California, USA	Mishra et al., 2019
0.1	Station-based and free-floating	Membership	Exogenous, Endogenous	-	Montreal, Canada	Sioui et al., 2013
Households with one or two vehicles	One-way station-based and free-floating	Membership	Exogenous	-	Turin, Italy	Ceccato and Diana, 2021

Average household vehicle ownership (vehicle/household)	Car-sharing service type	Studied impact	Direction of causation	Specific conditions	Geographic area	References
Households with zero or one vehicle	One-way station-based and free-floating	Usage	Exogenous	-	Seattle. USA	Dias et al., 2017
0.4 **1**	Round-trip- Free-floating	Membership	Endogenous	-	Vancouver, Canada	Lempert et al., 2019
About 0.8	Round-trip					
0.9	One-way (Mainly free-floating, partially Station-based)	Membership	Exogenous	-	Vancouver, Canada	Namazu et al., 2018
About 1.2	Round-trip, free-floating, and P2P	Membership	Exogenous	-	Switzerland	Juschten et al., 2017
Unspecified	Station-based	Membership	Exogenous	-	Athens, Greece	Efthymiou and Antoniou, 2014
About 0.6	Station-based	Membership	Exogenous	-	San Francisco Bay Area, USA	Clewlow, 2016
About 0.5	Station-based	Membership	Exogenous	-	San Francisco, USA	Ter Schure et al., 2012
About 0.7	Station-based	Membership	Exogenous	-	Montreal, Canada	Habib et al., 2012
About 0.2	One-way station-based	Membership	Exogenous	-	California, USA	Mishra et al., 2015
Less than about 0.8	One-way station-based	Membership	Exogenous	-	Salerno, Italy	De Luca and Di Pace, 2015
About 0.7	Round-trip	Usage	Exogenous, Endogenous	-	USA	Celsor and Millard-Ball, 2007
About 0.2	Round-trip	Membership	Exogenous, endogenous	-	North America	Martin et al., 2010
Households with zero or one vehicle	Round-trip	Membership	Exogenous	-	North America	Martin and Shaheen, 2011a
Households with zero or one vehicle	Round-trip	Membership	Exogenous, Endogenous	-	San Francisco, USA	Cervero et al., 2007
0.3	Round-trip	Membership	Endogenous	-	San Francisco, USA	Cervero and Tsai, 2004

To clarify the meaning of low ownership level, for each study, the vehicle ownership range considered a low level of vehicle ownership is specified in the first column of Table 8. It is important to note that vehicle ownership, unlike the previously reviewed socio-economic factors, can be seen as an exogenous variable (thus impacting car-sharing demand) and an endogenous variable (since car-sharing might impact vehicle ownership levels). It is important to distinguish the two opposite directions of causation from a transport policy viewpoint, although the literature does not focus adequately on such aspects. Therefore, the fourth column in Table 8 indicates whether vehicle ownership levels are considered exogenous, endogenous, or (perhaps more realistically) a mix.

Some studies have shown that vehicle ownership affects car-sharing demand. For example, in San Francisco in 2010, the average vehicle ownership for station-based car-sharing members was 0.47 vehicles per household, and for non-members, 1.22 vehicles per household (Ter Schure et al., 2012). The explanation that can be given is that most of the decline in vehicle ownership seems to be related to shifting to walking, cycling, and transit and shortening the average daily travel distance. Similarly, in Montreal, Canada, car-sharing members own fewer private cars than average (Sioui et al., 2013). Besides, in the US, households without vehicles or one vehicle have the highest rate of shared car use (Celsor and Millard-Ball, 2007). Regardless of residential density, the high level of vehicle ownership adversely influences one-way station-based and free-floating shared car usage (Dias et al., 2017). Probably, it is more comfortable and cost-effective for individuals to use personal cars than shared cars.

In general, the mobility behavior of car-sharing system members is more sustainable, and they are more multimodal than non-members (Becker et al., 2017a; Clewlow, 2016; Costain et al., 2012; Wang et al., 2017). Car-sharing is generally accepted by people who reside in families with fewer personal vehicles than non-members (Chicco et al., 2020). In this regard, Clewlow (2016) figure out that in city regions, members of station-based car-sharing own fewer cars (0.58) than non-members (0.96). It was shown that car-sharing system members have only made up 41.5% of their private cars' travels, but this figure is 61.8% for non-members. Also, car-sharing members have carried out about 15% of their travels in transit and around 35% of their travels on foot. However, these figures for non-members are 10.3% and 23.0%, respectively. Hence, car-sharing is linked to multimodal travel behavior. This effect looks greater for the station-based shared systems members (Namazu et al., 2018). Also, shared car members are more inclined to own cars with low carbon footprints (Kawgan-Kagan, 2015). Also, they are more inclined to have more sustainable car technologies. The portion of Ev's use is remarkably more among car-sharing members. Besides, about one-fifth of cars owned by car-sharing members were hybrid, plugin hybrid, or BEVs, while the diffusion rate of such vehicles among non-members is halved (Clewlow, 2016). This may indicate a possible link between membership in car-sharing and environmental attitudes.

In a study by Chicco et al. (2020), it was noted that in Frankfurt, Germany, people who chose both free-floating and station-based programs had less private car ownership than people who utilized only the free-floating service. Further, it was stated that in the Brussels Capital Region, the round-trip service members have five times fewer private cars than free-floating service members. Around 62% of round-trip car-sharing system members in the USA are from households that did not have a private car when joining car-sharing, and 31% of members had only one car. Therefore, more than 90% of them did not have more than one car (Martin and Shaheen, 2011a).

Some studies have indicated the effects of shared cars on car ownership. For example, in Montreal, Canada, car usage by people, who did not have a vehicle and used shared cars more than 1.5 times a week, was 25% lower than vehicle owners. This difference arises with a reduction in the frequency of car-sharing services usage (Sioui et al., 2013). This confirms the remarkable effect of car-sharing usage. Furthermore, round-trip car-sharing service usage sometimes decreases car ownership and use (Celsor and Millard-Ball, 2007). In North America, around one-third decline in the mean car kilometers traveled before and after joining the round-trip car-sharing program was observed. This figure was 6468 km per year for the former and 4729 km per year for the latter (Martin and Shaheen, 2011b). This reduction of about 1740 km per year means a 27% reduction in the driving distance before and after. In North America, round-trip car-sharing members' vehicle ownership dropped dramatically from around 0.47 cars per household to about 0.24 cars per household (Martin et al., 2010). Hence, the car-sharing service can facilitate a reduction in ownership of household vehicles as this service dramatically eliminates the need for a personal vehicle to complete travel. That way, car-sharing can only provide a car to a member if needed. Out of every 25 households joining round-trip car-sharing, six would shed off their private car within two years in San Francisco (Cervero and Tsai, 2004). The comfort of having access to a fleet of cars on demand may encourage some car owners to dispose of their second vehicles and give up car ownership altogether.

Similarly, Becker et al. (2017a) indicated that half of the comparison group members used their vehicles at least once weekly. However, it is 14% for free-floating shared car system members and 4% for station-based shared system members. It seems that members of different shared car system types belong to different households. Moreover, the motivation of the round-trip members is more for financial and environmental reasons. On the other hand, one-way shared car members are more motivated with more convenience and safety. In addition, members of one-way car-sharing consider car-sharing as an alternative to ride-hailing systems like Uber or Lyft. Round-trip members, however, see the shared car as a substitute for car ownership and a way to travel out of the city (Lempert et al., 2019).

Looking at different geographic areas, if station-based car-sharing programs were available in China, a small percentage (11%) of households with a private car would tend to shed one. This ratio is lower than that of previous European and North American research. However, those who want to buy a private car in the short term, within one year to three years, consider car-sharing because most of them tend to give up their purchase plans (Wang et al., 2012). Therefore, car-sharing in China seems to be more effective in preventing the purchase of vehicles than car-shedding. Car-sharing, especially free-floating services, may significantly influence postponing the purchase of additional private cars in Italy. However, in the Brussels Capital Region, members of free-floating car-sharing services did not necessarily see the service as a replacement for their private car but as a supplement (Chicco et al., 2020). In this regard, it should be stated that free-floating shared car members are more likely to agree that the personal vehicle is a symbol of status (Burghard and Dütschke, 2019).

The free-floating shared car program influenced the car ownership of 37% of users in London. Of this 37%, most users (83%) reported not wanting to purchase a private vehicle after car-sharing. Furthermore, 11% stated that they had not used their vehicle in the previous three months, and 6% indicated that they would sell their vehicle within the next three months (Le Vine and Polak, 2019). However, 63% of members stated that the car-sharing system did not influence their car ownership status. Some concerns can be raised because Le Vine and Polak (2019) surveyed users only three months after introducing the free-floating system in London. Users may change their minds after a while. Hence, these results may not reflect their actual long-term behavior. Also, most of that 37% of users probably did not own a private car.

There seems to be a complex two-way relationship between shared car membership and owning a car. For instance, in a survey by Martin et al. (2010), approximately 30% of respondents noted that they had joined car-sharing to throw away their cars or avoid purchasing an extra car. This highlights the influence of shared cars on vehicle ownership status. This group can be extended to suburban residents who do not access shared cars in their neighborhoods but utilize car-sharing when visiting city centers or workplaces. On the other hand, about 50% of respondents stated that they did not have a vehicle and had joined a shared car program to access the vehicles. This determines that the strength of the relationship is in the opposite direction. There may be a hypothesis that car-sharing affects increased driving and travel but does not reduce vehicle ownership. The second group of members joins the shared cars to reduce car ownership; however, further research is required to address such heterogeneity.

Some studies, such as Martin et al. (2010) and Firnkorn and Müller (2012) on the impact of car-sharing causality, have been conducted according to surveys of shared car members. The research addressed the two-way relationship between car ownership and car-sharing. Therefore, they try to control the reverse causality bias by examining the number of people's cars before registering in the shared car program and then the number of their cars after registration. The research did not evaluate impacts by comparing the changes with a comparison group. Instead, they assessed the impacts by asking respondents to describe their decision to car-shed and sign-up for car-sharing. For instance, in a study by Firnkorn and Müller (2012), car-sharing members were asked to explain whether their decision to eliminate or ignore future car purchases was taken because of using shared car programs or other reasons. Some studies have inferred causal impacts by comparing the trip behavior of members with non-members (Kopp et al., 2015; Sioui et al., 2013).

Moreover, to draw causal inferences, Cervero et al. (2007) compared the trip behavior of the members of shared car programs with those of individuals who requested to be part of a car-sharing scheme but were not yet (control group). It turned out that members of round-trip car-sharing avoid using personal cars almost 12% more than non-members. A decrease in car possession can accompany membership and a decline in car possession with more shared car travels.

Mishra et al. (2015) applied a survey to investigate the effects of shared cars on trip behavior. Propensity score matching was utilized to control the self-selection bias resulting from the observed differences. Each member has matched non-members with the same person and family demographics and lives vicinities with an analogous built environment. Vehicle ownership of members is significantly less than that of non-members. This difference also increases with the desire to register a car-sharing. However, there is a simultaneity bias in this study. Also, there is possibly the self-selection bias that differences in unobserved features may cause. Hence, this study cannot claim that car-sharing can cause the observed differences in trip behavior between matched pairs.

Mishra et al. (2019) estimated the car-sharing impact on car ownership and current members' trip behavior using the California household travel survey database. However, in this study, the surveys have not explored the features of trip behavior, particularly the chronology of events that might result in inverse causation.

To sum up, round-trip shared car service members may follow a more efficient and sustainable lifestyle than the one-way shared car system members. Sometimes, this difference can be significant, especially in China, where the effect of choosing car-sharing is more to prevent purchasing a new car than to reduce car ownership. For instance, a study conducted in Beijing, China, indicated that car ownership positively affects the number of one-way trips and negatively influences the round-trip travel numbers (Yoon et al., 2017). Generally, people attracted to the station-based shared car program have less vehicle ownership than those attracted to the free-floating shared car program. Besides, station-based shared car members can decrease vehicle ownership more than free-floating shared car members. Also, it should be stressed that the mean number of cars per family for car-sharing members in North America seems lower than in Europe.

Generally, most studies have focused on the effect of vehicle ownership on shared cars. However, further research on this two-way relationship is needed to have a deep insight into the direction of causation between shared cars and car ownership and consequently assess the sustainability of shared cars.

2.1.4.2 Trip-related characteristics

Trip-related characteristics such as travel time, departure time, travel purpose, and travel distance can play an essential role in the car-sharing demand rate.

2.1.4.2.1 Travel time

Whenever car-sharing users save significantly on trip time, they are willing to pay market prices for these advantages (Cervero, 2003; Carroll et al., 2017). The longer the travel time, the less satisfaction (Catalano et al., 2008; Efthymiou et al., 2013). Time pressure has an adverse effect on encouraging people to choose a shared car in the Netherlands (Kim et al., 2017c). Private cars are generally less time-consuming than car-sharing systems. Nonetheless, car-sharing services can outperform the subway, buses, and walking in terms of travel time (Martínez et al., 2017). Table 9 documents the positive impact of shorter travel time on car-sharing usage.

Table 9: The positive correlation between shorter travel time and car-sharing usage.

Car-sharing service type	Geographic area	References
One-way station-based	Greece	Efthymiou et al., 2013
One-way station-based	Palermo, Italy	Catalano et al., 2008
Round-trip	Netherlands	Kim et al., 2017c
Round-trip	Dublin, Ireland	Carroll et al., 2017
Round-trip	San Francisco, USA	Cervero, 2003

2.1.4.2.2 Travel distance

According to Li (2019), the car-sharing choice can vary depending on the travel distance. For example, the value of travel time savings (VTTS) for car-sharing in China is about \$3.3 per hour for middle-distance travel (2 km to 5 km) and \$12.2 per hour for long-distance travel (beyond 5 km). Hence, VTTS typically increases with travel length. Besides, to enhance car-sharing service usage, policies should focus on saving users' travel time for longer trips and saving users' travel costs for short trips. For example, the propensity for choosing car-sharing rises with trip length in Lisbon, Portugal (Martínez et al., 2017). It means that the longer the trip, the more likely people are to choose a car-sharing system. Similarly, individuals interested in car-sharing services have long commutes in Shanghai, China (Wang et al., 2012). However, in Toronto, car-sharing has played a role in increasing short-distance auto urban trips (Costain et al., 2012). Besides, car-sharing members usually have shorter commutes than most individuals living in the same area. Households living near their workplace mostly use the car-sharing program (Martin and Shaheen, 2011a). Table 10 shows the positive effect of different trip distance ranges on car-sharing usage.

Table 10: The positive relationship between different trip distance ranges and car-sharing usage.

Trip distance ranges	Car-sharing service type	Geographic area	References
Long	One-way station-based	Lisbon, Portugal	Martínez et al., 2017
	One-way station-based	Taiyuan, China	Li, 2019
	Round-trip	Shanghai, China	Wang et al., 2012
Short	One-way station-based	Taiyuan, China	Li, 2019
	Round-trip	North America	Martin and Shaheen, 2011a
	Round-trip	Toronto, Canada	Costain et al., 2012

2.1.4.2.3 Departure time

Car-sharing systems are commonly utilized to travel during off-peak hours or weekends when transport services are inadequate and have low traffic (Costain et al., 2012). Their use is also related to trip purposes because shopping and leisure or social trips are often made during off-peak hours. Also, car-sharing systems are generally not utilized during peak periods (Cervero, 2003). However, there was an insignificant correlation between peak-hour travel and demand for car-sharing services in Lisbon, Portugal (Martínez et al., 2017). It is important to stress that potential members do not utilize car-sharing services for systematic workday travel, even if the system is appropriate for urban trips on congested roads (short-distance and high-duration trips) (Ceccato, 2020). Table 11 covers the positive effect of travel on the rate of car-sharing use on weekends, during off-peak hours, or in the morning.

Table 11: The positive correlation between weekend traveling, off-peak hours, or in the morning and car-sharing usage.

Car-sharing service type	Geographic area	References
Free-floating	Turin, Italy	Ceccato, 2020
Round-trip	Toronto, Canada	Costain et al., 2012
Round-trip	San Francisco, USA	Cervero, 2003

2.1.4.2.4 Trip purpose

Car-sharing systems are more utilized for social, recreational, and personal business trips than non-discretionary trips such as trips to school or work in San Francisco (Cervero, 2003). The most common purpose of car-sharing users' travel is business activities in China (Wang et al., 2017). More than 84% of users traveling for non-working purposes were satisfied with car-sharing services in Salerno, Italy (Cartenì et al., 2016). Also, car-sharing is commonly utilized for non-compulsory trips such as shopping and leisure trips (Martin and Shaheen, 2011a; Kim et al., 2015). Users who do not have a car utilize the One-way car-sharing system to allow people to shop less, go to grocery stores less, and spend less time shopping (Le Vine, Adamou, and Polak, 2014).

Moreover, users who did not own a car were more likely to opt for Free-floating car-sharing systems for shopping purposes because the Free-floating cargo capacity system helps users carry bulky items (Le Vine and Polak, 2019). Finally, users are more likely to utilize BEV car-sharing for leisure trips than for commuting travels (Jin et al., 2020). Table 12 sets out two main trip purpose groups' impact on car-sharing use.

Table 12: Impact of different trip purpose groups to use car-sharing.

Trip purpose groups	Impact	Car-sharing service type	Geographic area	References
Social, Recreational, and Personal Business Trips, Shopping Trips, Non-working Trips, Non-commuting Trips	Positive Effect	Free-floating	China	Wang et al., 2017
		Free-floating	London, England	Le Vine and Polak, 2019
		One-way station-based	London, England	Le Vine, Adamou, and Polak, 2014
		One-way station-based	Salerno, Italy	Cartenì et al., 2016
		One-way station-based	Beijing, China	Jin et al., 2020
		Station-based	Seoul, South Korea	Kim et al., 2015
		Round-trip	North American	Martin and Shaheen, 2011a
		Round-trip	San Francisco, USA	Cervero, 2003
Non-discretionary trips such as travels to school or work	Negative Effect	Round-trip	San Francisco, USA	Cervero, 2003

2.1.4.3 Car-sharing characteristics

One of the most significant factors affecting car-sharing demand is the travel mode attributes, such as travel cost and comfort (Carroll et al., 2017). In a study considering the switching from private cars to EV car-sharing systems, the trip cost was the primary determinant of the selection process. In comparison, trip time changes did not significantly change the probability of switching from private cars to EV car-sharing systems (Cartenì et al., 2016).

The effect of the main car-sharing characteristics is reviewed in the following.

2.1.4.3.1 Travel cost

Trip cost is a significant factor in users' car-sharing choice behavior (Catalano et al., 2008; Lamberton and Rose, 2012; Carroll et al., 2017). Lower fares and more electric car supply can increase students who use car-sharing from 2% to 10-15% in Italy (Rotaris et al., 2019). Although travel time is statistically significant, travel cost had a much larger effect on car-sharing choices than travel time in Salerno, Italy (Cartenì et al., 2016). Similarly, travel costs were determined as important factors along with access time to car-sharing parking spaces, travel frequency, car availability, travel type (home-based), gender, and age in Salerno. Besides, changes in the car-sharing trip's cost had a much more significant impact on the likelihood of choosing a carpool than the probability of selecting a bus and private car (De Luca and Di Pace, 2015).

In both Round-trip and One-way travel, the cost gap (the cost of the original transport mode minus the car-sharing cost) significantly influences car-sharing choice. The consistency of the cost gap impact in One-way and Round-trip models emphasizes the significance of competitive fares for successful car-sharing systems (Yoon et al., 2017). More than 25% of those interested in the car-sharing program stated that if this system is reasonably priced, car-sharing usage will be considered by people in Beijing (Shaheen and Martin, 2010). Table 13 lists those studies documenting the positive impact of the low travel cost on car-sharing use.

Table 13: The positive correlation between the low travel cost and car-sharing use.

Car-sharing service type	Geographic area	References
One-way station-based	Palermo, Italy	Catalano et al., 2008
One-way station-based	Beijing, China	Shaheen and Martin, 2010
Round-trip	USA	Lamberton and Rose, 2012
One-way station-based	Salerno, Italy	De Luca and Di Pace, 2015
One-way station-based	Salerno, Italy	Cartenì et al., 2016
One-way and Round-trip	Beijing, China	Yoon et al., 2017
Round-trip	Dublin, Ireland	Carroll et al., 2017
Round-trip, One-way station-based, Free-floating	Rome and Milan, Italy	Rotaris et al., 2019

2.1.4.3.2 Travel comfort

Travel comfort can affect people's car-sharing choices, but only one study considered comfort an important factor in the USA's free-floating system (Schaefers, 2013).

2.1.4.4 Built environment and land use

Built environment and land use characteristics such as accessibility to car-sharing systems, fleet size, fleet age, and land use are the last factors considered in this review.

2.1.4.4.1 Land use

In general, many car-sharing members frequently use public transportation and live in medium to high-density areas (Cervero, 2003; Shaheen and Rodier, 2005; Burkhardt and Millard-Ball, 2006; Kortum and Machemehl, 2012; Kopp et al., 2015; Wagner et al.,2016; Dias et al., 2017; Namazu et al., 2018). Higher regional population levels are associated with more extended membership periods in the car-sharing program (Habib et al., 2012). According to Hu et al. (2018), an area with greater road density, a higher population density, or mixed land use is associated with higher car-sharing system use rates. Besides, stations around shopping malls, colleges, and transit hubs can attract more users to car-sharing. However, car-sharing stations are often oversupplied in transportation hubs. Also, car-sharing is more effective in areas with limited access to subway services. Millard-Ball (2005) stated that car-sharing is mainly concentrated in urban cores, and about 95% of the users are observed in these settings. A suitable environment for pedestrians, high density, and a combination of parking pressures and uses can contribute to car-sharing service success. It is important to consider that a private parking lot near the house severely negatively affects car-sharing system usage rates (Juschten et al., 2017; Ceccato and Diana, 2021). Table 14 presents the influence of two different land-use patterns on car-sharing usage.

Table 14: Impact of different land-use patterns to use car-sharing.

Land use patterns	Impact	Car-sharing service type	Geographic area	References
Living in Urban Cores, Medium to High Densely Populated Areas, Mix Land Use, Areas Where	Positive	Free-floating	Berlin, Germany	Wagner et al.,2016

Land use patterns	Impact	Car-sharing service type	Geographic area	References
Public Transportation Does Not Provide Service, Stations Around Shopping Malls, Colleges, And Transit Hubs		Free-floating	Munich and Berlin, German	Kopp et al., 2015
		Free-floating	Based, Switzerland	Becker et al., 2017a
		Free-floating	Austin, USA	Kortum and Machemehl, 2012
		One-way station-based and Free-floating	Seattle. USA	Dias et al., 2017
		Round-trip, One-way station-based, Free-floating	North America	Millard-Ball, 2005
		Round-trip, One-way (Mainly Free-floating, partially Station-based)	Vancouver, Canada	Namazu et al., 2018
		Station-based	Montreal, Canada	Habib et al., 2012
		Station-Based	Shanghai, China	Hu et al., 2018
		Round-trip	USA and Canada	Burkhardt and Millard-Ball, 2006
		Round-trip, One-way station-based, Business-to-Business (B2B)	San Francisco Bay Area, USA	Shaheen and Rodier, 2005
		Round-trip	San Francisco, USA	Cervero, 2003
Private Parking Lot Near the House	Negative	One-way station-based and Free-floating	Turin, Italy	Ceccato and Diana, 2021
		Round-trip, Free-floating, and Peer-to-Peer	Switzerland	Juschten et al., 2017

2.1.4.4.2 Accessibility

Ease of access is considered an important factor in car-sharing (Ciari and Axhausen, 2012). Also, there is an interrelationship between Station-based car-sharing systems and public transportation accessibility (Stillwater et al., 2008). In general, access to stations in terms of the distance between home/work and the nearest station is a dominant factor in joining a car-sharing program (Brook, 2004; Zheng et al., 2009; Costain et al., 2012). In addition, availability significantly influences the likelihood of using car-sharing (Kim et al., 2017b).

Most car-sharing system members have access to services from less than 1 km in Toronto, Canada (Costain et al., 2012). Increasing the number of stations within a 5 km radius of the household raises the likelihood of car-sharing membership in Switzerland (Juschten et al., 2017). Wider streets and regional rail access lead to lower demand rates in average monthly car-sharing usage hours. In contrast, the exclusive availability of light rail can lead to higher demand (Stillwater et al., 2008). Enacting active policies to limit private transport usage could raise car-sharing use by up to 10% in Palermo, Italy (Catalano et al., 2008). Table 15 details the impact of different accessibility conditions on car-sharing usage.

Table 15: Impact of different accessibility conditions to use car-sharing.

Accessibility condition	Impact	Car-sharing service type	Geographic area	References
Less Distance Between Home/Work and The Nearest Station, Shared Car Availability, High Number of Car-	Positive	Round-trip, Free-floating, and Peer-to-Peer	Switzerland	Juschten et al., 2017

Accessibility condition	Impact	Car-sharing service type	Geographic area	References
Sharing Stations, Higher Rates of Only Light Rail Availability, Limiting Private Transport Usage		One-way station-based	Palermo, Italy	Catalano et al., 2008
		Round trip and One-way station-based, Business-to-Business (B2B)	North America	Brook, 2004
		Round-trip	Toronto, Canada	Costain et al., 2012
		Round-trip	Madison, USA	Zheng et al., 2009
		Round-trip	USA	Stillwater et al., 2008
		Buyer-to-Consumer	Netherlands	Kim et al., 2017b
More street width and regional rail access	Negative	Round-trip	USA	Stillwater et al., 2008

2.1.4.4.3 Size and age of stations

Car-sharing station size substantially affects the availability and usage of car-sharing stations in Montreal, Canada. Also, larger stations have larger catchment basins than smaller ones and provide more vehicle options (De Lorimier and El-Geneidy, 2013). Although increasing the number of cars at stations does not necessarily affect member subscriptions, monthly usage increases (Habib et al., 2012). In addition, older car-sharing stations lead to higher demand for car-sharing systems (Stillwater et al., 2008). Table 16 lists papers assessing the positive effect of larger and older stations on car-sharing usage.

Table 16: The positive correlation between larger and older stations and car-sharing usage.

Car-sharing service type	Geographic area	References
Station-based	Montreal, Canada	De Lorimier and El-Geneidy, 2013
Station-based	Montreal, Canada	Habib et al., 2012
Round-trip	USA	Stillwater et al., 2008

2.1.4.5 Attitudinal effects (subjective factors)

Many studies have been done on the decision to use car-sharing for daily mobility. However, there are more opportunities to increase the behavioral realism of shared mobility choice models, and examining the impact of personal attitudes on mode choice decisions is one potential path. Regarding car-sharing choices, only a few recent studies have investigated the potential impact of a limited range of attitudinal factors, reviewed in the following subheads.

2.1.4.5.1 User satisfaction

User satisfaction with car-sharing services is considered an influential factor in their usage rates. People's satisfaction with their current travel patterns can significantly impact their intention to join a car-sharing program (Efthymiou and Antoniou, 2016; Kim et al., 2017b). Also, people who used car-sharing were satisfied with the service and wanted to use it in the future in Turin, Italy (Ceccato, 2020). Especially on congested streets, car-sharing appeared to be attractive for city travel. Besides, the expectation of perceived effort (e.g., degree of ease associated with use) could be one of the most influential psychological elements which can indicate the intention to use Business-to-Business (B2B) services (Fleury et al., 2017). Table 17 lists those studies that documented the positive effect of user satisfaction on car-sharing usage.

Table 17: The positive correlation between user satisfaction and car-sharing usage.

Car-Sharing Service Type	Geographic area	References
Free-floating	Turin, Italy	Ceccato, 2020
One-way station-based	Athens, Greece	Efthymiou and Antoniou, 2016
Buyer-to-Consumer	Netherlands	Kim et al., 2017b
Business-to-Business (B2B)	France	Fleury et al., 2017

2.1.4.5.2 Service awareness, environmental concerns, and social impact

Generally, individuals familiar with the car-sharing scheme are more likely to use it (Duan et al., 2020). Also, people aware of car-sharing are more likely to forgo private car purchases (Wang et al., 2017). The car-sharing choice was correlated with the attitude toward "Advocacy of car-sharing service" in Taiyuan, China (Li, 2019). Car-sharing use is also positively related to pro-environmental and privacy attitudes (Kim et al., 2017c). Pro-environmental and pro-technology attitudes positively correlate with car-sharing systems' perceived advantages (Acheampong and Siiba, 2020). The frequency of car-sharing usage rates was influenced by attitudes such as pro-environmental and neo-urban lifestyle preferences and socio-interactions (for example, people's behavior depends on their loved ones' behavior) in Seattle, USA (Vinayak et al., 2018). Furthermore, the social impact of car-sharing choices is important. The degree of social impact varies according to social relationships' strength in individuals (Kim et al., 2017a).

Table 18 illustrates the positive effect of high levels of environmental concerns and social impact on car-sharing use.

Table 18: The positive correlation between the high level of environmental concerns and the importance of social impacts and car use.

Car-sharing service type	Geographic area	References
Free-floating	China	Wang et al., 2017
One-way station-based and Free-floating	Seattle. USA	Vinayak et al., 2018
Station-based and Free-floating	Ghana, Sub-Saharan Africa.	Acheampong and Siiba, 2020
One-way station-based	Taiyuan, China	Li, 2019
One-way station-based	Shanghai, China	Duan et al., 2020
Round-trip	Netherlands	Kim et al., 2017a
Round-trip	Netherlands	Kim et al., 2017c

2.1.4.5.3 User's habits

People's habits can significantly affect their intention to use car-sharing (Efthymiou and Antoniou, 2016; Kim et al., 2017b; Zhou et al., 2020). Commuters need the right motivation to break the habits that may exist for a considerable period (Carroll et al., 2017). Hence, it is important to consider the users' habits to estimate the car-sharing demand. Members' activity in the last four months has affected the users' behavior in the current month in Montreal, Canada (Morency et al., 2012). Table 19 reflects the positive impact of experience on car-sharing usage.

Table 19: The positive correlation between previous experience and car-sharing usage.

Car-sharing service type	Geographic area	References
Station-based	North America	Morency et al., 2012
One-way station-based	Athens, Greece	Efthymiou and Antoniou, 2016
Round-trip	Dublin, Ireland	Carroll et al., 2017
Buyer-to-Consumer	Netherlands	Kim et al., 2017b
Peer-to-Peer, Buyer-to-Consumer	Australia	Zhou et al., 2020

2.1.4.5.4 Private car status symbol

The car-sharing choice is correlated with perceptions of the car's symbolic value (Kim et al., 2017c). Around 13% of the Free-floating car-sharing system's users concur with the statement that the private car is a status symbol, while only 6% of users of the Station-based car-sharing programs agree with it in Based, Switzerland (Becker et al., 2017a). An exploratory study on citizens' acceptance of car-sharing in Beijing, China, was conducted by Shaheen and Martin (2010). The results indicated that only 11% of the total sample cited the private car as a status symbol, which probably indicates that mobility is a priority for most Beijing people rather than property (Shaheen and Martin, 2010). Table 20 lists studies documenting the negative impact of private cars on car-sharing usage as a status symbol.

Table 20: The negative correlation between private car symbol status and car-sharing usage.

Car-sharing service type	Geographic area	References
Station-based and Free-floating	Based, Switzerland	Becker et al., 2017a
One-way station-based	Beijing, China	Shaheen and Martin, 2010
Round-trip	Netherlands	Kim et al., 2017c

2.1.4.5.5 Sense of ownership

According to Paundra et al. (2017), psychological ownership refers to people's possessive feelings about objects, whether the object legally belongs to them or not. The sense of ownership can affect car-sharing usage. Also, low psychological ownership may lead to a higher preference for a shared car under certain conditions. Besides, the price effect is less pronounced for individuals with high psychological ownership. Due to their strong sense of ownership over the target objects, such as cars, they prefer private cars to shared cars, regardless of their low price. Table 21 shows the effect of the sense of ownership on car-sharing usage.

Table 21: The positive correlation between sense of ownership and car-sharing usage.

Sense of Ownership Level	Impact	Car-Sharing Service Type	Geographic area	References
Low psychological ownership	Positive effect	Free-floating	Netherlands	Paundra et al., 2017
High psychological ownership	Negative effect	Free-floating	Netherlands	Paundra et al., 2017

2.1.5 Interaction effects among different factors

The previous section analyzed the effect of each factor on car-sharing demand. However, interaction effects are expected and have been studied in the literature. Therefore, this section focuses on the main ones documented in the literature. Table 22 shows a matrix mentioning those papers that explicitly studied the interactions between two specific factors concerning car-sharing use. Such interactions are then described in the following.

A study by Kawgan-Kagan (2015) indicated that females usually traveled shorter distances than males. Early female adopters of car-sharing systems were likelier to use BEVs than vehicles with internal combustion engines. They evaluated BEVs' performance positively, especially in Free-floating car-sharing systems. When utilizing the charging station, 40 % of females experienced a positive attitude, while even 20% of males did not state so. Dias et al. (2017) suggested that children's presence in households without high income adversely affected car-sharing usage rates in Seattle, USA. Rotaris and Danielis (2018) noted that in rural areas, unlike metropolitan areas where car-sharing was common among professionals, car-sharing programs were used mainly by the unemployed or students. Also, it was mentioned that car-sharing system usage in rural areas was more common for non-commuting and longer trips in rural areas. Moreover, Lamberton and Rose (2012) argued that the price was a significant factor in selecting a shared car system. The primary concern was to profit from selecting the shared vehicle for individuals with low psychological ownership. According to Li (2019), the user's willingness to use the car subscription increased with increasing travel distance in cold weather. In addition, when car-sharing was faced with a trade-off between time and cost, travelers were more concerned with saving travel costs on shorter trips and saving travel time on longer trips. Moreover, a car-sharing service for shorter trips was preferred for non-commuting trips. While in the case of longer trips, it was highly preferred for commuting trips. In addition, Wang et al. (2017) mentioned that individuals who knew better about the car-sharing program, male users, and people with higher income levels accepted high prices. Besides, Kim et al. (2015) noted that the members of electric car-sharing systems were likely to retain their membership program mainly for non-compulsory trips. However, there was little chance to change their car ownership behavior.

Table 22: Interactions matrix between factors on the use of car-sharing.

	Lower travel distance	**Battery electric vehicles (BEVs)**	**Low- and middle-income households**	**Rural area**	**Lower travel cost**	**Cold weather**	**Lower travel time**	**Non-commuting trips**	**Commuting trips**	**Male**	**Higher-income levels**	**Familiarity with the car-sharing program**
Female	+ (Kawgan-Kagan, 2015)	+ (Kawgan-Kagan, 2015)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Presence of Children	-	-	– (Dias et al., 2017)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unemployed or Students	NA	NA	NA	+ (Rotaris and Danielis, 2018)	NA	NA	NA	NA	NA	NA	NA	NA
Low psychological ownership	NA	NA	NA	NA	+ (Lamberton and Rose, 2012)	NA	NA	NA	NA	NA	NA	NA
Short travel distance	NA	NA	NA	NA	+ (Li, 2019)	NA	NA	+ (Li, 2019)	NA	NA	NA	NA
Long travel distance (beyond 5 km)	NA	NA	NA	+ (Rotaris and Danielis, 2018)	NA	+ (Li, 2019)	+ (Li, 2019)	NA	+ (Li, 2019)	NA	NA	NA
High travel cost	NA	NA	NA	NA	NA	NA	NA	NA	NA	+ (Wang et al., 2017)	+ (Wang et al., 2017)	+ (Wang et al., 2017)
Non-commuting trips	NA	+ (Kim et al., 2015)	NA	+ (Rotaris and Danielis, 2018)	NA	NA	NA	NA	NA	NA	NA	NA

NB: "+": positive interaction
"-": negative interaction.

2.1.6 Summary[2]

This study's key conclusions are reported in the following lists, separately considering the five factors.

The effect of different sociodemographic factors is summarized in the following list. Besides, to assess the corresponding level of support in the literature, the number of articles used to claim each result for the socio-demographic factors part is listed below.

- Gender: car-sharing seems to be accepted by both males and females (4 articles), even if there is much attraction for potential female members (3 articles); males are more likely to travel shorter distances and more frequently (1 article).
- Age: most car-sharing members/users are young (23 articles), typically in their mid-20s to mid-30s (12 articles).
- Education level: being attracted to car-sharing may be based on a certain level of social awareness, not strictly an economic decision (5 articles); most people looking to choose car-sharing seem to have a four-year college degree or higher (14 articles), especially a postgraduate or advanced degree (4 articles); beyond car-sharing membership, a high level of education can also increase the utilization of car-sharing (20 articles).
- Occupation and economic status: most shared car members earn more than non-members, and most are employed (12 articles); car-sharing members with middle to upper-income levels can also be cost-sensitive people (1 article).
- Marital status: car-sharing is attractive in places where the proportion of single-parent households is high (5 articles).
- Car ownership: the mean number of cars per family for car-sharing system members is lower than for non-members (21 articles); there is a complex two-way relationship between car ownership status and shared car demand (6 articles); car-sharing in China seems to be more effective in preventing the purchase of vehicles than car-shedding (1 article).

However, several interaction effects between different socio-demographic factors have been detected. The most important ones are the following:

- Between age and economic status: an older age (55 years or older) of people living in households without high income negatively affects the propensity to join a car-sharing scheme (1 article).
- Between age, marital status, and car-ownership status: car-sharing with Evs has a special added attraction for young couples with no private car (1 article). The same is true for young people who start a family and use car-sharing to complement their private car trips (1 article).
- Between occupation status and household size: shared cars are more utilized by employees living in low-size families (1 article).

[2] Most of the contents of the present section/appendix have been published in Amirnazmiafshar, E., & Diana, M. (2022). A review of the socio-demographic characteristics affecting the demand for different car-sharing operational schemes. Transportation Research Interdisciplinary Perspectives, 14, 100616.

- Between the presence of children's status and economic status: the presence of children may increase the desire to choose car-sharing (4 articles). However, it appears that the children’s presence can reduce shared car demand in low-and-middle-income households (1 article).

According to the above findings, the following policy implications and suggestions can be formulated to expand the demand for different car-sharing schemes.

It ought to be noted that the rate of young members and people with above-average income is higher among free-floating members. Also, males' adoption of this service is more elevated than station-based service. Also, the rate of female members in free-floating services is higher than in station-based services. Besides, as females seem more eager to opt for E-car-sharing services, free-floating services can attract females by offering this type of car, especially in Europe, where females are less attracted to car-sharing than females in North American countries. Also, since an older age (55 years or older) of people living in households without high income negatively affects the propensity to join a car-sharing scheme, free-floating operators should target this group through specific actions.

It is also interesting to mention that although users of round-trip car-sharing seem less educated than other car-sharing service users, car-sharing members may follow a more efficient and sustainable lifestyle than the one-way shared car system members. For example, round-trip service members have significantly fewer private cars than free-floating service members. However, the rate of young members in the free-floating services is more elevated than in station-based services. Since car-sharing with EVs has a special added attraction for young couples with no private car, round-trip operators can offer this kind of service to attract younger members. Furthermore, the probability of decreasing vehicle ownership by station-based shared car members is higher than among free-floating car-sharing members. It may be because members of free-floating shared car services do not necessarily see the service as a replacement for their private car but as a supplement. Finally, it is important to note that car-sharing with EVs has a special added attraction for young people who start a family and choose car-sharing to complement their private car trips. Concerning developing e-car-sharing, some articles identified the factors affecting the development or downturn of e-car-sharing services in the entire e-car-sharing industry concerning stakeholders. (Turoń et al., 2020). Also, Turoń et al. (2021) showed the main factors affecting the operation of the e-car-sharing market during the COVID-19 and post-quarantine periods.

It should be noted that this study has some limitations. First, the results and claims related to the effect of marital status and household size characteristics on car-sharing demand are based on only a few articles. Therefore, more research needs to be done to increase the robustness of the results, especially for free-floating and P2P services. In addition, more studies should be done on the impacts of child presence and vehicle ownership characteristics on demand for P2P services.

It is worth pointing out that although car-sharing has spread to the global markets, most research on shared car systems has been investigated in China, the USA, Canada, and some

European countries. Hence, more studies need to be implemented in other countries, especially in developing countries, to understand better the socio-demographic factors that affect car-sharing demand according to the geographical area. For example, differences in education levels between developed and underdeveloped countries may lead to different proportions of car-sharing because there may be a relationship between education level and country. In addition, other factors such as residence status (permanent residence or not, or tourist effect) could be worth investigating to broaden the view.

Lastly, another research gap is the direction of causation between private car ownership levels and car-sharing demand. There appears to be a complex two-way relationship between car ownership and shared car demand. However, most studies have worked on the vehicle ownership impacts on shared cars. Therefore, more research is required to work on vehicle ownership as exogenous and endogenous variables to clarify the direction of causality and better assess the shared car systems' sustainability.

Furthermore, the most remarkable trip-related characteristics that influence car-sharing use are as follows:

- The higher the in-vehicle travel time and walking time to reach the nearest vehicle, the less car-sharing usage is.
- Car-sharing is utilized chiefly for discretionary purposes.

The most important built environment and land use elements that affect the use of car-sharing are as follows:

- Car-sharing users tend to live in dense urban areas with high public transportation services.

The most considerable car-sharing characteristics that effects the use of car-sharing are as follows:

- The higher the travel costs, the less car-sharing usage.
- The convenience of traveling by Free-floating car-sharing can increase usage.

The most significant attitudinal effects that impact car-sharing use are as follows.

- Environmental awareness is often seen among car-sharing users and shared electric vehicles are preferred in this case.
- The private car status symbol can negatively affect car-sharing usage.
- The price effect is less pronounced for people with high psychological ownership; they prefer private cars.
- Car-sharing users often use sustainable transport modes, such as public transportation and non-motor modes.
- Technology dissemination seems to impact the acceptance of car-sharing positively.
- User satisfaction with the car-sharing service increases the likelihood that the person will use the service later.

- The number of times users have utilized the service in recent months is proportional to the current usage.
- Individuals' car-sharing choice behavior depends on their loved ones' car-sharing choice behavior.

The influence of interactions between sub-factors on car-sharing use is as follows:

- Females are more likely to use car-sharing for short travel distances.
- Unemployed people or students in rural areas choose car-sharing as their mode of transportation.
- Low psychological ownership may lead to a greater preference for car-sharing, especially with low travel costs.
- The presence of children in low- and middle-income households can decrease the use of car-sharing.
- As the travel distance increases, the user's willingness to use car-sharing rises in cold weather.
- Travelers are more concerned with saving trip costs on shorter trips and saving travel time on longer trips.
- For short trips, car-sharing is mostly used for non-commuting trips.
- For longer trips, users much prefer commuting trips.
- Electric car-sharing members are likely to retain their membership program mainly for non-compulsory trips.
- Car-sharing is common in rural areas for non-commuting and longer trips.

Most studies have been carried out by considering only one or two main factors in the car-sharing system. However, quantitative studies have considered several factors simultaneously. Hence, more critical factors should be simultaneously considered in future research.

2.2 An overview of bike-sharing

The bike-sharing system and its benefit are explained in Chapter 1. This section offers an overview of bike-sharing services to familiarize better with the important criteria and sub-criteria that can influence bike-sharing use. In this regard, a brief history of bike-sharing, integration of bike-sharing with other transport modes, bike, and its benefits, factors affecting demand for bikes and summary, as well as factors affecting demand for bike-sharing, and its summary are mentioned as follows.

2.2.1 A brief history of bike-sharing

As BSSs have proliferated, research on BSSs has emerged to ascertain the key attributes leading to bike-sharing use. The BSS has a long history, and various BSS have popped up worldwide (Si et al., 2019). According to Shaheen et al. (2010), there are four generations of BSSs, the first of which was the “White Bikes” program, a BSS (unregulated) with the installation of fifty unlocked and free bicycles dedicated to the public in Amsterdam, the Netherlands in 1965. In this scheme, bikes are distinguished by a color painted in a light color, and it was placed haphazardly and unlocked throughout the area so that everyone could use them freely. However, the stolen bikes caused the program to fail (Eren and Uz, 2020).

In order to prevent bike theft, the “Coin-Deposit” system, the second bike-sharing generation (Also known as Bycykel), was designed in Denmark in 1993. These bikes were specially manufactured and distinguished by color or unique design (DeMaio, 2003). The bike was locked and could be picked up and returned at designated bike stations throughout the city with a coin deposit that incentivized people to return the bike to balance the BSS. The second-generation systems were more expensive to operate than the first-generation ones. Both generations of bike-sharing created more cycling opportunities. However, owing to the lack of adequate support and reliable service, they could not induce people toward bike-sharing transport mode (Bonnette, 2007).

In the 2000s, the third generation of BSPs, such as "Velo'v" in France and "Call a Bike" in Munich, increased steadily over the decade. Also, the BSPs started to be established in other countries such as China, the USA, and Brazil (Eren and Uz, 2020). The third generation, known as “Station-Based Bike-Sharing” (SBBS), is an information-technology-based system that introduced a more attractive BSS planning to increase people's encouragement to use bicycles (Automated stations). This BSS is one of the intelligent transportation systems consisting of innovative parking units, bike rental stations, and smart bikes (Raviv and Kolka, 2013). This system employs kiosks or user interface technology, and bicycles are distinct by color, unique design, or advertisements.

Furthermore, using innovative technology such as mobile phones, mag-stripe cards, or smartcards, bikes can be picked up from the docking station and returned to each station belonging to the same system. Also, this technology contributes to preventing bicycle theft since members are required to provide identification, phone number, or bank card. Besides, non-members usually have to pay a large deposit to ensure the bike's return. Therefore, the integration of information technology has helped prevent bicycle theft. However, although the third generation enticed more people to embrace the BSS, significant investments are required to install adequate docking stations throughout the city.

The emergence of the fourth generation dockless bike, known as a “Free-Floating Bike-Sharing” system, was due to requiring less investment. This free-floating bike system possesses distinct bikes. This system is designed whereby people do not need to pick-up the bike from a station or return it to the docking station. Instead, users can find the available bikes using an embedded Global Positioning System (GPS). Given that the system does not require docking stations and, therefore, does not require built-in infrastructure, the system has been rapidly expanded globally (Shaheen et al., 2010; Shen et al., 2018). The smartphone application is utilized in FFBSs, and the payment method is by scanning the Quick Response (QR) code or by Near-Field Communication (NFC) (Shen et al., 2018).

Chen et al. (2020) compared the users’ attributes between the FFBS and SBBS in Hangzhou, China. It was identified that the user structures for FFBS and SBBS are quite similar, but the factors affecting the use frequency are different. SBBSs strength is providing a low travel cost with appropriate quality, while FFBS is more convenient and flexible for users. Therefore, the dockless design of the FFBS improves the users' experience at the end of the travel. Li et al. (2019) stated that the advent of FFBS has brought about essential changes in urban cycling and the urban dwellers' transport mode choice. FFBS trips are suitable for combination with bus and subway trips (Du et al., 2019). FFBS is ideal for connecting other travel modes and the temporary travel demand (Li et al., 2019). The high efficiency and flexibility of FFBS can integrate the BSS with public transport appropriately, leading to an efficient alternative for first/last-mile travel (Chen et al., 2020).

Similarly, Li et al. (2018) stated that FFBS is an effective solution to the first/last mile problem. In addition, the synergy of FFBS and public transport can increase BSS usage and enhance the benefits of both modes (Shen et al., 2018). Finally, Shaheen et al. (2012) pointed out that the fourth-generation targets efficiency, quality, and sustainability.

On the contrary, Sun (2018) noted that dockless BSSs yield negative consequences such as abatement of public space and bike-share vandalism. Also, these systems are not a substitute for private vehicles. Besides, oversupply has led to graveyards of bikes and deep concerns about maintenance, quality control, and management of these systems. Li et al. (2018) pointed out that the lack of policy for FFBS and delays in fixing bike defects are the major hurdles standing in the way of increasing FFBS usage in Jiangsu, China. Du and Cheng (2018) noted that if FFBS malfunctions are not addressed promptly, it can impede utilization or reduce the usage rate. Also, bicycle availability and easy finding are important factors in increasing FFBS demand.

2.2.2 Integration of bike-sharing with other transport modes

Cities across the globe are embracing BSSs, and people tend to integrate the bicycle-sharing journey into their daily travels (Schoner and Levinson, 2013; Mateo-Babiano et al., 2016). Because the BSS integrates cycling into the transportation system, it increases the mobility option providing a more convenient and attractive transport mode for users. Therefore, one feature that can affect BSS's success is its integration with effective public transport interchanges (Jennings, 2011; Bagloee et al., 2016). The purported benefits of BSS promote inner-city public transport options (Vogel and Mattfeld, 2011). Travel time is reduced when the BSS is well-integrated with the public transport network (McBain and Caulfield, 2018). A study carried out in Helsinki, Finland, by Jäppinen et al. (2013) determined that the use of BSP decreased the travel time of public transport by more than 10%, meaning about 6 min. Hence, the BSP strengthens public transport, enhances connections, and improves sustainable daily mobility (Shaheen, 2012; Jäppinen et al., 2013). The "Call-A-Bike" in Germany and the "Vélo'v," launched in May 2005 in Lyon, France cities, are examples of BSPs, deployed at public transport stops (Borgnat et al., 2011; Buehler and Pucher, 2011).

The BSSs target daily mobility and people choose the BSS on an as-needed basis (Hyland et al., 2018). Ma et al. (2019) mentioned that two-thirds of car drivers were willing to use Free-Floating Bike-Sharing (FFBS) for short-distance trips (within 2 km) in Nanjing, China. In addition, Perceived health, perceived ease of use, and perceived usefulness positively affect individuals' attitudes toward FFBS. Also, it was found that individuals' attitudes toward FFBS positively correlate with their willingness to shift. Also, BSS is utilized for access and egress to transit during peak hours (Noland et al., 2019). Levy et al. (2019) noted that buses could complement bikes for shorter trips, most concentrated in the city center. Besides, BSSs seem to be substituting buses for longer trips, most of which are focused on links dedicated to bike lanes. Shaheen et al. (2011) determined that the BSS acted as a complementary competitor to public transportation, and also, BSS seems to decrease car trips. Fishman et al. (2014) determined that due to the use of BSS, the alleviation in motor vehicle use was roughly 90,000 km per year in Minneapolis and Melbourne. Ricci (2015) noted that bike-sharing trips are predominantly utilized instead of public transportation and walking trips and are not a potential alternative to car trips. Also, some studies found that the BSS mainly substitutes for walking rather than public transportation and cars (Murphy and Usher, 2015; Zhang, 2017). Du et al. (2019) mentioned that FFBS attracted users whose main transport modes are private bikes (15%), walking (39%), and conventional buses (14%) in Nanjing, China.

2.2.3 Bike and its benefits

Before reviewing the factors influencing bike-sharing demand, an overview of the factors influencing bicycle selection can be contributory. Increased dependence on private vehicles imposes high social, economic, and environmental costs, which are likely to surge in traffic, raise energy consumption, and, to owe to the increased vehicle source emissions, degrade air quality (Litman and Laube, 2002; Saelens et al., 2003; Sener et al., 2009). Improving cycling to school can lead to increased healthy travel behaviors (Forsyth and Oakes, 2015). This is likely to be maintained in adulthood, helping the next generation develop greener travel behavior. Thus, urban planning and public health officials have been steadfast in persuading people to use active transportation modes in recent decades (Krizek et al., 2007).

According to reports, although nowadays people choose motorized vehicles for short trips, the "future belongs to walking and cycling" (Davis et al., 2012). Cycling is established as one of the best options among urban mobility alternatives since its facilities do not require much space; it is environmentally friendly and positively affects health, which is an important issue. Especially the physically inactive lifestyle is a significant challenge to public health (Sallis et al., 2004). As transportation is a routine in which we all engage, cycling has excellent potential to surge the level of daily physical activity (Strong et al., 2005). Besides, in urban areas of developed countries, the travel time of half of the trips can be less than 20 minutes by bike (Kamargianni, 2015). Thus, the growing presence of cycling can increase its role alongside other aims at promoting sustainable transport. For instance, it helps alleviate social, environmental, energy, and traffic congestion and concerns about the high rate of car use, and it could provide substantial health benefits (Wardman et al., 2007). People should change their travel behavior to lessen the deleterious effects of the private vehicle and achieve closely aligned objectives, including enhanced livability, raised physical activity, reduced traffic congestion, and reduced levels of air pollution. For instance, choosing a bike instead of a private vehicle can assist in obtaining these aims, such as decreasing vehicle-generated air pollution.

2.2.4 Factors affecting demand for bike

A wide-ranging set of factors influencing cycling behaviors has been studied recently. Exited literature has identified several factors that can influence bike choice. These factors can be categorized into five categories: 1. socio-demographic characteristics, 2. trip-related characteristics, 3. built environment and land use, 4. bike characteristics, and 5. natural environmental conditions.

2.2.4.1 Socio-demographic characteristics

The socio-demographic characteristics, including gender, age, education level and awareness, occupation and economic status, and ownership status, affect bike use.

2.2.4.1.1 Gender

Some studies found that males' cycling trips usually surpass females (Shafizadeh and Niemeier, 1997; Parkin et al., 2008; Baker, 2009). The influence of the cyclist's gender on mode choice behavior is due to the gender differences in risk aversion (Garrard et al., 2008). Also, females' perceptions of the feasibility of alternative transportation modes differ from that of males. For instance, to use a bike, the importance of being proximate to bicycle trails and paths is more for females than males (Akar et al., 2013). Female commuters are more inclined to choose the car for home-based school (HBSc) trips rather than walking and cycling, consistent with some surveys (Mota et al., 2007; Larsen et al., 2009). In girls' HBSc trips, street connectivity positively correlates with active commuting to school (Mota et al., 2007). Generally, Females prefer private motorized vehicles over active transport (Clifton, 2003; Timperio et al., 2006). Further, it is important to note that females are willing to cycle on routes with maximum separation along heavily traveled roads. When considering the existing cycle paths network, females value adequate and safe paths more than males (Kamargianni, 2015). Hence, providing bicycle paths and lanes obtaining a high degree of separation from motor traffic may be significant for raising bike commute rates amongst females (Garrard et al., 2008). As mentioned, feeling safe is positively associated with cycling choices (Akar et al., 2013).

2.2.4.1.2 Age

According to Shafizadeh and Niemeier (1997), younger commuters may be less willing to make longer commutes than the elders. Focusing on the age factor impacting the utility of bicycles, it is determined that youngsters consciously avoid private motorized vehicles (Davis et al., 2012; Axhausen, 2013). They have selected this lifestyle regardless of their income status (Kamargianni, 2015).

2.2.4.1.3 Education level and awareness

Ortuzar et al. (2000) explained that there is a lack of proper understanding of cycling in some areas. For instance, in Chile, there was public ridicule of riders on network television stations. In a household, the parent's attitudes toward cycling and obtaining a high level of education (bachelor's degree) by the mother significantly affect the teenager's desire to cycle. In General, people with college educations are more likely to choose cycling (Barnes and Krizek, 2005; Xing et al., 2010). Hence, people's culture and education influence bicycle use (Kamargianni and Polydoropoulou, 2013). Generally, traffic education and training for drivers and cyclists, creating enthusiasm to cycle, and broad public transport which supports cycling have raised the cycling levels (Pucher and Buehler, 2008). Also, the availability of school courses for safety skills on how to walk and cycle safely can grow cycling rates (Kamargianni, 2015).

2.2.4.1.4 Occupation and economic status

Some researchers mentioned that high income reduces the utility of active transport (Jara-Díaz and Videla, 1989; Sallis et al., 2004). Xing et al. (2010) argued that people with higher incomes, compared to individuals with lower incomes, would choose faster modes as they attach higher values to their time. Hence, the higher pocket money diminutions the utility of cycling to school (Kamargianni and Polydoropoulou, 2013). Nevertheless, in rural areas, with increasing pocket money, teenagers still prefer to ride a bike (Kamargianni, 2015).

2.2.4.1.5 Ownership status

Car ownership hurts the cycling demand. However, imposing a tax on car ownership and parking creates unpleasant and expensive driving in central cities, leading to higher cycling rates (Parkin et al., 2008).

2.2.4.2 Trip-related characteristics

Trip-related characteristics include travel time, trip purpose, and travel distance that impact bicycle use.

2.2.4.2.1 Travel time

People are generally sensitive to increasing trip length, represented as higher journey time, especially for non-motorized modes (Akar et al., 2013). Similarly, increasing the travel time of bicycles to school may result in adolescents refusing to choose bikes (Kamargianni and Polydoropoulou, 2013; Kamargiani, 2015). Usually, travelers younger than 24 and females pay more attention to travel time while choosing a bike (Krizek et al., 2005; Garrard et al., 2008; Dell'Olio et al., 2014). Whalen et al. (2013) mentioned that using a bicycle while traveling for less than 10 minutes can be overlooked because of the overuse of other modes. However, if the travel time is increased to 10 minutes, it may positively affect cycling and increase the bike's share to more than 14%. Therefore, there should be a travel time range in which the cycle use rate increases and begins to decrease for travel time beyond the range.

2.2.4.2.2 Travel distance

One of the considerable factors affecting bike use is travel distance. Long distance negatively impacts children's active movement (Timperio et al., 2006). Experienced cyclists can cycle the bike for a longer distance than other kinds of cyclists. Xing et al. (2010) showed that perceived trip distance influences cycling choice. Ortúzar et al. (2000) examined the fundamental factors conditioning use of bicycles in Santiago. It was determined that the trip length is one of the most influential factors in selecting cycling as an alternative mode of transport. Furthermore, it was found that although short trips are the most important market for bikes, a reduction in trip length and adequate incentive for metro and suburban railway station transfers can increase the level of cycling in a large city.

2.2.4.2.3 Trip purpose

Xing et al. (2010) focused on the trip purpose effect on cycle choice and mentioned that cycling usually is used for recreational trips.

2.2.4.3 Bike characteristics

Bike characteristics such as travel costs can significantly affect bike usage.

2.2.4.3.1 Travel cost

Travel costs can significantly affect adolescents and adults on their mode choice behavior (Kamargianni and Polydoropoulou, 2013). Wardman et al. (2007) found that a £2 per day for employees who cycle to work is highly effective and not far from doubling the amount of cycling and a 5.4% reduction in car demand. A £5 daily payment can also decrease car demand by 23.6%.

2.2.4.4 Built environment and land use

Land use, accessibility, infrastructure, trip end, and en-route facilities are substantial elements impacting bike usage.

2.2.4.4.1 Land use

It is important to note that land use is essential in cycling choices. For example, the employment densities at destinations, compared to the residential densities at origins, have more impact on the mode choice for home-based work (HBW) trips (Rodríguez and Joo, 2004). Also, the built environment is correlated with the children's active commuting to school (Kerr et al., 2006). Larsen et al. (2009) reported that the more land use mix and the presence of street trees, the more use of active transport modes in HBSc trips. Also, Winters et al. (2011) determined that scenic bike routes (aesthetically pleasing locations), traffic-calmed streets, trails segregated from motorized traffic, and away from traffic noise and pollution can be an important incentive for cyclists. Whereas streets with high-speed traffic and the risks from motorists are the top deterrent factors.

2.2.4.4.2 Accessibility

Accessibility is also a significant factor, as nearness to trails and the presence of agglomerations of hospitals, fast-food restaurants, offices, and clinics are influential environmental factors on cycling choices (Maurer et al., 2012).

2.2.4.4.3 Infrastructure, Trip End, and En-Route Facilities

Some studies investigated the importance of providing ample cycling facilities, including parking space availability, off-road and in-traffic facilities, bike paths, and lanes (Bowman et al., 1994; Nelson and Allen, 1997; Ortúzar et al., 2000; Dill and Carr, 2003; Krizek et al., 2007; Tilahun et al., 2007; Garrard et al., 2008; Pucher and Buehler, 2008; Krizek et al., 2009; Dill, 2009; Larsen and El-Geneidy, 2011; Buehler and Pucher, 2012; Kamargianni and Polydoropoulou, 2013; Bhat, 2015). The provision of infrastructure would infer the construction of more cycle paths across the city to elevate the convenience and safety of riders. Installing a network of bicycle rental stations can boost the accessibility of potential bike users who do not have bicycles. Hence, doing so would likely have significant implications for encouraging increased cycling levels (Nelson and Allen, 1997; Dill and Carr, 2003; Wardman et al., 2007; Hunt and Abraham, 2007; Dill, 2009; Handy et al., 2010; Winters et al., 2011; Buehler and Pucher, 2012).

Wardman et al. (2007) created a comprehensive model to predict future trends in urban commuting shares over time and the effects of different measures to increase the willingness to cycle to work. The results indicated that the en-route cycling facilities, utterly segregated cycleways, have the highest effect on cycling choice. However, the results showed only a 55% increase in cycling and a slight decrease in car commuting. Pucher and Buehler's (2008) research explains why cycling has become a relatively convenient, safe, and practical way to travel around cities in Dutch, Danish, and German cities where cycling is a way of life. It is clarified that the most important factor which has enticed people to cycle is generating separate cycling facilities along intersections and busy roads, coupled with the traffic calming of most residential areas. In addition, the broad cycling rights of way, adequate bike parking, and a fully integrated bike system with public transport have affected the bike use rates.

Dell'Olio et al. (2014) recognized the potential of cycling as a sustainable mode of transport in Santander, a medium-sized city with steep streets and relatively inclement weather in Spain. The results revealed that an extensive network of public and private bike docking stations is significantly more valuable than a network of cycle paths, which can ensure comfortable and safe cycling in the city.

Winters et al. (2011) indicated that the factors associated with the built environment for cycling, such as separation from motor vehicles, pleasant route conditions, and ease of cycling, significantly affect bike choice. In addition, the presence of bicycle signage and traffic signals leads to higher levels of bicycle commuting (Winters et al., 2010). They compared the modal split gained as a function of the existence of cycle paths with that of docking stations less than 400 m away. They determined that the ease of bicycle parking is more important than traveling safely and comfortably for bicycle commuters (Dell' Olio et al., 2014). Also, with the growing coverage of cycle lanes (i.e., cycle paths painted on the pavement but not segregated from the traffic) and cycleways between home and school, teens are more likely to choose cycling for the HBSc trips (Kamargianni and Polydoropoulou, 2013). Contrastly, poor access to lights or crossings and busy intersections between the home and school adversely affect the children's active commuting (Timperio et al., 2006). Beginner cyclists appreciate the presence of bike lanes 1.6 times more than experienced cyclists (Motoaki and Daziano, 2015) because a separated path or striped lane can augment a cyclist's perception of safety (Dill and Carr, 2003).

According to Hunt and Abraham (2007), the time spent cycling in mixed traffic is more onerous than time spent cycling on bike paths. Certainly, cycleways are safer than cycle lanes, and cycleways can increase the tendency to cycle more (Ortúzar et al., 2000). Hence, streets with separate paths, bicycle lanes, bicycle boulevards, and well-connected neighborhood streets can attract more adult cyclists (Dill, 2009). Furthermore, in rural areas, the coverage of cycleways is the most influential factor in choosing a bicycle (Kamargianni, 2015). In general, cities that possess cycling facilities in the right places witnesses a higher level of bike commuting and also a proper design that considers the type of the city could increase the cycling propensity (Krizek and Roland, 2005; Tilahun et al., 2007; Krizek et al., 2009; Winters et al., 2010; Winters et al., 2011; Flugel et al., 2015).

Furthermore, providing secure parking compared to showers attracts more people to cycle (Hunt and Abraham, 2007). The presence of bicycle parking lots in the schoolyard favors choosing a bicycle for adult students because they possess a place to park and lock their bicycles during school hours (Kamargianni, 2015). Hence, given the availability of safe and convenient infrastructure and the right built environment, people persuade to opt for cycling for their short trips (Kamargianni, 2015).

According to Wardman et al. (2007), the individuals who may have the willingness to select cycling as a mode of transport are not necessarily a homogenous group. Hence, providing packages of measures that include a range of motivations for cycling promotion is the best approach to enhance the propensity to cycle. Therefore, the most effective policy to increase the demand for cycling to work is to combine the amelioration of en-route facilities, the daily payment to cycle to work, and comprehensive trip-end facilities (provision of showers and indoor parking at the workplace). It would also have a considerable effect on decreasing the level of car use. In addition, Handy et al. (2010) determined that employing a comprehensive package of strategies targeting the factors of the individual, physical environment, and social environment has synergistic effects that are the best approach to raising cycling levels. Finally, it is important to note that adopting some practical policies, such as introducing a city center congestion charge for private cars, could heighten the economic value of the activity. Enacting this policy is likely to amend the negative situation and, by changing people's attitudes toward cycling, leads to inducing them to use bicycles in such areas.

2.2.4.5 Natural environmental conditions

The hilliness, weather conditions, temperature, humidity level, and air pollution factors are natural environmental conditions that influence bike use.

2.2.4.5.1 Hilliness

The road with a lower gradient attracts more cyclists (Waldman, 1977; Rietveld and Daniel, 2004; Rodríguez and Joo, 2004; Timperio et al., 2006; Parkin et al., 2008; Winters et al., 2010).

2.2.4.5.2 Weather condition

Weather condition is one of the most dominant factors in using a bike (Parkin et al., 2008; Kamargianni and Polydoropoulou, 2013; Dell'Olio et al., 2014; Wang, 2015). A study by Kamargianni (2015) investigated the factors impacting bike use for HBSc trips in different areas. It was determined that inclement weather conditions have the most significant impact on bicycle selection in urban areas. Dell' Olio et al. (2014) indicated a significant difference in the modal split between good and bad weather. When the weather is unfavorable, the most privileged mode for potential bicycle users is the private car. Cycling is the most attractive mode of transport when the weather is favorable. Winters et al. (2011) mentioned that snow and ice could decrease bike use. Nankervis (1999) studied the seasonal and weather-related variation patterns that indicated a decrease in bike use in winter and under inclement weather conditions. Ortúzar et al. (2000) demonstrated that weather (sunny days) is the factor that affects the utility of bicycles the most in all areas except the rural areas, where the most important factor is the percentage of cycleway coverage on the route between home and school. Even when the average temperature is minus 12 centigrade, teenagers use the bike to transport to school in rural areas. Commonly, even when the weather is sunny, females from all areas do not prefer to cycle. Motoaki and Daziano (2015) found that the adverse effect of rain and snow on less-skilled cyclists is 2.5 and 4 times higher, respectively, compared to cyclists with higher skills.

2.2.4.5.3 Temperature

One factor that can significantly impact the choice of cycling is the temperature (Parkin et al., 2008; Kamargianni and Polydoropoulou, 2013; Wang, 2015). According to Saneinejad et al. (2012), in Toronto, the levels of bike use are sensitive to wind speed and temperature only in conditions below 15 centigrade. In addition, the adverse effects of cold temperatures on the use of bicycles are higher for young people than for the elderly. Also, females' level of bike use is about 1.5 times more likely to be influenced by cold temperatures than males.

2.2.4.5.4 Humidity level

Cycling is generally incompatible with high humidity (Zahran et al., 2008).

2.2.4.5.5 Air pollution

Cycling is incompatible with high air pollution (Zahran et al., 2008).

2.2.5 Summary

As mentioned above, the natural environmental conditions, including the weather condition, temperature, humidity level, air pollution, and hilliness, are important factors in cycling choice. Moreover, the built environment and land use are significant factors in choosing a bike. For instance, land use, accessibility, and the provision of infrastructures, such as encompassing the coverage of cycle lanes and cycleways, the availability of bicycle parking lots, safety, and the introduction of public bicycle docking stations, are important factors. In addition, socio-demographic characteristics comprising gender, age, occupation and economic status, education level and awareness, and ownership status are influential factors in choosing a bike. In addition, bicycle characteristics such as travel costs can affect bicycle use. Also, trip-related characteristics such as trip purpose, distance, and travel time could be another object that must be addressed. To sum up, the factors affecting bike choice are indicated in Table 23.

Table 23: The effect of different factors on bicycle use.

Factors	**Sub-factors**	**Positive impact**	**Negative impact**	**References (bike docking station is not studied)**	**References (bike docking station is studied)**
Natural environmental conditions	Weather condition	Favorable weather (sunny)	Unfavorable weather (windy, rainy, and snowy)	Nankervis, 1999; Ortúzar et al., 2000; Parkin et al., 2008; Winters et al., 2011; Saneinejad et al., 2012; Kamargianni and Polydoropoulou, 2013; Kamargianni, 2015; Wang, 2015; Motoaki and Daziano, 2015	Dell'Olio et al., 2014
	Temperature		Cold	Ortúzar et al., 2000; Saneinejad et al., 2012	
	Humidity level		High	Zahran et al., 2008	
	Air pollution		High	Zahran et al., 2008	Winters et al., 2011
	Hilliness	Low gradients	High Gradients	Waldman, 1977; Rietveld and Daniel, 2004; Rodríguez and Joo, 2004; Timperio et al., 2006; Parkin et al., 2008; Winters et al., 2010	

Factors	Sub-factors	Positive impact	Negative impact	References (bike docking station is not studied)	References (bike docking station is studied)
Built environment and land use	Land use	More land use mix, trees through the route, higher employment, and population density		Rodríguez and Joo, 2004; Larsen et al., 2009	
	Accessibility	Near to important places (trails, fast-food restaurants, hospitals, clinics, and offices)	Poor access to lights or crossings,	Timperio et al., 2006; Maurer et al., 2012	
	Infrastructure, trip end, and En-route facilities	Infrastructure, trip end, and En-route facilities (cycleways, cycle lanes, showers, bike parking, bicycle sign, age, traffic signals, bike docking station, safety, and comfort)	High-speed traffic	Bowman et al., 1994; Nelson and Allen, 1997; Ortúzar et al., 2000; Dill and Carr, 2003; Kerr et al., 2006; Timperio et al., 2006; Krizek et al., 2007; Hunt and Abraham, 2007; Wardman et al., 2007; Tilahun et al., 2007; Garrard et al., 2008; Pucher and Buehler, 2008; Krizek et al., 2009; Dill, 2009; Winters et al., 2010; Handy et al., 2010; Buehler and Pucher, 2012; Kamargianni and Polydoropoulou, 2013; Kamargianni, 2015; Bhat, 2015	Winters et al., 2011; Dell'Olio et al., 2014
Trip-related characteristics	Trip purpose	Recreational trips		Xing et al., 2010; Larsen and El-Geneidy, 2011	
	Trip distance		Long-distance	Timperio et al., 2006; Xing et al., 2010; Kamargianni and Polydoropoulou, 2013	
	Travel time	Short trips (like 10 minutes)	Long trips	Ortúzar et al., 2000; Krizek et al., 2005; Garrard et al., 2008; Kamargianni and Polydoropoulou, 2013; Akar et al., 2013; Whalen et al., 2013; Kamargianni, 2015	Dell'Olio et al., 2014
Bike characteristics	Travel cost	Daily payment to employees who cycle to work, charge private cars	High public bike rental rates	Wardman et al., 2007; Pucher and Buehler, 2008; Parkin et al., 2008	Dell'Olio et al., 2014
Socio-demographic characteristics	Age	Young	Old	Shafizadeh and Niemeier, 1997; Davis et al., 2012; Axhausen, 2013; Kamargianni, 2015	
	Gender	Male	Female	Shafizadeh and Niemeier, 1997; Clifton, 2003; Timperio et al., 2006; Mota et al., 2007; Garrard et al., 2008; Parkin et al., 2008; Baker, 2009; Larsen et al., 2009; Akar et al., 2013; Kamargianni, 2015	
	Occupation and economic status	Lower-income	Higher-income	Jara-Díaz and Videla, 1989; Sallis et al., 2004; Xing et al., 2010; Kamargianni and Polydoropoulou, 2013; Kamargianni, 2015	
	Ownership status		Car ownership	Parkin et al., 2008;	
	Education level and awareness	College education received traffic Education (school course on safety)		Ortuzar et al., 2000; Barnes and Krizek, 2005; Wardman et al., 2007; Pucher and Buehler, 2008; Xing et al., 2010; Kamargianni and Polydoropoulou, 2013; Kamargianni, 2015	Winters et al., 2011

2.2.6 Factors affecting demand for bike-sharing

BSPs have spread swiftly throughout the world in recent decades (Tang et al., 2011). The benefits of the BSS can lead many people to choose it as a transport alternative mode that makes the BSS worthwhile for investment. Accurate estimation of bike-sharing demand is an important factor in the success of BSSs (Jennings, 2011). Therefore, urban planning agencies should predict bike-sharing demand to make investment decisions (Skov-Petersen et al., 2017). Also, identifying the factors influencing bike-sharing ridership is essential for policymaking (Duran-Rodas et al., 2019). Hence, it is necessary to examine the elements substantially affecting the levels of bicycle use. In order to achieve this aim, it is significant to take into account various elements such as social, individual, and other environmental influences to approach this field of study from a holistic perspective. The literature on the BSS has shed light on the key factors contributing to bike-sharing demand that can help assess the performance of BSPs comprehensively and would pave the way for building a complete and articulated picture of BSS's different aspects. Factors influencing the demand for bike-sharing can be classified into five characteristics: the socio-demographic, trip-related, bike-sharing, built environment and land use, and natural environmental conditions.

2.2.6.1 Socio-demographic characteristics

Examining the socio-demographic characteristics, including age, income, gender, residence status, and education level, is imperative to building a deeper understanding of the user profile of BSPs and boosting the users' loyalty and retaining them (Rixey, 2013; Li et al., 2019). Some socio-economic features, such as gender, ownership status, and employment, can affect users' willingness to use BSS more than travel restrictions strategies (Feng and Li, 2016).

2.2.6.1.1 Gender

Gender is also a considerable factor influencing BSS usage (Nikitas, 2018). A recent review of the scientific literature has concluded that males are more avid users of BSSs compared to females (Ogilvie and Goodman, 2012; Vogel et al., 2014; Ricci, 2015; Fishman, 2016; Raux et al., 2017; Du and Cheng, 2018). Also, Chen et al. (2020) noted that the proportion of male users is more than females for both SBBS and the FFBS in Hangzhou, China. The gender effect on BSP can be exemplified by the percentage of male users in Melbourne, 76.6%, in Brisbane, 59.8% (Buehler and Hamre, 2014), and the proportion in Montreal, 58% (Bachand-Marleau et al., 2012). Also, according to the results of the surveys conducted by Zanotto (2014) in Vancouver, Canada, 52.8% of BSS members were males.

Furthermore, females accounted for only 21% of Chicago’s Divvy BSS members in Chicago USA (Faghih-Imani and Eluru, 2015). Besides, Goodman and Cheshire (2014) showed that less than 20% of London BSP members are females. Also, Wang and Akar (2019) reported that more than two-thirds of the bike share trips were made by males in New York City, USA. Also, female users are more sensitive to traffic conditions and make fewer commuting trips. Further, the number of subway entrances and bus stops around bike-share stations negatively impacts females' use of bicycles. In addition, males may link bike-share trips to public transit services more than females. It is essential to state that, based on the Li et al. (2019) study, when the travel distance is between 4 km and 8 km, females are more likely than males to choose PBS for their travels.

2.2.6.1.2 Age

Age is a significant element in using BSSs (Raux et al., 2017; Nikitas, 2018). Older people tend to select PBS (Li et al., 2019). In contrast, young people prefer to choose the FFBS for their travels (Du and Cheng, 2018; Li et al., 2019). Vogel et al. (2014) revealed that the 18-49 age group accounts for about 80% of the total number of active subscribers and users in Vélo'v, Lyon. In general, young people are more likely to be involved in cycling than elderlies (Fuller et al., 2011; Ricci, 2015; Eren and Uz, 2020). Also, Chen et al. (2020) mentioned that in both the SBBS and the FFBS, most users are younger than 35 years old in Hangzhou, China. Besides, Wing et al. (2018) pointed out that the BSP is mainly used by the 28 to 37 age cohort in Manhattan, New York. Besides, Fishman et al. (2015) noted that 16.9% of BSS users were between 30 and 34 years old in Melbourne, Australia. Also, Zanotto (2014) mentioned that 67.5% of BSS members were between 16-54 years of age in Vancouver, Canada. Correspondingly, individuals aged 18-34 are 3.3 times more likely than other age groups to be members of the BSP in Australia.

2.2.6.1.3 Education level

Furthermore, education level is one of the influential factors in using bicycle-sharing systems (Fuller et al., 2011). BSS users are probably highly educated (Ricci, 2015; Du and Cheng, 2018; Li et al., 2019). For example, in the "Capital Bike-Share" program in Washington, DC, 95% of users have a four-year college degree, 56% of whom possess an advanced degree (Bachand-Marleau et al., 2012). Besides, Fishman et al. (2015) mentioned that 81% possessed a bachelor's degree or higher education. Also, Zanotto (2014) stated that 65.6% of BSS members had post-secondary education in Vancouver, Canada. In a study by Cheng et al. (2020) in Hangzhou, China, it was found that FFBS and SBBS users had at least a bachelor's degree. Also, for the SBBS, possessing a graduate-level degree was associated with higher use of SBBS, but not for the FFBS.

2.2.6.1.4 Occupation and economic status

Income is another factor impacting bike-sharing usage (Maurer, 2011). Affluent people are inclined to choose PBS (Fishman et al., 2015; Ricci, 2015; Murphy and Usher, 2015; Raux et al., 2017). Also, Li et al. (2018) noted that people with high incomes were more likely to use FFBS in Jiangsu, China. Besides, Rixey (2013) mentioned that mid-income positively relates to BSS usage. However, some barriers exist for low-income groups, such as providing credit card information or accessing the internet to receive a long-term bike-sharing rental card (Murphy and Usher, 2015). The results of an online survey set out by Fishman et al. (2015) in Melbourne, Australia, stated that 43% of the BSS users received an annual salary of 104,000 dollars or more. Also, according to the results of the surveys conducted by Zanotto (2014) in Vancouver, Canada, 72% of BSS members were employed, and 57.9% had an annual income of 50,000 dollars or higher.

2.2.6.1.5 Ownership status

Vehicle ownership is another factor in studying bike-sharing usage rates (Fishman et al., 2015). Shaheen and Guzman (2011) stated that the BSP members (22%) had higher car ownership rates than non-members (11%) in Hangzhou, China, in 2010. Fishman et al. (2015) found that 76.6% of the BSS users owned a car in Melbourne, Australia. Hence, car ownership does not appear to decrease the likelihood of bike-sharing usage.

On the other hand, Chen et al. (2020) stated that most SBBS and FFBS users did not own a car or e-bike in Hangzhou, China.

2.2.6.1.6 Residence status
Interestingly, the residence status of individuals affects the use of BSS. There is a difference in user confidence in the BSS; people with permanent residency are more likely to use PBS, while people without permanent residency prefer FFBS (Li et al., 2019). Du et al. (2019) reported that the residents without registered permanent residence use FFBS, residents with registered permanent residences use fewer FFBS systems, and most (64.68%) own private cars in Nanjing, China.

2.2.6.2 Trip-related characteristics
Trip-related characteristics contain travel time, departure time, travel distance, and trip purpose impact using bike-sharing.

2.2.6.2.1 Travel time
According to Buehler and Hamre (2014), because of the travel time (73% of users) savings in Washington, DC, many Capital Bikeshare (CaBi) riders tend to choose the bike-sharing transport mode. The Results of a study by Mateo-Babiano et al. (2016) revealed that the free initial period under the CityCycle program in Brisbane, Australia, has persuaded most users to choose short-term trips for not incurring any charges other than membership. Similarly, Ahillen et al. (2016) stated that the PBS program was utilized on short trips. Jensen et al. (2010) characterized the speed and paths of bike-sharing usage in Lyon, France. It was stated that using BSP for short trips with high-speed travel is prevalent. It was found that with almost no traffic lights or car impedance, the average speed of bike-sharing reached 14.5 km /h in the early morning of the week. Besides, when there were shortcuts to bicycle travel, most bicycle trips were shorter than car trips. It was also presented that when you are less in a hurry to reach a destination, such as traveling on weekend afternoons, the average travel speed is reduced to 10 kilometers per hour.

2.2.6.2.2 Departure time
The departure time is an important feature to consider. Generally, there are morning and evening peak-hour demands (Kaltenbrunner et al., 2010; Ahillen et al., 2016). Ahillen et al. (2016) found that the PBS program's demand for bikes rose in the morning and afternoon rush hours. Similarly, Ji et al. (2020) found that the departure time in the morning rush hours (7 am-9 am) and the afternoon peak hours (5 pm-7 pm) is positively correlated to both the SBBS and the FFBS usage on workdays. Zhang and Mi (2018) found that the peak hours are between 7 and 8 in the morning and between 5 and 6 in the evening.

Li et al. (2019) mentioned that the demand for bike-sharing is low in the afternoons in Beijing, China. However, Du and Cheng (2018) reported that the evening peak was more significant than the morning peak. Also, Faghih-Imani et al. (2014) indicated that the bike-sharing flow is higher in the evening than in the morning in Montreal, Canada. In this regard, Reiss and Bogenberger (2016) segmented the operating area into 40 zones in Munich, Germany. It turned out that the morning demand for bike-sharing rent was more than in the afternoon and evening at the edge of the operating area.

Conversely, in zones near the city center, the demand for bike-sharing was higher in the evening than in the morning. Also, in a study by Froehlich et al. (2008), usage patterns of the bike-sharing scheme in Barcelona, Spain, showed a rise in bike-sharing use from residential areas to commercial areas at 7 am on weekdays. Furthermore, the demand for BSS from commercial to residential areas increased after working hours.

Kim et al. (2012) identified the difference between weekday and weekend travel behavior in demand for BSSs in Goyang, South Korea. The latter possesses twice the amount of bike-sharing demand compared to the former. Also, the "CityCycle" scheme, the most extensive PBS program in Australia, is used chiefly on weekends for leisure in Brisbane (Mateo-Babiano et al., 2016).

In contrast, Corcoran et al. (2014) presented a general system-wide decrease in the number of travels taking place on weekends in Brisbane, Australia. Besides, Faghih-Imani et al. (2014) reported that the bike-sharing demand decreased over the weekend in Montreal, Canada. In addition, Heaney et al. (2019) reported that people were likelier to choose BSS on weekdays in New York City, USA. Also, Lin et al. (2020) indicated that daily bike-sharing use reduces by roughly 51.5% on public holidays or weekends compared to the workday in Beijing, China.

O'Brien et al. (2014) stated that there is no noticeable difference in the passenger flow of the BSS between weekends and weekdays in Washington, DC. Similarly, Kim et al. (2018) showed no remarkable difference in the number of bike-sharing rentals on weekdays and weekends, but on the weekend morning, the number of trips was reduced. In this regard, Kutela and Kidando (2017) mentioned that compared to evening peak hours (4 pm to 6 pm) and weekends, the morning peak hours and weekdays are accompanied by an increase in the likelihood of the Bikes Idle Duration (BID), respectively. Finally, it is worth noting that using intelligent public transport cards for bicycle rental can persuade users to use the BSS at night.

2.2.6.2.3 Trip purpose

A precise understanding of the trip purpose factor can aid in better comprehending the travel demand and the distribution of rental stations, which is essential information for planning the BSS (Li, 2019). Fishman (2016) noted that BSS annual members' most common trip purpose is commuting. Besides, Chen et al. (2020) found that the top three travel purposes for the SBBS and FFBS users were commuting, school, and leisure trips in Hangzhou, China. Moreover, Li et al. (2018) mentioned that FFBS was mainly used for short city trips, especially for commuting and schooling in Jiangsu, China. Li and Kamargianni (2018) noted that BSSs are more likely to be selected for leisure trips than commuting trips. Li et al. (2019) stated that for bike-sharing users, the commute and attending school are the primary trip purpose, followed by social entertainment and errand, and concluded that non-student users prefer to use PBS for fixed-purpose trips such as HBW trips. However, students are likely to use FFBS for flexible travel, such as recreation trips. Noland et al. (2019) mentioned that the trips which start and end at the same docking stations are primarily recreational.

2.2.6.2.4 Trip distance

Travel distance is an influential factor in bike-sharing usage (Fishman, 2016; Campbell et al., 2016; Du and Cheng, 2018; Li, 2019). There is a negative correlation between the bike-sharing ridership rate and the travel distance (between origin and destination) (El-Assi et al., 2017). Chen et al. (2020) stated that as the travel distance rose, SBBS and FFBS usage reduced. Ji et al. (2020) mentioned that the negative correlation is for both the SBBS and the FFBS; however, SBBS users are more likely to travel further and longer than FFBS users.

Du et al. (2019) found that the riding distance for FFBS is mostly (80%) between 1 km and 5 km. However, Li et al. (2019) noted that FFBS appeals more to those interested in long-distance travel. In the study of Du and Cheng (2018) in Nanjing, China, the travel patterns in FFBS were divided into three categories to detect the influential factors and characteristics of different travel patterns in FFBS. These three categories were 1) Origin to Destination Pattern (ODP) (the user uses FFBS to reach the destination directly), 2) Travel Cycle Pattern (TCP) (origin and destination are the same), and 3) Transfer Pattern (TP) (there is a transfer between FFBS and other travel modes). Results indicated that residents who travel short distances are more likely to select TCP and ODP, and when their travel distance reached 4 km, there was a considerable shift towards TP. In addition, the price affected residents' travel patterns, with residents showing a tendency to choose FFBS when traveling short distances if they found FFBS quickly.

2.2.6.3 Bike-Sharing characteristics

One of the most significant factors impacting the demand for bike-sharing is the bike-sharing characteristics, including travel cost, travel comfort, and helmet provision. The impact of bike-sharing characteristics is discussed below.

2.2.6.3.1 Travel cost

The cost of BSS tickets is an important factor to consider (Fishman, 2016; Du and Cheng, 2018; Nikitas, 2018). Li et al. (2019) found that changes in the price of BSS at different times of the day influence its use. For instance, a price reduction could increase the BSS usage from 7:00 am to 10:00 am if the losses from falling prices are less than the gains from raised usage. A sudden rise in the price of bike-sharing tickets can diminish the level of BSP use for low-income communities, unlike residents living in middle-income or high-income regions. It reflects the influence of socio-economic features on BSS (Goodman and Cheshire, 2014).

2.2.6.3.2 Travel comfort

Convenience is the primary factor motivating cycling and contains many facilities, such as simplicity of payment and membership procedures (Zanotto, 2014; Leister et al., 2018). Also, the ease of picking up and dropping- off the FFBS can increase demand rates (Li et al., 2019). In addition to the mentioned general tangible benefits of cycling, bicycle-sharing brings about a higher level of comfort for users, which can persuade more individuals to adopt cycling for short trips (Bachand-Marleau et al., 2012). Because of its flexibility, BSS is known as a convenient means of transportation for short distances and one-way trips (Hyland et al., 2018). Hence, BSSs are a promising initiative to raise the tendency for cycling among people, that their advantages to users and society are well known.

2.2.6.3.3 Helmet provision

It is clear that there is an adverse correlation between the use of helmets and BSS demand, and BSS members' helmet usage rate is less than that of private cyclists (Bonyun et al., 2012; Kraemer et al., 2012; Grenier, 2013; Fishman et al., 2013; Basch and Zagnit, 2014; Basch et al., 2014). BSS bikes are usually rented for "unplanned" short-term trips (Fishman, 2016). Also, mandatory helmet laws reduced bike-sharing demand, and the reason for this may be due to the unwillingness to carry the helmet and not because of wearing it (Fishman et al., 2014). In addition, Grenier et al. (2013) reported that females (50%) were more likely to wear a helmet compared to males (44%) in Montreal, Canada. In contrast, Basch and Zagnit (2014) mentioned that males (52.7 %) used helmets more often than females (41.2%). Besides, Grenier et al. (2013) noted that youths had more helmet usage levels than young adults, 73% and 34%, respectively. Also, the helmet-wearing use proportion was higher for commuting trips (58.9 %) versus recreational trips (42.4 %) in New York City, USA.

2.2.6.4 Built environment and land use

Infrastructure and Transportation Facilities, land use, and accessibility factors influence bike-sharing use.

2.2.6.4.1 Infrastructure and transportation facilities

It is necessary to determine the relationship between BSS usage, built environment, and land use attributes to comprehend people's bike-sharing choice behavior (Shen et al., 2018; Duran-Rodas et al., 2019). Up to the present, many studies have identified the built environment and land use factor that prevents/promotes the use of BSP (Faghih-Imani et al., 2017; Wang et al., 2018). It should be noted that the sustainability of the BSS pertains to bicycle network accessibility and connectivity. Knowing how to allocate resources at the station level is essential for BSPs. There is also ample evidence that public agencies need to perceive the temporal effects of bicycle lane investment on bicycle use, especially in smart cities where a keen understanding of interactions between bike-sharing operators and agencies is imperative (Chow & Sayarshad, 2014).

As previous research reported, there is a significant positive relationship between the presence of bike lanes and bike-sharing ridership (Buck and Buehler, 2012; Fishman et al., 2015). In general, the expansion of bike lane networks near bike-sharing stations is associated with the desire to cycle more (Krykewycz et al., 2010; Buck and Buehler, 2012; Faghih-Imani and Eluru, 2016b; Kabak et al., 2018). Besides, the bike-sharing stations placed along the same high-quality bike routes have higher trip rates than other pairs of stations (Noland et al., 2019). Also, bicycle lanes raise bike-sharing trips on weekends and holidays and increase casual users' travel (Noland et al., 2016). Bike-sharing stations, which are close to off-road infrastructure, are most active in Brisbane, Australia (Mateo-Babiano et al., 2016). Also, extending the length of off-street bike routes could remarkably promote BSS usage (Wang and Akar, 2019). Mateo-Babiano et al. (2016) stated that the length of off-road bikeways located within 400m of the bike-sharing stations strongly correlates to the use of the PBS program. Similarly, Zhou (2015) employed a flow clustering analysis to specify the optimal distance and reported that the appropriate value for buffer (service radius of bike share station) distance is 402 m. Besides, Wang et al. (2018) mentioned that the length of off-road within a 500m station buffer positively influences the amount of trip generation. Besides, it was mentioned that the length of the sidewalk does not affect the use of BSP.

Furthermore, bicycle-friendly facilities and concentrated amenities propel many people to use the BSS when paired with a well-designed public bicycle system (Gleason and Miskimins, 2012). Lu et al. (2018) noted that high-volume unmarked cycling routes reduce BSS usage. Also, bike-sharing users tend to select routes with separated lanes instead of the shortest routes.

Also, according to Jain et al. (2018), casual BSS users are more likely to ride bikes in areas with separate bike lanes and paths. Xu and Chow (2019) mentioned that installing additional miles of bike lanes and a more significant number of bike-sharing stations leads to higher bike-sharing ridership. Wang and Lindsey (2019) found that the length of on-street bike facilities positively correlates with BSS use. In addition, the impact of bicycle-sharing facility size is stronger than the influence of bike-sharing access on BSS usage. Wang and Akar (2019) found that installing bicycle racks positively affects the greater use of BSS. This effect is higher for females. Specifically, a 1% rise in the number of bike racks is associated with a 1.18% increment in BSS usage by females. Hence, the transport-related infrastructure plays a significant role in the bike-sharing users' decision choice (Jennings, 2011; Zanotto, 2014; Ricci, 2015; Faghih-Imani et al., 2017; De Chardon, 2017; Duran-Rodas et al., 2019).

However, De Chardon et al. (2017) mentioned that the system expansions, including increasing the number of stations, could not improve BSS performance. Also, Wang and Lindsey (2019) noted that installing new stations in areas without proper bike-share access and without creating and connecting them as part of a dense network system may not significantly raise BSS use. According to Shen et al. (2018), a more extensive FFBS fleet leads to greater use. Nevertheless, as the size of the fleet increase, the marginal effect reduces; hence, the utilization level of each bike decreases. Also, due to limited public space and road resources, such growth is not sustainable. Excessive use of the bicycle fleet damages its economic stability, causes visual pollution, and takes up much public space.

2.2.6.4.2 Land use

Population density and the city's labor market size are prominent indicators contributing to the bike-sharing trip generation and attraction factors (Hampshire and Marla, 2012; Zhang, 2017). Duran-Rodas et al. (2019) noted that the city population is important in using SBBSs. Wang and Lindsey (2019) reported that BSS usage is higher in areas with a higher percentage of retail land use and a higher population density. Also, Noland et al. (2016) stated that the more population and employment, the more BSS is used. According to Jain et al. (2018), casual BSS users are likelier to ride bikes in areas adjacent to tourist hotspots. However, long-term BSS users often cycle in areas close to high employment density districts. El-Assi et al. (2017) noted that population density is more decisive for trip generation, while employment density is more influential for trip attraction. The working point of interest (POI), transit POI, and residential POI promote using the FFBS and the SBBS (Ji et al., 2020). Noland et al. (2016) found that areas with higher residential populations were associated with higher subscriber travel rates, especially on non-working days.

Lin et al. (2020) found that parks can increase bike-sharing usage rates on weekends/holidays more than on weekdays. In addition, Etienne and Latifa (2014) found that bike-sharing stations near parks could increase BSS demand on the weekend afternoon in Paris, France. Also, Duran-Rodas et al. (2019) stated that city leisure facilities are among the factors influencing the use of SBBSs. Besides, the importance of the influence of some factors is temporarily different (e.g., the impact of nightclubs during the night). Also, the distance from a bike-sharing station to car-sharing stations, city centers, memorials, and bakeries affects the use of the SBBS.

Kutela and Kidando (2017) found that the BID in commercial areas is shorter than in residential land use. A study by Kim et al. (2012) in Goyang, South Korea, indicated that areas near commercial and residential buildings, parks, schools, and subway stations near the bike-sharing stations could positively affect bike-sharing. Also, it was observed that on non-rainy weekdays, commercial buildings could raise public bike usage fifteen times more than residential buildings; parks attract bike-sharing users three to five times more than subway stations or schools. Croci and Rossi (2014) identified that the presence of cinemas, universities, subway and train stations, museums, and limited traffic zones could significantly increase the levels of SBBS use in Milan, Italy. In contrast, bus and tram stations and theaters have adverse impacts.

Furthermore, Noland et al. (2016) found that subway stations proximate to bike-sharing stations lead to a rise in bike-sharing trips. It is worth noting that for both casual and long-term BSS users, proximity to major transportation hubs is a significant factor (Jain et al., 2018). According to Lin et al. (2020), the proximity to colleges does not show a noticeable rise in levels of bike-sharing use. Buck and Buehler (2012) stated that mixed-use planning, in which two or more residential, institutional, cultural, commercial, and industrial uses are blended, is essential in encouraging bike-sharing utilization. Hence, planning urban areas with more diverse economic activities can increase the use of FFBS (Shen et al., 2018).

In a study by Zhao et al. (2019) in Nanjing, China, it was reported that SBBS stations are prone to unbalanced demand, meaning that SBBSs are facing excessive demand or suffer from a shortage of parking supply. It was found that the factor of the built environment has a significant relationship with the number of bike-sharing reallocations. Also, SBBS stations with the highest number of reallocations are placed close to clinics/hospitals, residences, employment areas, bus stops, subway stations, amenities, parks, sports facilities, and restaurants. While stations proximate to educational institutions, hotels, leisure facilities, entertainment venues, and shopping malls are more likely to have balanced demand and supply. Besides, the stations' capacity is the most substantial factor in bike reallocation. In addition, it was revealed that the presence of restaurants and areas with high employment density positively impact bike removal in the morning and bike refilling in the afternoon at SBBS stations. Also, Vogel et al. (2011) stated that due to short-term rental and one-way utilization, imbalances occur in the spatial distribution of bicycles. Therefore, planning the right location for bike-sharing stations can reduce imbalances. Shen et al. (2018) mentioned that the general management, optimization, and rebalancing of SBBS are different from FFBS. In order to rebalance SBBS, it is only required to consider pick-up and drop-off at stations. However, since FFBS can be parked anywhere where parking is legal, it potentially complicates the rebalancing of FFBS.

2.2.6.4.3 Accessibility

Accessibility is a considerable factor influencing bike-sharing demand. Bachand-Marleau et al. (2012) attempted to ascertain the elements which enhance people's tendency to use the shared bike system and the factors affecting the frequency of use. It was revealed that the location of shared bicycle stations is an essential factor in using shared bicycles. The home's proximity to docking stations significantly impacts the likelihood of choosing the shared bicycle system. Hence, the higher the number of docking stations near the origins of potential users in residential areas, the higher the number of system users. Besides, access to the most proximate bike-sharing station is needed for pick-up and return activities (Shaheen et al., 2011). Hence, the bike-sharing stations should be in the nearest locations to gain the maximum coverage and attract the most significant number of people who desire to rent a bicycle (Dell'Olio, 2011). In addition, the proximity of bike-sharing stations to each other and the users' position raise the levels of bike-sharing use (Bachand-Marleau et al., 2012; Rixey, 2013). Also, Wang and Lindsey (2019) found that relocating old stations or placing new ones can reduce the distance to the stations, which leads to an improvement in access. Therefore, bike-sharing accessibility is higher in areas with dense bike-sharing services. Wag et al. (2016) stated that the proximity of bike-sharing stations to parks, a central business district, waterways such as lakes or rivers, and access to trails are essential factors in increasing the use of BSS.

In addition, Faghih-Imani et al. (2017) noted that bike station density and average capacity influenced the rate of BSS use. Faghih-Imani and Eluru (2015) indicated that bike-sharing members prefer high-density stations with small capacities; however, daily users are likely to favor fewer capacity stations with more extensive docks. SBBS systems possess many stations and ready-to-use bikes to quickly pick-up and return bikes in cities (Lin and Yang, 2011). In order for users to embrace such systems, it is significant to ensure high bicycle availability at stations (Froehlich et al., 2008; Vogel and Mattfeld, 2011; Feng and Li, 2016; Zhang, 2017). Also, the empty smart parking unit is needed at the stations to place the rented bicycle.

2.2.6.5 Natural environmental conditions

The hilliness, weather conditions, temperature, seasonal effects, and pollution factors are natural environmental conditions that can influence the demand for bike-sharing.

2.2.6.5.1 Hilliness

The steep slopes can make the ascents difficult for cyclists as the required power for cycling rises in proportion to the hill's gradient. Also, the descents can trigger unsafe high-speed and reduce levels of perceived safety for users (Frade and Ribeiro, 2014). In general, the use of BSS can be reduced when cycling uphill (Jennings, 2011; Bordagaray et al., 2016), especially when the slope is above 4% (Lu et al., 2018). Fricker and Gast (2016) suggested that reward policies could incentivize users to return bikes to stations to boost the bike-sharing usage rate and address the bike-sharing rebalancing problem at uphill stations.

2.2.6.5.2 Weather conditions

Moreover, one of the issues that affect user ridership choice behavior is the impact of weather conditions on cycling (Simons et al., 2013; Gebhart and Noland, 2014; Shen et al., 2018). Caulfield et al. (2017) noted that in favorable weather conditions, the travel time and the number of trips are higher in Cork, which is a small city in Ireland. On the other hand, theoretically, rainfall, colder weather, high wind speed, and extreme heat are negatively correlated with levels of bike-sharing use (Corcoran et al., 2014; Gebhart and Noland, 2014; Faghih-Imani and Eluru, 2016a; Hyland et al., 2018; Kim, 2018; Sun et al., 2018). Daily usage is reduced due to wind speed, snowfall, and rain (Lin et al., 2020). De Chardon et al. (2017) showed that wind could negatively influence BSS performance. According to Martinez's

(2017) study, lower wind speeds, precipitation rates, higher temperatures, and less snowfall can raise BSS usage in New York City. A study by Reiss and Bogenberger (2016) in Munich, Germany, stated that rainfall could reduce the use of bicycle-sharing by much less than the average, and the demand for bike-sharing trips returns to its average level 3 hours after heavy rains. Eren and Uz (2020) noted that rain is the most unfavorable weather condition that impacts the use of bicycles.

Gebhart and Noland (2014) utilized a rich dataset encompassing hourly usage information and weather patterns to survey the effect of weather on the frequency and the levels of bike-sharing use in Washington, DC, United States of America. Results showed that rainfall has more impact on the rate of bike-sharing trips when the bike-sharing stations are proximate to the subway stations compared to when the bike-sharing stations are far from the subway stations. Moreover, on rainy days, the number of trips is about 0.56 times less, and the travel time is around 2.8 min shorter than on non-rainy days. In that study, the average wind speed was 13.2 km/h, defined as a "gentle breeze." It was determined that increasing wind speeds reduces the number of bike-sharing trips and trip duration as people are less willing to cycle on windy days. Besides, it was specified that the impacts of fog, snowfall, and thunderstorms are not statistically significant for either the number of trips made or the duration of the trip. Also, it was found that fog and thunderstorms could raise the trip duration for registered users in the BSS (0.2% and 4.4%, respectively). Still, it significantly reduced the trip duration for casual users (36.1% and 29.3%, respectively). For registered users, trip durations declined by 9.4% in snow and 10.1% in the rain. Reduced trip duration for casual users in these weather conditions were much higher, 12.1% in snow and 22.4% in the rain. It was identified that if the subway station is available as an alternative transport mode, the rainy days, the temperature between -6.7° C and -1.7° C, and the absence of adequate daylight can cause a significant reduction in the number of bike-sharing trips.

2.2.6.5.3 Temperature

The impact of temperature on bike-sharing use has been studied as one of the most important factors. There is a positive relationship between bike-sharing demand and temperature rise (Faghih-Imani et al., 2014; Hyland et al., 2018). Eren and Uz (2020) mentioned that bike-sharing trip production positively correlates with the temperature when the temperature is between 0–20 °C. Also, temperatures of 20 to 30 °C without precipitation raise the likelihood of using the BSS. Wang et al. (2018) examined the impact of weather conditions on demand for BSSs in different age cohorts in New York City. The demand for bike-sharing for all age groups was positively related to the temperature of 12 to 16 °C. However, this demand negatively correlated with the weather temperature of 27–32 °C. Also, temperatures of 21–27 °C adversely impacted the demand for bike-sharing among young people between the ages of 16 and 27 but had a positive effect among other age groups. In Kim's (2018) research in Daejeon, South Korea, temperatures above 30 °C were considered "scorching heat." Because on only 49 days of the year, the temperature in 2015 was above 30 °C. It was found that when the temperature is above 30 °C, the use of the BSS is reduced. In contrast, El-Assi et al. (2017) noted that the demand for bike-sharing in Toronto, Canada, where the temperature can reach 42 °C, is rising at temperatures above 30 °C. Similarly, Jing and Zhao (2015) showed that the best temperature at which the demand for bicycle sharing reaches its maximum is between 30 °C and 35 °C in Washington, DC, USA. However, Lin et al. (2020) found that temperature was not linearly related to bike-sharing daily use in Beijing, China.

Proper ambient temperature is associated with positive changes in physical activity participation (Faghih-Imani and Eluru, 2016a). As Cycling is an important and widely used form of physical activity, Heaney et al. (2019) opted to elucidate the relationship between ambient temperature and levels of bike-sharing use. Also, it was investigated how rising ambient temperatures caused by climate change might affect active transportation in New York City. The results showed that the highest total hours of bike-sharing use and the maximum average distance traveled in the year's warm months (March-October) occurred. Although the levels of bike-sharing use are positively related to higher temperatures, bike-sharing use is reduced when the temperature is above 26°C–28°C in New York City. Also, Because of climate change, bike-sharing use might increase by up to 3.1% by 2070. In addition, in the future, the use of BSSs will increase in winter, spring, and fall. This projected increase outweighs the reductions which occur in the rate of bike-sharing use in summer. It should be stressed that although the use of the BSS in New York City is expected to increase by the middle of this century, this trend may be reversed if the temperature continuously rises.

The results of a study by Gebhart and Noland (2014) revealed that colder weather, rain, and high humidity decrease the trip duration and the probability of using the BSS. Further, most trips seem to be made when the temperature is between 26.7° C and 31.7° C. Besides, When the temperature is between -12.2° C and 4.4° C, the average trip duration is shorter, unlike when the temperature is in the range of 10° C to 15° C. Also, temperature between 21.1° C and 31.7° C was significantly associated with increased travel length. However, there was not any considerable difference between the trip duration of the temperature above 32.2 and the trip duration between 10° C and 15° C. Plus, it was found that a change of 1% in average humidity (63.63%) can reduce the travel frequency by 0.94%. Besides, it is usually assumed that 32.2° C to 37.2° C is not favorable for cycling. Surprisingly, it was found that the number of trips at temperatures of 32.2° C to 37.2° C has increased dramatically. Therefore, increasing humidity reduces bike-sharing trips, but high temperatures are not necessarily the case.

2.2.6.5.4 Seasonal effects

Moreover, there are seasonal effects, meaning most bike-sharing trips are made in the summer, while bike-sharing demand is relatively low in the spring and fall. Godavarthy and Taleqani (2017) observed that BSS usage in winter was equal to 10%-30% of its peak use in summer in the cold cities of the United States. Similarly, Rudloff and Lackner (2014) stated that demand for bike-sharing declines significantly in the winter, even at the heavily used stations in Vienna, Austria. In addition, Kutela and Kidando (2017) pointed out that the likelihood of long BID rises in the winter, especially when it snows and rains. Hyland et al. (2018) reported that members who use the BSS in the morning are less affected by winter weather than other users. These members are less likely than tourists or casual users to be influenced by snow and cold weather and rely on BSSs to improve their commute. Also, in terms of sensitivity to unfavorable weather, Fournier et al. (2017) noted that recreational cyclists are more sensitive to unfavorable weather than their daily commuting counterparts.

Miranda-Moreno and Nosal (2011) examined the sensitivity of cyclists to weather conditions in Montreal, Canada. It was observed that a sharp temperature rise could reduce the use of the BSS in warm months and raise bike-sharing usage in cold months. Cyclists seem more sensitive to low temperatures, regardless of whether the average temperature is cold or hot. Although a sharp drop in temperature can reduce bike-sharing usage in colder months, it can raise the usage of the bike-sharing level in warmer months. Furthermore, it was found that a rise of 10% in temperature from 14.7 °C causes an average increase of 4%-5% in the hourly volume of the BSS. Additionally, it was mentioned that the bike-sharing volume raised from 32% to 39% in the summer. However, when the humidity exceeds 60%, and the temperature exceeds 28 °C, the bike-sharing demand decreases.

2.2.6.5.5 Pollution

In a study by Lin et al. (2020), it was stated that heavy pollution and light do not significantly affect bike-sharing use; however, severe pollution adversely impacts bike-sharing usage in Beijing, China. Moreover, Li and Kamargianni (2018) realized that air pollution significantly negatively affected bike-sharing choices in Taiyuan, China. Nonetheless, improving BSS services, such as saving on access time and travel costs, is more effective in raising BSS use than improving air quality.

2.2.7 Summary

Factors such as natural environmental conditions, built environment and land use, trip-related characteristics, bike-sharing characteristics, and socio-demographic characteristics influence bike-sharing use. Table 24 indicates these factors and their sub-factors effects on the use of bike-sharing.

Table 24: Factors affecting bike-sharing choice.

Factors	Sub-factor	Positive impact	Negative impact	Reference (studied the SBBS)	References (Studied The FFBS)
Natural environmental conditions	Weather condition	Favorable weather	Adverse weather such as rainfall, high humidity	Miranda-Moreno and Nosal, 2011; Gebhart and Noland, 2014; Corcoran et al., 2014; Faghih-Imani and Eluru, 2016a; Caulfield et al., 2017; Fournier et al., (2017); De Chardon et al., 2017; Martinez, 2017; Kutela and Kidando, 2017; Sun et al., 2018; Lin et al., 2020; Eren and Uz, 2020	Reiss and Bogenberger, 2016: Shen et al., 2018
	Temperature	Warm temperature	Cold temperature	Miranda-Moreno and Nosal, 2011; Faghih-Imani et al., 2014; Corcoran et al., 2014; Gebhart and Noland, 2014; Jing and Zhao, 2015; Faghih-Imani and Eluru, 2016a; El-Assi et al., 2017; Martinez, 2017; Wang et al., 2018; Hyland et al., 2018; Kim, 2018; Heaney et al., 2019; Eren and Uz, 2020; Lin et al., 2020	
	Seasonal effect	Summer	Winter	Rudloff and Lackner, 2014; Godavarthy and Taleqani, 2017; Kutela and Kidando, 2017; Heaney et al., 2019; Eren and Uz, 2020	

Factors	Sub-factor	Positive impact	Negative impact	Reference (studied the SBBS)	References (Studied The FFBS)
	Pollution		Severe pollution	Li and Kamargianni, 2018	
	Hilliness		Steep roads	Jennings, 2011; Frade and Ribeiro, 2014; Fricker and Gast, 2016; Bordagaray et al., 2016	Lu et al., 2018
Built environment and land use	Land use	Living near a densely populated community, route, retail density, commercial buildings, leisure facilities, and presence of parks along the journey		Buck and Buehler, 2012; Kim et al., 2012; Hampshire and Marla, 2012; Bachand-Marleau et al., 2012; Noland et al., 2016; Croci and Rossi, 2014; Etienne and Latifa, 2014; Noland et al., 2016; Zhang, 2017; El-Assi et al., 2017; Kutela and Kidando, 2017; Jain et al., 2018; Duran-Rodas et al., 2019; Wang and Lindsey, 2019; Zhao et al., 2019; Duran-Rodas et al., 2019; Lin et al., 2020; Ji et al., 2020	Shen et al., 2018; Ji et al., 2020
	Accessibility	Living within a proximate distance to public transit stations and proximity of docking stations to residential Housing		Bachand-Marleau et al., 2012; Kim et al., 2012; Wang and Lindsey (2019); Zhao et al., 2019; Ji et al., 2020	
	Bike-sharing station distance from major roads	Station proximity to major roads		Zhou, 2015; Mateo-Babiano et al., 2016; Wang et al., 2018; Wang and Akar, 2019; Noland et al., 2019	
	Bike-sharing station distance from transit stops	Station proximity to transit stops		Croci and Rossi (2014); Noland et al., 2016; Jain et al., 2018; Duran-Rodas et al., 2019; Zhao et al., 2019	
	Bike-sharing station distance from bicycle lanes	Station proximity to bicycle lanes		Krykewycz et al., 2010; Buck and Buehler, 2012; Fishman et al., 2015; Noland et al., 2016; Faghih-Imani and Eluru, 2016b; Jain et al., 2018; Kabak et al., 2018; Xu and Chow, 2019	Lu et al., 2018
	Fleet size	The higher number of stations, larger size, and length of the facility		Bachand-Marleau et al., 2012; Faghih-Imani and Eluru, 2016b; Wang and Lindsey, 2019; Xu and Chow, 2019; Wang and Akar, 2019	Shen et al., 2018
	Bike-sharing design	Satisfy with the design of shared bikes		Bachand-Marleau et al. (2012)	
	Bike-sharing station distance from other bike-sharing stations	Station proximity to other bike-share stations		Bachand-Marleau et al., 2012; Rixey, 2013	
Trip-related characteristics	Trip purpose	Commuting, traveling to school, leisure trips		Fishman, 2016; Li and Kamargianni, 2018; Li, 2019; Noland et al., 2019; Li et al., 2019; Chen et al., 2020	Li et al. (2018); Li et al. 2019; Chen et al., 2020
	Trip distance		High travel distance	Fishman, 2016; Campbell et al., 2016; El-Assi et al., 2017; Li, 2019; Li et al., 2019; Ji et al., 2020; Chen et al. (2020)	Li et al., 2018; Du and Cheng, 2018; Du et al. 2019; Li et al., 2019; Ji et al., 2020; Chen et al., 2020

Factors	Sub-factor	Positive impact	Negative impact	Reference (studied the SBBS)	References (Studied The FFBS)
	Departure time	Peak hours		Froehlich et al., 2008; Kaltenbrunner et al., 2010; Kim et al., 2012; Faghih-Imani et al., 2014; O'Brien et al., 2014; Corcoran et al., 2014; Reiss and Bogenberger, 2016; Ahillen et al., 2016; Mateo-Babiano et al., 2016; Kutela and Kidando, 2017; Kim et al., 2018; Heaney et al., 2019; Li et al., 2019; Ji et al., 2020; Lin et al., 2020	Zhang and Mi, 2018; Li et al., 2019; Ji et al., 2020
	Travel time	Short trips		Jensen et al., 2010; Buehler and Hamre, 2014; Mateo-Babiano et al., 2016	
Bike-sharing characteristics	Travel cost	Low travel cost	High travel cost	Goodman and Cheshire, 2014; Fishman, 2016; Nikitas, 2018; Li and Kamargianni, 2018	Du and Cheng, 2018; Li et al., 2019
	Helmet provision		Mandatory helmet laws	Bonyun et al., 2012; Kraemer et al., 2012; Grenier, 2013; Fishman et al., 2013; Fishman et al., 2014; Basch and Zagnit, 2014; Basch et al., 2014; Fishman, 2016	
	Travel comfort	Comfort		Zanotto, 2014; Leister et al., 2018	
Socio-demographic characteristics	Age	Younger users		Fuller et al., 2011; Vogel et al., 2014; Zanotto, 2014; Fishman et al., 2015; Ricci, 2015; Raux et al., 2017; Nikitas, 2018; Wing et al., 2018; Li et al., 2019; Eren and Uz, 2020; Chen et al., 2020	Du and Cheng, 2018; Li et al., 2019; Chen et al., 2020
	Gender	Male users		Ogilvie and Goodman, 2012; Zanotto, 2014; Vogel et al., 2014; Goodman and Cheshire, 2014; Buehler and Hamre, 2014; Ricci, 2015; Faghih-Imani and Eluru, 2015; Fishman et al., 2015; Fishman, 2016; Raux et al., 2017; Nikitas, 2018; Wang and Akar, 2019; Li et al., 2019; Chen et al., 2020	Du and Cheng, 2018; Li et al., 2019; Chen et al., 2020
	Occupation and economic status	Higher-income, affluent people	Low income	Maurer, 2011; Rixey, 2013; Zanotto, 2014; Fishman et al., 2015; Ricci, 2015; Murphy and Usher, 2015; Raux et al., 2017; Li et al., 2019	Li et al., 2018; Li et al., 2019
	Residence status (permanent residence or not)		Permanent residence	Li et al., 2019; Du et al., 2019	Li et al., 2019; Du et al., 2019
	Ownership status (bike, car, scooter)			Bachand-Marleau et al., 2012; Shaheen and Guzman, 2011; Fishman et al., 2015; Chen et al., 2020	Du et al., 2019; Chen et al., 2020
	Education level	Well-educated background		Fuller et al., 2011; Bachand-Marleau et al., 2012; Zanotto, 2014; Fishman et al., 2015; Ricci, 2015; Li et al., 2019; Cheng et al., 2020	Du and Cheng, 2018; Li et al., 2019; Cheng et al., 2020

It is worth mentioning that although most of the factors affecting bicycle use and bike-sharing have similar effects, there are differences in some of them. For instance, the purpose of bicycle travel is primarily recreational trips. However, the purpose of bike-sharing trips is in the broader area, including commuting, school trips, and leisure trips. Moreover, people with higher incomes and affluent people use bike-sharing more than people with low incomes. On the other hand, low-income people ride bicycles more than high-income people. Besides, owning a car does not seem to reduce the likelihood of using bike-sharing. However, it can reduce the use of bicycles.

2.3 An overview of scooter-sharing

The scooter-sharing system and its benefit are explained in Chapter 1. This section provides an overview of scooter-sharing services to figure out better the important criteria and sub-criteria that can impact the use of scooter-sharing. In this regard, a brief history of e-scooter-sharing, advantages and disadvantages of e-scooters, e-scooter vs. other transport modes, and factors affecting demand for e-scooters and its summary are noted as follows.

2.3.1 A brief history of e-scooter-sharing

In 2017, Bird and Lime (American transportation companies) introduced dockless electric kick scooters, which are a modern means of transportation (micro-mobility) (Almannaa et al., 2020). In Europe's case, the most significant interest in scooter-sharing services occurred in 2018, when these systems began operating in Europe's largest capitals (Turoń and Czech, 2019). This trend soon spread to several cities in the USA and around the world to various European countries, Canada, Central and South America, Australia, New Zealand, and so on (Sipe and Pojani, 2018; Choron and Sakran, 2019; Petersen, 2019; Shaheen et al., 2020). E-scooters are considered the newest means of transport in the evolving sharing economy (Popov and Ravi, 2020). This new mobility solution is becoming more popular with shared mobility operators and new social trends (Turoń and Czech, 2019). It seems that e-scooters can meet instant demand (Gössling, 2020). With the rapid growth of the on-demand and sharing economy, the scooter-sharing market has accelerated rapidly over the past year, and cities worldwide host scooter-sharing activities (He and Shin, 2020). The increasing use and acceptance of shared e-scooter services reflect the untapped demand for innovation in urban mobility, representing another disruptive force in transport services. Besides, most e-scooter-sharing users were not-regular, while 22% utilized the e-scooter-sharing service several times a month in Europe and North America (Popov and Ravi, 2020).

2.3.2 General advantages and disadvantages of e-scooters

E-scooters have some pros and cons. The main ones are as follows.

2.3.2.1 Advantages

- Provide an additional transportation solution that allows users to address the first/last mile issue (Turoń and Czech, 2019),
- A sustainable alternative to fossil fuels cars (Carrese et al., 2021),
- Weaving through dense traffic (Sanders et al., 2020),
- Contribute to reducing traffic congestion (Carrese et al., 2021),

- Additional transportation solutions enhance the attractiveness of tourism in the urban environment where e-scooter-sharing is located (Turoń and Czech, 2019),
- Positive effect on the environment because of the e-mobility and negative noise reduction (Turoń and Czech, 2019),
- Low maintenance costs (Turoń and Czech, 2019),
- Relatively low cost of purchasing a scooter (Turoń and Czech, 2019),
- Education for e-mobility because of the high availability of e-scooters across the entire society (Turoń and Czech, 2019),
- It requires less physical effort than cycling or walking (Younes et al., 2020).

According to Popov and Ravi (2020), providers of e-scooter-sharing services promote e-scooters as a better option than cars for environmental reasons. Hence, service providers promote e-scooter usage by influencing the customers to believe that they are making the right decision by utilizing an e-scooter-sharing service and contributing to the carbon-free transportation mode. Also, promoting e-scooter-sharing as an environmentally friendly option can raise service loyalty. Most e-scooter-sharing service users (millennials) consider using their e-scooters to be environmentally friendly and recognize that sharing services are sustainable and reflect a modern lifestyle.

2.3.2.2 Disadvantages

- Low speed compared to car or bus (Turoń and Czech, 2019),
- Need to charge (Turoń and Czech, 2019),
- It cannot carry more than one person (Turoń and Czech, 2019),
- Limited load carrying capacity, such as difficulty in carrying luggage (Turoń and Czech, 2019),
- A short lifespan (Moreau et al., 2020),
- The problem of parking them on the sidewalk (James et al., 2019),
- Accidents and injuries (Schlaff et al., 2019).

E-scooter-sharing is expanding significantly and can reduce traffic congestion in dense cities. Nevertheless, this new micro-mobility transport mode creates many operational, privacy, and safety concerns (Li et al., 2020). Immediately after the deployment of e-scooters, there were complaints from non-users, especially pedestrians, who felt another violation in their public space (Tuncer and Brown, 2020). Some users park their e-scooter without following the traffic rules. They leave the e-scooter in positions and places that dramatically reduce urban space and interfere with pedestrians and other vehicles. In order to counter poor parking and increase the popularity of e-scooters among city dwellers, some agents have been hired by e-scooter-sharing companies. Their main task is to reposition e-scooters at short distances to eliminate inappropriate and irregular parking created by users and ensure urban decoration (Carrese et al., 2021).

James et al. (2019) surveyed 181 users and non-users of e-scooters and examined their perceived safety for e-scooters users and the experiences of scooter-blocked sidewalks in Virginia, USA. It was found that there were highly divergent responses about safety and perception of sidewalk blockage. It was also demonstrated that 16% of respondents noticed that the e-scooters were not appropriately parked, and 6% of the e-scooters blocked the pedestrian crossing. In contrast, Fang et al. (2018) reported that most scooters were well parked in downtown San Jose, USA. Additionally, less than 2% of scooters blocked access for the disabled. Of the scooters parked on the sidewalks, 90% are not parked in pedestrian traffic. Most did not obstruct pedestrian traffic, even among the 10% of scooters parked on the sidewalk that was not in the street furniture zone or sidewalk edge. Importantly, more secure infrastructure and lower street speed limits reduce sidewalks' illegal use (Shaheen and Cohen, 2019). The almost spontaneous proliferation of e-scooters has prompted e-scooter-sharing companies and the government to address issues partly due to concerns about the large number of e-scooters entering vehicle traffic. These issues are affected by the e-scooter users' decisions and behaviors that, despite being licensed to drive passenger vehicles, have potentially limited experience with an e-scooter in traffic (Todd et al., 2019). Hence, the complexities of micro-level interactions in macro-level decision-making have to be considered by governments (Gibson, 2020). Municipal governments have enacted e-scooter regulations to raise riders' and pedestrians' safety, prevent visual pollution, and ensure safety, management, and operation (Anderson-Hall et al., 2019; Almannaa et al., 2020). Safety, promoting equitable access to services, assessing the effects of e-scooters on traffic, and sustainability are the primary purposes that most cities focus on (Clewlow, 2019). Urban planners should cautiously introduce maximum speed, mandatory use of bicycle infrastructure, and private parking and limit authorized operators' numbers (Gössling, 2020). It is worth noting that differences in city size, climate, geography, and other characteristics may lead to different policies and approaches (Riggs and Kawashima, 2020).

E-scooters face safety challenges due to increased vibrations, speed changes, and limited ride environments (Ma et al., 2021). Therefore, safety is of paramount significance on a shared footpath. While lower riding speed can decrease the likelihood and severity of injuries, the speed of e-scooters may not be the only factor in assessing perceived risk on a shared footpath. Because of feeling safe, pedestrians had a similar perception of the speed of 10 km/h or 15 km/h (Che et al., 2020). For instance, in Oslo, Norway, one in ten e-scooter users have had an accident. Most users (46%) feel safe in traffic. However, one in four pedestrians and cyclists feels unsafe interacting with e-scooter users (Berge, 2019). In Portland, USA, 83% of e-scooter-related injuries did not involve other means of transportation, 13.6% involved a motor vehicle, and 2.8% related to a pedestrian (Shaheen and Cohen, 2019). Also, only one collision (0.6%) involved two scooters. In Brisbane, Australia, not wearing a helmet, consuming alcohol, and speeding more than 30 km/h were essential factors in e-scooter accidents (Haworth and Schramm, 2019).

The introduction of the e-scooter-sharing service has created a new injury risk. In Australia, dislocations or fractures were observed in 32% of patients and 26% with head injuries, one of which was severe. In addition, isolated partial musculoskeletal injuries were seen in 46% of patients (Beck et al., 2020). Since the launch of e-scooter-sharing in Salt Lake, USA, a substantial increase in e-scooter-related trauma has been seen. Of note is the number of patients with major musculoskeletal and head injuries (Badeau et al., 2019). Similarly, in Brisbane, Australia, abrasions/contusions and dislocations/fractures were the most common injuries (Mitchell et al., 2019). In Los Angeles, USA, 11% of the injured patients were under 18 years old, and only 4% of the users have documented the use of helmets (Trivedi et al., 2019). Also, head and face injuries in Dallas, USA, accounted for 58% of all injuries. The prevalence of extremity injuries indicates that patients fell off the e-scooter when they had an accident. In addition, wearing a helmet can decrease craniofacial trauma associated with e-scooters (Trivedi et al., 2019). In the USA, approximately 87% of emergency visits were for patients undergoing treatment and discharge. Besides, roughly 15% of injuries related to e-scooters occurred on the face, ankles, head, knees, and low leg.

Moreover, about 45% of injuries occurred in people aged 10-29. Further, of the 51 million person-trips taken by e-scooters, 346 injuries per million trips were reported. However, of 4.7 billion person trips taken by bikes, 114 injuries/million trips were reported. The most dangerous behavior for e-bike and bike cyclists was cycling against the traffic flow in a naturalistic environment. For e-scooter users, it was riding without a helmet (Watson et al., 2020). A study at Auckland City Hospital in New Zealand also identified an increased need for urgent radiology imaging in the first two months after the e-scooters launch (Mayhew and Bergin, 2019).

The emergence of many e-scooters in urban traffic leads to many legal and safety issues. There are problems with moving and parking e-scooters on the streets, pavements, and intersections (Turoń and Czech, 2019). In the usage phase, the user's behavior affects operational safety, particularly compliance with the applicable rules. Besides, dropping off the scooter is of particular significance for all traffic users' safety in the vehicle's final stage. The mobile app supporting users in vehicle performance affects system safety (Tubis et al., 2019). In Brisbane, Australia, roughly 44.7% of shared e-scooter users rode illegally, such as double-riding (2%), not wearing a helmet (35.8%), and riding on the road (6.9%). The correct use of the helmet in e-scooter-sharing was lower than in bike-sharing, 60.9% and 81%, respectively (Haworth and Schramm, 2019). Therefore, policies must be adopted to reduce e-scooter-related injuries, including lower speed limits, night-time curfew, zero blood alcohol concentrations, and helmet use (Brownson et al., 2019; Bloom et al., 2021). Also, e-scooters require curb space management because they share public right-of-way with other transport modes, such as pedestrians on the sidewalk (Ma et al., 2021).

2.3.3 E-scooter vs. other transport modes

E-scooter-sharing has been hailed as an alternative to personal motor transportation, primarily cars, by urban transportation planners (Gössling, 2020; Caspi et al., 2020). Some e-scooter-sharing users in Portland, USA, replaced the motor vehicle with e-scooter-sharing. E-scooter-sharing has also replaced low-emission active transport trips (Shaheen and Cohen, 2019). Also, e-scooters replaced walking and public transportation in Oslo, Norway (Berge, 2019). Besides, e-scooters can replace up to 1% of taxi trips in Manhattan, USA (Lee et al., 2019). It is important to notice that e-scooter-sharing can be paired with other mobility modes, especially public transport (Schellong et al., 2019). For example, e-scooters can increase access to employment centers in Chicago, USA. Compared to the number of job opportunities currently only available through walking and public transportation, e-scooters can make approximately 16% more jobs (reachable within 30 min) accessible. Besides, for short trips between 0.5 and 2 miles, e-scooters can be a new alternative to the private car (Smith and Schwieterman, 2018).

A Toronto study found that 21% of people would like to consider e-scooters for some of their current travels, and most would replace their walking (60%) and transit (55%) travels with e-scooter-sharing (Mitra and Hess, 2021). In the USA, e-scooter-sharing expands transportation options, creates a car-free lifestyle, and is a viable alternative to private cars or ride-hailing services for short travels (Clewlow, 2019). In addition, e-scooters can complement public transportation. By providing a joint service of local public transportation and e-scooter-sharing, e-scooter-sharing can be promoted as a complementary option rather than an alternative to public transportation (Severengiz et al., 2020). Furthermore, with motorized and dockless features, dockless e-scooter-sharing provides more comfortable and faster first/last mile connections in the city than conventional bicycle-sharing (He and Shin, 2020).

2.3.4 Factors affecting demand for e-scooters

The elements impacting the usage rate need to be identified to better view the demand for e-scooter. In the literature, the natural environmental conditions, built environment and land use, trip-related characteristics, scooter-sharing characteristics, and socio-demographic characteristics have been considered important factors affecting e-scooter-sharing demand.

2.3.4.1 Socio-demographic characteristics

The socio-demographic features, including ownership status, occupation and economic status, age, education level, and gender of users, affect e-scooter usage.

2.3.4.1.1 Gender

Gender factor plays an essential role in the e-scooter usage rate. In Vienna and New Zealand, e-scooter-sharing users are mostly male (Laa and Leth, 2020; Curl and Fitt, 2020). In Brisbane, Australia, males accounted for 75.6% of e-scooter-sharing users (Haworth and Schramm, 2019). Similarly, in Austin, USA, males were more likely than females to travel on e-scooters (Jiao and Bai, 2020). Also, in Oslo, Norway, the percentage of using e-scooter by males is higher than females, 44% and 28%, respectively (Berge, 2019). It is important to state that females might feel more secure when using e-scooters. This may be because they are smaller than males and can easily ride e-scooters on sidewalks. Besides, females are less likely than males to cycle long distances. E-scooters enable them to travel long distances more comfortably. Because females are more likely to wear clothes like skirts, making it easier to stand on the e-scooter than on bikes (Clewlow, 2019).

2.3.4.1.2 Age

The age of e-scooter users affects the level of e-scooters usage. In Vienna and New Zealand, e-scooter-sharing users are primarily young (Laa and Leth, 2020; Curl and Fitt, 2020). Similarly, in Brisbane, Australia, most e-scooter-sharing program users (89.2%) were adults (Haworth and Schramm, 2019). Also, 10.8% of shared e-scooter users were under 18 years old. However, this figure was 2% for shared bike users. In addition, most e-scooter users in Oslo, Norway, are under 30 (Berge, 2019). Likewise, the relationship between e-scooters usage and the percentage of young people in Minneapolis, USA, was significantly positive (Bai and Jiao, 2020). Most e-scooter-sharing users belong to the millennial generation, precisely 20 to 30 years (Popov and Ravi, 2020). Surprisingly, a study conducted in Austin, USA, found that the proportion of residents under 25 in a neighborhood and the use of e-scooters were negatively correlated (Jiao and Bai, 2020). In Portland, USA, younger adults positively perceived e-scooter-sharing. It should be pointed out that younger adults (under 35) are most concerned about illegally parked and dangerous scooters. However, the elderly (55 years and older) were most concerned about riding on the sidewalk (Shaheen and Cohen, 2019). Hence, generally, young people are the most frequent users of e-scooter-sharing. The reason is their lifestyle and priorities (Rahimuddin et al., 2020). Also, the elders cannot simply use e-scooters (Clewlow, 2019).

2.3.4.1.3 Education level

Education level is also a significant factor affecting e-scooter usage. Highly educated people are encouraged to use e-scooters in Austin, USA (Jiao and Bai, 2020). Also, in Vienna, most e-scooter subscribers are highly educated (Laa and Leth, 2020).

2.3.4.1.4 Occupation and economic status

Household income level is another factor that can affect the use of e-scooter-sharing. Generally, low-income households have a positive impression of e-scooters (Shaheen and Cohen, 2019). For example, low-income households were more likely to generate e-scooter travel in Austin, USA (Jiao and Bai, 2020). Also, e-scooters usage correlates with areas with high employment rates in Austin, Texas. Also, e-scooters are used by students who are likely to have lower incomes but are not socio-economically low. The lower the income rate in the area, the more departures and arrivals are made in the morning on weekdays (Caspi et al., 2020). Overall, e-scooters may have higher acceptance rates by low-income groups and can potentially help cities achieve justice purposes (Clewlow, 2019).

2.3.4.1.5 Vehicle Ownership

In Europe and North America, about 79% of the e-scooter-sharing scheme users did not possess an e-scooter; 12% owned an e-scooter. Almost 9% of the users did not have an e-scooter, but they considered purchasing an e-scooter in the future (Popov and Ravi, 2020). In Portland, USA, 6% of the local users had sold a vehicle, and only 16% of users have considered selling a vehicle as they used e-scooter-sharing in Portland, USA. Unlike purchasing a car, acquiring an e-scooter is relatively inexpensive and easy for people (Popov and Ravi, 2020). In addition, the rental price of e-scooters is high for sharing services. As a result, some people are eager to purchase the e-scooter. Hence, there are many separate scooters on the streets and e-scooter-sharing. This type of personal transportation is called "personal transportation" (Turoń and Czech, 2019). Hence, the benefits of owning an e-scooter may undermine loyalty to the e-scooter-sharing service. However, owning an e-scooter does not significantly impact service loyalty. On the other hand, not owning an e-scooter has advantages, such as the social benefits of sharing and sustainability (Popov and Ravi, 2020).

2.3.4.2 Trip-Related Characteristics

Trip-related characteristics contain Coronavirus Disease (COVID-19), travel time, departure time, travel distance, and trip purpose impact using e-scooter-sharing.

2.3.4.2.1 Travel time

E-scooter-sharing users seem somewhat more sensitive to travel time than station-based bike-sharing subscribers (Younes et al., 2020). With high accessibility, usability, and little waiting time, using an e-scooter on daily trips can save time (Berge, 2019). Traveling short distances of 3 miles (4.83 km) or less using an e-scooter is faster than driving a car or utilizing a ride-hailing service in many urban areas of the United States (Clewlow, 2019). In California, USA, the average travel time with an e-scooter may be less than that with a shared e-bike. The maximum legal speed of an e-scooter is 15 miles per hour (24.14 kph). This speed is similar to a cyclist's traveling on flat terrain and almost twice the average speed of individuals who ride a bike (regular and electric) through the bike-sharing program (Todd et al., 2019).

2.3.4.2.2 Travel distance

For many people, e-scooters are a fun and convenient way to travel short distances (Gössling, 2020). The average distance traveled per trip is approximately 1.5 miles (about 2.41 Km) (Todd et al., 2019). Approximately 35% of all personal trips cover distances of less than 2 km, and 75% are less than 10 km. Also, e-scooters were usually used for trips of 0.5 km to 4 km, equivalent to 5 to 45 minutes of walking (Schellong et al., 2019). In Berlin, Germany, e-scooters are mainly used for short distances, with an average distance of 1.54 km (Wüster et al., 2020). It is worth noting that passengers traveling between half a mile (about 800 m) and two miles (around 3.22 km) receive the most out of e-scooters. Longer scooter trips, especially trips of more than three miles (approximately 4.83 km), are usually too expensive and impossible to afford for ordinary city travelers. Most travelers who travel more than three miles use scooters to access bus and train stations (Smith and Schwieterman, 2018).

2.3.4.2.3 Departure time

Departure time is one of the influential factors on demand for e-scooter-sharing that should be considered. In Portland, USA, the two peak periods of using e-scooter-sharing are recreational trips on weekends between 2 and 5 pm and the evening commute on weekdays between 3 and 6 pm (Shaheen and Cohen, 2019). Interestingly, the temporal characteristics of the e-scooter usage patterns in Minneapolis and Austin are different. More e-scooter traffic in the afternoons and weekends in Austin, while Minneapolis experienced more evening riding and consistent daily vehicle miles traveled during the week (Bai and Jiao, 2020). In Austin, USA, the distribution of hourly e-scooters trip rates on weekdays displays the long afternoon plateau. Moreover, the average daily use is higher on holidays and weekends. Also important is the morning distance from the origin to the central business district. It may be because morning travels are more concentrated around Austin's core (Caspi et al., 2020). In Washington, D.C., e-scooter usage varies between weekends and weekdays, while the AM/PM difference is negligible (Younes et al., 2020). In Indianapolis, USA, most scooter activities are observed between 11:00 am and 9:00 pm. It is significantly different from the usual AM / PM traffic peaks. Besides, the use of scooters in the morning was relatively low. This shows that scooters were not a practical option for commuting in the morning to work in Indianapolis (Mathew et al., 2019).

2.3.4.2.4 Trip purpose

Trip purpose can be influential in choosing e-scooter-sharing. In Oslo, Norway, the two primary trip purposes of e-scooter users are leisure (40%) and travel to/from school or work (29%) (Berge, 2019). In Portland, USA, 71% of respondents in a survey reported using e-scooter-sharing to reach their destination, while 29% chose it for recreational purposes (Shaheen and Cohen, 2019). In Washington, DC, e-scooter travels originated predominantly from the public/recreational area and ended in the same land use, while bike-share travels are primarily home-based commutes (McKenzie, 2019). In Louisville, USA, e-scooters are probably not being used for commute trips but could be chosen for short commutes (Noland, 2019). Hence, commuting does not seem to be the primary travel purpose. Also, e-scooters might be an alternative to non-working short trips (Caspi et al., 2020).

2.3.4.2.5 COVID-19

Some studies have shown that the covid-19 epidemic has negatively affected the e-scooter market (Button et al., 2020). Popov and Ravi (2020) state that COVID-19 is essential to e-scooter ownership advantages. Also, e-scooter-sharing services are disappearing in more and more cities as the coronavirus continues to spread worldwide. The simple reason not to use e-scooter-sharing services is that no one wants to trip by touching brakes and handlebars that may be infected because many people use the shared e-scooters. Thus, it can have serious negative consequences for the shared mobility sector. In contrast, Elhenawy et al. (2020) stated that during the COVID-19 epidemic, more individuals switched to micro-mobility ride-sharing systems. It is also less affected by COVID-19 than other public transport modes, such as trains and buses. Hence, COVID-19 effects on the usage of shared e-scooters are controversial.

2.3.4.3 Scooter-sharing characteristics

One of the most important factors influencing e-scooter-sharing usage is the scooter-sharing characteristics, such as travel comfort, transportation facilities, service quality, and travel cost. The impact of the main scooter-sharing characteristics is examined in the following.

2.3.4.3.1 Travel cost

E-scooter-sharing subscribers seem to be more sensitive to changes in gasoline prices than station-based bike-sharing subscribers (Younes et al., 2020). Perceived price is an important factor in service loyalty, and, in a way, perceived price performance increases service loyalty through customer satisfaction. It may be especially important for companies offering e-scooter-sharing services because they are a relatively immature market prone to price fluctuations. E-scooter-sharing services such as Lime or Bird have recently raised their prices, leading to less demand for the service. It is also noteworthy that as prices increase, the e-scooter-sharing service becomes less attractive to users, and users prefer to purchase their e-scooter (Popov and Ravi, 2020). US cities embrace e-scooters-sharing warmly. Because the price of e-scooters-sharing is flexible; hence, it is much cheaper than station-based bike-sharing for short-distance trips (Bai and Jiao, 2020).

2.3.4.3.2 Travel comfort

When using e-scooter-sharing, the need for comfort in daily travel is somewhat less than the need for freedom and time savings. E-scooter-sharing is sensitive to rough roads and pavements and requires constant attention while riding (Berge, 2019). E-scooter-sharing is a no-sweat way of reaching your destination. However, there is nowhere to stow groceries or other belongings for e-scooter users (Schellong et al., 2019). However, in comparison to e-bikes, e-scooter-sharing has more advantages. The user can stand, which means no wrinkles on clothes for office workers. In addition, the posture is more comfortable for females who wear dresses or skirts. Also, unlike bikes, in some places, the e-scooter is not subject to wear a helmet (Sipe and Pojani, 2018).

2.3.4.3.3 Transportation facilities

The transportation facilities factor is another noticeable element to consider. Interestingly, the use of e-scooter has a positive relationship with transportation facilities in Austin, USA, but a negative relationship with the Minneapolis transport facilities. In Austin, people could connect their transit trips with e-scooters, while in Minneapolis, e-scooters were probably independent of transportation (Bai and Jiao, 2020). In Austin, USA, e-scooters usage is associated with areas with bike infrastructure. Also, the origins and destinations of e-scooter trips are associated with bus stop locations; hence, users may link bus trips and e-scooters (Caspi et al., 2020). Also, if the streets are equipped with bicycle lanes, they will probably attract more e-scooter traffic (Zou et al., 2020).

2.3.4.3.4 Service quality

The quality of services is indirectly an important factor in service loyalty. Improving the quality of the e-scooter-sharing service can also raise customer satisfaction, which is a critical factor in service loyalty (Popov and Ravi, 2020).

2.3.4.4 Built environment and land use

Land use and accessibility factors are considerable elements impacting the demand for e-scooter-sharing.

2.3.4.4.1 Land use

The land-use factor is a significant element affecting e-scooter-sharing use. The effect of the degree of land use mix on e-scooter-sharing use is more significant than the effect of the percentage of the education level and open space to ride (Jiao and Bai, 2020). In Indianapolis, the USA, 15% of scooters were used for more than an hour daily. Therefore, it is important to understand the proportion of scooter use, especially in densely populated areas (Mathew et al., 2019). In Washington, DC, local arteries and streets with heavy traffic are the most popular facilities used by the shared e-scooters. It is important to underscore that e-scooter-sharing is the best solution for high-density downtown (Katona and Juhasz, 2020). In Austin, areas with higher population density are associated with more e-scooter travel. Also, a shorter distance from the city center and more complex land use raised the usage of e-scooter (Jiao and Bai, 2020).

Minneapolis and Austin cities differ in size and density but are similar in terms of urban shape and land-use layout near the city center. The densest use of e-scooters occurred in city university campuses and downtown areas. Also, proximity to the city center and greater land-use diversity positively correlate with higher e-scooter usage rates in Austin and Minneapolis, USA. Besides, compared to single-family residential zones, office and institutional land use are more likely to be associated with higher e-scooter ride rates in both cities. Curiously, e-scooter-sharing use has a statistically positive relationship with parks and commercial areas only in Austin (Bai and Jiao, 2020). In Austin, USA, the e-scooter trip is less likely to start and end in recreational areas and is more likely to do so in industrial, commercial, and residential areas. Also, in Austin's center, individuals use e-scooter-sharing regardless of the neighborhood's wealth; thus, e-scooters are widely used in different areas. Besides, e-scooter-sharing services can work well on campuses or college towns (Caspi et al., 2020).

2.3.4.4.2 Accessibility

One of the remarkable factors influencing e-scooter-sharing demand is the accessibility factor. Better access to transit is positively associated with the increased use of e-scooters in Austin and Minneapolis, USA (Bai and Jiao, 2020). Transit stations and better street connectivity increase the usage of e-scooter in Austin, USA (Jiao and Bai, 2020). Moreover, increasing service visibility in popular areas such as bus stops, student residences, and train stations can alleviate the first-mile / last-mile problems in urban transportation (Popov and Ravi, 2020).

2.3.4.5 Natural Environmental Conditions

The hilliness, weather conditions, and temperature factors are natural environmental conditions that influence e-scooter-sharing usage.

2.3.4.5.1 Hilliness

E-scooters do not perform well in brick-lined streets or hilly areas (Schellong et al., 2019).

2.3.4.5.2 Weather condition

E-scooters are ill-suited for adverse weather (Schellong et al., 2019). In Louisville, Kentucky, USA, rain and snow reduced the use of e-scooters. Also, strong winds slightly decreased travel distance. Travel distance also decreases when it rains (about 0.06 km per cm) (Noland, 2019). However, compared to station-based bike-sharing users, e-scooter-sharing users are less sensitive to weather changes (Younes et al., 2020).

2.3.4.5.3 Temperature

Generally, a higher average temperature is unrelated to a higher travel rate. However, it can lead to faster and longer trips in some places, such as Louisville, Kentucky, USA, where the average daily minimum and maximum temperatures are -11.67º C and 29.44º C, respectively (Noland, 2019).

2.3.5 Summary

The socio-demographic characteristics, containing ownership status, occupation and economic status, age, education level, and gender of users, affect e-scooter usage. Also, trip-related characteristics, including COVID-19, departure time, travel distance, and trip purpose, affect e-scooter-sharing usage. Besides, the built environment and land use factors comprising land use and accessibility factors influence the usage of e-scooter-sharing remarkably. Moreover, natural environmental conditions like hilliness, weather, and temperature affect e-scooter-sharing demand. Furthermore, scooter-sharing characteristics influence demand, including service quality, travel cost, travel comfort, and transportation facilities. Table 25 is given to better view the factors affecting the use of e-scooter-sharing.

Table 25: Influence of factors on the use of e- scooter-sharing.

Factors	Sub-factor	Positive impact	Negative impact	No impact	Reference
Natural environmental conditions	Hilliness	-	Brick-lined streets or hilly areas	-	Schellong et al., 2019
	Temperature	-	-	Warm temperature (only leads to faster and longer trips)	Noland, 2019
	Weather condition	Appropriate weather	Adverse weather, rain, snow	Wind (only decreases the travel distance)	Schellong et al., 2019; Noland, 2019
Built environment and land use	Land use	Proximity to the city center, greater land-use diversity, local arteries, streets with heavy traffic, parks, high-density downtown, higher population density areas, university campuses, office and institutional land use, commercial areas, more complex land-use, residential areas, college towns	-	-	Zou et al., 2020; Katona and Juhasz, 2020; Bai and Jiao, 2020; Jiao and Bai, 2020; Caspi et al., 2020
	Accessibility	Better access to transit, better street connectivity, service visibility	-	-	Bai and Jiao, 2020; Jiao and Bai, 2020; Popov and Ravi, 2020
Trip-related characteristics	Trip purpose	Leisure or recreational trips travel to/from school or work, non-working short trips	Commute trips	-	Berge, 2019; Shaheen and Cohen, 2019; Noland, 2019; Caspi et al., 2020
	Trip distance	Short distance, between half-mile (about 800 m) and two miles (around 3.22 km)	Long-distance, more than three miles (approximately 4.83 km)	-	Smith and Schwieterman, 2018; Schellong et al., 2019; Todd et al., 2019; Wüster et al., 2020; Gössling, 2020
	Departure time	Recreational trips on weekends, evening commute on weekdays, holidays, and weekends	Morning	-	Mathew et al., 2019; Shaheen and Cohen, 2019; Younes et al., 2020; Bai and Jiao, 2020; Caspi et al., 2020
	Covid-19	Covid-19			Elhenawy et al., 2020
			Covid-19		Button et al., 2020; Popov and Ravi, 2020
	Travel time	Shorter travel time	-	-	Berge, 2019; Clewlow, 2019; Todd et al., 2019; Younes et al., 2020
Scooter-sharing characteristics	Service quality	High-quality	-	-	Popov and Ravi, 2020
	Travel cost	Lower price	-	-	Popov and Ravi, 2020; Bai and Jiao, 2020; Younes et al., 2020
	Travel comfort	No need to wear a helmet in some places, also traveling with no problem with wrinkles, sweating, or wearing a skirt	Nowhere to stow groceries or other belongings	-	Sipe and Pojani, 2018; Schellong et al., 2019; Berge, 2019
	Transportation facilities	Bike-sharing path	-	-	Caspi et al., 2020; Bai and Jiao, 2020; Zou et al., 2020

Factors	Sub-factor	Positive impact	Negative impact	No impact	Reference
Socio-demographic characteristics	Occupation and economic status	Low-income people, employed people, student	-	-	Shaheen and Cohen (2019); Clewlow, 2019; Jiao and Bai, 2020; Caspi et al., 2020
	Gender	Males	-	-	Haworth and Schramm, 2019; Berge, 2019; Laa and Leth, 2020; Curl and Fitt, 2020
	Ownership status	Non-ownership	Ownership	-	Popov and Ravi; Turoń and Czech, 2019; Shaheen and Cohen, 2019; Popov and Ravi, 2020
	Education level	Well-educated people	-	-	Jiao and Bai, 2020; Laa and Leth, 2020
	Age	Young adult	Elder	-	Haworth and Schramm, 2019; Berge, 2019; Clewlow, 2019; Shaheen and Cohen, 2019; Popov and Ravi, 2020; Bai and Jiao, 2020; Laa and Leth, 2020; Curl and Fitt, 2020; Rahimuddin et al., 2020

Over the past few years, e-scooter-sharing has blossomed as a micro-mobility system that can alleviate some of the challenges facing today's large cities and pave the way for sustainable urban transportation development. This study aims to offer a framework that determines the factors influencing the demand for e- scooter-sharing. These results enable decision-makers or planners to understand the key elements affecting e-scooter-sharing demand.

This study's key conclusions, separately considering the six factors, are reported in the following lists.

The most significant socio-demographic characteristics that impact the demand for e-scooter-sharing are as follows:

- E-scooters cater to many young urban dwellers' special preferences due to youths' lifestyles and priorities.
- E-scooter-sharing users are primarily male.
- Well-educated people are more interested in using e-scooters.
- The higher the employment rate in the area, the higher the use of e-scooter-sharing.
- E-scooters can be more popular with low-income groups and can potentially help cities achieve justice goals.
- The lower user's income, the more departures, and arrivals are made on weekday mornings.
- E-scooters are used by students who are likely to have lower incomes but are not socio-economically low.
- Not owning an e-scooter has benefits such as shared social benefits and sustainability.
- Elders cannot simply use e-scooters.
- Females may feel more secure when using e-scooters, and e-scooters enable females to travel long distances.

- Although the benefits of owning an e-scooter may undermine loyalty to the e-scooter-sharing service, the impact is not significant.

The most significant trip-related characteristics that affect the use of e-scooter-sharing are as follows.

- E-scooter-sharing is chosen chiefly for weekend recreational trips, weekday commutes, and holidays.
- Using an e-scooter on daily trips, especially compared to bicycles and e-bikes, can save time.
- Passengers traveling half a mile (about 800 m) and two miles (around 3.22 km) receive the most out of e-scooters.
- Most travelers who travel more than three miles (approximately 4.83 km) use scooters to access bus and train stations.
- E-scooters may be an alternative to some non-working short trips, and commuting does not seem to be the primary trip purpose.
- The use of e-scooters in the morning is relatively low, indicating that e-scooters are not a suitable transportation option for morning commuting.
- COVID-19 effects on the usage of shared e-scooters are controversial.

The most important scooter-sharing characteristics that affect the use of e-scooter-sharing are as follows:

- The use of e-scooter-sharing can be increased when the origin and destination of e-scooter trips are linked to bus station locations or the streets are equipped with bicycle lanes.
- Higher service quality leads to higher service loyalty.
- When the travel cost of e-scooter-sharing is less than that of bike-sharing, e-scooter-sharing can attract more people.
- E-scooter-sharing is a no-sweat way of reaching your destination; however, it does not have any place to stow belongings.
- Riding e-scooter-sharing does not cause wrinkles in clothes. Also, females can easily ride it with a skirt. Also, in some places, no need to wear a helmet. Hence, the travel comfort of e-scooter-sharing can be greater than the e-bike.
- For e-scooter-sharing users, the need for comfort in daily travel is somewhat less than the need for freedom and time savings.

The most remarkable built environment and land use features that influence e-scooter-sharing use are as follows:

- Proximity to the city center, more complex land-use, greater land-use diversity, local arteries, streets with heavy traffic, parks, high-density downtown, higher population density areas, university campuses, college towns, commercial areas, residential areas, office, and institutional land use can lead to increasing e-scooter use.

- Better access to transit is positively associated with the increased use of e-scooter-sharing.
- Increasing service visibility in popular areas can reduce urban transportation's first/last mile problems.

The influence of natural environmental conditions on e-scooter-sharing use is as follows:

- E-scooters do not perform well in brick-lined streets or hilly areas.
- E-scooters are not suitable for adverse weather.
- Although higher average temperatures are not associated with higher travel rates, they can lead to faster and longer trips.

The impact of factors that can affect the demand for e-scooter-sharing is a significant issue for study. Much research needs to be conducted since not much time has passed since the emergence of e-scooter-sharing. Furthermore, in most studies, only one or two main factors affecting the demand for shared e-scooters have been investigated. Further, quantitative research has considered several factors simultaneously. Therefore, in future research, more factors should be considered concurrently.

2.4 Definition of the criteria and sub-criteria that impact the demand for different shared mobility services

A literature review helps determine important criteria and sub-criteria for comparing shared mobility services, including bike-sharing, car-sharing, and scooter-sharing. Sub-criteria included in each criterion share some common characteristics among them. Based on the above literature and knowledge of the author, each criterion includes some sub-criteria, listed in Table 26. Table 26 summarizes the criteria and sub-criteria significantly impacting demand for car-sharing, bike-sharing, and scooter-sharing services.

Table 26: Criteria and sub-criteria influencing the use of each shared mobility system.

Criteria	Sub-criteria	Shared mobility systems Car-sharing	Bike-sharing	E-scooter-sharing
Trip-related characteristics	Travel time	Cervero, 2003; Catalano et al., 2008; Efthymiou et al., 2013; Kim et al., 2017c; Carroll et al., 2017	Jensen et al., 2010; Buehler and Hamre, 2014; Mateo-Babiano et al., 2016	Berge, 2019; Clewlow, 2019; Todd et al., 2019; Younes et al., 2020
	Travel distance	Martin and Shaheen, 2011a; Costain et al., 2012; Wang et al., 2012; Martínez et al., 2017; Li, 2019; Li, 2019	Fishman, 2016; Campbell et al., 2016; El-Assi et al., 2017; Li, 2019; Li et al., 2019; Ji et al., 2020; Chen et al. (2020)	Smith and Schwieterman, 2018; Schellong et al., 2019; Todd et al., 2019; Wüster et al., 2020; Gössling, 2020
	Departure time	Cervero, 2003; Costain et al., 2012; Ceccato, 2020	Froehlich et al., 2008; Kaltenbrunner et al., 2010; Kim et al., 2012; Faghih-Imani et al., 2014; O'Brien et al., 2014; Corcoran et al., 2014; Reiss and Bogenberger, 2016; Ahillen et al., 2016; Mateo-Babiano et al., 2016; Kutela and Kidando, 2017; Kim et al., 2018; Heaney et al., 2019; Li et al., 2019; Ji et al., 2020; Lin et al., 2020	Mathew et al., 2019; Shaheen and Cohen, 2019; Younes et al., 2020; Bai and Jiao, 2020; Caspi et al., 2020
	Trip purpose	Cervero, 2003; Martin and Shaheen, 2011a; Le Vine,	Fishman, 2016; Li and Kamargianni, 2018; Li, 2019;	Berge, 2019; Shaheen and Cohen, 2019;

Criteria	Sub-criteria	Shared mobility systems Car-sharing	Bike-sharing	E-scooter-sharing
		Adamou, and Polak, 2014; Kim et al., 2015; Cartenì et al., 2016; Wang et al., 2017; Le Vine and Polak, 2019; Jin et al., 2020	Noland et al., 2019; Li et al., 2019; Chen et al., 2020	Noland, 2019; Caspi et al., 2020
Travel mode characteristics	Travel cost	Catalano et al., 2008; Shaheen and Martin, 2010; Lamberton and Rose, 2012; De Luca and Di Pace, 2015; Cartenì et al., 2016; Yoon et al., 2017; Carroll et al., 2017; Rotaris et al., 2019	Goodman and Cheshire, 2014; Fishman, 2016; Nikitas, 2018; Li and Kamargianni, 2018	Popov and Ravi, 2020; Bai and Jiao, 2020; Younes et al., 2020
	Travel comfort	Schaefers, 2013	Zanotto, 2014; Leister et al., 2018	Sipe and Pojani, 2018; Schellong et al., 2019; Berge, 2019
	Infrastructure, trip end, and en-route facilities, transportation facilities	Irrelevant	Krykewycz et al., 2010; Buck and Buehler, 2012; Bachand-Marleau et al., 2012; Rixey, 2013; Croci and Rossi, 2014; Zhou, 2015; Fishman et al., 2015; Faghih-Imani and Eluru, 2016b; Mateo-Babiano et al., 2016; Noland et al., 2016; Jain et al., 2018; Wang et al., 2018; Kabak et al., 2018; Wang and Lindsey, 2019; Xu and Chow, 2019; Duran-Rodas et al., 2019; Wang and Akar, 2019; Zhao et al., 2019; Noland et al., 2019	Caspi et al., 2020; Bai and Jiao, 2020; Zou et al., 2020
	Service quality	Research gap	Research gap	Popov and Ravi, 2020
	Helmet provision	Irrelevant	Bonyun et al., 2012; Kraemer et al., 2012; Grenier, 2013; Fishman et al., 2013; Fishman et al., 2014; Basch and Zagnit, 2014; Basch et al., 2014; Fishman, 2016	Research gap
Availability and accessibility	Land-use	Cervero, 2003; Shaheen and Rodier, 2005; Millard-Ball, 2005; Burkhardt and Millard-Ball, 2006; Kortum and Machemehl, 2012; Habib et al., 2012; Kopp et al., 2015; Wagner et al.,2016; Juschten et al., 2017; Becker et al., 2017a; Dias et al., 2017; Namazu et al., 2018; Hu et al., 2018; Ceccato and Diana, 2021	Buck and Buehler, 2012; Kim et al., 2012; Hampshire and Marla, 2012; Bachand-Marleau et al., 2012; Noland et al., 2016; Croci and Rossi, 2014; Etienne and Latifa, 2014; Noland et al., 2016; Zhang, 2017; El-Assi et al., 2017; Kutela and Kidando, 2017; Jain et al., 2018; Duran-Rodas et al., 2019; Wang and Lindsey, 2019; Zhao et al., 2019; Duran-Rodas et al., 2019; Lin et al., 2020; Ji et al., 2020	Zou et al., 2020; Katona and Juhasz, 2020; Bai and Jiao, 2020; Jiao and Bai, 2020; Caspi et al., 2020
	Accessibility	Brook, 2004; Catalano et al., 2008; Stillwater et al., 2008; Stillwater et al., 2008; Zheng et al., 2009; Costain et al., 2012; Kim et al., 2017b; Juschten et al., 2017	Bachand-Marleau et al., 2012; Kim et al., 2012; Wang and Lindsey (2019); Zhao et al., 2019; Ji et al., 2020	Bai and Jiao, 2020; Jiao and Bai, 2020; Popov and Ravi, 2020
	Size and age of stations	Stillwater et al., 2008; Habib et al., 2012; De Lorimier and El-Geneidy, 2013	Bachand-Marleau et al., 2012; Faghih-Imani and Eluru, 2016b; Wang and Lindsey, 2019; Xu and Chow, 2019; Wang and Akar, 2019	Research gap
Natural environmental conditions	**Hilliness**	Irrelevant	Jennings, 2011; Frade and Ribeiro, 2014; Fricker and Gast, 2016; Bordagaray et al., 2016	Schellong et al., 2019
	Weather condition	Irrelevant	Miranda-Moreno and Nosal, 2011; Gebhart and Noland, 2014; Corcoran et al., 2014; Faghih-Imani and Eluru, 2016a; Caulfield et al., 2017; Fournier et al., (2017); De Chardon et al., 2017; Martinez, 2017; Kutela and Kidando, 2017; Sun et al., 2018; Lin et al., 2020; Eren and Uz, 2020	Schellong et al., 2019; Noland, 2019
	Temperature	Irrelevant	Miranda-Moreno and Nosal, 2011; Faghih-Imani et al., 2014;	Noland, 2019

Criteria	Sub-criteria	Shared mobility systems Car-sharing	Bike-sharing	E-scooter-sharing
			Corcoran et al., 2014; Gebhart and Noland, 2014; Jing and Zhao, 2015; Faghih-Imani and Eluru, 2016a; El-Assi et al., 2017; Martinez, 2017; Wang et al., 2018; Hyland et al., 2018; Kim, 2018; Heaney et al., 2019; Eren and Uz, 2020; Lin et al., 2020	
	Air pollution	Irrelevant	Li and Kamargianni, 2018	Research gap
	Seasonal effect	Irrelevant	Rudloff and Lackner, 2014; Godavarthy and Taleqani, 2017; Kutela and Kidando, 2017; Heaney et al., 2019; Eren and Uz, 2020	Research gap
Socio-demographic characteristics	**Gender**	Cervero, 2003; Martin and Shaheen, 2011a; Firnkorn and Müller, 2012; Morency et al., 2012; Kawgan-Kagan, 2015; Kopp et al., 2015; Ciari et al., 2015; Wielinski et al., 2015; Cartenì et al., 2016; Becker et al., 2017a; Yoon et al., 2017; Ceccato and Diana, 2021; Hu et al., 2018; Shaheen et al., 2018; Acheampong and Siiba, 2020	Ogilvie and Goodman, 2012; Zanotto, 2014; Vogel et al., 2014; Goodman and Cheshire, 2014; Buehler and Hamre, 2014; Ricci, 2015; Faghih-Imani and Eluru, 2015; Fishman et al., 2015; Fishman, 2016; Raux et al., 2017; Nikitas, 2018; Wang and Akar, 2019; Li et al., 2019; Chen et al., 2020	Haworth and Schramm, 2019; Berge, 2019; Laa and Leth, 2020; Curl and Fitt, 2020
	Age	Brook, 2004; Lane, 2005; Millard-Ball, 2005; Burkhardt and Millard-Ball, 2006; Shaheen and Martin, 2010; Martin et al., 2010; Martin and Shaheen, 2011a; Firnkorn and Müller, 2012; Kortum and Machemehl, 2012; Sioui et al., 2013; Wielinski et al., 2015; Kim et al., 2015; Cartenì et al., 2016; Clewlow, 2016; Becker et al., 2017a; Perboli et al., 2017; Ceccato and Diana, 2021; Vinayak et al., 2018; Shaheen et al., 2018; Rotaris and Danielis, 2018; Burghard and Dütschke, 2019; Ceccato, 2020	Fuller et al., 2011; Vogel et al., 2014; Zanotto, 2014; Fishman et al., 2015; Ricci, 2015; Raux et al., 2017; Nikitas, 2018; Wing et al., 2018; Li et al., 2019; Eren and Uz, 2020; Chen et al., 2020	Haworth and Schramm, 2019; Berge, 2019; Clewlow, 2019; Shaheen and Cohen, 2019; Popov and Ravi, 2020; Bai and Jiao, 2020; Laa and Leth, 2020; Curl and Fitt, 2020; Rahimuddin et al., 2020
	Occupation and economic status	Millard-Ball, 2005; Cervero et al., 2007; Martin et al., 2010; Martin and Shaheen, 2011a; Efthymiou et al., 2013; Efthymiou and Antoniou, 2014; Kim et al., 2015; Kawgan-Kagan, 2015; Clewlow, 2016; Dias et al., 2017; Yoon et al., 2017; Winter et al., 2017; Ceccato and Diana, 2021; Vinayak et al., 2018; Shaheen et al., 2018; Ceccato, 2020	Maurer, 2011; Rixey, 2013; Zanotto, 2014; Fishman et al., 2015; Ricci, 2015; Murphy and Usher, 2015; Raux et al., 2017; Li et al., 2019	Shaheen and Cohen (2019); Clewlow, 2019; Jiao and Bai, 2020; Caspi et al., 2020
	Vehicle ownership status	Cervero and Tsai, 2004; Cervero et al., 2007; Celsor and Millard-Ball, 2007; Martin et al., 2010; Martin and Shaheen, 2011a; Ter Schure et al., 2012; Habib et al., 2012; Sioui et al., 2013; Efthymiou and Antoniou, 2014; De Luca and Di Pace, 2015; Mishra et al., 2015; Kopp et al., 2015; Clewlow, 2016; Juschten et al., 2017; Dias et al., 2017; Ceccato and Diana, 2021; Namazu et al., 2018; Burghard and Dütschke, 2019; Mishra et al., 2019; Lempert et al., 2019; Ceccato, 2020	Bachand-Marleau et al., 2012; Shaheen and Guzman, 2011; Fishman et al., 2015; Chen et al., 2020	Popov and Ravi; Turoń and Czech, 2019; Shaheen and Cohen, 2019; Popov and Ravi, 2020
	Household size	Cooper et al., 2000; Millard-Ball, 2005; Kortum and Machemehl, 2012; Ceccato and Diana, 2021; Ceccato, 2020	Research gap	Research gap

Criteria	Sub-criteria	Shared mobility systems Car-sharing	Bike-sharing	E-scooter-sharing
	Marital status	Celsor and Millard-Ball, 2007; Efthymiou and Antoniou, 2014; Carroll et al., 2017	Research gap	Research gap
	Presence of children	Sioui et al., 2013; Coll et al., 2014; Kopp et al., 2015; Carroll et al., 2017; Kim et al., 2017; Dias et al., 2017; Vinayak et al., 2018; Rotaris and Danielis, 2018	Research gap	Research gap
	Residence status (permanent residence or not)	Research gap	Li et al., 2019; Du et al., 2019	Research gap
	Education level	Cooper et al., 2000; Brook, 2004; Millard-Ball, 2005; Burkhardt and Millard-Ball, 2006; Martin et al., 2010; Shaheen and Martin, 2010; Martin and Shaheen, 2011a; Firnkorn and Müller, 2012; Wang et al., 2012; Coll et al., 2014; Kawgan-Kagan, 2015; Kopp et al., 2015; Dias et al., 2017; Becker et al., 2017a; Juschten et al., 2017; Carroll et al., 2017; Prieto et al., 2017; Shaheen et al., 2018; Vinayak et al., 2018; Ceccato, 2020	Fuller et al., 2011; Bachand-Marleau et al., 2012; Zanotto, 2014; Fishman et al., 2015; Ricci, 2015; Li et al., 2019; Cheng et al., 2020	Jiao and Bai, 2020; Laa and Leth, 2020

Chapter 3

Methodology: Multi-Criteria Decision-Making Methods

After defining the research questions in Chapter 1 and providing a comprehensive literature view to understand the important factors affecting each shared mobility service (car-sharing, bike-sharing, and scooter-sharing), in this section, the proper method according to the purpose of this study should be chosen. This chapter explains the different methods of Multiple-Criteria Decision-Making (MCDM). MCDM is also known as Multiple-Criteria Analysis (MCA) or Multiple-Criteria Decision Analysis (MCDA). In this research, MCDM is used for greater clarity.

Decision-making is commonly described as the cognitive process of choosing an alternative from a set of alternatives. In the MCDM problem, the decision-maker has to identify the best alternative from a set of alternatives taking into account a set of criteria.

A discrete MCDM problem is usually indicated as a matrix, as presented in Eq. (1) (Kalpoe, 2020b).

$$P = \begin{array}{c c} & \begin{array}{cccc} c_1 & c_2 & \dots & c_n \end{array} \\ \begin{array}{c} a_1 \\ a_2 \\ \vdots \\ a_m \end{array} & \begin{pmatrix} p_{11} & p_{12} & \dots & p_{1n} \\ p_{21} & p_{22} & \cdots & p_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ p_{m1} & p_{m2} & \cdots & p_{mn} \end{pmatrix} \end{array} \tag{1}$$

Where,

$\{a_1, a_2, \dots, a_m\}$: a set of alternatives

$\{c_1, c_2, \dots, c_n\}$: a set of criteria

p_{ij}: the score (indicator value) of alternative i (i=1,…,m) concerning criterion j (j=1,…,n)

Choosing the best (e.g., most favorable, most substantial) alternative (with the best value) is the purpose of the MCDM problem, as displayed in Eq. (2) (Jong and Stone, 1976). The highest V_i represents the most desirable alternative. Hence, V_i is the overall value of alternative i that can be computed utilizing the additive value function as shown in Eq. (2). When the weight w_j is assigned to criterion j, V_i is determined by multiplying the score p_{ij} with the respective weight w_j of criterion j. Hence, a set of alternatives and a set of decision criteria by which the alternatives can be evaluated are required. The weight of the criteria is then determined, and there are different methods for inferring the weight of the criteria in the literature.

$$V_i = \sum_{j=1}^{n} w_j \, p_{ij}^{norm} \qquad w_j \geq 0, \sum w_j = 1 \tag{2}$$

Where

V_i: overall value of alternative i

w_j: weight assigned to criterion j

p_{ij}^{norm} : the normalization of each score (indicator value) of alternative (p_{ij}), (i=1,…,m, and j=1,…,n)

Scores are gathered from accessible sources of data (for the objective and accessible ones like the price) or measured utilizing qualitative methods such as the Likert scale or computed like the criteria weights (for the subjective ones such as quality) and normalized utilizing a normalization formula. Hence, to normalize, if the alternative scores (performance matrix) are in different scales, the scores have to be normalized, as mentioned in Eq. (3) (Brispat, 2017). In Eq. (3), p_{ij}^{norm} is the normalization of each score of alternative (p_{ij}), which can be determined by dividing each score of alternative (p_{ij}) by the largest value of that score among the alternatives $\max\{p_{ij}\}$). The inverse equation is applied for a criterion value, such as price, considered a negative value.

$$p_{ij}^{norm} = \begin{cases} \dfrac{p_{ij}}{\max\{p_{ij}\}}, if\ p_{ij}\ is\ positive\ (such\ as\ quality) \\ 1 - \dfrac{p_{ij}}{\max\{p_{ij}\}}, if\ p_{ij}\ is\ negative\ (such\ as\ price) \end{cases} \tag{3}$$

p_{ij}: the score of alternative i concerning criterion j

p_{ij}^{norm} : the normalization of each score of alternative (p_{ij})

In this study, Perception-Based Analysis (PBA) is conducted. Different stakeholders participate in perception-based analysis, and quantitative and qualitative data can be considered to specify different stakeholders' perceptions of shared mobility systems (Scholten et al., 2017). It assists in calculating stakeholders' perceptions, including their opinion, interpretations, and understanding. As a result, it can provide more insights into the stakeholders' perceptions, leading to a clearer decision-making process. In this regard, information regarding stakeholder perceptions can be utilized when determining the problem, and possible solutions to deal with it are provided. Besides, after selecting, confirming, and implementing the system, information based on perception can be utilized to raise the level of satisfaction (e.g., user satisfaction), which can even change the perception of users (Brispat, 2017).

3.1 Multi-actor multi-criteria analysis

Stakeholders are an important aspect to consider. Therefore, how different stakeholders rate the importance of comparison factors must be determined. Hence, it is necessary to specify the appropriate method for the analysis, considering the various stakeholders. In this regard, prof. Cathy Macharis developed Multi-Actor Multi-Criteria Analysis (MAMCA) in 2005. This method can be described as a multi-criteria decision analysis that enables decision-makers to evaluate different projects simultaneously (Macharis et al., 2010). One of the most important advantages of MAMCA is that MAMCA explicitly considers the views of different stakeholders. It is important to decide which investment in shared mobility will be most efficient. Stakeholder participation in the early stages gives policymakers an understanding of their problem. It also allows them to understand the views of other stakeholders. Figure 2 indicates the seven steps required to perform a MAMCA, as defined by Macharis et al. (2010).

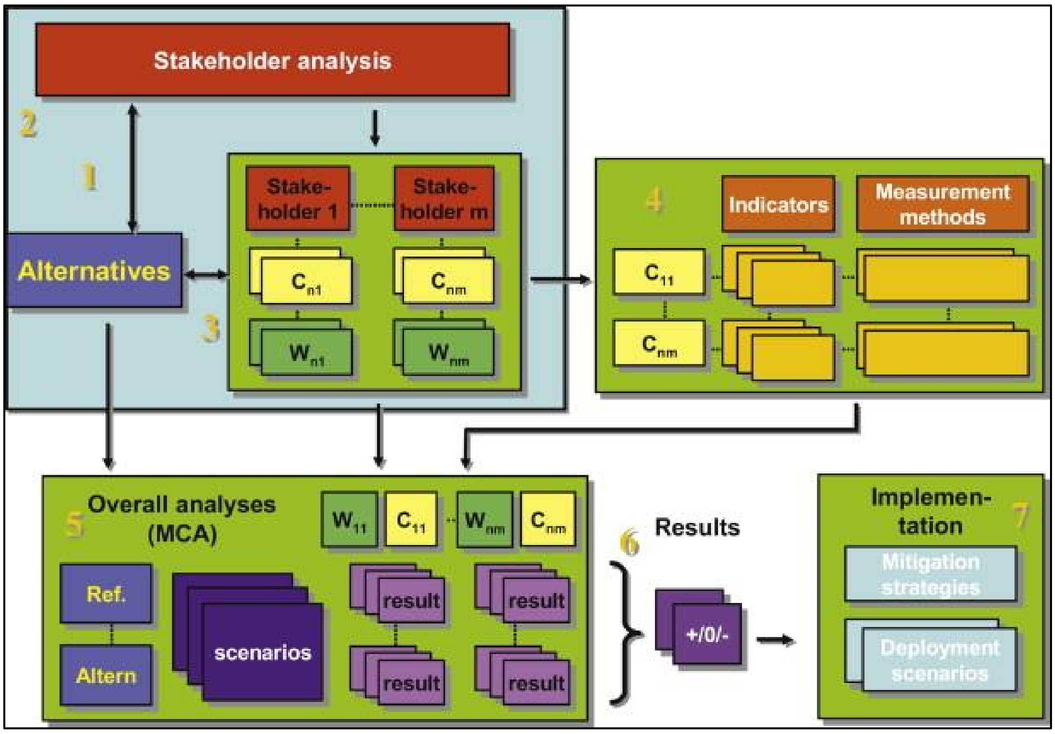

Figure 2: Various steps of the MAMCA method (Macharis et al., 2010).

The steps presented in Figure 2 for the MAMCA method can be described as follows (Macharis et al., 2012).

3.1.1. Defining the problem and specifying alternatives (step 1)

In the first step, the problem must be defined, and several possible alternatives must be specified. These alternatives can be evaluated later.

3.1.2. Stakeholder analysis (step 2)

This stage is defined as the stakeholder analysis in which all important stakeholders are identified because considering important stakeholders in the early stages will benefit the result. Analyzing stakeholders reveals certain aspects, such as priorities, problems, interests, and conflicts, in the early stages of decision-making. This can be further considered in the overall process and lead to an improvement in the final result. In addition, this analysis also provides insight into the project policy level, which clarifies the impact of the project, and the governmental level (municipal, provincial, national, European) can be considered (if needed in the study).

3.1.3. Specify criteria and weights (step 3)

The third step is to define the criteria for stakeholders and set weights to indicate their importance. The criteria are selected based on the stakeholders' objectives and the purpose of the considered alternatives. It also means that the different sets of criteria can be important for each stakeholder group based on their specific goals. In order to show the stakeholders involved with their goals and objectives, it is possible to provide a hierarchical criteria tree (at this stage). With the stakeholders, weights can be determined based on the amount of value assigned to their objectives. These weights then show the importance of the criteria. Finally, if necessary, it is possible to assign weight to stakeholders. These can show the importance of stakeholders in the decision-making process.

3.1.4. Criteria, indicators, and measurement methods (step 4)

In the fourth step, the indicators are specified for the criteria set in step 3. The previously specified stakeholder criteria are 'operationalized' by constructing indicators (also called variables or metrics) that can be applied to gauge whether an alternative contributes to each metric or to what extent.

3.1.5. Overall analysis and ranking (step 5)

At this stage, each alternative is evaluated and compared using the criteria and indicators mentioned above. This allows further elaboration on the alternatives in a way that translates to the scenarios. Once the scenarios are identified, an evaluation table can be provided for each stakeholder.

3.1.6. Results (step 6)

After a general analysis and ranking, the proposed alternative classification can be provided. This step helps decision-makers in their decision-making process by pointing out which criteria have a positive or negative impact on alternatives for each stakeholder. This determines the preference of each stakeholder for each alternative and the importance of the alternative for each stakeholder.

3.1.7. Implementation (step 7)

Finally, the information and data collected can formulate a policy recommendation for the decision-makers. Macharis et al. (2012) outlined two implementation approaches from the decision-makers perspective. The first approach is implementing the alternative that benefits society the most. The second approach is an alternative implementation that helps to consider all stakeholders' interests and make compromises.

3.2 Presentation of different MCDM methods

One of the appropriate methods for performing PBA is MAMCA. In the third step of the MAMCA, the weight of the criteria must be well determined to calculate each stakeholder's perception. To do this, different MCDM methods can be combined with MAMCA. To find the most suitable method to combine it with MAMCA, different MCDM methods should be identified in this study. A comparison between them is essential to find the best method. This chapter is a way to understand which MCDM method is suitable for combining with MAMCA to conduct PBA and why.

It is important to note that although there are various MCDM methods in the literature, the following MCDM methods are chosen for comparison in this study. This is because they are broadly used in the literature (Triantaphyllou, 2000; Mulliner et al., 2016; Kolios et al., 2016; Serrai et al., 2017). In this regard, it can be mentioned that Yannis et al. (2020) identified the most commonly used MCDM techniques in the transport sector. It was figured out that almost 29% of the studies in the transportation field applied the AHP method. Besides, each of the following three methods was used in 10% of studies: Elimination and Choice Translating Reality, Preference ranking organization method for enrichment evaluation, and the Weighted Product Model. The Technique for Order of Preference by Similarity to Ideal Solution (6%) and MAMCA (6%) are other important MCDM methods. These well-known methods account for about 71% of the MCDM methods in the literature. Also, Brispat (2017) emphasized the importance of the following methods among MCDM methods, especially the Best-Worst Method.

1. Elimination and Choice Translating Reality
2. Weighted Sum Model
3. Weighted Product Model
4. Analytic Hierarchy Process
5. The Technique for Order of Preference by Similarity to Ideal Solution

6. Preference ranking organization method for enrichment evaluation
7. Best-Worst Method

After a brief description of all these methods, the decision on the most appropriate MCDM method for PBA is made in Section 3.3.

3.2.1 Elimination and choice translating reality

The Elimination and Choice Translating Reality (ELECTRE) method was first introduced around 1966 by Bernard Roy, and it can be described as a pairwise comparison method (Benayoun et al., 1966). ELECTRE is run by comparing two alternatives for each criterion. This prevents ELECTRE from always being able to categorize the most interesting option, which can be an important drawback depending on the purpose of the problem (Triantaphyllou, 2000). However, when a situation with few criteria and a large number of alternatives occurs (Lootsma, 1990), ELECTRE may be a great choice for comparing different solutions. This method can also deal with both quantitative and qualitative factors simultaneously. However, since ELECTRE can be described as a complex decision method, a large amount of data is needed to perform the proper analysis. This method can be used in different contexts to determine which alternatives are preferred according to a set of criteria (Vahdani et al., 2010).

To perform ELECTRE analysis, concordance and discordance indices are considered (Roy, 1990). Comparing alternative A_j with alternative A_k, the concordance index demonstrates when the criteria of one alternative prevail over the criteria of another alternative ($a_{ji} > a_{ki}$). Conversely, the discordance index indicates when the criteria of A_k predominate over that of alternative A_j ($a_{ji} < a_{ki}$). Finally, Eq. (4) estimates the concordance index (Botti and Peypoch, 2013).

$$C\ (\text{hSk}) = \frac{\sum_{j \in l'} w_j}{\sum_{j \in l} w_j} \tag{4}$$

Where C (hSk) is the concordance index, and l and l' represent all criteria and the concordance criteria, respectively.

Eq. (5) calculates the discordance index (Botti and Peypoch, 2013).

$$D\ (\text{hSk}) = \max_{\{j: r_{hj} < r_{hk}\}} \{r_{kj} - r_{hj}\} / d_{max} \tag{5}$$

Where D (hSk) is discordance index

- r_{hj}: performance of alternative i with criterion j.
- d_{max}: maximum difference in the performance of the alternatives.

3.2.2 Weighted sum model

One of the easiest and most common methods of MCDM is the Weighted Sum Model (WSM) (Kolios et al., 2016). This method was developed in 1967 by Peter C. Fishburn; it is easy to use and can be utilized in combination with other methods. The WSM method compares alternatives based on a set of specific criteria. First, each criterion is given a certain weight. Then, the optimal solution is easily provided by multiplying the weight of the criteria by the score of the alternatives.

The WSM problem leads to finding the optimal solution for Eq. (6) (Fishburn, 1967).

$$A^*_{WSM} = max \sum_{i}^{m} p_{ij} \times w_j \tag{6}$$

Where $i = 1, \dots, m$

A^*_{WSM} indicates the weighted sum score obtained by multiplying the weights by the alternative scores. The p_{ij} is the score of alternative i concerning criterion j. The w_j is the weight of criterion j.

It is essential to mention that one of the disadvantages of WSM is that when it comes to using qualitative and quantitative comparison factors, it becomes difficult to do so. This change in the optimal solution can also occur when some scores are exaggerated.

3.2.3 Weighted product model

The weighted Product Model (WPM) method is an MCDM method with many similarities to the above-introduced WSM (Kolios et al., 2016) and was developed in 1969. However, the most significant difference with WSM is that a WPM uses multiplication to calculate the optimal solution instead of the sum (Triantaphyllou, 2000). Eq. (7) shows a comparison between the alternatives A_K and A_j. If R is greater than or equal to 1, the alternative A_K is preferred over the alternative A_j.

The optimal solution Is found using Eq. (7) (Bridgman, 1922; Miller and Starr, 1963).

$$R\left(\frac{A_K}{A_j}\right) = \prod_{j=1}^{n} (\frac{p_{Kj}}{p_{jj}})^{w_j} \tag{7}$$

Where n represents the number of criteria and $R\left(\frac{A_K}{A_j}\right)$ is a comparison between the alternatives A_K and A_j. The p_{ij} shows the score of alternative i concerning criterion j. w_j is the weight of criterion j.

3.2.4 Analytic hierarchy process

Thomas L. Saaty developed the Analytic Hierarchy Process (AHP) method in 1980. This method is mainly used in considering conflicting criteria and energy planning (Kolios et al., 2016). Conflicting criteria are typical in evaluating alternatives. Typical examples of criteria that conflict with each other are a measure of quality versus price. There is even a case of developing an AHP-based approach to dealing with problems where uncertain data is available (Cobuloglu and Büyüktahtakın, 2015). The AHP method used hierarchical structure and pairwise comparison to decide complex decision-making problems.

3.2.4.1 Hierarchical structure (step 1)

The first step involves creating a decision problem in a hierarchical structure. At the top of the structure is the purpose of decision-making. In addition, the criteria and sub-criteria influencing decision-making are at lower levels. Finally, alternatives are placed at the bottom of the structure.

3.2.4.2 Criteria weights (step 2)

In the second step, the weight of each criterion must be obtained. The pairwise comparison matrix (A) or the judgment matrix must be compiled. Each aspect in the matrix, a_{ij}, can be defined as the importance of criterion i relative to criterion j by considering the alternative. Eq. (8) shows the weight vector.

$$W_i = (w_1, w_2, \dots, w_n)^T \tag{8}$$

Where W_i reflects the importance of the i-th criterion and is estimated as the means of the inputs of row i of the normalized matrix A (Saaty, 1980).

Eq. (9) and Eq. (10) are used to examine the consistency of pairwise comparisons (Saaty, 1980).

$$\lambda_{max} = \frac{1}{n} \sum_{i=1}^{n} \frac{i^{th}\ entry\ in\ AW^T}{i^{th}\ entry\ in\ W^T} \tag{9}$$

Where λ_{max} indicates the largest eigenvalue of the Matrix A.

After finding the maximum eigenvalue (λ_{max}), the Consistency Index (CI) is defined as presented in Eq. (10) (Saaty, 1980).

$$CI = \frac{(\lambda_{max}) - n}{n - 1} \tag{10}$$

Once the CI is found, the Consistency Ratio (CR) in the AHP method can be calculated by dividing the CI by the Random Index (RI) to determine whether the degree of consistency is satisfactory. To do this, RI must be defined. RI is the average of CI values of various sizes of comparison matrices. In the literature, different authors have calculated and obtained different RIs, depending on the simulation method and the number of matrices generated involved in the process. For example, Lane and Verdini (1989), Golden and Wang (1990), and Noble (1990) performed 2500, 1000, and 5000 simulation runs. Besides, Forman (1990) provided values for matrices of sizes 3 through 7 using examples from 17672 to 77487 matrices. Tumala and Wan (1994) subsequently performed the experiment with 4600 to 470000 matrices. Furthermore, Saaty (1980) simulated the experiment with 500 matrices with the following algorithm, shown in Table 27.

The steps of the algorithm were (Saaty, 1980);

- Generate a random matrix (Uniform distribution)
- Calculate the corresponding Cis (for each matrix).
- Obtain the average of these values for each size (RI of each size).

Table 27: RI for different values n (Saaty, 1980).

n	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

If $CR = {CI}/{RI} > 0.1$, serious inconsistencies may present, while if $CR = {CI}/{RI} < 0.1$, the degree of consistency is considered satisfactory.

3.2.4.3 Performance alternatives for criteria (step 3)

The third step is to find the score of each alternative for each criterion. Finally, after calculating the score of each criterion, the overall score can be determined in the last step.

3.2.4.4 Alternative ranking (step 4)

In the fourth step, the score of the alternatives, AHP_i, is calculated according to Eq. (11) (Saaty, 1980).

$$AHP_i = \sum_{j=1}^{n} \frac{p_{ij}}{\sum_{i=1}^{m} p_{ij}} \times w_j \tag{11}$$

Where,

AHP_i: the score of the i-th alternative

m is the number of alternatives

n is the number of criteria

w_j is the weight of importance of the j-th criterion.

p_{ij} represents the actual value of the i-th alternative in terms of the j-th criterion

3.2.5 Technique for order preference by similarities to ideal solution

Technique for Order Preference by Similarities to Ideal Solution (TOPSIS) method is widely used in various research fields (Kolios et al., 2016) and Hwang and Yoon developed it in 1981. This method uses the Euclidean distance to find the best solution at the closest (shortest distance) possible to the ideal alternative and, at the same time, the farthest (longest distance) from the most negative solution. Both the best and the most negative solutions are obtained from this method, and any criterion can change utility (Triantaphyllou, 2000). Finally, changing the utility for each criterion can lead to an ideal and non-ideal solution and an optimal alternative in this range. Figure 3 displays the necessary methodological steps.

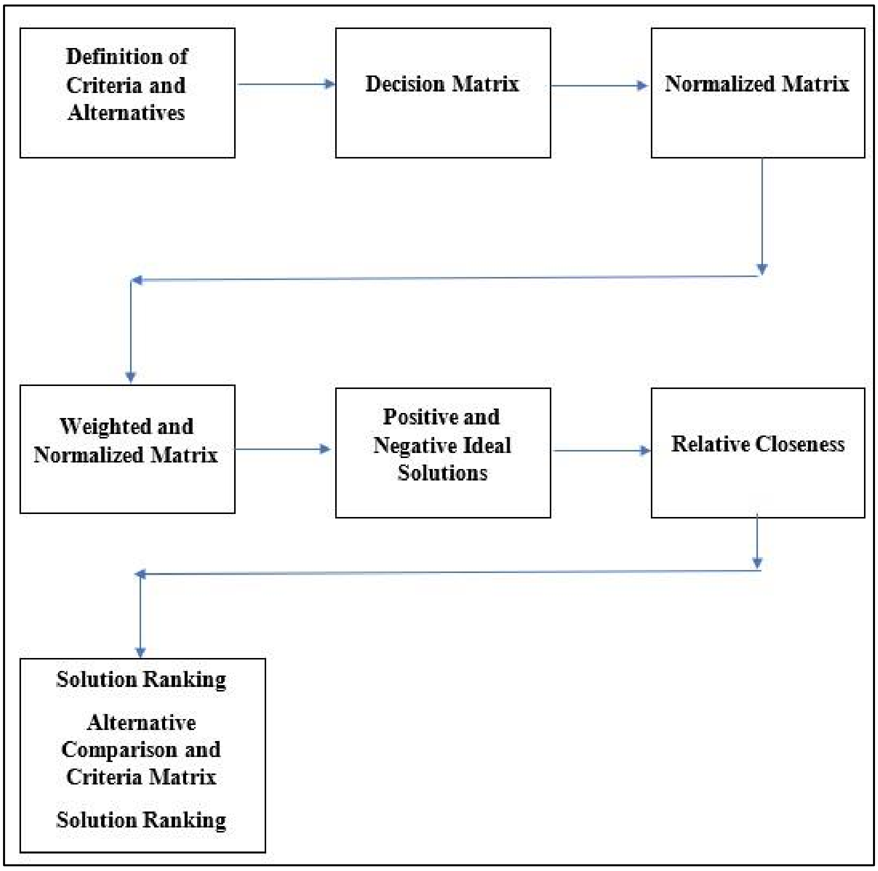

Figure 3: RI for different values n (Saaty, 1980).

The first four steps are similar to the steps in the other methods. An explanation of the following steps is given below.

3.2.5.1 Positive and negative ideal solutions (step 1)

The positive ideal A^{+} and negative ideal solution A^{-} are derived as given in Eq. (12) and Eq. (13), respectively. In these equations, I' and I'' are associated with the benefit and cost criteria (positive and negative variables) (Kolios et al., 2016).

$$A^{+} = \{v_1{}^{+}, \dots, v_n{}^{+}\} = \left\{\left(MAX_j v_{ij} \middle| i \in I'\right), \left(MIN_j v_{ij} \middle| i \in I''\right)\right\} \quad (12)$$

$$A^{-} = \{v_1{}^{-}, \dots, v_n{}^{-}\} = \{\left(MIN_j v_{ij} \middle| i \in I'\right), \left(MAX_j v_{ij} \middle| i \in I''\right)\} \quad (13)$$

Where,

A^{+}: the positive ideal

A^{-}: the negative ideal solution

v_{ij}: normalized decision values

I': benefit criteria

$I^{''}$: negative criteria

3.2.5.2 Relative closeness (step 2)

The n-dimensional Euclidean distance is applied to calculate the distance from the alternatives to A^{+} and A^{-}. ${D_j}^{+}$ is calculated in Eq. (14) as the separation of each alternative from the ideal solution. The separation from the negative ideal solution, ${D_j}^{-}$ is given in Eq. (15) (Kolios et al., 2016).

$$ {D_j}^{+} = \sqrt{\sum_{i=1}^{n} (v_{ij} - {v_i}^{+})^2} \tag{14} $$

$$ {D_j}^{-} = \sqrt{\sum_{i=1}^{n} (v_{ij} - {v_i}^{-})^2} \tag{15} $$

Where,

${D_j}^{+}$, ${D_j}^{-}$: n-dimensional Euclidean distance

v_{ij}: normalized decision values

C_j , the relative proximity to the ideal solution of each alternative is calculated as shown in Eq. (16) (Kolios et al., 2016).

$$ C_j = \frac{{D_j}^{-}}{{D_j}^{+} + {D_j}^{-}} \tag{16} $$

Where,

C_j: ideal solution of each alternative

With $1 \geq C_j \geq 0$, where $C_j = 1$, if $A_i = A^{+}$ and $C_j = 0$, if $A_i = A^{-}$

3.2.5.3 Solution ranking (step 3)

After sorting the C_j values, the maximum value corresponds to the best solution to the problem. The best alternative should be the shortest distance from A+ and the longest distance from the non-ideal solution.

3.2.6 Preference ranking organization method for enrichment evaluation

Brans developed the Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) method in 1985 (Brans and Vincke, 1985; Brans et al., 1986) and is widely applied to problems in the energy sector (Kolios et al., 2016). This method uses pairwise comparisons to provide an overall ranking of options based on positive and negative prediction flows. PROMETHEE is an easy-to-use method, especially compared to other MCDM methods

(Tuzkaya et al., 2010). In addition, PROMETHEE can deal with quantitative and qualitative factors (Serrai et al., 2017).

Figure 4 displays the steps of the PROMETHEE method, and below figure 4, an explanation of the method and its five steps is given (Brans et al., 1986; Geldermann and Rentz, 2001; Cao et al., 2006; Tuzkaya et al., 2010; Vulević and Dragović, 2017).

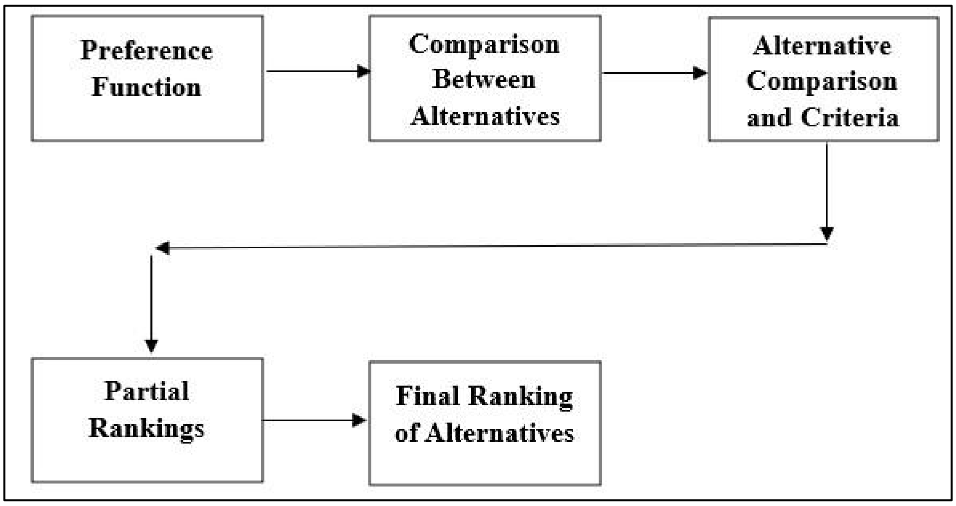

Figure 4: PROMETHEE methodology (Kolios et al., 2016).

3.2.6.1 Preference function (step 1)

First, each criterion's preference function and weight have to be specified. In order to demonstrate the importance of each criterion, a certain weight is given to them. If the decision-maker thinks that all the criteria are equal, they will be assigned the same weight; they do not need to be normalized.

3.2.6.2 Comparison between alternatives (step 2)

Eq. (17) estimates the global preference index to specify alternative preference over b and associated criteria f_j (Brans and Vincke, 1985).

$$P_j(a,b) = f_j\left[d_j\,(a,b)\right], \qquad j = 1, \dots, m \tag{17}$$

Where,

(a, b): alternatives

f_j: criterion

$d_j\,(a,b)$: the difference between evaluating alternatives a and b on the criterion. $d_j\,(a,b) = f_j(a) - f_j(b)$.

$P_j(a,b)$: the preference of alternative a with regard to alternative b on each criterion as a function of $d_j\,(a,b)$.

3.2.6.3 Alternative comparison and criteria matrix (step 3)

Eq. (18) determines the amount of preference between a and b (Brans and Vincke, 1985).

$$Đ\,(a,b) = \sum_{j=1}^{m} P_j(a,b)\, w_j\,, \qquad \forall\ \mathrm{a,b} \in \mathrm{A} \tag{18}$$

Where, ð (a,b) of a over b (from 0 to 1) is defined as the weighted sum $P_j(a,b)$ for each criterion, and w_j is the weight associated with jth criteria. $P_j(a,b)$ shows the preference function and w_j indicates the weight of the criteria j.

3.2.6.4 Partial rankings (step 4)

Eq. (19) and Eq. (20) estimate positive outranking flow ($\phi^+(a)$) and negative outranking flow (incoming flow) ($\phi^-(a)$), respectively (Brans and Vincke, 1985). $\phi^+(a)$ indicates how an alternative a is superior to the others. This is its power and superior character. The higher $\phi^+(a)$, the better the alternative. On the other hand, $\phi^-(a)$ shows how an alternative "a" is outranked by all the others. It is its weakness, its outranked character. The lower $\phi^-(a)$, the better the alternative.

$$\phi^+(a) = \frac{1}{n-1} \sum_{x\,\in \mathrm{A}} \pi\ (\mathrm{a,x}) \tag{19}$$

$$\phi^-(a) = \frac{1}{n-1} \sum_{x\,\in \mathrm{A}} \pi\ (\mathrm{x,a}) \tag{20}$$

3.2.6.5 Final rankings of alternatives (step 5)

Finally, the net outranking flow $\phi\ (a)$ for each alternative is measured using Eq. (21) (Brans and Vincke, 1985).

$$\phi\ (a)\ =\ \phi^+(a) -\ \phi^-(a) \tag{21}$$

The higher $\phi^+(a)$ and the lower $\phi^-(a)$ means a more positive alternative.

3.2.7 Best Worst Method

The Best Worst Method (BWM) is a vector-based multi-criteria decision-making method developed by Jafar Rezaei in 2015. This method can be described as a pairwise comparison between a set of criteria for determining the weight (w_j) of the criteria. Pairwise comparison a_{ij} designates how much an individual prefers criterion i to criterion j. For determination of such preference, Likert scales (for example, very low…very high) can be used with the corresponding numerical scale, such as:

0.1, 0.2, …, 1 (0.1: Equally important, …, 1: i is much more important than j).

1, 2, …, 100 (1: Equally important, …, 100: i is much more important than j).

1, …,9 (1: Equally important, …, 9: i is much more important than j).

From the set of criteria, participants choose one criterion they consider the most important (best) and the least important (worst). The best criterion is then compared to the remaining one, and the same is done for the worst.

The original BWM is presented as a nonlinear optimization problem (Rezaei, 2015). There is also a linear approximation (Rezaei, 2016), a multiplicative version (Brunelli and Rezaei, 2019), group decision-making with the BWM (Mou et al., 2016; Hafezalkotob and Hafezalkotob, 2017; Mohammadi and Rezaei, 2020), and some hybrid versions like BWM-MULTIMOORA (Hafezalkotob et al., 2019) and BWM-VIKOR.

This approach is also widely used in many real-world applications containing, but not limited to, supply chain management (Rezaei et al., 2015; Rezaei et al., 2016; Ahmad et al., 2017; Ahmadi et al., 2017; Vahidi et al., 2018; Gupta and Barua, 2018; Kusi-Sarpong et al., 2019), transportation and logistics (Rezaei et al., 2017; Groenendijk et al., 2018; Rezaei et al., 2019), technology management (Gupta and Barua, 2016), science and research assessment (Salimi and Rezaei, 2016; Salimi, 2017), risk management (Torabi et al., 2016) and energy (Gupta, 2018; Ren, 2018). Table 28 lists some of the studies in which BWM is used for various research areas.

Table 28: Some of the studies that applied BWM.

Type of study	**Application area**	**Data source**	**Number of respondents**	**Method**	**Number of criteria**	**Geographic coverage**	**Useful for**	**Authors**
Application	Information Sharing Arrangements	Interview	4	BWM	16	International comparison	All Stakeholders	Praditya and Janssen, 2017
Case study	-	-	-	Group decision-making method based on BWM	-	-	-	Safarzadeh et al., 2018
Case study	Equipment selection	Secondary Use		BWM, MULTIMOORA, weighted aggregated sum product assessment	9	-	-	Hafezalkotob et al., 2018
Review paper	-	-	-	-	-	-	-	Mi et al., 2019
Case study	Maintenance evaluation of hospitals	Interview	-	Fully fuzzy BWM	8	Metropolitan Level	-	Karimi et al., 2020
Case Study	Introducing BWM	Ad-hoc Survey	46	BWM	6			Rezaei, 2015
Case Study	Introducing linear BWM	Ad-hoc Survey	-	Linear BWM	-	-	-	Rezaei, 2016
Application	Supply chain Sustainability	Ad-hoc Survey	48	BWM	6	International comparison	Stakeholders, integrated oil and gas companies	Sadaghiani et al., 2015
Case Study	Companies	Interview	-	BWM	12	-	Companies	Rezaei et al., 2015
Application	Transportation	Ad-hoc Survey	-	BWM	8	Regional Level	Dairy industry	Sharma et al., 2019
Case Study	Transportation	Ad-hoc Survey	7	Rough BWM-Rough WASPAS	8	-	-	Stević et al., 2018
Research paper	Transportation	Ad-hoc Survey	19	BWM	17	International comparison	Industry and policy	Rezaei et al., 2019

Type of study	Application area	Data source	Number of respondents	Method	Number of criteria	Geographic coverage	Useful for	Authors
Case Study	Transportation	Ad-hoc Survey	140	BWM	7	Metropolitan Level	Governments and transport operators	Groenendijk et al., 2018
Case Study	--	-	-	-	-	-	-	Brunelli and Rezaei, 2019
Case study	-	-	-	-	-	-	-	Mohammadi and Rezaei, 2020
Research paper								Zhang et al., 2017
Case study	Freight transportation	Ad-hoc Survey	50	BWM	6	International comparison	Governments, policymakers, decision-makers, and researchers	Liu, 2016
Case Study	Transportation	-	-	BWM	3	National level	Supply freight	Rezaei et al., 2017

In order to perform the Best Worst Analysis, the following five steps are necessary, which are described based on the Rezaei (2015, 2016) papers.

3.2.7.1 Definition of the decision criteria (step 1)

A set of decision criteria must first be determined. If the number of criteria is more than nine, if possible, they can be classified into different groups because, in general, humans can only compare seven ± two attributes (Miller and Starr, 1963; Glassman et al., 1994). In that case, there are main criteria and their sub-criteria. The weights obtained for the sub-criteria of the BWM are called local weights. The local weights can only be utilized to compare the importance of sub-criteria belonging to the same main criterion. For each sub-criterion, the global weight can be acquired by multiplying each local weight of the sub-criterion by the weight of its respective main-criteria. These weights are called 'global weights' because they can be compared in importance, regardless of the classification (main criteria) to which they belong.

At this stage, a set of criteria $\{c_1, c_2, c_3, \ldots, c_n\}$ is selected for decision. These are criteria that can be compared to determine the best result. The set of decision criteria for different decision-makers might vary (if needed). For further understanding, Figure 5 shows the set of criteria from 1 to n.

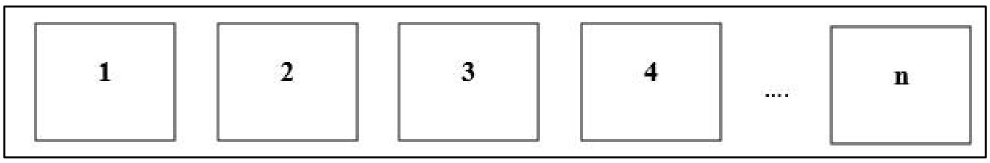

Figure 5: Set of criteria from 1 to n.

3.2.7.2 Determine the best and the worst criteria (step 2)

The best criterion (e.g., most important, most desirable) and the worst criterion (e.g., least important, least desirable) must be designated. The decision-maker generally picks the best and worst criteria at this stage, and there is still no comparison. For better insight, Figure 6 displays the selection criteria for the best and worst.

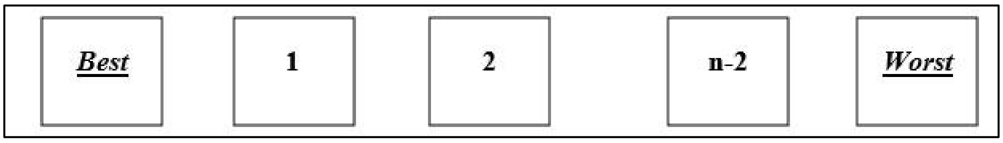

Figure 6: Choosing the criteria of the best and the worst.

3.2.7.3 Determining preference of best criterion over other criteria (step 3)

The strength of the preference of the best criterion over other criteria is designated utilizing a number between one and nine (or different scales). The number one meaning is an equal preference between the best and the other criterion. On the other hand, the number nine means an extreme preference for the best criterion over another. The result of this stage is the vector of Best-to-others, which is as follows: $A_B = (a_{B1}, a_{B2}, a_{B3}, \dots, a_{Bn})$, Where a_{Bj} shows the preference of the best criterion B over criterion j, and it can be concluded that $a_{BB} = 1$. For more apprehension, Figure 7 presents the preference of the best criterion over other criteria.

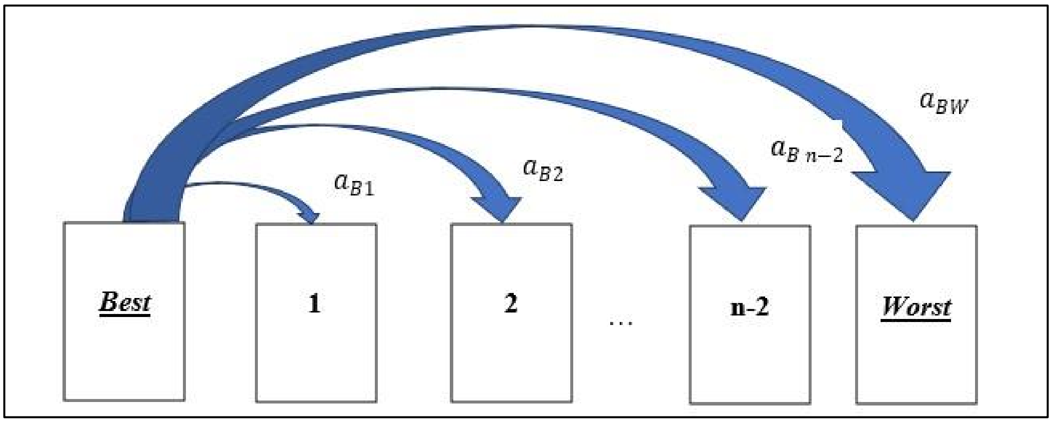

Figure 7: The preference of the best criterion over other criteria.

3.2.7.4 Determining preference of other criteria over worst criterion (step 4)

By utilizing a number between one and nine, the preference of all criteria over the worst criterion is designated. The result of this stage is the vector of others-to-worst, which is as follows: $A_W = (a_{1W}, a_{2W}, a_{3W}, \dots, a_{nW})^T$, where the a_{jW} states the preference of criterion j over the worst criterion W; it can be concluded that $a_{WW} = 1$. For further comprehension, Figure 8 demonstrates the preference of all criteria over the worst criterion.

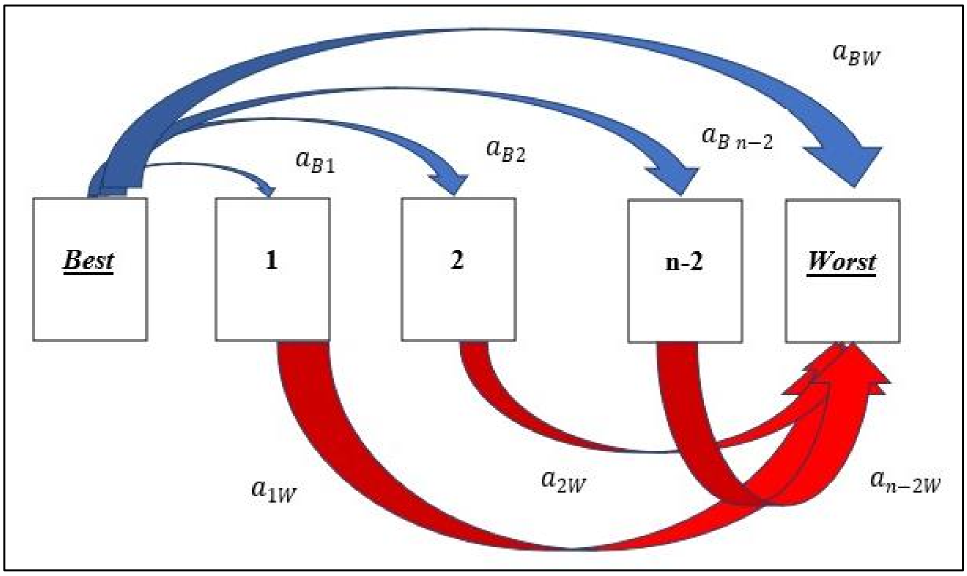

Figure 8: The preference of each criterion over the worst criterion (Rezaei, 2015).

3.2.7.5 Finding the optimal weights: the first approach

Optimal weights $(w_1^*, w_2^*, w_3^*, \dots, w_n^*)$ must be calculated. The optimal weight of the criteria meets the following conditions: For each pair of w_B/w_j and w_j/w_W, $w_B/w_j = a_{Bj}$ and $w_j/w_W = a_{jW}$.

Hence, to achieve these conditions for all j, the maximum value of the set $\{|\frac{w_B}{w_j} - a_{Bj}|, |\frac{w_j}{w_W} - a_{jW}|\}$ should be minimized. The problem can be formulated as indicated in Eq. (22) (Rezaei, 2015).

$$\begin{gathered} min \max_j \{|\frac{w_B}{w_j} - a_{Bj}|, |\frac{w_j}{w_W} - a_{jW}|\} \\ \text{Subject to} \\ \sum_j w_j = 1 \\ w_j \geq 0, \forall j \end{gathered} \tag{22}$$

Problem (4) can be converted (converted min-max) to Eq. (23) (Rezaei, 2015).

$$\begin{gathered} \text{Min}\ \xi \\ \text{Subject to} \\ |\frac{w_B}{w_j} - a_{Bj}| \leq \xi, \forall j \\ |\frac{w_j}{w_W} - a_{jW}| \leq \xi, \forall j \\ \sum_j w_j = 1 \\ w_j \geq 0, \forall j \end{gathered} \tag{23}$$

For each value of ξ, multiply the first set of the constraints of Eq. (23) by w_j and the second set of constraints by w_W, the solution space of Eq. (23) is an intersection of $4n - 5$ linear constraints. It includes $2(2n-3)$ comparison constraints and a constraint for the sum of the weights; hence, the value of ξ is given large enough that the solution space is not empty. Optimal weights $(w_1^*, w_2^*, w_3^*, \ldots, w_n^*)$ and ξ^* are obtained by solving Eq. (23).

3.2.7.5.1 Consistency ratio in BWM

A comparison is entirely consistent when $a_{Bj} \times a_{jW} = a_{BW}$, for all j, where the preference of the best criterion over the criterion j is represented as a_{Bj}, a_{jW} is the preference of criterion j over the worst criterion, and the preference of the best criterion over the worst criterion is indicated as a_{BW} (Rezaei, 2015). For more understanding, Figure 9 shows the concepts of a_{Bj}, a_{jW}, and a_{BW}.

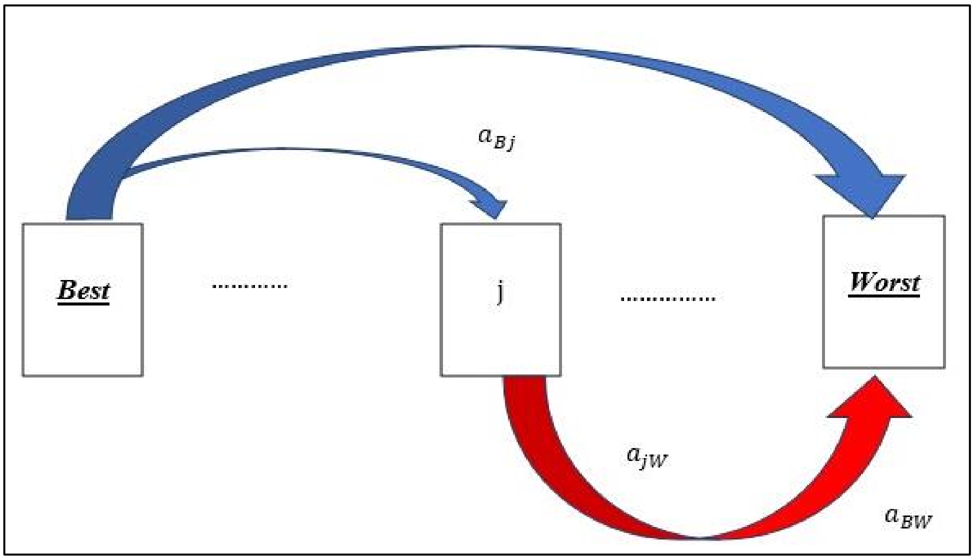

Figure 9: The concepts of $\boldsymbol{a_{Bj}}$, $\boldsymbol{a_{jW}}$, and $\boldsymbol{a_{BW}}$.

3.2.7.5.1.1 Consistency ratio definition in BWM (output-based approach)

Since there is probably no full consistency, the level of consistency can be calculated utilizing a strong indicator called the Consistency Ratio (CR). Calculating the minimum consistency of comparison is important. The $a_{ij} \in \{1, \ldots, a_{BW}\}$ where 9 is the highest possible value for a_{BW}. Consistency reduces when $a_{Bj} \times a_{jW}$ is lower or higher than a_{BW} or equivalently $a_{Bj} \times a_{jW} \neq a_{BW}$, and most inequality happens when a_{Bj} and a_{jW} have the maximum value (equal to a_{BW}), which results in ξ. The $\frac{w_B}{w_j} \times \frac{w_j}{w_W} = \frac{w_B}{w_W}$, and given the highest inequality as a result of assigning the maximum value by a_{Bj} and a_{jW}, ξ is a value that should be subtracted from a_{Bj} and a_{jW} and added to a_{BW}, or equivalently shown in Eq. (24).

$$(a_{Bj} - \xi) \times (a_{jW} - \xi) = (a_{BW} + \xi) \tag{24}$$

As for the minimum consistency $a_{Bj} = a_{jW} = a_{BW}$, Eq. (25) is given.

$$\begin{aligned} &(a_{BW} - \xi) \times (a_{BW} - \xi) = (a_{BW} + \xi) \\ &\qquad \Rightarrow \xi^2 - (1 + 2a_{BW})\xi + \left(a_{BW}{}^2 - a_{BW}\right) = 0 \end{aligned} \tag{25}$$

Solving for different values of $a_{BW} \in \{1, 2, \dots, 9\}$, the maximum possible ξ (max ξ) can be found. The maximum values are used as CI, as indicated in Table 29. CI (max ξ) is found by using Table 29, which lists the CI (max ξ) according to the a_{BW} (Rezaei, 2015).

Table 29: CI (max ξ) according to the a_{BW} (Rezaei, 2015).

a_{BW}	1	2	3	4	5	6	7	8	9
CI (max ξ)	0	0.44	1.00	1.63	2.30	3.00	3.73	4.47	5.23

The CR is calculated using ξ* and the corresponding CI, as shown in Eq. (26).

$$\mathrm{CR} = \frac{\xi^*}{\mathrm{CI}} \tag{26}$$

Since the consistency measurement proposed in the original BWM is based on ξ*which is the optimal objective value (the output); it is called an Output-Based Consistency measurement. CI is a consistency index, CR is a consistency ratio, and CR ∈ [0, 1]. As much as CR is lower, the comparisons are more consistent; therefore, the results are more reliable. Specifically, a CR equal to zero means that the comparisons are cardinally consistent.

The solution space of Eq. (23) contains all positive values for w_j, $j = 1, \dots, n$. The weights sum is one, and the violation of all the weight ratios from their corresponding comparison is a maximum of ξ.

3.2.7.5.1.2 Input-based approach

According to Liang et al. (2020), unlike the Output-based Consistency Ratio, the Input-based Consistency Ratio (CR^{I}) can immediately show the level of consistency of decision-makers. This is because instead of going through the whole optimization process, this approach uses the input provided by the respondent, i.e., the respondent's preferences. The equation relevant to CR^{I} is as follows.

$$\mathrm{CR}^I = \max_j CR_j^I \tag{27}$$

Where

$$CR_j^I = \begin{cases} \dfrac{|a_{Bj} \times a_{jW} - a_{BW}|}{a_{BW} \times a_{BW} - a_{BW}} & a_{BW} > 1 \\ 0 & a_{BW} = 1 \end{cases} \tag{28}$$

CR^I is the global input-based CR for all criteria, CR_j^I indicates the local consistency level associated with the criterion C_j. a_{Bj} shows the preference for the best criterion over C_B over criterion C_j, j= 1, 2, …, n. a_{jW} represents the preference for criterion C_j over the worst criterion C_W, j= 1, 2, …, n. a_{BW} indicates the preference for the best criterion over the worst criterion.

Input-based consistency measurement has advantages over output-based consistency measurement. These advantages are mentioned according to Liang et al. (2020).

- Input-based consistency measurement can provide immediate feedback. Input-based consistency measurement is based on input (preferences), meaning completing the entire elicitation process is unnecessary. On the other hand, output-based consistency measurement is based on output (weights), making it difficult to determine the level of consistency. The simple input-based consistency measurement calculation makes it easy to provide immediate feedback to the decision-makers.
- Its interpretation is simple: it is the maximum normalized discrepancy between the value of a_{BW} and its estimated value calculated as the indirect comparison $a_{Bj} \times a_{jW}$.
- It can provide clear guidance to decision-makers on how to appeal inconsistent judgment(s). The Output-based Consistency Ratio represents the level of global consistency but cannot determine which judgments should be modified. However, the Input-based Consistency Ratio demonstrates the levels of consistency related to individual criteria. After determining the maximum local Input-based Consistency Ratio, the most inconsistent judgment can be found, after which the decision-maker can modify the judgments accordingly instead of revising without instructions.
- It is independent of the model. In other words, the Input-based Consistency Ratio can be used independently to measure the consistency level in various BWM models, for example, a non-linear or linear model or a multiplicative model (Brunelli and Rezaei, 2019). For instance, the linear BWM model does not have an effective consistency measurement (Rezaei, 2016). Also, the non-linear BWM model (Rezaei, 2015) has a different interpretation than the multiplicative BWM model (Brunelli and Rezaei, 2019). However, the CR^I is the same in all three models. Therefore, input-based consistency measurement does not depend on optimization models.

Considering the advantages of input-based consistency ratio (CR^I) over the out-put based consistency ratio, CR^I is used in this study. Hence, it is important to know the CR^I thresholds.

The algorithm for obtaining the threshold for the consistency ratio is shown below (Liang et al., 2020).

1. Create pairwise comparison vectors (step 1). When there are n criteria ($n = 3, 4, \mathrm{I}, 9$), two random vectors $A_{BO} = (a_{B1}, \dots, a_{Bn})$ and $A_{OW} = (a_{1W}, \dots, a_{nW})$ with the maximum scale m ($m = 3, \mathrm{I}\dots, 9$), are generated to represent the vectors of the pairwise comparison A_{BO} and A_{OW} in BWM. The elements in A_{BO} and A_{OW} are integers randomly selected from the domain $[1, m]$.
2. Create the ordinal-consistent group (step 2). After generating a pair of vectors a_B and a_W, it is assigned to the ordinal-consistent group if it meets the ordinal consistency condition, which is "$(a_{Bi} - a_{Bj}) \times (a_{jW} - a_{iW}) > 0, or\ (a_{Bi} = a_{Bj} = a_{iW})\ for\ all\ i\ and\ j$", and $i = i + 1$.
3. Create the ordinal-inconsistent group (step 3). If the paired vector created in Step 1 does not meet the ordinal consistency condition, it is assigned to the ordinal-inconsistent group and $j = j + 1$.

4. In step 4, continue to create the ordinal-consistent and ordinal-inconsistent groups through steps 1–3 until the size of both groups is 10,000.
5. Step 5 calculates CR^I for all paired vectors in these two groups using Eq. (27) and Eq. (28).
6. In step 6, calculate the empirical cumulative distribution of CR^I for the two groups using Eq. (29) and Eq. (30).

$$\widehat{F}(á) = \frac{1}{N} \sum_{i=1}^{N} I\left\{{CR^I}_i \le á\right\} \tag{29}$$

Where $\widehat{F}(á)$ is the empirical cumulative distribution of CR^I for the two groups. $I\{{\mathrm{CR}^I}_i \le á\}$ is the indicator function shown in Eq. (30). N is the pair number of pairwise comparisons, ${\mathrm{CR}^I}_i$ is the ith ($i \in \{1, \dots, \mathrm{N}\}$) input-based CR^I obtained from this N pairs of preferences, $á \in [0, 1]$ is the possible threshold.

$$I\{{CR^I}_i \le á\} = \begin{cases} 1 & if\ {CR^I}_i \le á \\ 0 & Otherwise \end{cases}, \tag{30}$$

Where,

${CR^I}_i$: the ith ($i \in \{1, \dots, \mathrm{N}\}$) input-based CR^I

á: possible threshold

7. In step 7, calculate the relative rejected proportion of the CR^Is in the acceptable group ($P^A_{Rejected}$) and the accepted proportion of the CR^Is in the unacceptable group ($P^U_{accepted}$) using Eq. (31) and Eq. (32).

$$P^A_{Rejected} = \frac{1 - \widehat{F}^A(á)}{1 - \widehat{F}^A(á) + \widehat{F}^U(á)} \tag{31}$$

$$P^U_{accepted} = \frac{\widehat{F}^U(á)}{1 - \widehat{F}^A(á) + \widehat{F}^U(á)} \tag{32}$$

Where,

$P^A_{Rejected}$: relative rejected proportion of the CR^Is in the acceptable group

$P^U_{accepted}$: accepted proportion of the CR^Is in the unacceptable group

8. In step 8, if there is a ${\mathrm{CR}^I}_T$ making $P^A_{Rejected} = P^U_{accepted}$, then ${\mathrm{CR}^I}_T$ is the threshold. If not, go to the next step.
9. In step 9, specify the cross point of the lines of $P^A_{Rejected}$ and $P^U_{accepted}$, the CR^I at this point is used as the threshold.

The CR^I thresholds according to the number of criteria and maximum value in the pairwise comparison system (a_{BW}) are listed in Table 30. The CR^I values below the threshold are acceptable.

Table 30: CR^I thresholds based on the number of criteria and a_{BW} (Liang et al., 2020).

a_{BW}	Number of criteria						
	3	**4**	**5**	**6**	**7**	**8**	**9**
3	0.1667	0.1667	0.1667	0.1667	0.1667	0.1667	0.1667
4	0.1121	0.1529	0.1898	0.2206	0.2527	0.2577	0.2683
5	0.1354	0.1994	0.2306	0.2546	0.2716	0.2844	0.2960
6	0.1330	0.1990	0.2643	0.3044	0.3144	0.3221	0.3262
7	0.1294	0.2457	0.2819	0.3029	0.3144	0.3251	0.3403
8	0.1309	0.2521	0.2958	0.3154	0.3408	0.3620	0.3657
9	0.1359	0.2681	0.3062	0.3337	0.3517	0.3620	0.3662

3.2.7.5.2 BWM: post-optimality

If there are more than three criteria and a CR is greater than zero, Eq. (23) has multiple optimal solutions. The upper and lower bounds of weights are acquired by solving Eq. (33) and Eq. (34). Also, ξ, which is on the right-hand side of the constraints of Eq. (23), is replaced by ξ* in Eq. (33) and Eq. (34) (Rezaei, 2016).

$$\begin{gathered}\min w_j \\ \text{Subject to} \\ \left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi^*, \forall j \\ \left|\frac{w_j}{w_W} - a_{jW}\right| \leq \xi^*, \forall j \\ \sum_j w_j = 1 \\ w_j \geq 0, \forall j\end{gathered} \tag{33}$$

$$\begin{gathered}\max w_j \\ \text{Subject to} \\ \left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi^*, \forall j \\ \left|\frac{w_j}{w_W} - a_{jW}\right| \leq \xi^*, \forall j \\ \sum_j w_j = 1 \\ w_j \geq 0, \forall j\end{gathered} \tag{34}$$

An individual chooses an optimal solution from the interval weights that could be, for example, the center of the intervals.

3.2.7.5.3 Linear BWM, min-max

Eq. (23) could result in multiple optimal solutions. If, instead of minimizing the maximum value among the set of $\{|\frac{w_B}{w_j} - a_{Bj}|, |\frac{w_j}{w_W} - a_{jW}|\}$, minimizing of the maximum among the set of $\{|w_B - a_{Bj}w_j|, |w_j - a_{jW}w_W|\}$, the problem can be formulated as Eq. (35) (Rezaei, 2016).

$$min \max_j \{|w_B - a_{Bj}\, w_j|, |w_j - a_{jW}\, w_W|\} \tag{35}$$

Subject to

$$\sum_j w_j = 1$$

$$w_j \geq 0, \forall j$$

Eq. (35) is converted (converted min-max) to Eq. (36). As it is linear, ξ is denoted by ξ^L (Rezaei, 2016).

$$\text{Min } \xi^L$$

Subject to

$$\begin{aligned} &|w_B - a_{Bj} w_j| \leq \xi^L, \forall j \\ &|w_j - a_{jW} w_W| \leq \xi^L, \forall j \\ &\sum_j w_j = 1 \\ &w_j \geq 0, \forall j \end{aligned} \quad (36)$$

Eq. (36) is an excellent linear approximation of Eq. (23). Hence, it offers a unique solution to the problem (Rezaei, 2016). After solving the problem (10), the optimal weights $(w_1^*, w_2^*, w_3^*, \dots, w_n^*)$ and ξ^{L*} are obtained. Ξ^{L*} can be considered directly as an indicator of the consistency of the comparisons in this model. It should be noted that ξ^{L*} , which is obtained from Eq. (36), should not be divided by the values of the CI mentioned in Eq. (26). The closer the value of ξ^{L*} is to zero, the higher the consistency.

3.2.7.6 Finding the optimal weights: an alternative approach based on Bayesian BWM (A group decision-making model)

BWM cannot integrate the preferences of multiple decision-makers into the so-called group decision problem. Utilizing the average operator, for example, the geometric or arithmetic mean, is a common way to aggregate the preferences of multiple decision-makers. Averages, however, are sensitive to outliers and provide limited information about the overall preferences of all decision-makers. Mohammadi and Rezaei (2020) developed a Bayesian hierarchical model that can determine the optimal weights of a set of criteria according to the preferences of multiple decision-makers utilizing the best-worst framework. BWM first gains the weight of each decision-maker and then applies arithmetic mean to aggregate them. However, using probabilistic modeling, Bayesian BWM calculates the aggregated distribution and all individual preferences at once. The following is the description of Bayesian BWM based on the article by Mohammadi and Rezaei (2020). The Bayesian BWM is a valid method to predict the importance of criteria (Kalpoe, 2020a).

3.2.7.6.1 Group decision-making: a joint probability distribution

Assume that the k^{th} decision-maker, $k = 1, \dots, K$, evaluates the criteria $c_1, \dots, c_n$ by providing the vectors A_B^k and A_W^k. The set of all vectors of K decision-makers is represented by $A_B^{1:K}$ and $A_W^{1:K}$. The superscript $^{1:K}$ demonstrates the total of all vectors in the base. In addition, the overall optimal weight is denoted by w^{agg}.

Estimation w^{agg} requires the use of several auxiliary variables. Specifically, w^{agg} is calculated according to the optimal weights of K decision-makers indicated by w^k, $k = 1, \dots, K$. Therefore, the Bayesian model can compute w^{agg} and $w^{1:K}$ simultaneously. Before making any statistical inference, it is required to write the joint probability distribution of all random variables according to the available data. The $A_B^{1:K}$ and $A_W^{1:K}$ are given, and w^{agg} and $w^{1:K}$ must be calculated accordingly in group decision-making within the BWM. Eq. (37) indicates the joint probability distribution (Mohammadi and Rezaei, 2020).

$$P(w^{agg}, w^{1:K} | \, A_B^{1:K}, A_W^{1:K}) \tag{37}$$

Where,

$P(w^{agg}, w^{1:K} | \, A_B^{1:K}, A_W^{1:K})$: joint probability distribution

$A_B^{1:K}$ and $A_W^{1:K}$: set of all vectors of K decision-makers

w^{agg}: overall optimal weight

w^k: optimal weights of K decision-makers

After calculating the probability in Eq. (37), the probability of each variable can be estimated utilizing Eq. (38) (Mohammadi and Rezaei, 2020).

$$P(x) = \sum_y P(x, y) \tag{38}$$

Where $P(x)$ is the probability of each variable, and x and y are two arbitrary random variables.

3.2.7.6.2 Bayesian hierarchical model

In order to develop a Bayesian model, the independence and conditional independence of variables need first to be recognized. Figure 10 illustrates the probabilistic graphical model of the Bayesian BWM.

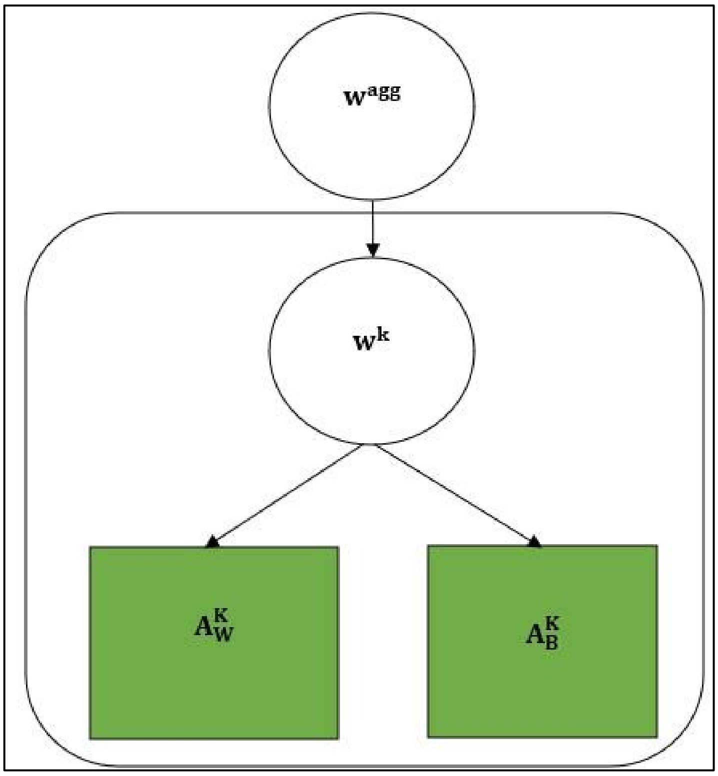

Figure 10: The probabilistic graphical model of the Bayesian BWM (Mohammadi and Rezaei, 2020).

In figure 10, the nodes are the variables. Also, rectangles are the observed variables that are the original BWM inputs. Besides, circular nodes are variables that require to be calculated. Further, arrows indicate that the node at the origin depends on the node at the other end. This means that the value of w^k depends on A_B^K and A_W^K, and the value of w^{agg} depends on w^k.

The plate that covers a set of variables implies that the corresponding variables are iterated for each decision-maker. There is no w^{agg} on the plate because there is only one w^{agg} for all decision-makers.

The conditional independence between various variables is clear based on Fig. 6. For example, A_W^K is independent of w^{agg} given w^k i.e., Eq. (39) (Mohammadi and Rezaei, 2020).

$$P\left(A_W^k \middle| \, w^{agg}, w^k \right) = P\left(A_W^k \middle| \, w^k \right) \tag{39}$$

Where,

$P(w^{agg}, w^{1:K} | \, A_B^{1:K}, A_W^{1:K})$: joint probability distribution

$A_B^{1:K}$ and $A_W^{1:K}$: set of all vectors of K decision-makers

w^{agg}: overall optimal weight

w^k: optimal weights of K decision-makers

Taking into account all the independence between the various variables, the application of the Bayes rule for the joint probability (Eq. (37)) leads to Eq. (40) (Mohammadi and Rezaei, 2020).

$$P(\, w^{agg}, w^{1:K} \mid A_B^{1:K}, A_W^{1:K}) \propto P(A_B^{1:K}, A_W^{1:K} \mid w^{agg}, w^{1:K})\, P(w^{agg}, w^{1:K}) \\ = P(w^{agg}) \prod_{\mathrm{k}=1}^{K} \mathrm{P}\left(A_W^k \middle| w^k\right) \mathrm{P}\left(A_B^k \middle| w^k\right) \mathrm{P}(w^k | w^{agg}) \tag{40}$$

where the last equality is achieved utilizing the probability chain rule and conditional independence of various variables, and each decision-maker independently presents the preferences. There is a chain between different parameters because the calculation of the parameters in Eq. (40) relies on other variables. The chain is the reason for being called a hierarchical model. A_B and A_W can be well modeled utilizing the multinomial distribution, meaning that they retain the original idea of BWM. It is important to note that A_B indicates the preference of all criteria over the worst criterion, while A_W shows the preference of the best criterion over other criteria. Therefore, they can be modeled as shown in Eq. (41) (Mohammadi and Rezaei, 2020).

$$A_B^k \Big| w^k \sim multinomial\left(\frac{1}{w^k}\right), \forall \mathrm{k} = 1, \ldots, \mathrm{K} \\ A_W^k \Big| w^k \sim multinomial\,(w^k), \forall \mathrm{k} = 1, \ldots, \mathrm{K} \tag{41}$$

The multinomial represents a multinomial distribution. Given w^{agg} one can expect each w^k to be in its vicinity. For this purpose, the Dirichlet distribution is re-parametrized concerning its mean and concentration parameter. Eq. (42) presents the models w^k given w^{agg} (Mohammadi and Rezaei, 2020).

$$w^k | w^{agg} \sim Dir(\gamma \times w^{agg}), \forall \mathrm{k} = 1, \ldots, \mathrm{K} \tag{42}$$

Where

w^{agg}: mean of the distribution

γ: concentration parameter

Eq. (42) stated that the weight vector w^k associated with each decision-maker must be adjacent to w^{agg} because it is the mean of the distribution, and the non-negative parameter γ controls their proximity. This technique is applied to various Bayesian models (Kruschke, 2014). The concentration parameter should also be modeled utilizing the distribution. Eq. (43) gives a reliable option: the gamma distribution satisfies the non-negativity constraints (Mohammadi and Rezaei, 2020).

$$\gamma \sim \mathrm{gamma}(a, b) \tag{43}$$

Where

a and b: Gamma distribution shape parameters.

The previous distribution on w^{agg} is shown utilizing an uninformative Dirichlet distribution with the parameter $\alpha = 1$ in Eq. (44) (Mohammadi and Rezaei, 2020).

$$w^{agg} \sim Dir\,(\alpha) \tag{44}$$

As the determined model does not bear a closed-form solution, the Markov-chain Monte Carlo (MCMC) technique is utilized to calculate the posterior distribution. For the MCMC sampling, "Just Another Gibbs Sampler" (JAGS) is utilized (Plummer, 2004), which is a probabilistic language for sampling and posterior computation (Forman and Peniwati, 1998). Hence, the model's output is the posterior distribution of weights for each decision-maker and the aggregated w^{agg} (Mohammadi and Rezaei, 2020).

3.2.7.6.3 Credal ranking

The Bayesian BWM brings forward the credal ranking concept to measure the relationship between a pair of main-criteria or sub-criteria (Mohammadi and Rezaei, 2020). Compared to the traditional method, which utilizes only two figures to specify the superiority of confidence, it can design a Bayesian test in order to calculate the confidence of each credal ranking. By employing this principle in the real-world case, the superiority of confidence between different pairs of competence criteria can be calculated (Li et al., 2020). Credal ranking can calibrate the degree of superiority of one criterion over another. The posterior distribution of weights assists in measuring the confidence of the relationships between different criteria. A weighted directed graph visualizes the credal ranking based on which the interrelation of criteria and confidences are merely understood. In this graph, each node represents a criterion, and each edge indicates the obtained confidence. Eq. (45) describes the credal ordering O , for a pair of criteria c_i and c_j (Mohammadi and Rezaei, 2020).

$$O = (c_i, c_j, R, d) \tag{45}$$

Where

R: the relationship between the criteria c_i and c_j, i.e., $>$, $<$, or $=$;

$d \in [0, 1]$: confidences of the relationship

For a set of criteria $\mathrm{C} = (c_1, c_2, c_n)$, the credal ranking is a set of credal orderings that contains all pairs (c_i, c_j), for all $c_i, c_j \in \mathrm{C}$.

Confidence in the credal ordering can offer more information to decision-makers who can make better decisions in particular. Eq. (46) provides a Bayesian test according to which the confidence of each credal ordering can be calculated (Mohammadi and Rezaei, 2020).

$$P(c_i > c_j) = \int I_{(w_i^{agg} > w_j^{agg})} P(w^{agg}) \tag{46}$$

Where

$P(w^{agg})$: posterior distribution of w^{agg}

I: $\begin{cases} 1 \; if \; the \; condition \; in \; the \; subscript \; is \; met \\ 0 \qquad\qquad\qquad\qquad\qquad otherwise \end{cases}$

This integration can be estimated from the Markov-chain Monte Carlo (MCMC) samples. Having Q samples of the posterior distribution, the confidence can be calculated as shown in Eq. (47) (Mohammadi and Rezaei, 2020).

$$P(c_i > c_j) = \frac{1}{Q}\sum_{q=1}^{Q} I\,(w_i^{agg_q} > w_j^{agg_q})$$
$$P(c_j > c_i) = \frac{1}{Q}\sum_{q=1}^{Q} I\,(w_j^{agg_q} > w_i^{agg_q}) \qquad (47)$$

Where

w^{agg_q}: q^{th} sample of w^{agg} from the MCMC samples.

Therefore, one can calculate the confidence of superiority (confidence level) over the other for each pair of criteria. Credal ranking can be changed to traditional one (the common way of ranking criteria): since $P(c_i > c_j) + P(c_j > c_i) = 1$, c_i is more important than c_j if and only if $P(c_i > c_j) > 0.5$. The traditional ranking of criteria can be achieved by setting a threshold of 0.5 for credal ranking. The closer the Confidence Level (CL) is to 1, the more pronounced the degree of certainty about the relation, which indicates that one criterion is certainly considered more important than another (Mohammadi and Rezaei, 2020).

It is important to note that the credal ranking can be changed into the conventional ranking merely by applying the threshold of 0.5 to the obtained confidence. However, the threshold can vary from problem to problem, and choosing a particular threshold value is entirely up to the decision-maker. In other words, credal ranking can be shaped so that they show the ranking of criteria in various problems based on the confidence desired by decision-makers (Mohammadi and Rezaei, 2020).

3.2.7.6.4 Introducing the CL classification in the credal ranking (Bayesian BWM)

There is no specific classification to describe CL in the literature. Hence, this study intends to introduce the CL classification to explain the results according to the previous studies (Kalpoe, 2020; Li et al., 2020; Mohammadi and Rezaei, 2020). In this regard, Table 31 introduces a description of each CL range for a threshold value of 0.5.

Table 31: Description for each CL range for a threshold value of 50.

CL range	Description
0.8 ≤ CL	One criterion is certainly more important than the other
0.60 ≤ CL < 0.80	One criterion is more important than another
0.50 ≤ CL < 0.60	Superiority of one criterion over another is not well established

It should be noted that when the threshold value is 0.5, values less than 0.5 are not considered in this classification because values less than 0.5 ($CL < 0.5$) must be interpreted inversely. For instance, when the confidence level for comparing C1 and C2 is 0.30, C2 is more important than C1, with a confidence of 0.7 (i.e., $1 - 0.3 = 0.7$).

3.3 Comparative analysis and selection of the MCDM method that will be used

MCDM methods can be compared with the following criteria according to the literature (Brispat, 2017).

- Year of development or method proposal: This aspect is only intended to clarify the age of the method. The advantage of using the method developed a long time ago is that it has been used for a long time, offering reliability and results. Nevertheless, time changes and a younger method may be more useful in this dynamic environment than the old methods.
- Transparency of the method: Extent and ease of understanding of the method. Some methods are challenging to understand, while others are easy. This criterion indicates whether this method is easily understood and hence easily applicable.
- Required data: The amount of data required is also an important factor to consider. The fewer data needed to achieve reliable results, the more points the method scores in this area.
- Quality of the weights: This is used to evaluate the result of pairwise comparison.
- Ability to combine with other methods: The ability to combine with other MCDM methods
- Avoid equalizing bias: Equalizing bias refers to a condition in which the individual gives (approximately) the same weight to all the decision-making attributes (Fox and Clemen, 2005; Tervonen et al., 2017, Marttunen et al., 2018).

The two main categories of information required by PROMETHEE are the weight of the criteria and the preference of decision-makers if any. In other words, there is no particular method for determining weight, which can be considered a disadvantage. In addition, dealing with more criteria (eight or higher) can make the situation difficult for the decision-maker (Serrai et al., 2017). This makes it challenging to achieve a reliable and realistic perception of the stakeholders. Finally, transparency can be classified at a very low level due to difficulty. Also, the transparency of the ELECTRE method is very low due to the comprehensive description.

TOPSIS method is complex and takes time to understand, resulting in low transparency. Because using the Euclidean distance, any correlation between the criteria is not considered, and the qualitative weight parameters may be problematic (Sarai et al., 2017).

In general, understanding and implementing the AHP method is not much complex. With the four steps (Saaty, 1994; Bian et al., 2017), the transparency of the AHP method is at the same level as the best-worst method. Therefore, the transparency of BWM can be considered in the middle category and not in the high transparency category. It should also be noted that study results by (Rezaei et al., 2021) pointed out that AHP and BWM have a low equalizing bias.

On the other hand, WSM and WPM methods are easy to understand and do, which leads to very high transparency.

To evaluate MCDM methods, Table 32 summarizes their benefits, drawbacks, and features according to the literature (Brispat, 2017, Rezaei et al., 2021) and our analysis.

Table 32: Evaluation of MCDM methods.

MCDM	Year of development or method proposal	Transparency of the method	Required data	Quality of weights	Ability to combine with other methods	Avoid equalizing bias
ELECTRE	1966	Very negative	Neutral	Positive	Positive	Not available
WSM	1967	Very positive	Very positive	Not available or very negative	Very positive	Not available
WPM	1969	Very positive	Very positive	Not available or very negative	Very positive	Not available
AHP	1980	Neutral	Neutral	Positive	Neutral	Positive
TOPSIS	1981	Negative	Neutral	Not available or very negative	Not available or very negative	Not available
PROMETHEE	1985	Very negative	Neutral	Positive	Negative	Not available
BWM	2015	Neutral	Very positive	Very positive	Very positive	Positive

The MAMCA method explicitly considers the interests of different stakeholders in the analysis. Therefore, one of the essential parts of the decision-making process is paying attention to the stakeholders' interests. For this reason, MAMCA has been chosen as a way to determine perception. Especially, MAMCA is a method that is not difficult to understand and has seven steps; therefore, the transparency of this method can be placed in the middle category. Step 3 MAMCA analysis is to determine the important criteria and their weight. Then, using another MCDM method combined with the MAMCA analysis, weights can be assigned to criteria. Weight allocation requires a comparison method that allows a fair and accurate comparison of criteria. More accurate results can be obtained using pairwise comparisons because only two factors are compared at a time.

Nevertheless, most pairwise comparison methods, such as ELECTRE, PROMOTHEE, and AHP, cannot resolve recurring inconsistencies. The BWM method uses a different pairwise comparison and makes more consistent results possible with less information. The weights are determined by comparing the best criterion with the rest and other criteria against the worst criterion. It is essential to notice that AHP requires the pairwise comparison of all n decision criteria, i.e., $\frac{n\,(n-1)}{2}$ pairwise comparisons. On the contrary, BWM requires only the so-called reference pairwise comparisons, i.e., $2n - 3$ pairwise comparisons (Liang et al., 2020). In addition, the special structure of BWM generates two vectors comprising only integers, which avoids a fundamental distance problem related to the fractions used in pairwise comparisons (Salo and Hämäläinen, 1997).

BWM seems to be one of the best ways to decide on the weight of parameters (Serrai et al., 2017). This is because the users predefined the best and worst criteria and the comparisons of other elements. In addition, this method is not difficult to understand (average), and the need for fewer data makes this method attractive to use. Besides, BWM has a low equalizing bias. BWM is an easy-to-apply and easy-to-understand approach that makes the comparisons structured and results in more consistent comparisons, thus, more reliable weights/rankings. It is appropriate for both conditions when flexibility is not desirable (linear BWM), and flexibility is desirable (nonlinear BWM). Suitable for both group and individual decision-making. Supports reaching consensus in a natural way. It is efficient in terms of input data. It can be used for various MCDM problems with quantitative and qualitative criteria. Finally, it is compatible with many other MCDM approaches.

To conclude and summarize the above analysis, the appropriate method for conducting the analysis, considering the various stakeholders, is MAMCA. The third step of the MAMCA is to determine the main criteria and weights. This means that another method is required in order to determine the essential criteria and weights for comparing alternatives. This chapter analyzed popular MCDM methods and reported which method will perform PBA. BWM (Bayesian BWM) is the only method with a very high quality of weight (described in section 3.2.7.6 of Chapter 3) and requires a small amount of data. Also, it has a low equalizing bias. Also, the other advantages of this method include the combination of weight quality, fewer inconsistencies between criteria, fewer data required to obtain highly reliable results, and average transparency of the method. Bayesian BWM is used in this study because different groups of stakeholders are involved. Before calculating the optimal group weights by Bayesian BWM, the consistency of the respondents can be examined using the Input-based approach (Eq. (27 and 28) in section 3.2.7.5.1.2 of Chapter 3), and acceptable ones (their obtained global input-based consistency ratio is less than the input-based consistency ratio thresholds) can be considered (Liang et al., 2020). After eliminating pairwise comparisons with unacceptable consistency ratios (section 3.2.7.5.1.2 of Chapter 3), different sample sizes can be obtained and utilized for different levels of the model. Also, it is important to note that Bayesian BWM can provide much more information than the original BWM. Bayesian BWM can provide the credal ranking and confidence level in the weight-directed graph. This helps to understand the importance perceived by stakeholders of one criterion over other criteria.

Chapter 4

Method Implementation

After choosing MAMCA and Bayesian BWM as the methods used for this study (section 3.3 of Chapter 3), this section applies such methodologies for determining each stakeholder's perception of the importance of criteria. However, it is important to note that after determining unacceptable data using the input-based approach (described in 3.2.7.5.1.2 of Chapter 3) and excluding them from the analysis (section 5.4.3 of Chapter 5), the rest data can be used in Bayesian BWM (explained in section 3.2.7.6 of Chapter 3) to find the importance of each criterion.

The first step in MAMCA is defining the problem and identifying the alternatives covered in Section 4.1. Step 2 of MAMCA is the stakeholder analysis explained in section 4.2, which aims to describe the important stakeholders in shared mobility systems. Then the selection of criteria is described in section 4.3 as follows.

4.1. Problem definition and alternatives selection

The first step of the MAMCA (mentioned in section 3.1.1 of Chapter 3) implies defining the problem and classifying the possible alternatives. The problem is identifying the gap between different stakeholders' needs, expectations, and perspectives of the important shared mobility services. In this regard, the research questions are mentioned in Chapter 1. This study focuses on the main modes of shared mobility that are available in Turin (the selection of Turin as the case study is mentioned in section 5.1.2 of Chapter 5) at the time of writing: car-sharing, bike-sharing, and scooter-sharing (Sharing di Monopattini Elettrici) (Comune Torino, 2021). Information about shared mobility services in Turin is mentioned in section 5.1.2 of Chapter 5.

4.2 Stakeholder analysis

The second step of the MAMCA (mentioned in section 3.1.2 of Chapter 3) is to perform a stakeholder analysis to recognize the stakeholders involved. Macharis et al. (2010) define stakeholders as those interested in or influenced by decisions made during the process. Stakeholder analysis can be performed to visualize stakeholder alignment and demonstrate common and conflicting interests. This helps to minimize project threats and barriers and maximize collaboration.

The shared mobility system user group is an important stakeholder to be considered (Jia et al., 2018) and directly affects the demand for these services. Operators are also major shareholders. Operators invest in vehicles and infrastructure, system operations, and day-to-day operations management (Zhang et al., 2105). The public authorities are another important stakeholder (Lan et al., 2017). Public authorities are called government members in this study, including three levels. The first level contains regional executive directors and staff. The second level includes metropolitan city executive directors and staff. Finally, the third level comprises municipal policy-makers, executive directors, and staff. The government can control the norms, policies, and regulations, such as limiting the number of shared mobility vehicles and dividing parking lots by local authorities. Another example is providing regulations for developing the shared mobility industry at the national level (Miller et al., 2016). In this regard, Zhang et al. (2105) showed that government participation and bike-sharing companies' investment in operations management are of considerable importance in the sustainable development of the bike-sharing industry. Also, the government could improve the legal framework for creating dedicated parking spaces for car-sharing vehicles on public streets by redesigning road traffic regulations. Also, municipalities can improve pedestrian, bicycle, and public transportation infrastructure as complementary modes of transportation for car-sharing. In addition, they can install reserved parking spaces for shared vehicles in crowded cities or near public transportation junctions and limit motorized traffic within cities (Loose et al., 2006).

Furthermore, the government can also improve media communication efforts to influence user behavior (Jia et al., 2018). On the other hand, a shared mobility system can benefit the government and the people. For instance, by e-scooter-sharing development, governments can lead to developing sustainably by addressing development problems such as pollution and traffic during rush hour (Ling et al., 2015; Axsen and Sovacool, 2019). Hence, the most relevant stakeholders to the shared mobility systems are operators, government members, and passengers (Turoń et al., 2020). Having a better understanding of the views of these stakeholders and extensive interactions may improve the state of the shared mobility system. In addition, the development of sustainable urban mobility plans or new sustainable transport regulations may influence local transport policymakers (Dörry and Decoville, 2016; Le Pira et al., 2016; Le Pira et al., 2017). This study also considers the non-users of shared mobility systems in order to understand their perception. This can help to understand the gap (if any) in the views of users and non-users of shared mobility services, which can help to provide some policies to attract them to use these services and increase demand. For a better view of the stakeholders involved in this study, the important stakeholders of shared mobility services and their relationship are shown in Figures 11 and 12, respectively.

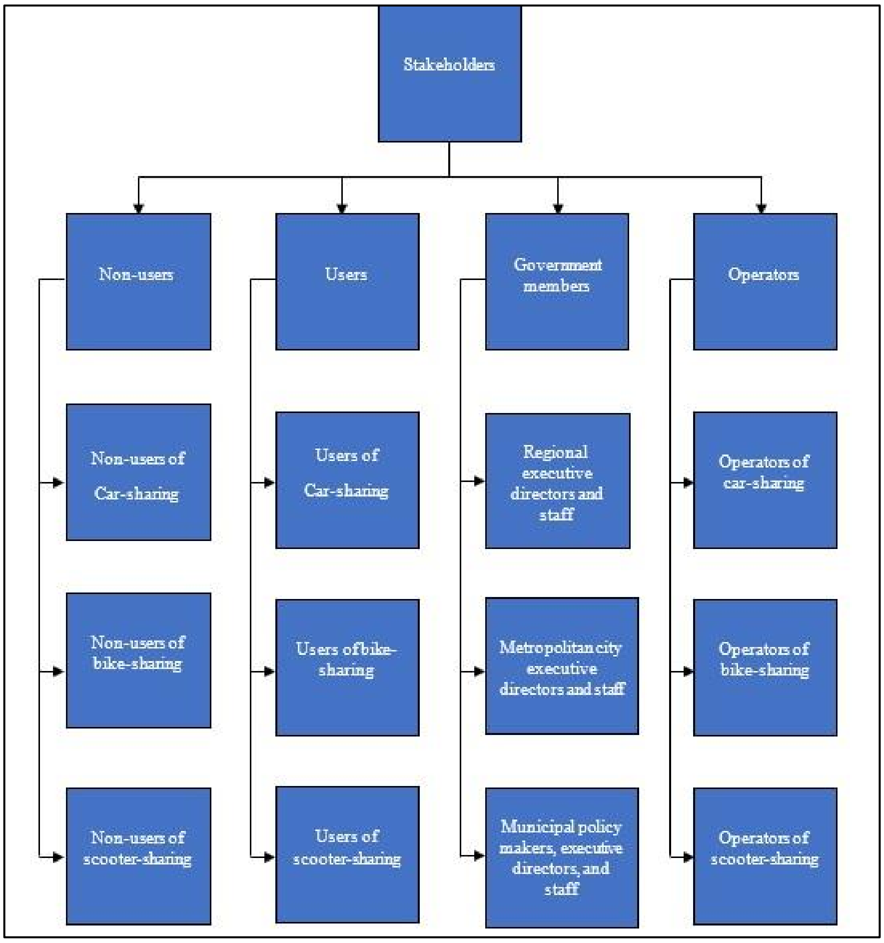

Figure 11: Important stakeholders of shared mobility services.

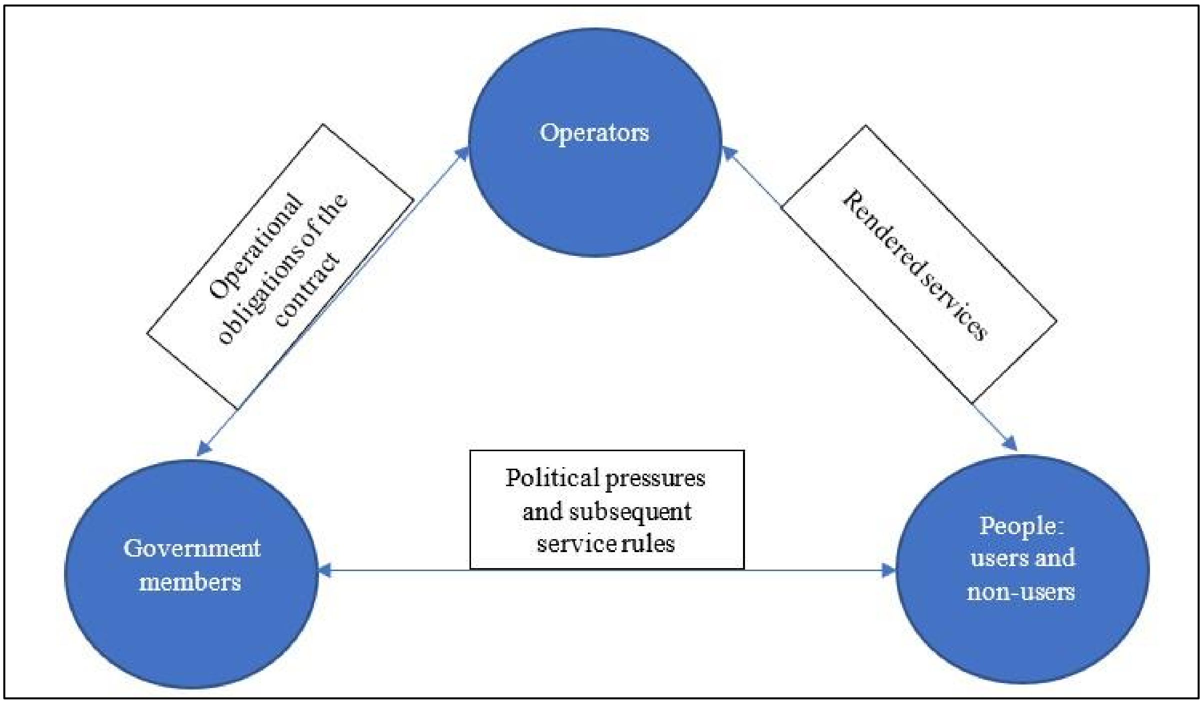

Figure 12: Relationship between the stakeholders of shared mobility services.

4.3 Selection of criteria

This study considers four shared mobility service stakeholders: users, non-users, government members, and operators. In this section, the selection of criteria is described. The third step of the MAMCA (mentioned in section 3.1.3 of Chapter 3) is the selection of important criteria, and weights for stakeholders, including users/non-users (common criteria for users and non-users are used to find the gap in their opinions about the importance of the criteria), government members and operators explained in sections 5.3.1, 5.3.2 and 5.3.3, respectively. It is important to note that as mentioned in section 3.1.3 of Chapter 3, in order to show the stakeholders involved with their goals and objectives, it is possible to provide a hierarchical criteria tree (at this stage); however, it is not used in this study since it is not among the research purpose. In this regard, it can be noted that the criteria selection is based on the objectives of the stakeholders involved and according to the considered alternatives (car-sharing, bike-sharing, and scooter-sharing). Also, as stated in section 3.1.3 of Chapter 3, it is possible to assign weights to stakeholders if necessary. These can show the importance of stakeholders in the decision-making process contributing to determining the importance of the criteria from all stakeholders' views simultaneously (the overall importance of each criterion according to the combinations of perspectives). However, it is not used in this study because, in this section, the purpose of the study is to determine the point of view of each stakeholder separately. According to the research objectives, this research has two parts, including an analysis of shared mobility services (as a whole, not for a specific shared mobility service) and an analysis of each shared mobility service (separately), as follows.

- ***Analysis of shared mobility services (as a whole, not for a specific shared mobility service):*** in this part, the perspectives of stakeholders (users, non-users, government members, and operators) of shared mobility services (as a whole, not for a specific shared mobility service) about the importance of the criteria associated with each stakeholder is determined. In other words, users and non-users determine the importance of each criterion (associated with their perspectives) depending on the extent to which it motivates them to use (more use) shared services. Members of the government specify the importance of each criterion (relevant to their perspective) when a new shared mobility system is launched in Turin, Italy. Also, Operators determine the importance of each criterion (related to their perspective) to the extent that it can motivate them to implement their shared mobility system in Turin. The importance of each criterion (weight) can be found using Bayesian BWM (explained in section 3.2.7.6 of Chapter 3). Besides, at the end of this part, since data on users' and non-users' opinions on the value of each criterion (indicator value, explained in section 3.1.4 of Chapter 3) are also collected (presented in Chapter 5), the preferred shared mobility service (car-sharing, bike-sharing, and scooter-sharing) from the perspectives of users and non-users groups can be determined (using step five through seven of MAMCA, mentioned in 3.1.1.5, 3.1.1.6, and 3.1.1.7 of Chapter 3). Also, the gap between (if any) perceptions of users and non-users (perception analysis) can be found. Further, sensitivity analysis and scenarios can be done from users’ and non-users' perspectives.
- ***Analysis of each shared mobility service (separately):*** this part determines the perspective of each stakeholder (users, non-users, government members, and operators) of car-sharing,

bike-sharing, and scooter-sharing services on the importance of each criterion and sub-criterion affecting passengers' shared mobility choice behavior. These criteria and sub-criteria are the same among the stakeholders of all three shared mobility services. This helps to find differences in their views (if any) about the importance of each criterion and sub-criterion. The importance of each criterion (weight) can be found using Bayesian BWM.

In order to have a better understanding of the study purpose of these two parts, Figure 13 shows the purpose of each part separately.

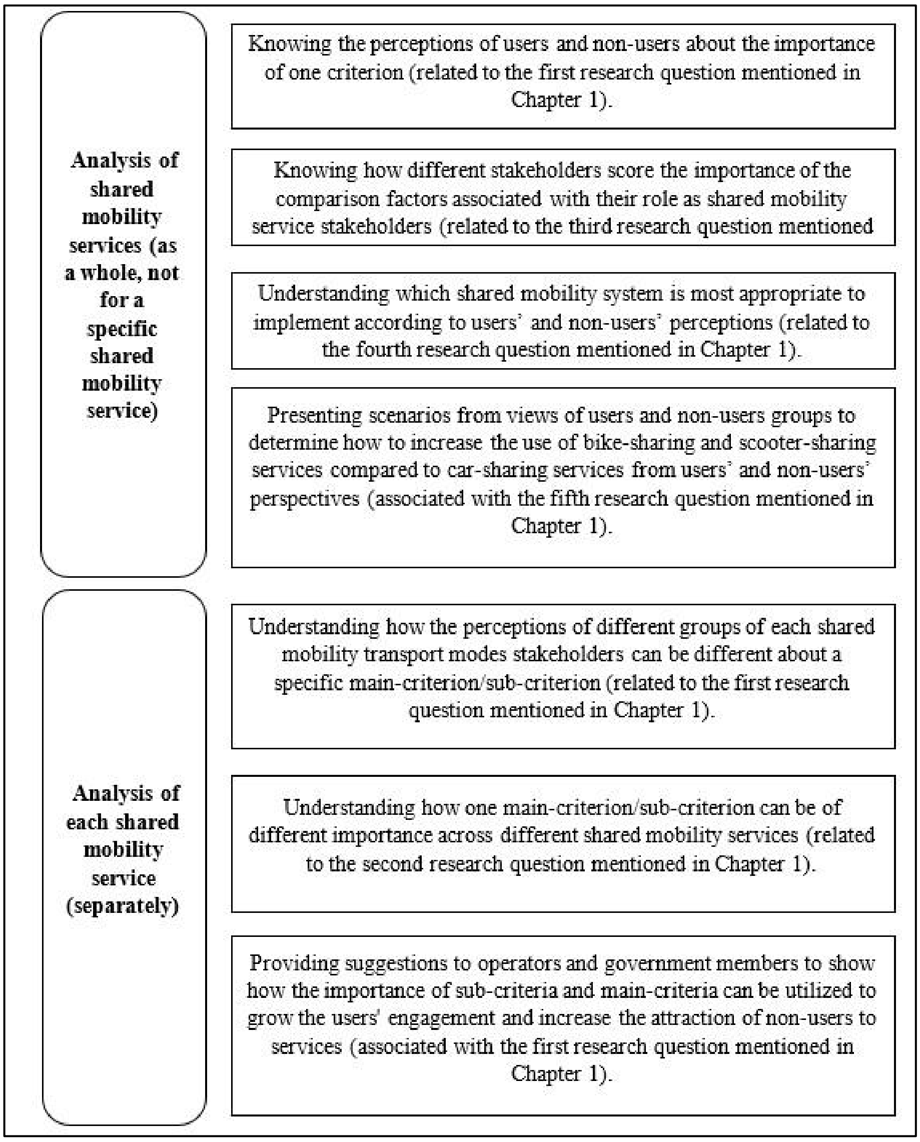

Figure 13: Purpose of analysis of shared mobility services (as a whole, not for a specific shared mobility service) and an analysis of each shared mobility service (separately).

4.3.1. Analysis of perspectives of stakeholders of shared mobility services (as a whole, not for a specific shared mobility service)

According to the description of the analysis of shared mobility services (as a whole, not for a specific shared mobility service), this analysis can be divided into three sub-sections. The sub-section 4.3.1.1 identifies the influential characteristics in choosing a shared mobility service for a trip for users and non-users. Also, in sub-section 4.3.1.2, important characteristics for government members when a new shared mobility system is set up in Turin, Italy, are specified. In addition, sub-section 4.3.1.3 sets out characteristics that can be considered important elements for the shared mobility operators to implement the shared mobility system in a city.

4.3.1.1 User and non-user perspectives about shared mobility services (as a whole, not for a specific shared mobility service) perspectives

The main characteristics that users and non-users of shared mobility services (as a whole, not for a specific shared mobility service) consider when selecting a shared mobility service to make a trip are listed below in a similar study (Brispat, 2017) and also author's knowledge summarized in section 2.4. It is important to note that in this study, the 7-point Likert scale is used to measure the respondent's opinions about the criteria. According to Khandelwal (2021), this scale is the most accurate Likert scale because it best represents the respondent's feelings. Therefore, it provides better accuracy in results and is very useful for researchers. However, it should be noted that the 7-point Likert items suffer from bias in response style. The definition and explanation of the measurement of the criteria used in this research are as follows. Again according to Brispat (2017) and knowledge of the author, items in the list are sorted from the most important to the least important:

- **Accessibility:** ease of access, availability of a shared vehicle, proximity to the location of the parked shared vehicle. For travelers, this aspect may occupy an important place in selecting a shared mobility system. It is essential to figure out how easy or difficult it is for passengers to access these shared mobility services. Passenger safety can be defined between [1-7], which means 1 is very difficult, and 7 is very easy.
- **Cost**: expenses for shared mobility usage, such as service subscription fees or usage fees. Ticket prices can be the main aspect to consider. For instance, travelers are more likely to opt for cheaper shared mobility services. Therefore, it is essential to determine how passengers rate the cost of usage or membership fee. It can be measured in degrees between [1-7], meaning that 1 is very expensive, and 7 is very cheap.
- **Comfort**: vehicle characteristics that make passengers feel comfortable during the trip. It can vary between shared transportation services; hence, travelers may prefer a shared transportation service based on travel comfort. Hence, it is required to know how comfortable passengers feel on each trip of the shared transport service. It can be measured in degrees between [1-7], meaning 1 is very uncomfortable, and 7 is very uncomfortable.
- **Travel Safety**: the level of safety of the individuals during the trip, such as the rate of accidents, harassment, assault, and theft. Passenger safety information provides insight into how safe a passenger feels when using a shared transportation service. These safety measures can be different within the service and have a different sense of safety. For instance, travelers who use a shared transportation service perceive safety as a perception or feeling of safety. Therefore, it is important to determine how safe the passenger feels with each shared mobility service. In this case, passenger safety can be defined between [1-7], which means 1 is very unsafe, and 7 is very safe.

- **Operational speed**: the average velocity that a shared mobility system overpasses. It should be specified how passengers would rate the travel speed of each shared mobility service. It can be measured in degrees between [1-7], which means 1 is very poor and 7 is very good.
- **User-friendliness**: easy for beginners to learn, easy to use, and provide travel information in the app. To understand how easy or difficult it is for passengers to access any shared mobility service, this characteristic can be defined between [1-7], which means that 1 is very difficult, and 7 is very easy.
- **Image**: the image of a shared mobility system in passengers' eyes. It is expected, for example, that the image of a car-sharing service differs from a bike-sharing service or a scooter-sharing service. Hence, it is important to know how passengers would rate each shared mobility service overall. The image of a system can be measured in degrees between [1-7], which means that 1 is very poor and 7 is very good.
- **Possibility of carrying items**: possibility of carrying luggage or bags or shopping items in the shared vehicle. For instance, passengers can carry their luggage by shared car but not by scooter-sharing. Thus, it is necessary to know whether it is difficult or easy for passengers to carry belongings when using any shared mobility service. It can be defined between [1-7], which means 1 is very difficult, and 7 is very easy.

The characteristics studied differ for government members, operators, and people (users/non-users) of shared mobility services (as a whole, not for a specific shared mobility service). Therefore, it is better to indicate them with different symbols. In this regard, "Cp" denotes the criteria related to both users and non-users. These symbols are presented in Table 33.

Table 33: Symbolize each criterion associated with users and non-users.

Criteria	Symbols
People safety	**Cp1**
Operational speed	**Cp2**
Accessibility	**Cp3**
User-friendliness	**Cp4**
Image	**Cp5**
Comfort	**Cp6**
Cost	**Cp7**
Possibility of carrying items	**Cp8**

4.3.1.2 Government perspective about shared mobility services (as a whole, not for a specific shared mobility service)

It is remarkable to know the views of government members on some of the features associated with shared mobility services (as a whole, not for a specific shared mobility service) that may be important to members of the government. These criteria are presented according to a similar study (Brispat, 2017), and the knowledge of the author is listed from the most important to the least important.

- **Average number of trips per vehicle per day**: it gives insight into the efficiency of the vehicle that shows the efficiency of the service.
- **Greenhouse gases (GHGs):** the amount of greenhouse gas emissions by a shared mobility system.

- **Parking issues:** illegal parking of shared vehicles like parking in inappropriate places.
- **Emission of pollutants (CO_2/km):** pollutants emitted by a shared vehicle. Governmental members care about sustainability and strive for fewer emissions.
- **Integration of the shared mobility service with public transport:** complementarity of a shared vehicle for public transport. Their integration can increase urban mobility.
- **Vehicle fee (Euro):** the fee that a shared mobility operator may pay to the municipality. For example, car-sharing operators paid a fee to the municipality, which allowed their shared cars to go to city centers or places where traffic was restricted.

In terms of the notation of characteristics, “Cg” denotes criteria related to the stakeholder group of government members. These symbols are presented in Table 34.

Table 34: Symbolize each criterion associated with government members.

Criteria	Symbols
Average number of trips per vehicle per day	Cg1
Greenhouse gases (GHGs)	Cg2
Parking issues	Cg3
Emission of pollutants	Cg4
Integration of the shared mobility service with public transport	Cg5
Vehicle fee	Cg6

4.3.1.3 Operators' perspectives about shared mobility services (as a whole, not for a specific shared mobility service) perspectives

The following characteristics can be considered important elements for system implementation for a shared mobility operator planning to run the shared mobility system in a city. These criteria are presented according to a similar study (Brispat (2017)), and the knowledge of the author is listed from the most important to the least important.

- **Vehicle utilization rate (%)**: total time (minutes) that all shared vehicles are used each day divided by the time they can potentially be used per day in 24 hours, which shows the efficiency of the service.
- **Usage fees (membership fees) (€)**: operators experience higher revenue with higher usage fees (membership fees), and it affects earnings.
- **Average number of trips per vehicle per day**: it gives insight into the efficiency of the vehicle that shows the efficiency of the service.
- **Operational speed (Km/h)**: the average velocity a shared mobility system passes.
- **The lifespan of the vehicle (year)**: system lifespan is measured in years and is indicated by the lifespan of vehicles.

In terms of the notation of characteristics, “Co” represents criteria related to the stakeholder group of operators. These symbols are offered in Table 35.

Table 35: Symbolize each criterion associated with operators.

Criteria	Symbols
Vehicle utilization rate	Co1
Usage fees	Co2
Average number of trips per vehicle per day	Co3
Operational speed	Co4
The life span of the vehicle	Co5

4.3.2. Criteria related to traveler choices that are common across stakeholders and shared mobility services

The characteristics that different stakeholders (government members, operators, and users and non-users) rank by importance for each shared mobility service (car-sharing, bike-sharing, and scooter-sharing) are all related to the passenger choices on whether to use the service or not, and they should be the same. According to the literature (Chapter 2) and the author's knowledge, twelve important characteristics can affect shared mobility services. These characteristics include travel time, travel distance, departure time, trip purpose, cost, comfort, safety, service quality, environment-friendly system, user-friendliness, service availability, vehicle availability and accessibility. As explained in section 3.2.7.1 of Chapter 3, when the number of criteria is more than nine, if possible, they can be classified into different groups since, generally, humans can only compare seven ± two attributes (Miller and Starr, 1963; Glassman et al., 1994). According to the literature (Chapter 2), these important characteristics can be divided into trip-related characteristics, service-related characteristics, and availability and accessibility as follows (listed from the most important to the least important.).

4.3.2.1 Trip-related characteristics

Individuals could consider some trip-related characteristics in selecting each shared mobility service to make a trip. These characteristics are listed below (listed from the most important to the least important).

- **Travel time**: the time it takes with a given means to travel from origin to destination. Stakeholders should be asked to specify which characteristics, including short-time trips (less than 30 min), long-distance trips (beyond 30 min), or both, might drive people to use (or use more) each shared mobility service.
- **Travel distance**: the distance between origin and destination. It is important to ask stakeholders to identify which characteristics, including short-distance travel (less than 5 km), long-distance travel (beyond 5 km), or both, might induce people to use (or use more) each shared mobility service.
- **Departure time**: the trip's start time, such as in the morning or evening, on weekends, or on weekdays, during peak or off-peak hours. It is required to ask stakeholders to specify which characteristics, including peak hours, off-peak hours, or both, might encourage individuals to use (or use more) each shared mobility service. Also, it is required to ask stakeholders to specify which characteristics, including traveling on a weekday morning, on a weekend morning, on a weekday evening, or/and a weekend evening might induce people to use (or use more) each shared mobility service.
- **Trip purpose**: the purpose of the trip, such as traveling to work, school, shopping, or meeting a friend. Stakeholders should be asked to determine which characteristics, including travel for leisure trips (e.g., visiting friends or shopping), non-leisure trips (going to work/school), or both, might induce people to use (or use more) each shared mobility service.

4.3.2.2. Service-related characteristics

Some characteristics of each shared mobility service affect people's behavior in choosing each shared mobility service for travel. These characteristics are listed below (listed from the most important to the least important).

- **Cost**: expenses for each shared mobility service usage, such as service subscription fees or usage fees.
- **Comfort**: vehicle characteristics that make you feel comfortable during the trip.
- **Safety**: the level of safety of the individual during the trip, such as the rate of accidents, harassment, assault, and theft.
- **Service quality**: quality of each shared mobility system and given services.
- **Environment-friendly system**: a system that reduces environmental impacts.
- **User-friendliness**: easy for beginners to learn, easy to use, and provide travel information in the app.

4.3.2.3 Availability and accessibility

The definitions of two characteristics, including the availability and accessibility of each shared mobility service that influence each shared mobility service demand, are as follows (listed from the most important to the least important).

- **Service availability**: availability of each shared mobility service around shopping malls, colleges, transportation centers, city centers, and densely populated areas.
- **Vehicle availability and accessibility**: availability of the vehicle where I need it, easiness to reach and access the vehicle, proximity to the location of the parked vehicle from my starting point.

4.3.3. Summary of the main-criteria and sub-criteria to be considered

In summary, Table 36 presents the three main-criteria and twelve sub-criteria that are common across stakeholders and shared mobility services in analyzing each shared mobility service (separately).

Table 36: The three main-criteria and twelve sub-criteria that are common across stakeholders and shared mobility services.

Main-criteria	Sub-criteria
C1. Trip-related characteristics	C1.1. Travel time C1.2. Travel distance C1.3. Departure time C1.4. Trip purpose
C2. Car-sharing characteristics	C2.1. Travel cost C2.2. Travel comfort C2.3. Safety C2.4. Service quality C2.5. Environment-friendly system C2.6. User-friendly
C3. Availability and accessibility	C3.1. Service availability C3.2. Vehicle availability and accessibility

Chapter 5

Experimental Activities

This section is dedicated to the experimental activities of this study. After the problem definition and alternatives selection (step 1 of MAMCA, mentioned in section 3.1.1 of Chapter 3 and 4.1 of chapter 4), stakeholder analysis (step 2 of MAMCA, given in section 3.1.2 of Chapter 3 and section 4.2 of Chapter 4), selection of the criteria for each study purpose (step 3 of MAMCA, presented in section 3.1.3 of Chapter 3 and section 4.3 of chapter 4), to obtain the weight of each criterion (explained in section 4.3. of Chapter 4), first, the required data should be gathered. To do this, the study area must be well explained, given in section 5.1. Then, all the information related to questionnaire design, data collection activities, and collected data are offered in sections 5.2, 5.3, and 5.4, respectively.

5.1 Study area

5.1.1. Shared mobility services in Italy

To better understand the shared transport services in Italy, it is better to explain their evolution in chronological order, based on Ciuffini et al. (2021), a national report on shared mobility released almost every year.

According to Ciuffini et al. (2021), the first Station-based bike-sharing was born in Ravenna in 2000, followed by the first Station-based car-sharing in Milan in 2001. Later came Free-floating car-sharing services that overlapped the previous station-based services, followed by the new Free-floating bike-sharing and scooter-sharing services. The first Free-floating car-sharing service was launched in Milan in 2013. In 2015, electric Free-floating car-sharing was launched. Also, the first Free-floating bike-sharing service was introduced in Italy in 2016. Besides, the Free-floating scooter-sharing service was launched in Italy in late 2019 and early 2020. Demand for car-sharing, bike-sharing, and scooter-sharing in 2020 is 6.4 million rentals (down 48% from 2019 due to Covid-19), 5.7 million rentals (down 55% from 2019 due to Covid-19), and 7.4 million rentals, respectively. The number and percentage of available services, available vehicles, and rentals of each shared mobility system in Italy are illustrated in Figures 14 to 16, respectively (Ciuffini et al., 2021).

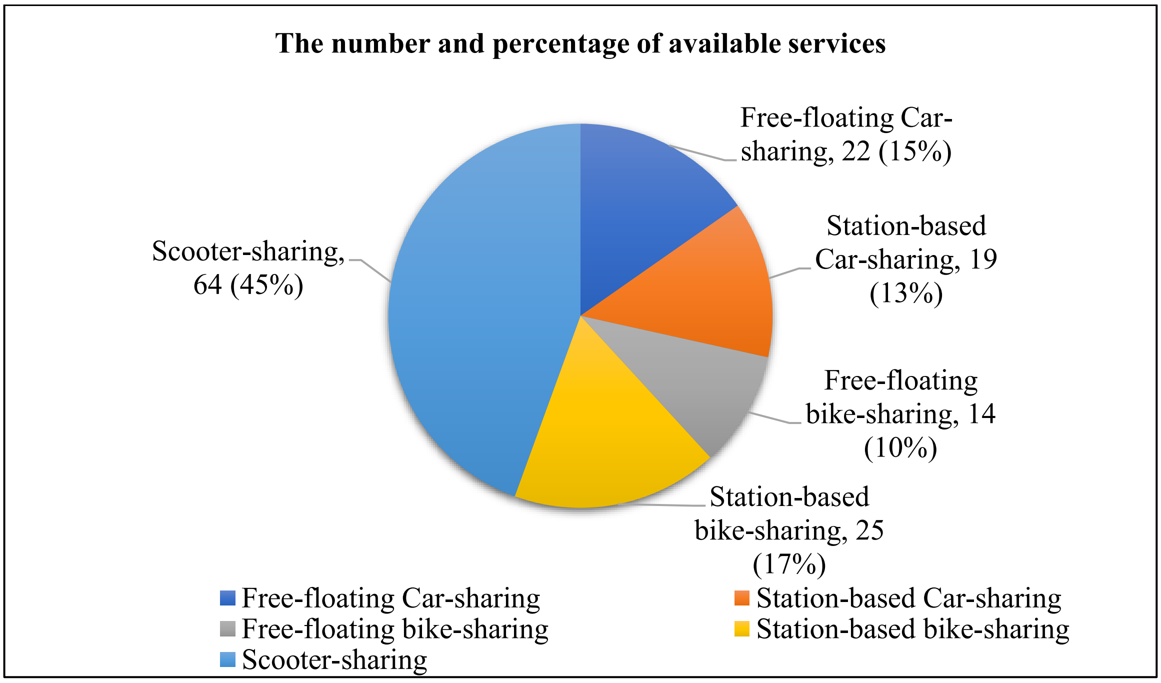

Figure 14: Number and percentage of available services of each shared mobility system in Italy in 2020 (Ciuffini et al., 2021).

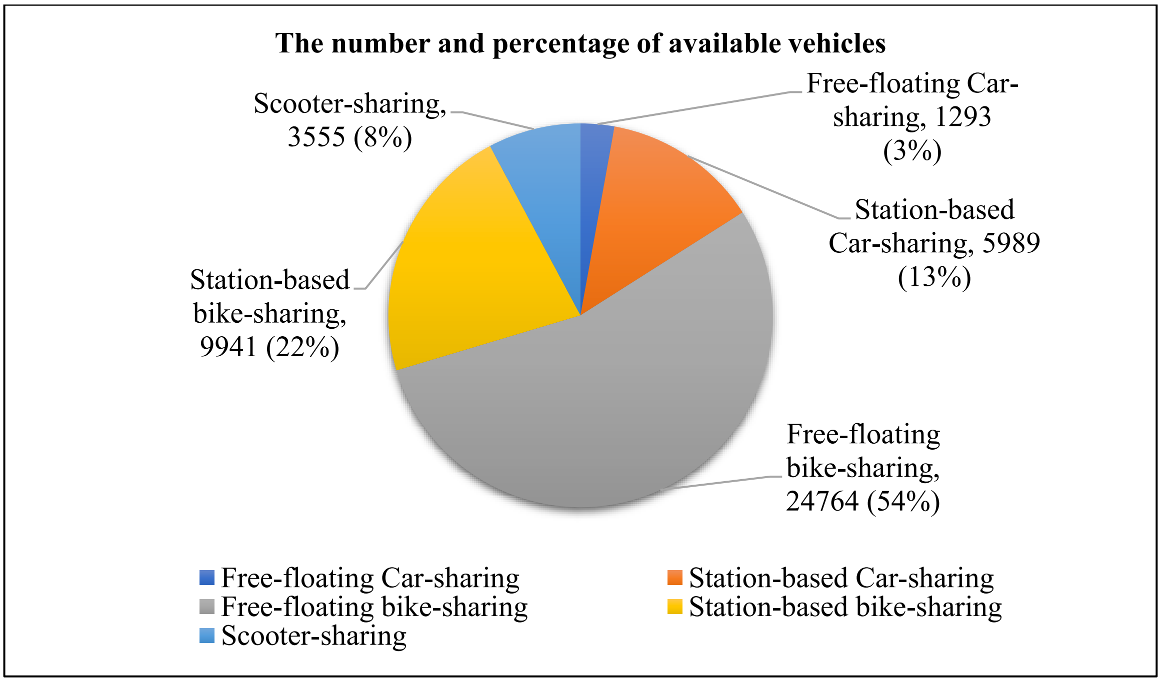

Figure 15: Number and percentage of available vehicles of each shared mobility system in Italy in 2020 (Ciuffini et al., 2021).

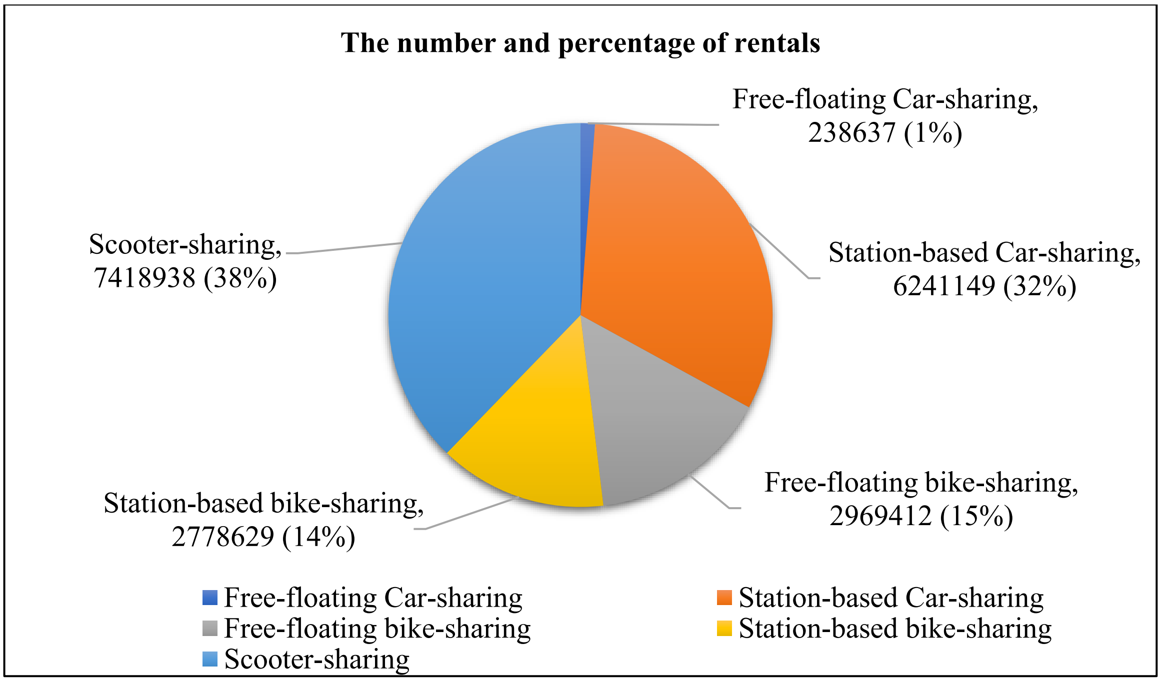

Figure 16: Number and percentage of rentals of each shared mobility system in Italy in 2020 (Ciuffini et al., 2021).

Furthermore, in order to better understand the diffusion of shared mobility services in Italy, knowing the number of subscribers of each shared transportation service where this service is available in Italy (Ciuffini et al., 2021) and the population[3] of the province and city[4], the ratio of the subscribers of each shared mobility service to the population of the province and city (in percentage) is obtained, which is presented in Table 37.

Table 37: The ratio of the subscribers of each shared mobility service to the population of the province and city (Ciuffini et al., 2021).

Type of shared mobility service	City Name	Province population	City population	Number of service subscribers in 2020	Subscribers/province population ratio	Subscribers /city population ratio
Free-floating car-sharing*	Rome	4222631	2761632	824049	19.52%	29.84%
	Milan	3237101	1371498	934777	28.88%	68.16%
	Florence	994717	367150	164720	16.56%	44.86%
	Turin	2205104	848885	266027	12.06%	31.34%
	Bologna	1015701	392203	57546	5.67%	14.67%
	Arezzo	334634	96672	229	0.07%	0.24%
Station-based car-sharing**	Rome	4222631	2761632	3200	0.08%	0.12%
	Turin	2205104	848885	12779	0.58%	1.51%
	Genoa	816250	560688	2774	0.34%	0.49%
	Brescia	1254322	196850	65	0.01%	0.03%
	Bolzano	535774	107025	1142	0.21%	1.07%
	Trento	542158	118509	700	0.13%	0.59%
	Parma	450044	196655	695	0.15%	0.35%
	Trapani	415233	64486	124	0.03%	0.19%
	Palermo	1199626	630828	5133	0.43%	0.81%
	Enna	155982	27586	47	0.03%	0.17%
	Catania	1068835	298324	500	0.05%	0.17%
	Cagliari	419770	148881	2016	0.48%	1.35%

[3] The population of provinces where shared mobility service is available in Italy, as listed at https://www.tuttitalia.it/province/ - accessed 22 October, 2022.
[4] The population of cities where shared mobility service is available in Italy, as listed at https://www.tuttitalia.it/citta/popolazione/ - accessed 22 October, 2022.

Type of shared mobility service	City Name	Province population	City population	Number of service subscribers in 2020	Subscribers/province population ratio	Subscribers /city population ratio
Free-floating bike-sharing* **	Rome	4222631	2761632	201564	4.77%	7.30%
	Milan	3237101	1371498	442521	13.67%	32.27%
Station-based bike-sharing******	Turin	2205104	848885	4159	0.19%	0.49%
	La Spezia	214879	92216	876	0.41%	0.95%
	Como	594657	83626	691	0.12%	0.83%
	Bergamo	1102670	120207	370	0.03%	0.31%
	Brescia	1254322	196850	29400	2.34%	14.94%
	Bolzano	535774	107025	710	0.13%	0.66%
	Trento	542158	118509	1434	0.26%	1.21%
	Treviso	876755	84793	337	0.04%	0.40%
	Padua	930898	209829	1004	0.11%	0.48%
	Udine	517848	97761	1700	0.33%	1.74%
	Trieste	230623	200594	10480	4.54%	5.22%
	Parma	450044	196655	605	0.13%	0.31%
	Modena	702787	185644	3188	0.45%	1.72%
	Ravenna	386007	156080	2633	0.68%	1.69%
	Forlì	391524	116861	242	0.06%	0.21%
	Pisa	417245	89828	1145	0.27%	1.27%
	Siena	262046	53724	254	0.10%	0.47%
	Terni	218254	107314	37	0.02%	0.03%
	Reggio Calabria	518978	182455	511	0.10%	0.28%
	Palermo	1199626	630828	3207	0.27%	0.51%
Scooter-sharing*****	Rome	4222631	2761632	390734	9.25%	14.15%
	Milan	3237101	1371498	204070	6.30%	14.88%
	Turin	2205104	848885	118882	5.39%	14.00%
	Bergamo	1102670	120207	4231	0.38%	3.52%
	Monza	870112	122099	22503	2.59%	18.43%
	Verona	927108	257274	50098	5.40%	19.47%
	Parma	450044	196655	34873	7.75%	17.73%
	Modena	702787	185644	7894	1.12%	4.25%
	Rimini	336916	150051	50000	14.84%	33.32%
	Pisa	417245	89828	8927	2.14%	9.94%
	Pesaro	351993	94237	2042	0.58%	2.17%
	Naples	2967117	914758	22666	0.76%	2.48%
	Bari	1224756	316140	62457	5.10%	19.76%
	Lecce	772276	95253	31263	4.05%	32.82%

*** Free-floating car-sharing systems are also offered in Venice, Parma, Ferrara, Latina, Naples, Palermo, and Cagliari; however, since the number of subscribers is unknown, they are not reported in the table.**

**** Station-based car-sharing systems are also offered in Milan, Venice, Padua, Arezzo, Messina, and Sassari; however, since the number of subscribers is unknown, they are not reported in the table.**

***** Free-floating bike-sharing systems are also offered in Turin, Bergamo, Mantua, Venice, Padua, Reggio Emilia, Bologna, Ferrara, Florence, and Pesaro; however, since the number of subscribers is unknown, they are not reported in the table.**

******Station-based bike-sharing systems are also offered in Genoa, Milan, Verona, and Livorno; however, since the number of subscribers is unknown, they are not reported in the table.**

******* Scooter-sharing systems are also offered in La Spezia, Trento, Venice, Ravenna, Cesena, Florence, Latina, Pescara, Caserta, and Taranto; however, since the number of subscribers is unknown, they are not reported in the table.**

5.1.2 Description of the study area and shared mobility services in Turin

The study area is located in the northwestern part of Italy. It includes the metropolitan area of Turin, which consists of the municipality of Turin and its surrounding municipalities. In the former, about 800,000 people live in about 130 square kilometers, while in the latter, about 544,000 people live in about 708 square kilometers. The population density in Turin is about 7,014 people per square kilometer and about 909 people per square kilometer outside the city (Agenzia per la Mobilità Metropolitana e Regionale, 2015).

The motorization rate in metropolitan Turin is one of the highest in Italy, with around 664 private cars per 1000 inhabitants in 2017 (Regione Piemonte, 2017). In addition, most residents of the Turin metropolitan area are satisfied with the various transportation services.

Specifically, in 2013, approximately 83% of the population was satisfied with public transportation services, 88% with their car, and 92% with bikes (Agenzia per la Mobilità Metropolitana e Regionale, 2015). Therefore, the diffusion of private cars and satisfaction with public transportation and other active modes in the metropolitan area of Turin makes this study area a good test bed for the analysis of the introduction of shared mobility services, as shared transport modes were introduced where existing travel modes usage was consolidated.

The districts of Turin are the 8[5] administrative macro-zones into which the city of Turin has been divided since 2016, with relative civic centers. In turn, the district group a total of 94 statistical zones divided into 34[6] corresponding city districts. Figure 17 depicts the name of each district.

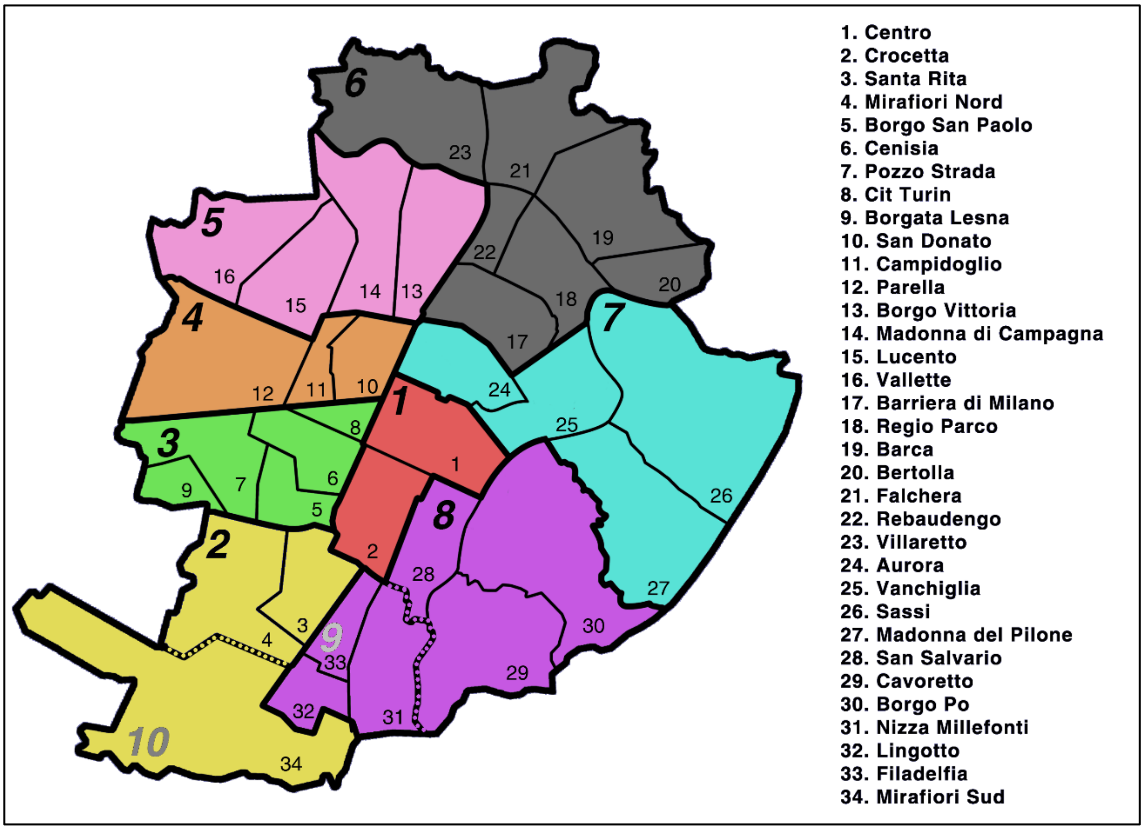

Figure 17: Map of the district of Turin[7].

Furthermore, as demonstrated in Figure 18, each of the 31 municipalities surrounding Turin corresponds to a specific zone (Agenzia per la Mobilità Metropolitana e Regionale, 2015).

[5] Turin, Italy, has 8 administrative macro-zones, as mentioned on https://www.museotorino.it/view/s/6de880fd1093417bbf1558809ff07266 - Accessed 22, September, 2021.

[6] Turin, Italy, has 34 districts, as mentioned on http://www.comune.torino.it/statistica/osservatorio/annuario/2002/pdf/03_Territorio.pdf - Accessed 22 September, 2021

[7] A map of the 34 districts of Turin By .mau. at Italian Wikipedia, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=63326088 - Accessed- 22 September, 2021.

Figure 18: Map of the Traffic Analysis Zones outside the municipality of Turin (Agenzia per la Mobilità Metropolitana e Regionale, 2015).

According to Ciuffini et al. (2021), Turin is one of the few cities in Italy where the provision of all three shared mobility services, including car-sharing, bike-sharing, and scooter-sharing, is well-developed. As such, it is a good case study for that country. The number of station-based car-sharing rentals in Turin in 2020 was 114128. Also, the number of Free-floating car-sharing rentals in Turin in 2019, 2020, and 2021 were 1720224, 1002327, and 845323, respectively. This drop in the number of Free-floating car-sharing rentals in Turin from 2019 to 2021 reflects the impact of Covid-19 on the use of car-sharing (Ciuffini et al., 2021; 2022). In 2020, Turin had 278806 car-sharing subscribers (266027 for Free-floating and 12779 for Station-based car-sharing). Besides, in Turin, the average distance traveled by car-sharing in 2020 was 6 km, and the average duration of its use was 27 minutes. In Turin, the total average distance traveled by all car-sharing in 2020 was 6723588 km (5879041 km for Free-floating car-sharing and 844547 km for Station-based car-sharing). Further, it should be stated that the number of car-sharing fleets in Turin in 2020 was 881 (557 Free-floating car-sharing vehicles and 324 Station-based car-sharing vehicles). Three car-sharing services [8] were in Turin: Enjoy (Free-floating car-sharing), Car2go (Share Now) (Free-floating car-sharing), and BlueTorino (Electric Station-based car-sharing) in 2021.

Regarding bike-sharing, it can be stated that two bike-sharing services[9], ToBike (Station-based bike-sharing) and Mobike (Free-floating bike-sharing), provided services in Turn in 2021. In 2020, TOBike offered a fleet of 300 Station-based shared bikes, and the fleet size of operator Movi's free-floating bike-share service was 1550. Also, the number of Station-based bike-sharing rentals in Turin in 2020 was 159285. Additionally, in Turin, the total average distance traveled by Station-based bike-sharing in 2020 was 476581 km. Moreover, in 2020, there were 4159 station-based bike-sharing subscribers.

Furthermore, in 2021, there were 3000 scooter-sharing fleets with six services in Turin. In 2021, there are nine scooter-sharing services[10], including Bird, BIT mobility, Dott, Helbiz An, Circ, Lime, Wind, Link, and Vo i. In 2020, there were 1079032 rental scooter-sharing in Turin. Besides, in Turin, the total average distance traveled by all scooter-sharing in 2020 was 1941837 km. Moreover, in 2020, there were 118882 scooter-sharing subscribers.

Furthermore, it is important to mention that from 2021 to 2022, some new shared transportation services have been added, and some shared moving services have disappeared. Turin has ten scooter-sharing services[11] in 2022, including Californian Bird, BIT mobility, Bolt, Circ, Dott, Helbiz An, Lime, Link, Tier, and Vo i. Besides, regarding bike-sharing, it should be mentioned that two operators[12], ToBike and Ridemove operators, provide services in 2022. Also, three operators[13], LeasysGO, Enjoy, and ShareNow, offer services for car-sharing in 2022.

5.2 Questionnaires design

In this study, nine different types of surveys are designed to understand the perspective of four different main stakeholders (government members, operators, users, non-users) of the three different shared mobility services (car-sharing, bike-sharing, scooter-sharing services) and

[8] Turin, Italy, had three car-sharing services in 2021, as mentioned on https://piemonte.movimentoconsumatori.it/news/car-sharing-e-sharing-mobility-a-torino-unalternativa-al-trasporto-pubblico/ - accessed 22, November 2021.
[9] Turin, Italy, had two bike-sharing services in 2021, as mentioned on https://piemonte.movimentoconsumatori.it/news/car-sharing-e-sharing-mobility-a-torino-unalternativa-al-trasporto-pubblico/ - accessed 22, November 2021.
[10] Turin, Italy, had ten scooter-sharing services in Turin in 2021, as mentioned on http://www.comune.torino.it/torinogiovani/vivere-a-torino/sharing-di-monopattini-elettrici-a-torino - accessed 22, November 2021.
[11] Turin, Italy, has ten scooter-sharing services in 2022, as mentioned on http://www.comune.torino.it/torinogiovani/vivere-a-torino/sharing-di-monopattini-elettrici-a-torino - accessed 20, September 2022.
[12] Turin, Italy, has two bike-sharing services in 2022, as mentioned on http://www.comune.torino.it/torinogiovani/vivere-a-torino/bike-sharing-e-noleggio-bici-a-torino - accessed 20, September 2022.
[13] Four car-sharing operators offer services in Turin in 2022, as mentioned on http://www.comune.torino.it/torinogiovani/vivere-a-torino/car-sharing-a-torino#carsharing – accessed 20, September 2022.

shared mobility services (as a whole). It is important to note that the surveys are the same for users and non-users. Also, government members and operators answered identical surveys for each shared mobility service. The designed surveys are given in Appendix 2.

All stakeholders were asked to answer surveys and rank criteria. Although one or two people in an organization generally make the final decisions, they obtain their information from consultants who analyze and make recommendations. Hence, in some cases (if more were available), more than one or two operators or government members have responded to the surveys (for each shared mobility service).

In this study, nine different surveys are used to understand the perspectives of four stakeholders of three shared mobility services, including car-sharing, bike-sharing, and scooter-sharing (individually), as well as shared mobility services (as a whole, not for a specific shared mobility service). These nine surveys, numbered from 1 to 9, are listed as follows.

- Survey 1: users and non-users of car-sharing services
- Survey 2: users and non-users of bike-sharing services
- Survey 3: users and non-users of scooter-sharing services
- Survey 4: government members and operators of car-sharing services
- Survey 5: government members and operators of bike-sharing services
- Survey 6: government members and operators of scooter-sharing services
- Survey 7: users and non-users of shared mobility services (as a whole, not for a specific shared mobility service)
- Survey 8: government members who respond to the shared mobility services (as a whole, not for a specific shared mobility service) surveys
- Survey 9: operators of shared mobility services (as a whole, not for a specific shared mobility service).

Figure 19 shows these nine types of surveys (nine line arrows) associated with stakeholders and each shared mobility service (car-sharing, bike-sharing, and scooter-sharing) as well as shared mobility services (as a whole). In Figure 19, each line arrow drawn between stakeholders and shared mobility services helps to understand which stakeholder is responding to the survey associated with each shared mobility service. Users and non-users answer only one survey among the car-sharing, bike-sharing, and scooter-sharing surveys (surveys 1, 2, 3, or 7). Also, each government member responds to one of the car-sharing, bike-sharing, and scooter-sharing surveys (surveys 4, 5, or 6), plus one survey associated with the shared mobility service (as a whole, not for a specific shared mobility service) (survey 8). Besides, each operator answers a survey related to the service operator (surveys 4, 5, or 6), plus answers one survey associated with the shared mobility service (as a whole, not for a specific shared mobility service) (survey 9).

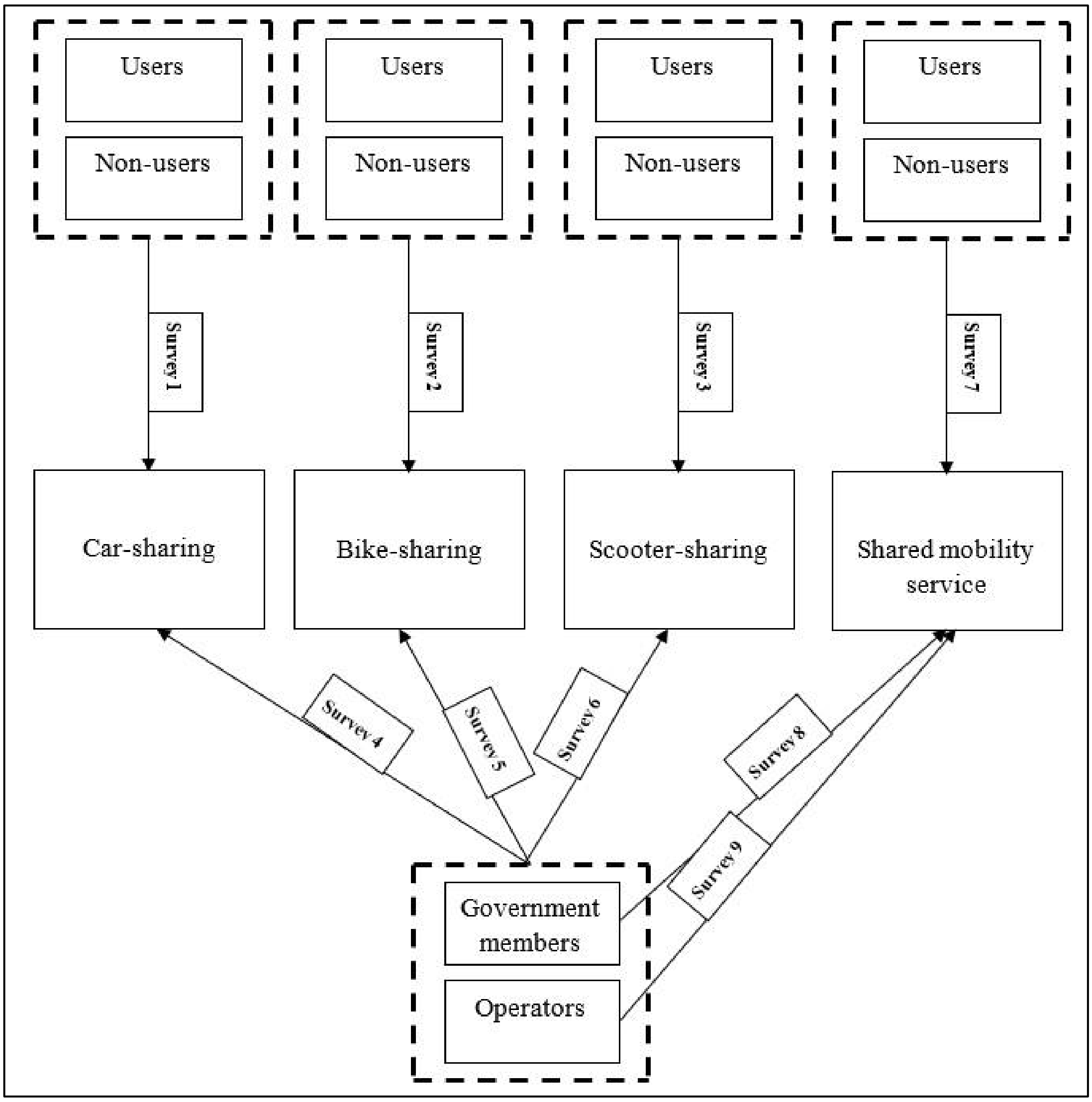

Figure 19: Stakeholders and the survey associated with each shared mobility service to which they responded.

Each survey can have different aspects according to the purpose for which it is designed. For a better understanding, these aspects are given below.

- Question set A, *BWM-related questions*: these questions help to determine stakeholders' views on the importance of the criteria and sub-criteria (if needed), such as cost and travel time. An example of these questions (related to users/non-users of shared mobility services (as a whole, not for a specific shared mobility service)) is given in Figure 20, taken from survey 7.
- Question set B, *Routines, daily travel views*: these help to figure out the routines and daily travel views of the users and non-users of each shared mobility service. For instance, it contributes to knowing which mode of transportation users and non-users are most likely to use to get to work or school. An example of these questions is given in Figure 21, taken from surveys 1 to 3. It is also important to note that non-users are not currently using the service (some have experience using it, and some have not); hence, some of the questions are hypothetical concerning the use of the service.

- Question set C, *Socio-demographic characteristics questions*: they contribute to understanding the socio-demographic characteristics of the users and non-users of each shared mobility service, such as gender, age, and educational level. An example of these questions is given in Figure 22, taken from surveys 1 to 3.
- Question set D, *Characteristics that might induce non-users to use and also users to use more shared services*: this help to understand the views of government members and operators of each shared mobility service on the characteristics such as departure time and travel distance that might induce people to use (or use more). An example of these questions is given in Figure 23, taken from surveys 4 to 6.
- Question set E, *Characteristics affecting the use of shared mobility services*: they help to explore the perspectives of users/non-users of each shared mobility service (as a whole, not for a specific shared mobility service) on some characteristics such as travel speed and safety affecting the use of shared mobility services)). It will be used for the Multi-Actor Multi-Criteria Analysis. An example of these questions is given in Figure 24, taken from survey 7.

B1. There are several characteristics that could be considered in selecting shared mobility to make a trip.

In your opinion, what is the MOST IMPORTANT, and what is the LEAST IMPORTANT characteristic among the above eight that could drive your choice?

	Select the most important characteristic in the cell below	Select the least important characteristic in the cell below
Travelers safety	o	o
Operational speed	o	o
Accessibility	o	o
User-friendliness	o	o
Image	o	o
Comfort	o	o
Cost	o	o
Possibility of carrying items	o	o

B2. In the above question, you have chosen *accessibility* as the most important characteristics. Could you please rate to which extent you consider *accessibility* as more important than the other seven characteristics?

	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Image	o	o	o	o	o	o	o	o	o
Travelers safety	o	o	o	o	o	o	o	o	o
Operational speed	o	o	o	o	o	o	o	o	o
User-friendliness	o	o	o	o	o	o	o	o	o
Comfort	o	o	o	o	o	o	o	o	o
Cost	o	o	o	o	o	o	o	o	o
Possibility of carrying items	o	o	o	o	o	o	o	o	o

B3. Also, you have chosen *image* as the least important characteristics. Could you please rate to which extent you consider the other six characteristics as more important than *image*?

	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Travelers safety	o	o	o	o	o	o	o	o	o
Operational speed	o	o	o	o	o	o	o	o	o
User-friendliness	o	o	o	o	o	o	o	o	o
Comfort	o	o	o	o	o	o	o	o	o
Cost	o	o	o	o	o	o	o	o	o
Possibility of carrying items	o	o	o	o	o	o	o	o	o

Figure 20: Screenshot of the survey with BWM-related questions (question set A in survey 7).

Q9. In your opinion, which of the following advantages might induce you to use (or use more) {car, bike, scooter}-sharing? Multiple answers are possible (maximum 3).

Respondents can choose up to 3 options at a time.

- Availability of shared cars near my home/workplace.
- To reduce expenses, such as maintenance and insurance
- To travel more sustainably.
- Increased comfort when traveling.
- The convenience of having a car only when I need it.
- To avoid responsibilities with maintenance and repairs of my own car.
- {Bike-sharing and scooter-sharing questionnaire only: Smooth track without slope}.

If 1, 2 or 3 in Q2

Q10. In your opinion, which of the following weather conditions can make you use the {car, bike, scooter}-sharing service more than other modes of transportation? Multiple answers are possible (maximum 3).

Respondents can choose up to 3 options at a time.

- Bad weather (e.g., rainy, or snowy weathers).
- Good weather (e.g., sunny weather).
- Scorching weather.
- Favorable air temperature.
- Freezing weather.
- High humidity level.
- Favorable humidity level.
- High air pollution.
- Low air pollution.
- In winter.
- In spring.
- In summer.
- In autumn.

Q11. In your opinion, which of the following situations might induce you to use (or use more) {car, bike, scooter}-sharing?

- Travel less than 5 km
- Travel 5 km or more
- Both

Q12. In your opinion, which of the following situations might induce you to use (or use more) {car, bike, scooter}-sharing?

- Travel less than 30 min
- Travel 30 min or more
- Both

Q13. In your opinion, which of the following situations might induce you to use (or use more) {car, bike, scooter}-sharing?

- Travel during peak hours
- Travel during off-peak hours
- Both

Figure 21: Screenshot of the survey with routines and daily travel views questions (question set B in surveys 1 to 3).

Q35. How many people, including yourself, live in your household?

- 1
- 2
- 3
- 4
- 5 or more

Q36. How many drivers, including yourself, are there in your household?

- 0
- 1
- 2
- More than 2

Q37. Do you have children living in your household?

- Yes
- No

If yes in Q37

Q38. How old are your children? (You can select more than one option)

Respondents can choose more than one option.

- 0-3 years old
- 4-6 years old
- 7-15 years old
- 16 years old or older

Q39. How many cars are available in your household? (Please also count company cars you have received from your employer that are authorized for personal use).

- No car
- One car
- Two cars
- Three or more cars

Q40_01. Approximately, what is your personal monthly income after taxes?

- Up to 500Euro
- 501Euro - 1000Euro
- 1001Euro - 1500Euro
- 1501Euro - 2000Euro
- 2001Euro - 2500Euro
- 2501Euro - 3000Euro
- 3001Euro - 4000Euro
- 4001Euro - 5000Euro
- 5001Euro - 6000Euro
- € 6001 - € 10,000
- More than 10.001 Euros

Figure 22: Screenshot of the survey with socio-demographic characteristics questions (question set C in surveys 1,2 and 3).

Please answer the following questions to determine your opinion about some of the characteristics that might induce people to use (or use more) {car, bike, scooter}-sharing.

Q1. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing?

- Short distance travels (less than 5 km)
- Long-distance travels (beyond 5 km)
- Both

Q2. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing?

- Short time travels (less than 30 min)
- Long-distance travels (beyond 30 min)
- Both

Q3. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing?

- During peak hours
- During off-peak hours
- Both

Q4. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing? (Multiple answers are possible (maximum 3).

Respondents can choose up to 3 options at a time.

- On weekday morning
- On weekend morning
- On weekday evening
- On weekend evening

Q5. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing?

- For leisure trips (e.g., vising friends or shopping)
- For non-leisure trips (going to work/school)
- Both

Figure 23: Screenshot of the survey with questions about some characteristics that might induce people to use (or use more) (question set D in surveys 4, 5, and 6).

Please answer the following questions to determine your opinion on characteristics affecting car-sharing, bike-sharing, and scooter-sharing use.

Q1. How safe do you feel on car-sharing trips?

- 1 (Very unsafe)
- 2
- 3
- 4
- 5
- 6
- 7 (Very safe)

Q2. How safe do you feel on bike-sharing trips?

- 1 (Very unsafe)
- 2
- 3
- 4
- 5
- 6
- 7 (Very safe)

Q3. How safe do you feel on scooter-sharing trips?

- 1 (Very unsafe)
- 2
- 3
- 4
- 5
- 6
- 7 (Very safe)

Q4. How would you rate the travel speed of car-sharing service?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q5. How would you rate the travel speed of bike-sharing service?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Figure 24: Screenshot of the survey with questions about some characteristics affecting the use of shared mobility services (question set E in survey 7).

To better understand the design of the nine surveys and their various aspects, first, section 5.2.1 explains the surveys associated with stakeholders of car-sharing, bike-sharing, and scooter-sharing services (surveys 1 to 6). Then, section 5.2.2 describes the surveys associated with stakeholders of shared mobility service services (as a whole, not for a specific shared mobility service) (surveys 7 to 9).

5.2.1 Surveys associated with stakeholders of car-sharing, bike-sharing, and scooter-sharing services (surveys 1 to 6)

This section is dedicated to surveys associated with stakeholders (users, non-users, operators, and government members) of car-sharing, bike-sharing, and scooter-sharing services (surveys 1 to 6). In this section, it is important to note that surveys 1 to 3 for users and non-users were similar. Also, government members and operators answered identical surveys (surveys 4 to 6) for each shared mobility service. For the four stakeholders, the BWM-related questions (question set A in surveys 1 to 6) were the same (to understand the difference in their views on the same factors). Still, the rest of the questions users and non-users (surveys 1 to 3) asked differed from those of government members and operators (surveys 4 to 6). In subsection A2.1 and A2.2 (in Appendix 2), two surveys are presented separately for users and non-users stakeholders (surveys 1 to 3) and the government members and operators stakeholders (surveys 4 to 6), respectively. The explanation of these surveys is as follows.

- There are questionnaires for users and non-users of each shared mobility service. This type of survey is designed for users and non-users of car-sharing, bike-sharing, and scooter-sharing services, and it includes two parts (surveys 1 to 3). In the first part, there are questions related to BWM analysis (question set A in surveys 1 to 3). In the second part, there are questions relevant to the respondents' routines, daily travel views (question set B in surveys 1 to 3), and socio-economic situation (question set C in surveys 1 to 3). Hence, in addition to BWM-related questions (question set A in surveys 1 to 3), questions about their routines, daily travel views (question set B in surveys 1 to 3), and socio-demographic characteristics (question set C in surveys 1 to 3) are also included in the surveys (surveys 1 to 3), most of which were taken from the STARS project questionnaire[14]. This helps to have standard and precise questions in the surveys (surveys 1 to 3).
  There are questionnaires for government members and operators of each shared mobility service. This type of survey is designed for government members and operators of car-sharing, bike-sharing, and scooter-sharing services (surveys 4 to 6), and it includes two parts. In the first part, there are questions related to BWM analysis (question set A in surveys 4 to 6). In the second part, questions are relevant to the respondent's opinion about some of the characteristics that might induce people to use (or use more) {car, bike, scooter}-sharing (question set D in surveys 4 to 6).

5.2.2 Surveys associated with stakeholders of shared mobility service services (as a whole, not for a specific shared mobility service) (surveys 7 to 9)

This section is dedicated to surveys associated with stakeholders (users, non-users, operators, and government members) of shared mobility services (as a whole, not for a specific shared mobility service), i.e., surveys 7 to 9 in the above list. In this section, it should be noted that the type of surveys conducted among government members (survey 8) and operators (survey 9) for shared transportation services (as a whole, not for a specific shared mobility service) was different because the purpose was to understand the importance of factors related to their decision, which were different for these two groups. Hence, three surveys for users/non-users (survey 7), government members (survey 8), and operators (survey 9) of shared mobility services (as a whole, not for a specific shared mobility service) are presented separately in the three subsections A2.3, A2.4, and A2.5, respectively. The description of these surveys (7 to 9) is as follows.

- There are questionnaires for users and non-users of shared mobility services (as a whole, not for a specific shared mobility service) (survey 7). This type of survey is

[14] STARS project was Launched in October 2017. This project aimed to investigate the diffusion of car-sharing in Europe, its relationships with technological and social innovations, and its effect on other transport modes such as bicycles, walking, cars, public transport, and taxis.
Questions about people's routines, daily travel views, and socio-demographic characteristics in the surveys were taken from the STARS project questionnaires available on
https://zenodo.org/record/3608887#.YswGVnZBy3B - accessed 11 November 2021.

designed for users and non-users of shared mobility services (as a whole, not for a specific shared mobility service), and it includes two parts. In the first part, there are questions related to BWM analysis (question set A in survey 7). In the second part, questions are relevant to the respondent's opinions on characteristics affecting car-sharing, bike-sharing, and scooter-sharing use (question set E in survey 7).

- There is a questionnaire for government members about shared mobility services (as a whole, not for a specific shared mobility service) (survey 8). This type of survey is designed for government members and is about shared mobility services (as a whole, not for a specific shared mobility service). In this survey, there are questions related to BWM analysis (question set A in survey 8).
- There is a questionnaire for operators of shared mobility services (as a whole, not for a specific shared mobility service). This type of survey is designed for operators of shared mobility services (as a whole, not for a specific shared mobility service). In this survey, there are questions related to BWM analysis (question set A in survey 9).

The above importance ranking exercise was complemented by 3*8 = 24 rating questions to gather the respondents' evaluations on the performance of car-sharing, bike-sharing, and scooter-sharing related to each of these eight criteria. The 7-point semantic scales were used (question set E in survey 7) to this effect, ranging, for instance, from very unsafe to very safe for the first criterion, from very poor to very good for the second criterion, and so on. An example of a 7-point semantic scale question is illustrated in Figure 25.

Q17. How comfortable do you feel on bike-sharing trips?

- 1 (Very uncomfortable)
- 2
- 3
- 4
- 5
- 6
- 7 (Very comfortable)

Q18. How comfortable do you feel on scooter-sharing trips?

- 1 (Very uncomfortable)
- 2
- 3
- 4
- 5
- 6
- 7 (Very comfortable)

Q19. How would you rate the usage or membership fees of car-sharing services?

- 1 (Very expensive)
- 2
- 3
- 4
- 5
- 6
- 7 (Very cheap)

Figure 25: A sample of a 7-point semantic scale question (question set B in survey 7).

5.3 Data collection activities

In this study, SWG[15] collected data from 19/11/2021 to 09/ 02/2022. The data on operators and government members were collected through phone calls (in Italian) to targeted contact points, whereas for users and non-users, it was possible to resort to their panel to have a representative sample of the population in the study area.

As the number of operators and government members was relatively small, data collection was done by phone call to clarify the questions better (compared to an online survey) and to obtain more accurate responses (surveys 4, 5, 6, 8, and 9). Furthermore, online surveys have been used to collect data from users and non-users of car-sharing (survey 1), bike-sharing (survey 2), scooter-sharing (survey 3), and shared mobility services (as a whole) (survey 7), as it is standard practice with panels maintained by surveying companies. It is important to note that although face-to-face data collection with individuals and clarifying questions could provide better (less biased) answers, it was not possible to do it in person due to the relatively large number of users and non-users. It should be mentioned that before data collection, all online surveys were repeatedly reviewed by the author to ensure their accuracy and the absence of problems in the online data collection process.

As an example, Figure 26 shows question 1 (B1) of the BWM online survey questions (question set A in survey 1). The questions in the surveys are in Italian.

[15] SWG, founded in 1981 in Trieste, is a leading Italian company in surveys, market research, sector studies, and observatories (https://www.swg.it/).

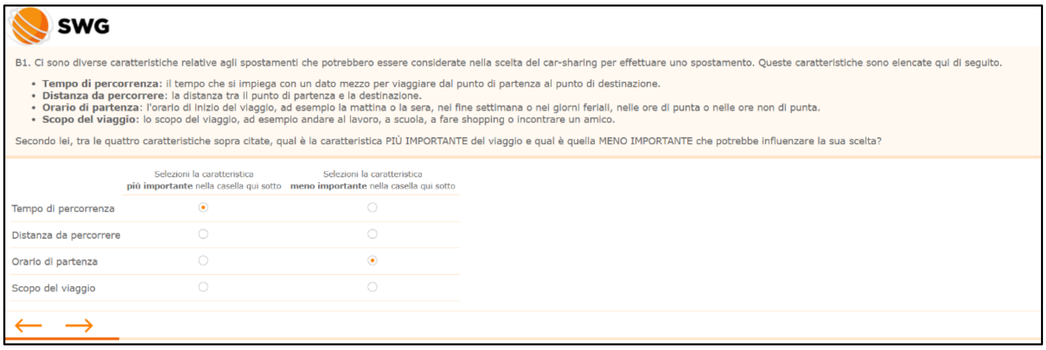

Figure 26: Screenshot from the original online survey (first BWM question (question B1)) (question set A in survey 1).

The survey data is utilized to calculate the criteria and sub-criteria weights to determine how the comparative criteria are rated in terms of importance by different stakeholders of different shared mobility services. Hence, surveys help to gain insights into how specific individuals or groups perceive specific aspects. In addition, it contributes to constructing criteria/sub-criteria weights and assists in understanding how the weights receive scores (against each other).

5.4 Collected data

To better understand the collected data, the number of stakeholders of each shared mobility service to participate in surveys (surveys 1 to 9) (that was requested to SWG by the author) and the number of stakeholders of each shared mobility service that responded to the surveys (survey 1 to 9) are presented in Table 38.

Table 38: The number of survey responses requested (to SWG) and received from the stakeholders of each shared mobility service (surveys 1 to 9).

Type of shared mobility service	Stakeholders of shared mobility services							
	Government members		Operators		Users		Non-users	
	Requested	Received	Requested	Received	Requested	Received	Requested	Received
Car-sharing	3	4	3	3	15	76	15	126
Bike-sharing	3	5	3	3	15	75	15	127
Scooter-sharing	3	3	3	3	15	77	15	126
Shared mobility (as a whole)	9	9	9	9	15	100	15	104

As seen in Table 38, the minimum number of survey responses requested to SWG is the same among the same stakeholder of car-sharing, bike-sharing, and scooter-sharing services so that the results can be better compared (surveys 1 to 6). Also, each government member was supposed to respond to the shared mobility services (as a whole) survey (surveys 8). Hence, at least nine shared mobility services (as a whole) surveys (survey 8) needed to be completed. Operators are supposed to do the same (survey 9). However, it is important to mention that since some of these responses to the BWM-related questions (set A in surveys 1 to 9) could be omitted, the number of surveys administered was equal to or greater than the requested number, especially for the user and non-user surveys (surveys 1, 2, 3, and 7). Besides, as the author requested from SWG, the number of responses received from the same stakeholder (e.g., operators) is the same or similar for car-sharing, bike-sharing, and scooter-sharing services.

5.4.1 Socio-demographic characteristics of users and non-users

It is essential to mention that this study assumes that the probability of being part of the survey panel is completely unrelated to the probability of being a shared mobility subscriber. With this assumption, it can be claimed that the results are valid for the general population (all users and non-users in Turin). Additionally, the possible responses to the closed-form survey questions used in this study are the same as the STARS project surveys. Therefore, most of the socio-demographic ranges (question set C in surveys 1 to 3) used are the same socio-demographic range used in the STARS project surveys (to be the standard ranges). The socio-demographic characteristics of survey respondents who are users and non-users of car-sharing, bike-sharing, and scooter-sharing services (question set C in surveys 1 to 3) are given in Table A10 in section A4.1 of Appendix 4. Figures 27 and 28 present the percentage (as well as the absolute number) of users and non-users of each shared mobility service (question set C in surveys 1,2, and 3 respondents), respectively, living in Turin and outside Turin. As offered in Figures 27 and 28, the majority of users and non-users of car-sharing, bike-sharing, and scooter-sharing services (question set C in surveys 1, 2, and 3 respondents) live in Turin, which is the case study of this research.

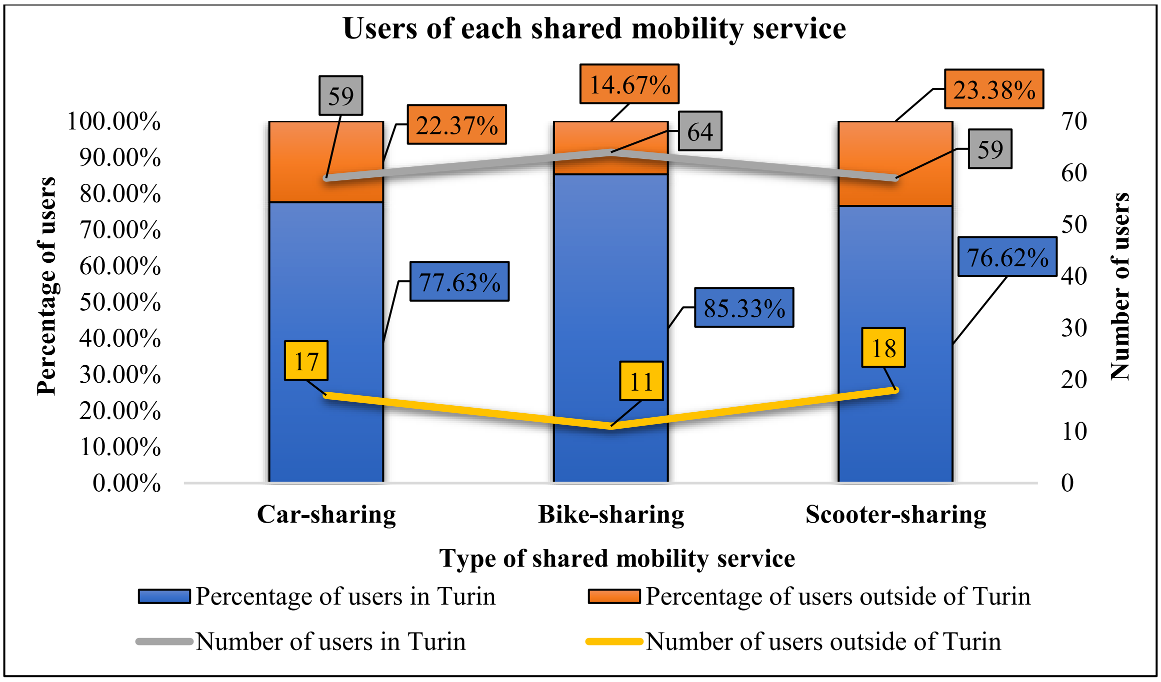

Figure 27: Percentage (as well as the absolute number) of users of each shared mobility service (question set C in surveys 1 to 3 respondents) living in Turin and outside Turin.

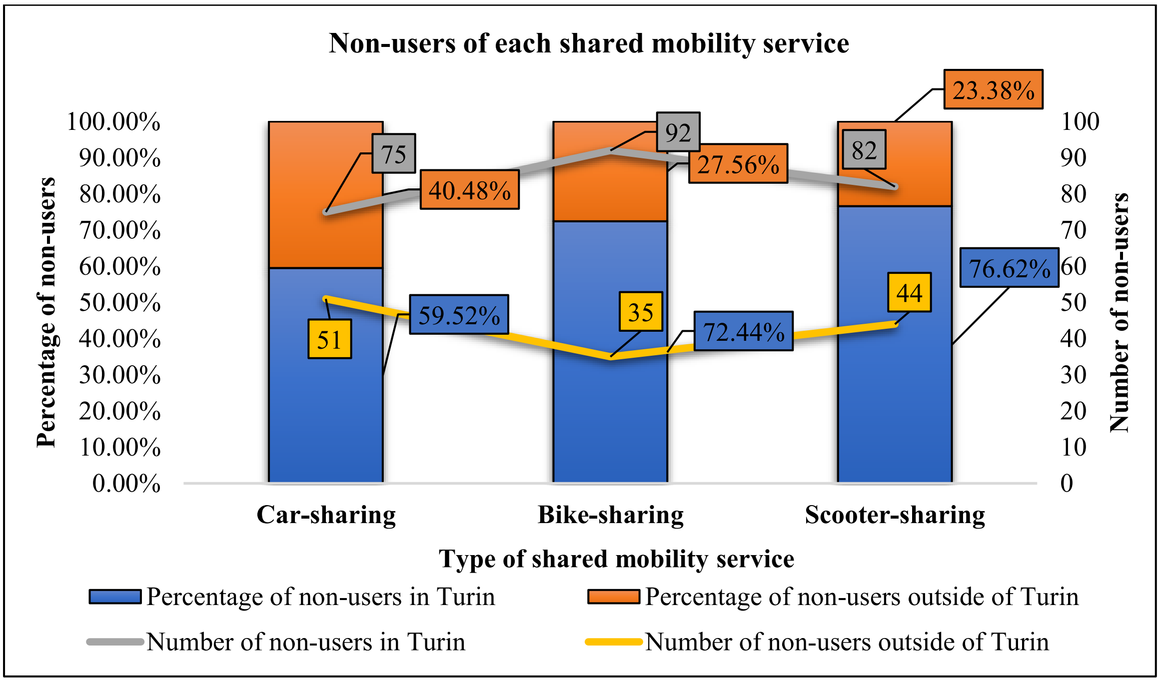

Figure 28: Percentage (as well as the absolute number) of non-users of each shared mobility service (question set C in surveys 1 to 3 respondents) living in Turin and outside Turin.

5.4.2. Routines and daily travel views of users and non-users

The routines and daily travel views of survey respondents who are users and non-users of car-sharing, bike-sharing, and scooter-sharing services (question set B in surveys 1 to 3) are given in Table A11 in section A4.2 of Appendix 4. The percentage (as well as the absolute number) of users and non-users of each shared mobility service who use and do not use their private car daily is shown in Figures 29 and Figure 30, respectively. Also, it should be mentioned that nearly 40% of non-users of bike-sharing users use their private cars daily; however, this figure for bike-sharing users is only 16%. On the other hand, almost 30% of bike-sharing users use it 1-3 days a week; however, this figure for non-users is about 17%. Hence, unlike bike-sharing, car-sharing and scooter-sharing usage do not remarkably impact reducing private car use.

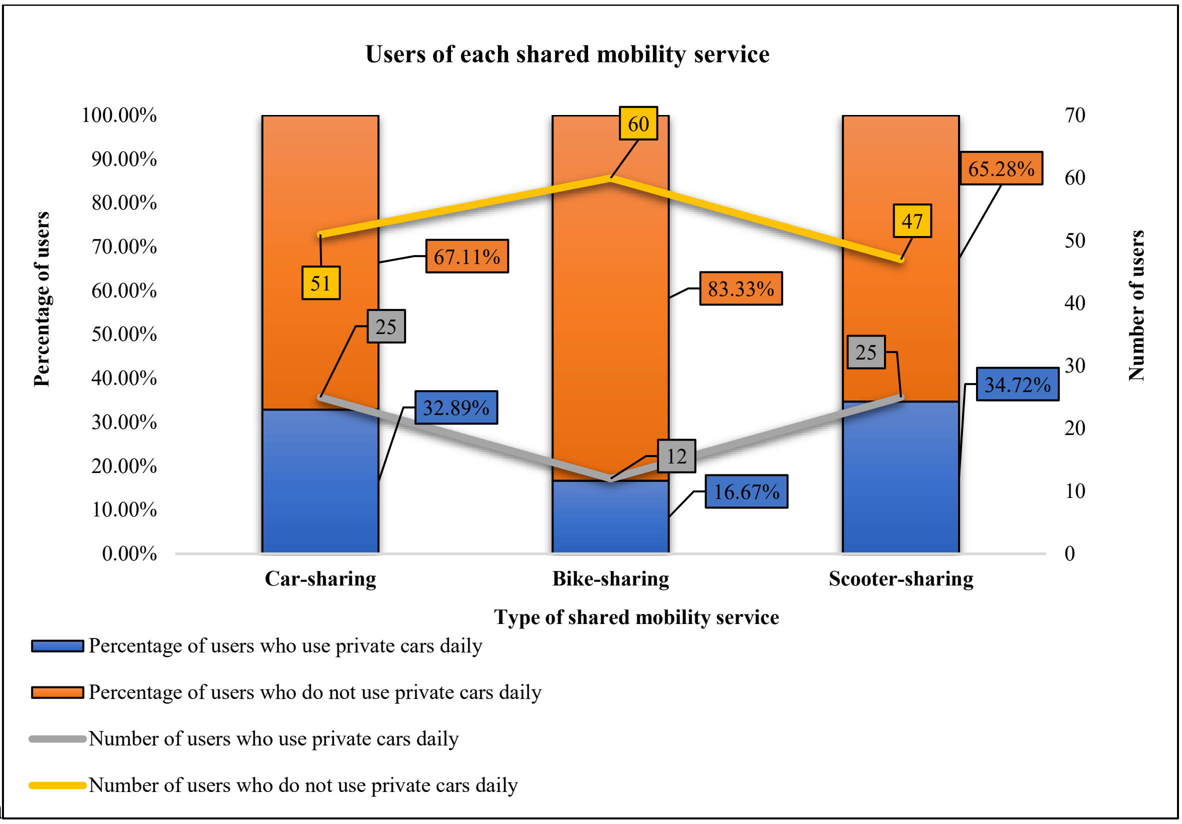

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Figure 29: The percentage (as well as the absolute number) of users of each shared mobility service who use and do not use their private car on a daily basis (question set B in surveys 1 to 3 respondents).

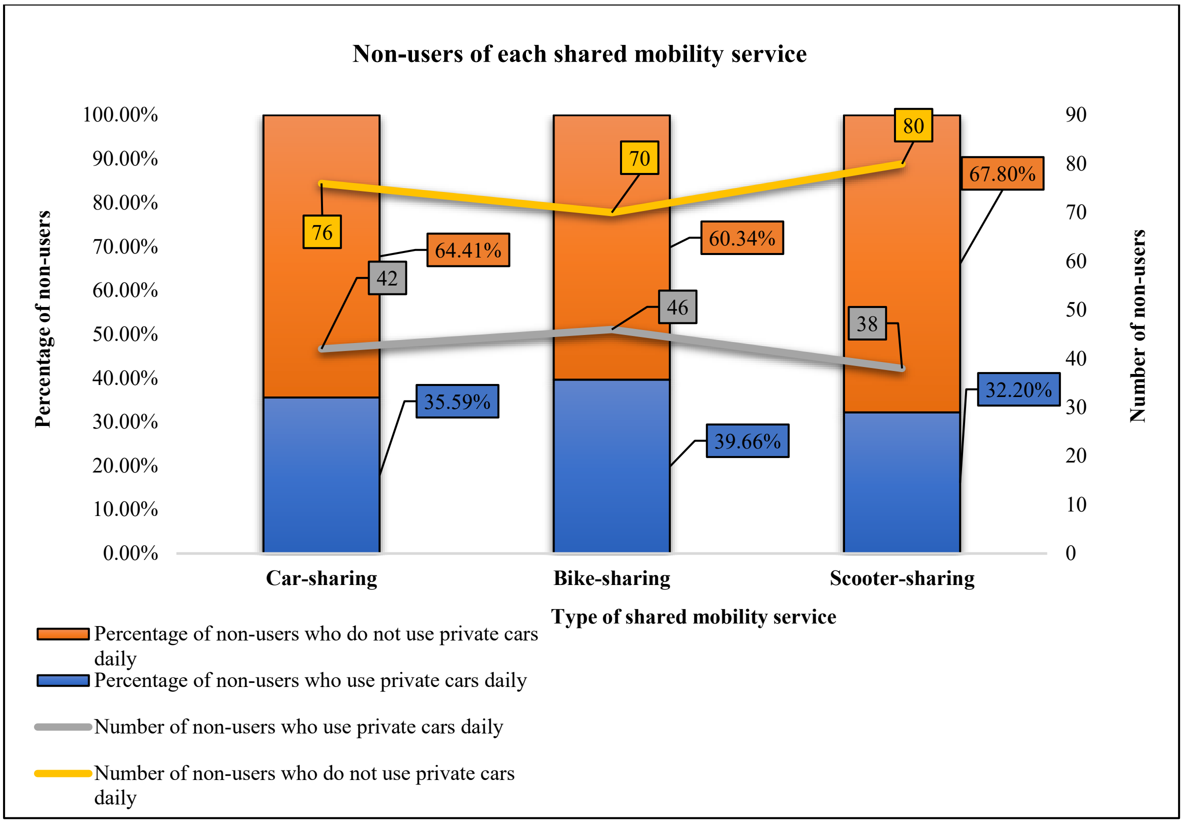

Figure 30: The percentage (as well as the absolute number) of non-users of each shared mobility service who use and do not use their private car on a daily basis (question set B in surveys 1 to 3 respondents).

The percentage of car-sharing and bike-sharing users who have pick-up locations near their home (or their home is in an operational area) is at least 1.5 times higher than that of non-users (who are at least familiar with the service). This numerical ratio is similar between car-sharing and bike-sharing users and non-users for whom pick-up locations are close to their most frequent destinations (or locations are in the operational area). Therefore, the presence of pick-up locations near home and the destination area can increase the demand for car-sharing and bike-sharing among people who are at least familiar with the service.

Approximately 34% of car-sharing users use car-sharing once a few times a month. Interestingly, around 59% of bike-sharing and 62% of scooter-sharing users rarely or never use car-sharing. It is interesting to know that the use of public transport is higher among scooter-sharing users than non-users. It represents the integration of scooter-sharing services with public transportation systems. Besides, it can point out that most car-sharing, bike-sharing, and scooter-sharing users and non-users are reluctant to use motorcycles/scooters, taxis, and personal bikes; however, both are interested in daily walking. Also, most car-sharing and bike-sharing users choose public transport and walking to do an errand in the city center, while most scooter-sharing users and the majority of the three shared mobility non-users use their car (as a driver) for this purpose. In addition, most of both car-sharing, bike-sharing, and scooter-sharing users and non-users prefer their private car (as a driver) for other trip purposes, including going to work or school, visiting a close relative/friends/relatives/family, going out for dinner, taking an excursion in nice weather, visiting a shopping center, and for weekend activities. Also, users and non-users of these shared mobility services prefer walking to other transport modes to go to smaller shops. It is also worth stating that the highest percentage of individuals likely to use car-sharing for travel purposes (among those mentioned in Table A11 in section A4.2 of Appendix 4) is about 15.8%, which is to perform a work-related activity in the city center. However, the highest percentage of people likely to use bike-sharing and scooter-sharing for travel purposes (among those listed in Table A11 in section A4.2 of Appendix 4) is around 10.7% and 6.5%, respectively, related to weekend activities.

Interestingly, both users and non-users groups believe that the impact of health concerns caused by the Covid-19 pandemic does not reduce their motivation to use. Also, it is found that the majority of users and non-users are of the opinion that cost reduction is the most important factor (among the factors asked) that may encourage them to use (or use more) car-sharing. Therefore, it can indicate the importance of the effect of a service cost on demand. Further, it should be noted that the availability of a scooter-sharing service close to home/work is the biggest motivation for using this service for both users and non-users. This indicates the high impact of the availability of scooter-sharing on its demand. Likewise, the availability of bike-sharing is the most important motivation for users to use bike-sharing. However, in the eyes of non-users of bike-sharing, the most important reason that can encourage them to use bike-sharing is the convenience of having it only when needed. It is interesting to know that a smooth and non-sloping path does not greatly affect the use of shared bikes and scooters.

Moreover, bad weather (e.g., rainy or snowy) is the most important weather condition that can drive most users and non-users to use car-sharing. This shows the important role that car-sharing can play as a mode of transportation in inclement weather. On the other hand, for most users and non-users of bike-sharing and scooter-sharing, good weather (e.g., sunny weather) is the weather condition that induces them to use the service (answers only belong to people who are at least familiar with the service). It should also be mentioned that the humidity and air pollution levels do not affect the demand for these three types of shared transportation services. In addition, among the seasons, winter is the season when most car-sharing users use this service, whereas most bike-sharing and scooter-sharing users use the service in spring.

The distance that may persuade most users and non-users of bike-sharing and scooter-sharing services to use the service is less than 5 km. Also, most users and non-users of car-sharing, bike-sharing, and scooter-sharing services prefer to use the service for less than 30 minutes, demonstrating the importance of shared mobility services for short trips. Although most car-sharing users prefer to use this service during off-peak hours, most bike-sharing and scooter-sharing users and non-users prefer to utilize this service during peak hours. This shows the important role each shared mobility service can play in the transportation system at certain times.

Furthermore, weekday morning is chosen as the preferred departure time by the majority of users and non-users of each shared mobility service (they could select more than one departure time option in their preference in the survey). This indicates that the departure time that might cause them to use the shared mobility service is a weekday morning. This reveals the undeniable role of shared transportation services in weekday morning transportation systems.

Interestingly, around 41% of non-users would like to use car-sharing for non-leisure trips (going to school or work); however, about 39.5% of car-sharing users choose this service for leisure trips (e.g., visiting friends or shopping) and non-leisure trips. This shows that non-users are not paying attention to the potentialities of this service for leisure travel. Regarding bike-sharing services, bike-sharing could be used for leisure trips by approximately 43% of non-users (if they want to use it); however, almost 37% of bike-sharing users use this service for leisure and non-leisure trips. This demonstrates that non-users have not considered the capacity of this service for non-recreational trips. Finally, in regard to scooter-sharing services, about 40% of scooter-sharing users prefer to use this service for travel for leisure trips, while almost 44% of non-users would use this service for non-leisure trips. This shows that this service has the potential to be used for both travel purposes.

It should be remarked that car-sharing, bike-sharing, and scooter-sharing are relatively enjoyable for users and for non-users (who have experience using the service but no longer use it). This suggests that car-sharing is enjoyable for this kind of non-users; hence, there are other reasons behind not using the service. It should be stated that about 40% of non-users of bike-sharing (who have previous experience) disagree that bike-sharing provides a good service. This might be one of the reasons why they do not use it anymore. Moreover, they are less likely than users to agree that the service is predictable and trustworthy. These are other reasons that make them less attracted to the service.

It is important to note that most of the non-users of car-sharing, bike-sharing, and scooter-sharing (who do not have the experience of using the service but are familiar with it) do not support its implementation well in society, especially compared to users. This is because their view of the service is less favorable compared to users. It is worth mentioning that most of these non-users disagree that they are sure they can choose this service for their regular trips in the next week. Therefore, their decision not to use the service is profound. Interestingly, they disagree that booking on the website/app is complex. Therefore, these services are user-friendly; hence, there is no need to invest much in this sector (making the service more user-friendly) to attract this kind of non-users to use these services.

Furthermore, the majority of both groups agree that using these shared mobility services is relatively environmentally friendly. Besides, users and non-users believe that the urgent need to reduce ecological destruction caused by car use has not been overestimated. Also, they believe that the use of cars brings many environmental problems. Further, non-users, like users, would feel better if they traveled more sustainably. Therefore, awareness of environmental issues and interest in reducing related problems is not sufficient motivation for non-users to use shared mobility services. It can also be pointed out that the political orientation of users and non-users is neither left nor right. Therefore, people's political orientation does not affect their use or non-use of shared transportation services.

It is essential to state that differences in the routines and daily travel patterns of male and female users of each shared transportation service (question sets B and C in surveys 1 to 3) can be seen as shown in Table A12 in section A4.2 of Appendix 4. These differences include the motivation to use the service, the time of departure, and the purpose of the trip that may cause the use of the service. As delivered in Table A12, the role of cost reduction as a motivation to use car-sharing is greater for males than females. On the other hand, increased comfort during travel (by car-sharing) is more important for females than males as a motivation to use the service. In the case of bike-sharing users, it is interesting to note that increased comfort during travel is more important to male bike-sharing users than female users. On the other hand, it can be pointed out that the availability of the service near the user's home/work and avoiding responsibilities related to maintenance and repairs are more important for females than males as a motivation to use bike-sharing. Regarding the incentives that may make users use scooter-sharing, it should be noted that more sustainable travel and increased comfort during travel (by using scooter-sharing) are more critical motivations for males than females. On the other hand, reducing costs and avoiding responsibilities related to maintenance and repairs are more important for females than males.

Interestingly, 31% and 25.86 % of times, the weekday evening and weekend morning, respectively, were chosen by male car-sharing users as preferred departure times. Meanwhile, 31.58% and 29.82% of times, the weekend evening and weekday morning, respectively, are chosen by female car-sharing users as the preferred departure time.

It can also be noted that compared to female car-sharing users, male car-sharing users are more interested in using the service only for non-leisure (going to work/school) trips. Meanwhile, in comparison to female bike-sharing users, male bike-sharing users are more inclined to use the service only for leisure (e.g., visiting friends or shopping) trips. Also, regarding traveling only for non-leisure (going to work/school), female bike-sharing users are more interested than male bike-sharing users. Furthermore, concerning leisure-only travel (e.g., visiting friends or shopping), female scooter-sharing users are keener than male users.

5.4.3 Selected data (responses to the BWM-related questions) in this study

First, it should be noted that the members of the government and executives have acknowledged that they agree with the criteria and sub-criteria used in this research (according to the goals of this research) and have not added a new one (before responding to the BWM-related questions (question set A in surveys 8 and 9)).

To be more familiar with the selected data that passed the quality check, unacceptable data (responses to the BWM questions (set A in surveys 1 to 9)) should be excluded. In this regard, before calculating the optimal group weights by Bayesian BWM, one can check the global input-based consistency ratio obtained using Equations 27 and 28 (in section 3.2.7.5.1.2 of Chapter 3). Before calculating the optimal group weights by Bayesian BWM, the consistency of the respondents can be examined using the Input-based approach (Eq. (27 and 28) in section 3.2.7.5.1.2), and acceptable ones (their obtained global input-based consistency ratio is less than the input-based consistency ratio thresholds) can be considered (Liang et al., 2020). As mentioned in section 3.2.7.5.1.2 of Chapter 3, one of the advantages of using the input-based approach is to obtain an immediate input-based consistency ratio to check (with its thresholds). The response could be revised if the input-based consistency ratio was greater than its thresholds. However, since face-to-face interaction with respondents was not possible in this study and surveys and telephone calls were used for data collection by the SWG (not by the author), this positive aspect of the input-based approach was not used. Hence, after eliminating pairwise comparisons with unacceptable consistency ratios (section 3.2.7.5.1.2), different sample sizes can be obtained and utilized for different levels of the model.

For more information about government members (surveys 4, 5, 6, and 8) and operators (surveys 4, 5, 6, and 9) participating in the respective surveys whose responses to the BWM questions (question set A in surveys 4, 5, 6, 8, and 9) were selected in this study, their job status according to the type of shared transportation service is given in Table A2 to A9 in section A3.6 of appendix 3.

As shown in Table 38, 76 respondents completed the survey on behalf of car-sharing users (survey 1). However, not all these observations can be used for the Bayesian BWM model. In fact, before calculating the optimal group weights, the consistency of the respondents was also checked, and the ones with an acceptable consistency ratio were considered (Liang et al., 2020). As a result, a different sample size was utilized for each set of criteria. A sample size of 15 respondents (n=15) was used for the main-criteria set, a sample size of 39 respondents was used for the trip-related characteristics sub-criteria set (n=39), and a sample size of 36 was used for the car-sharing characteristics sub-criteria set (n=36). For the availability and accessibility sub-criteria-set, a sample size of 39 instead of 76 was used (n=39) to obtain more reliable results.

Since there are only two criteria in the availability and accessibility sub-criteria for user respondents, the mistake of not assigning the highest value to the best-worst vector does not occur. As a result, all 76 respondents are only included in this subset because, technically, this mistake cannot happen if there are only two criteria (best and worst). However, suppose this subset contains more than two criteria. In that case, there could also be the possibility of conducting the wrong pairwise comparison, leading to the omission of respondents in this set (as is the case of the main set, trip-related characteristics subset, and car-sharing characteristics subset). Therefore, the result may be less reliable because the data in this sub-criteria set is based only on technicality. Hence, the second-highest sample size (closest to n=76) is considered to determine the criteria weights for the availability and accessibility subset, including respondents who performed the pairwise comparison correctly. As a result, the respondents of the trip-related characteristics sub-criteria-set were used (n=39). This process is done for other stakeholders as well. After these quality checks, the number of utilized responses to the BWM questions of each stakeholder of car-sharing services (question set A in surveys 1 and 4) for the main-criteria and each sub-criteria set is listed in Table 39.

Table 39: Number of responses that passed quality checks from each stakeholder for the main-criteria and each sub-criteria set for the car-sharing, out of the total number of responses shown in the last column (question set A in surveys 1 and 4).

Type of stakeholder	**Main criteria set (trip-related characteristics, car-sharing characteristics, and availability and accessibility)**	**Sub-criteria Sets**			**Total sample size**
		Trip-related characteristics (travel time, travel distance, departure time, trip purpose)	**Car-sharing characteristics (cost, comfort, safety, service quality, environment-friendly system, user-friendliness)**	**Availability and accessibility (service availability, vehicle availability, and accessibility)**	
Users	15	39	36	39	76
Non-users	24	59	56	59	126

Operators	2	3	3	3	3
Government Members	2	3	4	4	4

Similarly, the number of utilized responses to the BWM-related questions of each stakeholder for the main criteria and each sub-criterion set for bike-sharing (question set A in surveys 2 and 5) is listed in Table 40.

Table 40: The number of used responses from each stakeholder for the main-criteria and each sub-criteria set for the bike-sharing (question set A in surveys 2 and 5).

Type of Stakeholder	**Main criteria set (trip-related characteristics, bike-sharing characteristics, and availability and accessibility)**	**Sub-criteria Sets**			**Total sample size**
		Trip-related characteristics (travel time, travel distance, departure time, trip purpose)	**Bike-sharing characteristics (cost, comfort, safety, service quality, environment-friendly system, user-friendliness)**	**Availability and accessibility (service availability, vehicle availability, and accessibility)**	
Users	18	38	37	38	75
Non-users	32	69	63	69	127
Operates	2	3	3	3	3
Government Members	2	4	4	4	5

The number of utilized responses to the BWM questions of each stakeholder for the main criteria and each sub-criterion set for scooter-sharing (question set A in surveys 3 and 6) is listed in Table 41.

Table 41: The number of used responses from each stakeholder for the main-criteria and each sub-criteria set for the scooter-sharing (question set A in surveys 3 and 6).

Type of Stakeholder	**Main criteria set (trip-related characteristics, scooter-sharing characteristics, and availability and accessibility)**	**Sub-criteria Sets**			**Total sample size**
		Trip-related characteristics (travel time, travel distance, departure time, trip purpose)	**Scooter-sharing characteristics (cost, comfort, safety, service quality, environment-friendly system, user-friendliness)**	**Availability and accessibility (service availability, vehicle availability, and accessibility)**	
Users	13	42	37	42	77
Non-users	24	66	48	66	126
Operates	1	3	3	3	3
Government Members	2	3	3	3	3

Finally, the number of utilized responses to the BWM questions of each stakeholder of the shared mobility services (as a whole) (question set A in surveys 7 to 9) is listed in Table 42.

Table 42: The number of used responses from each stakeholder of the shared mobility services (as a whole) (question set A in surveys 7 to 9).

Type of Stakeholder	**Number of used responses to the BWM questions for the criteria set**
Users	45
Non-users	55
Operates	8
Government members	7

5.4.4. Socio-demographic characteristics of selected users and non-users of each of the shared mobility services

The socio-demographic characteristics of survey respondents who are users and non-users of car-sharing, bike-sharing, and scooter-sharing services (question set C in surveys 1 to 3), and their responses to the BWM questions (question set A in surveys 1 to 3), which have been utilized are mentioned in Tables A13 to A18, respectively, in section A4.3 of appendix 4.

5.4.5. Views of whole operators and members of the government regarding some of the travel routines of users of each of the shared transportation services

It is essential to know the opinions of operators (related to each shared mobility service) and government members about some of the travel routines of users of each shared mobility service (question set D in surveys 4 to 6), listed in Table A19 (in section 4.4 of Appendix 4). This contributes to determining the gaps between the opinions of operators and government members about the travel routine of users of each shared mobility and what users expressed about it.

In this regard, it is important to mention that from the perspective of 56.58% of car-sharing users (shown in Table A11 in section A4.2 of Appendix 4) and 50% (listed in Table A11 in section A4.2 of Appendix 4) of government members (who responded to the car-sharing survey) (survey 4), short-time trips (less than 30 min) can induce people to use (or use more) car-sharing, however, trips beyond 30 min cannot do that. Furthermore, table A19 (in section 4.4 of Appendix 4) shows that none of the car-sharing operators agree with the statement. This designates the gap between the views of car-sharing operators (question set D in survey 4) and the perspective of car-sharing users (question set E in survey 1) and government members (who responded to the car-sharing survey) (question set D in survey 4) about the effect of short-time trips on car-sharing demand.

Chapter 6

Results

In this section, the results are offered. In this regard, after the problem definition and alternatives selection (step 1 of MAMCA, mentioned in section 3.1.1 of Chapter 3 and 4.1 of chapter 4), stakeholder analysis (step 2 of MAMCA, given in section 3.1.2 of Chapter 3 and section 4.2 of Chapter 4), selection of the criteria for each study purpose (step 3 of MAMCA, presented in section 3.1.3 of Chapter 3 and section 4.3 of chapter 4) and gathering the required data (offered in Chapter 5), in order to obtain the weights (step 3 of MAMCA, presented in section 3.1.3 of Chapter 3 and section 4.3 of chapter 4), first, the input-based approach is used to eliminate the unacceptable responses (mentioned in section 3.2.7.5.1.2 of Chapter 3 and section 5.4.3 of Chapter 5). Then, Bayesian BWM is used to find the weights of the criteria (explained in section 3.2.7.6 of chapter 3). In this regard, more details on the analysis for each shared mobility service (separately) and the analysis for shared mobility services (as a whole, not for a specific shared mobility service) are presented in sections 6.1 and 6.2, respectively. Finally, since the indicator (value) (clarified in section 3 of Chapter 3, and is step 4 of MAMCA, explained in section 3.1.4 of Chapter 3) for each criterion associated with the users and non-users of shared mobility services (as a whole, not for a specific shared mobility service) is gathered, the perception-based analysis and sensitivity analysis and scenarios can be given in sections 6.2.6 and 6.2.7 (clarified in section 3 of Chapter 3 and is in step 5 to 7 of MAMCA, described in section 3.1.5 to 3.1.7 of Chapter 3).

6.1 Results of the Analysis for Each Shared Mobility Service (Separately)

In this section, initially, under one specific shared mobility service, four groups of stakeholders are compared in terms of their perception of a particular main-criterion/sub-criterion (four different stakeholders have reviewed common criteria and sub-criteria). This contributes to understanding how the perceptions of different groups of each shared mobility transport modes stakeholders can be different about a specific main-criterion/sub-criterion (related to the first research question mentioned in Chapter 1).

Furthermore, the differences in the importance of one main-criterion/sub-criterion across the three types of shared mobility services, including car-sharing, bike-sharing, and scooter-sharing, are examined for each specific type of stakeholder. This helps to understand how one main-criterion/sub-criterion can be of different importance across different shared mobility services (related to the second research question mentioned in Chapter 1). Furthermore, suggestions can be given to operators and government members to show how the importance of sub-criteria and main-criteria can be utilized to grow the users' engagement and increase the attraction of non-users to services (related to the first research question mentioned in Chapter 1). It is important to mention that these research questions mentioned in Chapter 1 can be answered with visual data (especially credal ranking of the criteria) and tables. However, since Bayesian BWM is used in this study, the p-values of the comparison analysis method are not applicable.

Since there are three shared mobility services, three sections (one section for each shared mobility service) will be provided. Also, a section will be given to determine the importance of each main-criterion/sub-criterion across the three types of shared mobility services. Therefore, a total of four sub-sections for the results of this section are given below.

6.1.1 Car-sharing services

In this part, the group weight of each stakeholder, including government members, operators, users, and non-users of car-sharing services, is analyzed for the main-criteria and sub-criteria. This helps show their priority for the main-criteria and the sub-criteria.

6.1.1.1 Group weight of government members for car-sharing services

The optimal government members' group weights of the main-criteria for car-sharing services are listed in Table 43.

Table 43: Government members' group weights of the main-criteria for car-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.3603
C2. Car-sharing characteristics	0.3824
C3. Availability and accessibility	0.2574

As presented in Table 43, from the point of view of government members, the most important main-criterion that individuals could consider in using car-sharing is car-sharing characteristics (C2), with a weight w^{agg} = 0.3824. This means that government members believe that people place more value on main criterion C2 when using car-sharing than on main-criteria trip-related characteristics (C1) and availability and accessibility (C3). Figure 31 shows the credal ranking of the main-criteria from the perspective of government members (for car-sharing services) and the assigned confidence level CL. The definition of CL is given in section 3.2.7.6.4 of Chapter 3.

In the Bayesian BWM, the criteria can be compared through credal ranking graphs, where the nodes are the criteria (e.g., C1, C2, and C3 in Figure 31). Also, on each edge, $A \xrightarrow{d} B$ (e.g., $C2 \xrightarrow{0.71} C3$ in Figure 31) indicates that criterion A is more important with confidence d (degree of certainty about the relation of criteria) than B. The notation "confidence d" was present in the main article (Mohammadi and Rezaei, 2020), in which the Bayesian Best-Worst Method was introduced. However, the same value is also called the confidence level (CL) in recent literature (Kalpoe, 2020). In this study, the latter notation is used. To be more precise, in Bayesian BWM, confidence is basically the extent to which we can claim one criterion is more important than the other. This comes from the probabilistic nature of the model.

The different colors indicate the relationship between each criterion and the less important criteria. For example, in Figure 31, red is used for the relationship between C2 and the less important criteria than C2 (C1 and C3). Also, blue is used for the relationship between C1 and the less important criterion than C1 (C3).

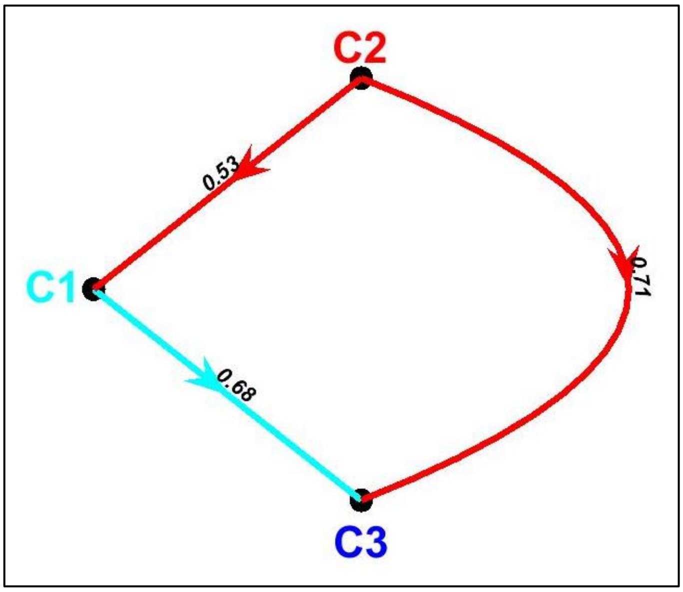

Figure 31: Credal ranking of main-criteria from government members' view for car-sharing services.

Figure 31 shows that the main-criterion car-sharing characteristics (C2) has a relatively high CL of 0.71 compared to the main-criterion availability and accessibility (C3). As mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50 and the CL is around 60 to 80, it can be pointed out that one criterion is more important than the other. On the other hand, when the threshold value is 50, and the CL is 50 (equal to the threshold value), or slightly higher (from 50 to less than 60), the superiority of one criterion over another is not well established. In this regard, the main-criterion C2 does not have a high CL compared to the main-criterion trip-related characteristics (C1) (CL=0.53). In other words, the superiority (i.e., a more important and influential factor in people's car-sharing use) of the main-criterion C2 over the main-criterion C1 is not well established. Hence, although C2 is considered more important than the other two main-criteria, a confidence of 0.53 between it and C1 implies that some government members believe that C1 plays a more important role. On the other hand, between C1 and C3, the former is more important than the latter, with a confidence of 0.68.

Table 44 presents the optimal group weights of government members for car-sharing services. The main-criteria followed by the sub-criteria are listed. Also, the optimal groups' local weights for each sub-criterion and the relevant global weights and their ranking are shown. The definition and use of local and global weights and how to calculate global weights are given in section 3.2.7.1 of Chapter 3. For example, the global weight of travel time (C1.1) is acquired as follows: global weight of C1.1 = local weight of C1.1 × weight of C1 from Table 43; therefore, 0.1047 = 0.2906 × 0.3603.

Table 44: The optimal groups' weights of government members in each sub-criterion for car-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	**C1.1. Travel time**	0.2906	2	0.1047	4
	C1.2. Travel distance	0.2036	4	0.0734	6
	C1.3. Departure time	0.2097	3	0.0756	5
	C1.4. Trip purpose	0.2961	1	0.1067	3
C2	**C2.1. Travel cost**	0.2894	1	0.1107	2
	C2.2. Travel comfort	0.1434	3	0.0548	8
	C2.3. Safety	0.1392	5	0.0532	10
	C2.4. Service quality	0.1258	6	0.0481	11
	C2.5. Environment-friendly system	0.1428	4	0.0546	9
	C2.6. User-friendly	0.1594	2	0.0610	7
C3	**C3.1. Service availability**	0.1553	2	0.0400	12
	C3.2. Vehicle availability and accessibility	0.8447	1	0.2174	1

In this study, the overall rank of the most important sub-criterion determines the starting point for explaining the sub-criteria. For example, as listed in table 44, the sub-criterion vehicle availability and accessibility (C3.2) has the best overall ranking (first rank), and this sub-criterion belongs to the main-criterion availability and accessibility (C3). Hence, the explanation begins by describing all sub-criteria of category C3 (according to their rank in category C3). Then, the description of the sub-criteria of category car-sharing characteristics (C2) is provided (according to their rank in category C2) because travel cost (C2.1) has the highest overall rank (second rank) among the rest ten sub-criteria and belongs to the main-criterion C2. Finally, the sub-criteria of the remaining category is explained, which is trip-related characteristics (C1) (according to their rank in category C1). This table explanation procedure is also used for related tables in the bike-sharing and scooter-sharing sections.

Table 44 displays that from the perspective of government members, vehicle availability and accessibility (C3.2) is the most important sub-criterion that individuals consider in car-sharing usage (w^{agg} = 0.2174) among the 12 identified sub-criteria. Although the related main-criterion availability and accessibility (C3) weighs less than the other two main-criteria trip-related characteristics (C1) and car-sharing characteristics (C2), as shown in Figure 31, the latter two main-criteria do not have a very high CL compared to C3. Also, only two sub-criteria were introduced for C3, and the local weight of the sub-criterion C3.2 is much higher than that of the other sub-criterion (approximately 5.5 times higher). This is not surprising since, in the survey, all government member respondents chose C3.2 as the best sub-criterion and never selected as the worst sub-criterion. Also, C3.2 and service availability (C3.1) are the best and the worst sub-criterion out of all 12 sub-criteria, respectively.

Figure 32 displays the credal ranking of sub-criteria belonging to the main-criterion availability and accessibility (C3). As illustrated in Figure 32, in the eyes of government members, the sub-criterion vehicle availability and accessibility (C3.2) is absolutely more important than the sub-criterion service availability (C3.1), with CL equal to 1. As explained in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50 and CL is above 80, it can be noted that one criterion is definitely more important than another. This may be because, as mentioned, all members of the government made the same choice on the best and worst sub-criterion between these two, although they gave different scores when comparing them.

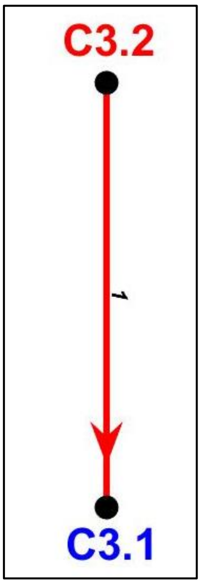

Figure 32: Credal ranking of sub-criteria belonging to the main-criterion C3 from government members' view (car-sharing services).

Table 44 also demonstrates that among the 12 sub-criteria, travel cost (C2.1) is the second most important sub-criterion (w^{agg} = 0.1107). Also, the local weight of the sub-criterion C2.1 is much higher than the other sub-criteria (about twice) in the category car-sharing characteristics (C2). Figure 33 indicates the credal ranking of sub-criteria belonging to C2 from the perspective of government members for car-sharing services. It shows that C2.1 is completely superior to the other three sub-criteria (CL close to 1). As mentioned in Table 44, the second most important sub-criterion in this category is user-friendly (C2.6). Furthermore, looking at Figure 33, it can also be stated that the sub-criterion travel comfort (C2.2) is more important than the sub-criterion service quality (C2.4) (CL=0.66). However, one cannot be sure of the sub-criterion C2.2 superiority over the sub-criteria environment-friendly system (C2.5) (0.51) and safety (C2.3) (0.54). It can also be noted that the sub-criterion C2.5 is more important for individuals on car-sharing use than the sub-criterion C2.4 (CL=65). However, it cannot be mentioned that the sub-criterion C2.5 is assuredly perceived as more important than the sub-criterion C2.3 (CL=0.53). Also, among the six sub-criteria in category C2, C2.4 is the least important criterion; even C2.3 is ranked higher with a confidence of 0.62.

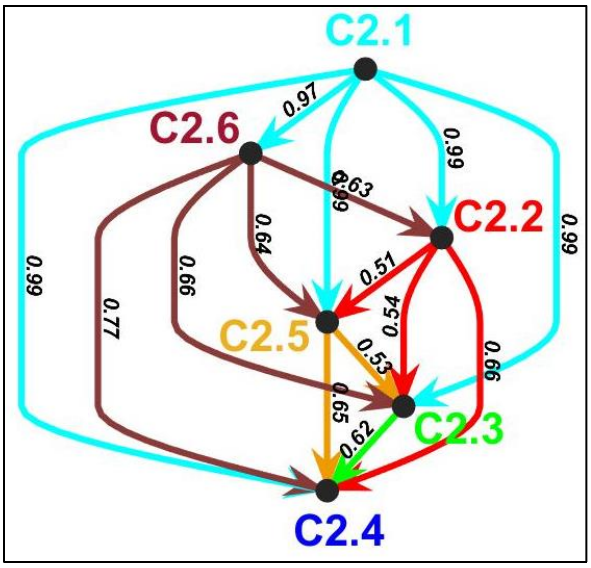

Figure 33: Credal ranking of sub-criteria belonging to the main-criterion C2 from government members' view (car-sharing services).

As listed in Table 44, according to members of the government, among the 12 sub-criteria, trip purpose (C1.4) is the third most important sub-criterion that plays a role in people's car-sharing use. Also, C1.4 is the most important sub-criterion in the category trip-related characteristics (C1). Figure 34 indicates the credal ranking of sub-criteria belonging to the main-criterion trip-related characteristics (C1). As illustrated in Figure 34, in this category, the C1.4 is certainly more important than the sub-criteria departure time (C1.3) (CL=0.8) and travel distance (C1.2) (CL=0.82). Especially since Table 44 indicates that the local weight of the sub-criterion C1.4 is about 1.5 times higher than these two sub-criteria.

As shown in Figure 34, travel time (C1.1) ranks second in the category trip-related characteristics (C1), which means it is still more important than departure time (C1.3) and travel distance (C1.2), with a confidence of about 0.80. It is worth noting that although among the sub-criteria of the C1 category, people assign the least amount of value to the sub-criterion C1.2, the sub-criterion C1.3 does not have a high CL compared to the sub-criterion C1.2 (CL=0.53). Also, as presented in Table 44, the local weight of these two sub-criteria is approximately equal. Therefore, one cannot comment definitively on the superiority of the sub-criterion C1.3 to the sub-criterion C1.2. Besides, it is important to note that in this category, the lowest CL is between trip purpose (C1.4) and C1.1, indicating that government members highly value both of these factors when assessing the criteria affecting people's car-sharing use.

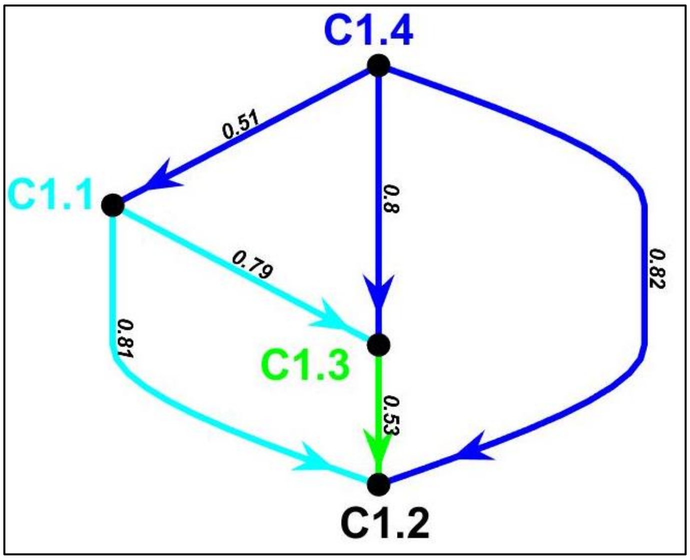

Figure 34: Credal ranking of sub-criteria belonging to the main-criterion C1 from government members' view (car-sharing services).

In summary, to better understand the views of government members on the impact of factors on people's car-sharing usage, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), travel cost (C2.1), and trip purpose (C1.4), respectively, and the weight of the least important sub-criterion, which is the service availability (C3.1), are presented in Figure 35.

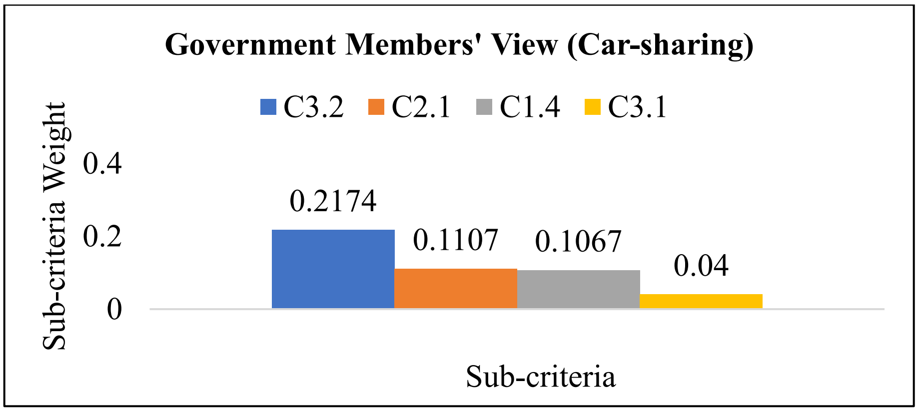

Figure 35: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of government members for car-sharing choice).

6.1.1.2 Group weight of operators for car-sharing services

The optimal operators' group weights of the main-criteria for car-sharing services are listed in Table 45.

Table 45: Operators' group weights of the main-criteria for car-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.0963

Main-criteria	Weights
C2. Car-sharing characteristics	0.4835
C3. Availability and accessibility	0.4203

As presented in Table 45, from the point of view of operators, the most important main-criterion that individuals could consider in using car-sharing is car-sharing characteristics (C2), with a weight $w^{agg} = 0.4835$. This means that operators believe that people place more value on main-criterion C2 when using car-sharing rather than on main-criteria trip-related characteristics (C1) and availability and accessibility (C3). Figure 36 shows the credal ranking of the main-criteria from the operators' perspective (for car-sharing services) and the assigned CL.

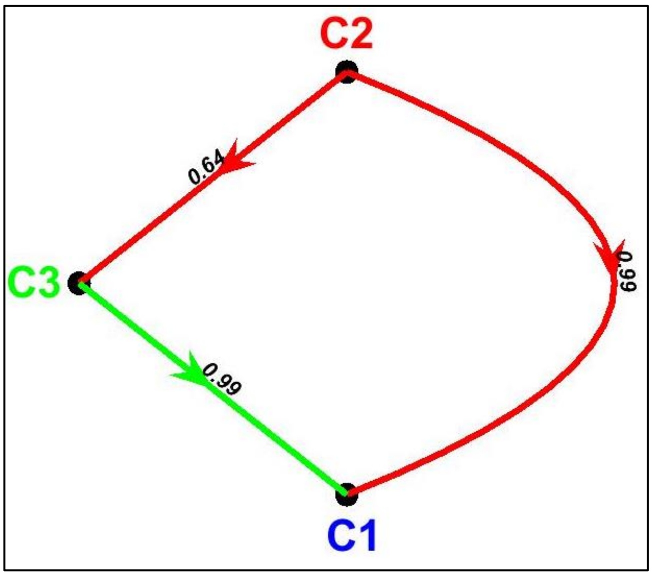

Figure 36: Credal ranking of main-criteria from operators' view for car-sharing services.

Figure 36 indicates that the main-criterion car-sharing characteristics (C2) is more important than the main-criterion availability and accessibility (C3) (CL=0.64), and these two main-criteria are definitely superior to the main-criterion trip-related characteristics (C1), with CL equal to 0.99. Also, Table 45 shows that the weight of C2 and C3 is about 4.37 and 5 times more than that of C1, respectively.

Table 46 gives the optimal group weights of operators for car-sharing services. The main-criteria followed by the sub-criteria are mentioned. Also, the optimal groups' local weights for each sub-criterion and the relevant global weights and their ranking are presented.

Table 46: The optimal groups' weights of operators in each sub-criterion for car-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	**C1.1. Travel time**	0.2335	2	0.0225	10
	C1.2. Travel distance	0.2263	3	0.0218	11
	C1.3. Departure time	0.1244	4	0.0120	12
	C1.4. Trip purpose	0.4159	1	0.0401	8
C2	**C2.1. Travel cost**	0.1651	4	0.0798	6
	C2.2. Travel comfort	0.1068	5	0.0516	7

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
	C2.3. Safety	0.2015	2	0.0974	4
	C2.4. Service quality	0.2013	3	0.0973	5
	C2.5. Environment-friendly system	0.0770	6	0.0372	9
	C2.6. User-friendly	0.2482	1	0.1200	3
C3	**C3.1. Service availability**	0.3184	2	0.1338	2
	C3.2. Vehicle availability and accessibility	0.6816	1	0.2865	1

Table 46 displays that from the perspective of operators, vehicle availability and accessibility (C3.2) is the most important sub-criterion that individuals consider in car-sharing usage (w^{agg} = 0.2865) among the 12 identified sub-criteria. In addition, it shows that although service availability (C3.1) is the second most important sub-criteria among all 12 sub-criteria (w^{agg} = 0.1338), the local weight of sub-criterion C3.2 is twice that of sub-criterion service availability (C3.1). Besides, Figure 37 displays the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It shows that the sub-criterion C3.2 is certainly more important than the sub-criterion C3.1, with Cl equal to 0.91.

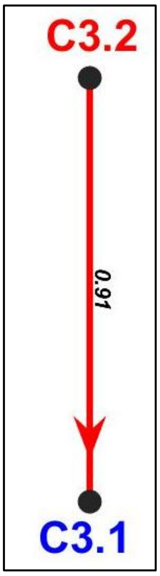

Figure 37: Credal ranking of sub-criteria belonging to the main-criterion C3 from operators' view for car-sharing services.

Table 46 also demonstrates that among the 12 sub-criteria, user-friendly (C2.6) is the third most important sub-criterion (w^{agg} = 0.1200). Also, Figure 38 indicates that although sub-criterion safety (C2.3) is the second most important sub-criterion in the category car-sharing characteristics (C2), the confidence of 0.5 between sub-criteria C2.3 and service quality (C2.4) implies that some operators believe that sub-criterion C2.4 plays a more important role. Hence, the superiority of the sub-criterion C2.3 over the sub-criterion C2.4 is not well established. Also, among the six sub-criteria in category C2, the environment-friendly system (C2.5) is the least important criterion; even travel comfort (C2.2) is ranked higher with a confidence of 0.76.

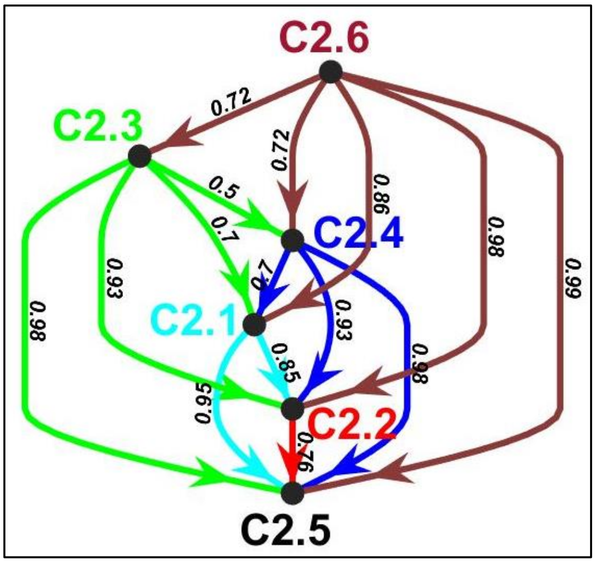

Figure 38: Credal ranking of sub-criteria belonging to the main-criterion C2 from operators' view for car-sharing services.

Figure 39 indicates the credal ranking of sub-criteria belonging to the main-criterion trip-related characteristics (C1). It shows that sub-criterion trip purpose (C1.4) is certainly more important than other sub-criteria. Especially since Table 46 indicates that the local weight of the sub-criterion C1.4 is about 1.8 times higher than that of sub-criterion travel time (C1.1) and sub-criterion travel distance (C1.2), and it is approximately 3.35 times higher than that of sub-criterion departure time (C1.3).

Furthermore, Figure 39 indicates that although travel time (C1.1) is the second most important sub-criterion in the category trip-related characteristics (C1), one cannot comment definitively on the superiority of the sub-criterion C1.1 to the sub-criterion travel distance (C1.2). In particular, as listed in Table 46, their local weight is almost equal. In addition, Table

46 shows that out of 12 sub-criteria, operators believe that people assign the lowest value to sub-criterion departure time (C1.3).

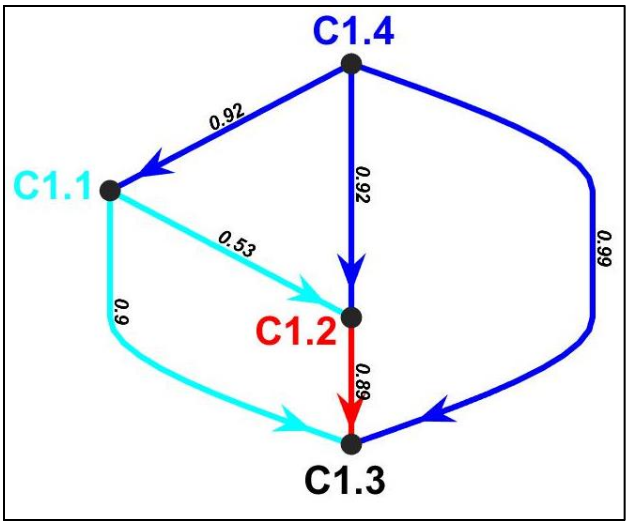

Figure 39: Credal ranking of sub-criteria belonging to the main-criterion C1 from operators' view for car-sharing services.

In summary, to better understand the views of operators on the impact of factors on people's car-sharing usage, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), service availability (C3.1), and user-friendly (C2.6), respectively, and the weight of the least important sub-criterion, which is the departure time (C1.3), are presented in Figure 40.

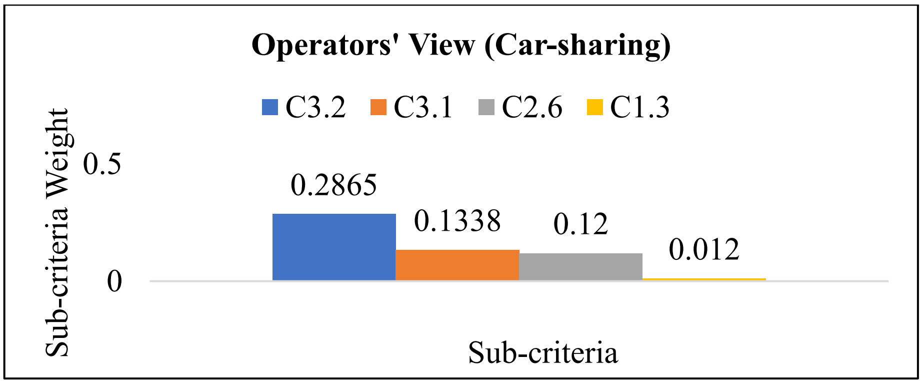

Figure 40: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of car-sharing operators).

6.1.1.3 Group weight of users for car-sharing services

The optimal users' group weights of the main-criteria for car-sharing services are listed in Table 47.

Table 47: Users' group weights of the main-criteria for car-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.3088
C2. Car-sharing characteristics	0.3089
C3. Availability and accessibility	0.3823

Table 47 indicates that from the point of view of users, the most important main-criterion that they could consider in using car-sharing is availability and accessibility (C3), with a weight w^{agg} = 0.3823. This implies that from the users' point of view, the most important main-criterion that can lead them to use car-sharing is C3. Figure 41 shows the credal ranking of the main-criteria from the users' perspective (for car-sharing services) and the assigned CL.

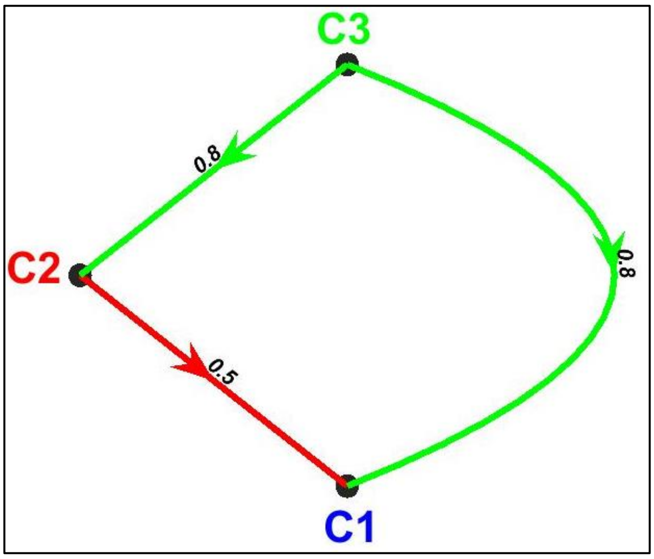

Figure 41: Credal ranking of main-criteria from users' view for car-sharing services.

Figure 41 demonstrates that the main-criterion availability and accessibility (C3) is more important than the main-criterion car-sharing characteristics (C2) and trip-related characteristics (C1). Also, it shows that one cannot comment on the superiority of the main-criterion C2 over the main-criterion C1 with Cl equal to 0.5. Especially, Table 47 indicates that the weights of these two main-criteria are approximately equal.

Table 48 gives the optimal group weights of users of car-sharing services. The main-criteria followed by the sub-criteria are presented. Also, the optimal groups' local weights for each sub-criterion and the relevant global weights and their ranking are listed.

Table 48: The optimal groups' weights of users in each sub-criterion for car-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	C1.1. Travel time	0.3760	1	0.1161	3
	C1.2. Travel distance	0.2321	2	0.0717	4
	C1.3. Departure time	0.1854	4	0.0573	7
	C1.4. Trip purpose	0.2065	3	0.0638	6
C2	C2.1. Travel cost	0.2268	1	0.0701	5
	C2.2. Travel comfort	0.1418	5	0.0438	11
	C2.3. Safety	0.1768	2	0.0546	8
	C2.4. Service quality	0.1691	3	0.0522	9
	C2.5. Environment-friendly system	0.1467	4	0.0453	10
	C2.6. User-friendly	0.1389	6	0.0429	12
C3	C3.1. Service availability	0.3483	2	0.1332	2
	C3.2. Vehicle availability and accessibility	0.6517	1	0.2491	1

Table 48 shows that vehicle availability and accessibility (C3.2) is the most important sub-criterion that users consider in car-sharing usage (w^{agg} = 0.2491) among the 12 identified sub-criteria. Besides, it displays that although service availability (C3.1) is the second most important sub-criteria among all 12 sub-criteria (w^{agg} = 0.1332), the local weight of sub-criterion C3.2 is 1.88 times higher than sub-criterion C3.1. In addition, Figure 42 presents the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It shows that the sub-criterion C3.2 is absolutely more important than the sub-criterion C3.1 with Cl equal to 1.

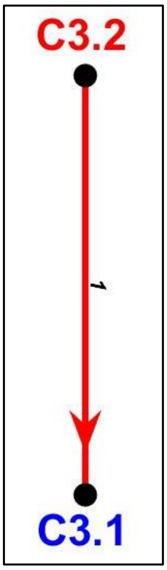

Figure 42: Credal ranking of sub-criteria belonging to the main-criterion C3 from users' view for car-sharing services.

Table 48 also establishes that among the 12 sub-criteria, travel time (C1.1) is the third most important sub-criterion (w^{agg} = 0.1161). Additionally, Figure 43 indicates that C1.1 is definitely more important than other sub-criteria in the category trip-related characteristics C1 (CL=1). Similarly, Table 48 shows that in category C1, the local weight of the sub-criterion C1.1 is almost 1.62 to 2 times higher than that of other sub-criteria. Furthermore, Figure 43 demonstrates that travel distance (C1.2) is the second most important sub-criterion in this category, which is certainly more important than the trip purpose (C1.4). Both of these sub-criteria are definitely more important than the sub-criterion departure time (C1.3).

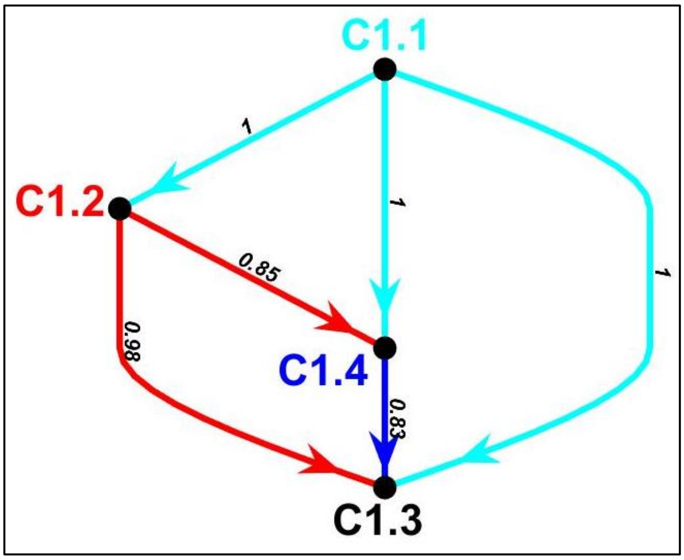

Figure 43: Credal ranking of sub-criteria belonging to the main-criterion C1 from users' view for car-sharing services.

Figure 44 indicates the credal ranking of sub-criteria belonging to the main-criterion car-sharing characteristics (C2). It reveals that sub-criterion travel cost (C2.1) is certainly more important than other sub-criteria. Further, although Table 48 indicates that the sub-criterion user-friendly (C2.6) is the least important sub-criterion in the category C2 (w^{agg} = 0.0429), the confidence of 0.57 between the sub-criteria travel comfort (C2.2) and C2.6, as displayed in Figure 44, implies that some users believe that sub-criterion C2.6 plays a more important role. Hence, the superiority of the sub-criterion C2.2 over the sub-criterion C2.6 is not well established.

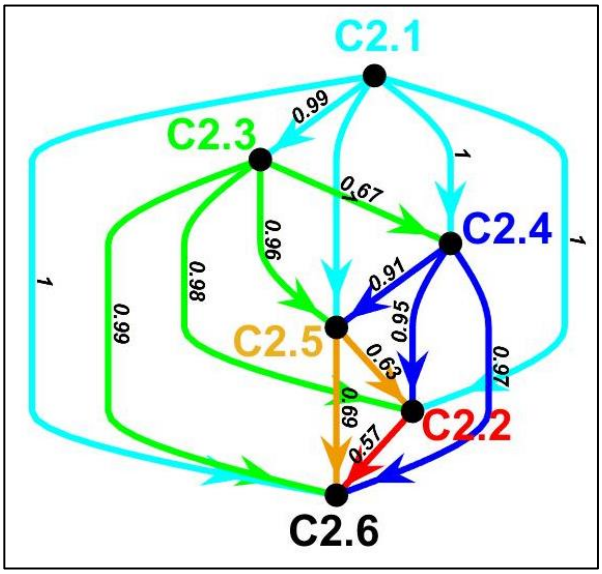

Figure 44: Credal ranking of sub-criteria belonging to the main-criterion C2 from users' view of car-sharing services.

In summary, to better understand users' views on the impact of factors on their car-sharing usage, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), service availability (C3.1), and travel time (C1.1), respectively, and the weight of the least important sub-criterion, which is the user-friendly (C2.6), are presented in Figure 45.

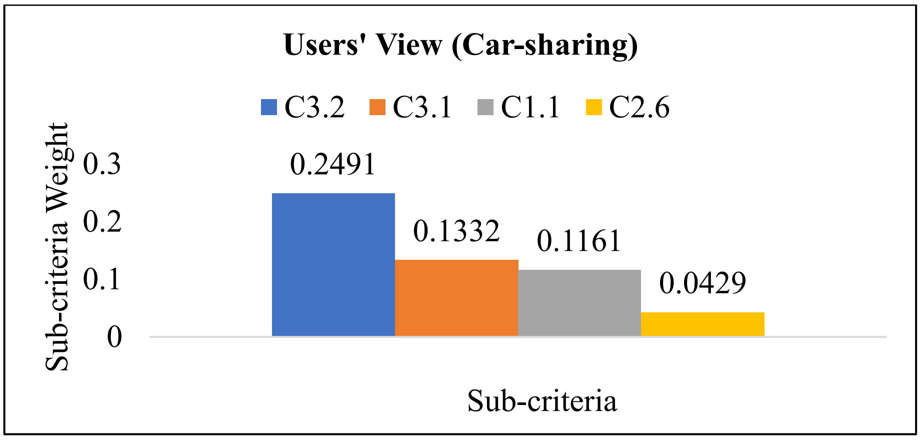

Figure 45: The global weight of the least important sub-criterion and the three most important sub-criteria (from users' perspective of car-sharing).

6.1.1.4 Group weight of non-users for car-sharing services

The optimal non-users' group weights of the main-criteria for car-sharing services are shown in Table 49.

Table 49: Non-users' group weights of the main-criteria for car-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.2465
C2. Car-sharing characteristics	0.3811
C3. Availability and accessibility	0.3724

Table 49 designates that from the non-users perspective, car-sharing characteristics (C2) is the most important main-criterion that they could consider in using car-sharing, with a weight w^{agg} = 0.3811. This implies that from the non-users' standpoint, the most important main-criterion that can lead them to use car-sharing is C2. Figure 46 displays the credal ranking of the main-criteria from the non-users' point of view (for car-sharing services) and the assigned CL.

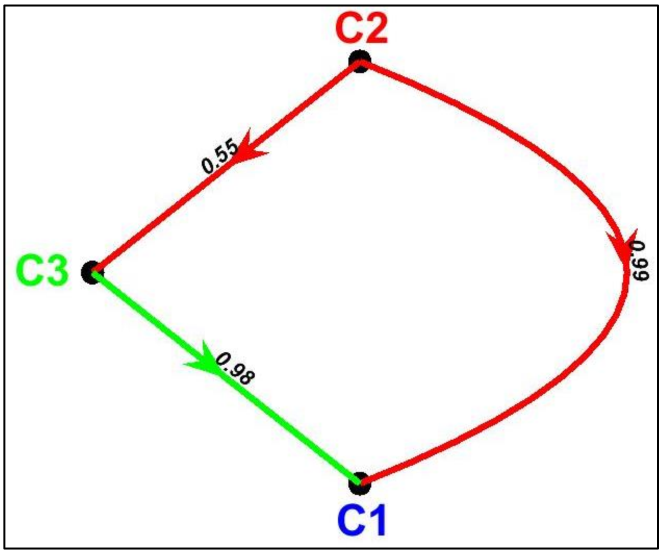

Figure 46: Credal ranking of main-criteria from non-users' view for car-sharing services.

Figure 46 indicates that although the main-criterion car-sharing characteristics (C2) is the most important main-criterion in this category, one cannot comment on the superiority of the main-criterion C2 over the main-criterion availability and accessibility (C3) with Cl equal to 0.55.

Table 50 presents the optimal group weights of non-users of car-sharing services. The main-criteria followed by the sub-criteria are given. Moreover, the optimal groups' local weights for each sub-criterion, relevant global weights, and ranking are mentioned.

Table 50: The optimal groups' weights of non-users in each sub-criterion for car-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	**C1.1. Travel time**	0.3237	1	0.0798	4
	C1.2. Travel distance	0.2425	2	0.0598	8
	C1.3. Departure time	0.2346	3	0.0578	9
	C1.4. Trip purpose	0.1992	4	0.0491	11
C2	**C2.1. Travel cost**	0.2136	1	0.0814	3
	C2.2. Travel comfort	0.1278	6	0.0487	12
	C2.3. Safety	0.1729	3	0.0659	6
	C2.4. Service quality	0.1730	2	0.0659	5
	C2.5. Environment-friendly system	0.1501	5	0.0572	10
	C2.6. User-friendly	0.1626	4	0.0620	7
C3	**C3.1. Service availability**	0.3528	2	0.1314	2
	C3.2. Vehicle availability and accessibility	0.6472	1	0.2410	1

Table 50 establishes that vehicle availability and accessibility (C3.2) is the most important sub-criterion that non-users could consider in car-sharing usage (w^{agg} = 0.2410) among the 12 identified sub-criteria. The sub-criterion C3.2 is 4.95 times more important than travel comfort (C2.2), the least important sub-criterion. Besides, it indicates that although service availability (C3.1) is the second most important sub-criteria among all 12 sub-criteria (w^{agg} = 0.1314), the local weight of sub-criterion C3.2 is 1.83 times higher than sub-criterion C3.1. Furthermore, Figure 47 illustrates the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It designates that the sub-criterion C3.2 is definitely more important than the sub-criterion C3.1 with CL equal to 1.

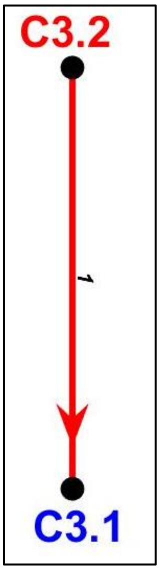

Figure 47: Credal ranking of sub-criteria belonging to the main-criterion C3 from non-users' view of car-sharing services.

Table 50 also determines that among the 12 sub-criteria, travel cost (C2.1) is the third most important sub-criterion (w^{agg} = 0.0814). In addition, Figure 48 reveals that C2.1 is absolutely more important than other sub-criteria in the category car-sharing characteristics (C2) (CL=1). Similarly, Table 50 shows that in category C2, the local weight of the sub-criterion C2.1 is almost 1.23 to 1.67 times higher than that of other sub-criteria. Additionally, Figure 48 establishes that although service quality (C2.4) is the second most important sub-criterion in this category, the confidence of 0.50 between the sub-criteria C2.4 and safety (C2.3) implies that some non-users believe that sub-criterion C2.3 plays a more important role. Hence, the superiority of the sub-criterion C2.4 over the sub-criterion C2.3 is not well established.

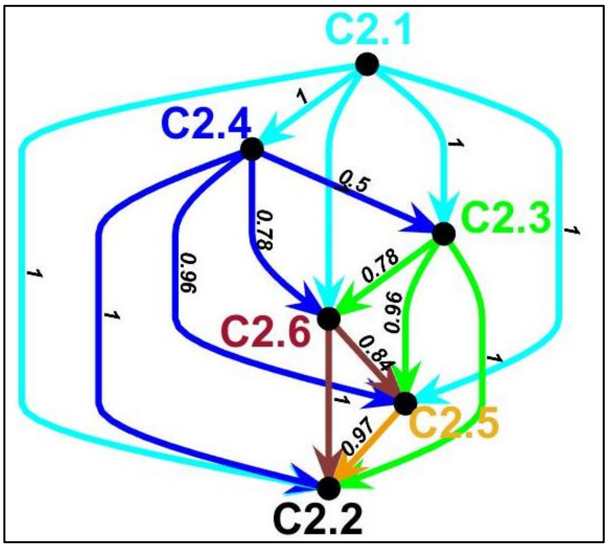

Figure 48: Credal ranking of sub-criteria belonging to the main-criterion C2 from non-users' view of car-sharing services.

Figure 49 displays the credal ranking of sub-criteria belonging to the main-criterion trip-related characteristics (C1). It reveals that sub-criterion travel time (C1.1) is surely more important than other sub-criteria.

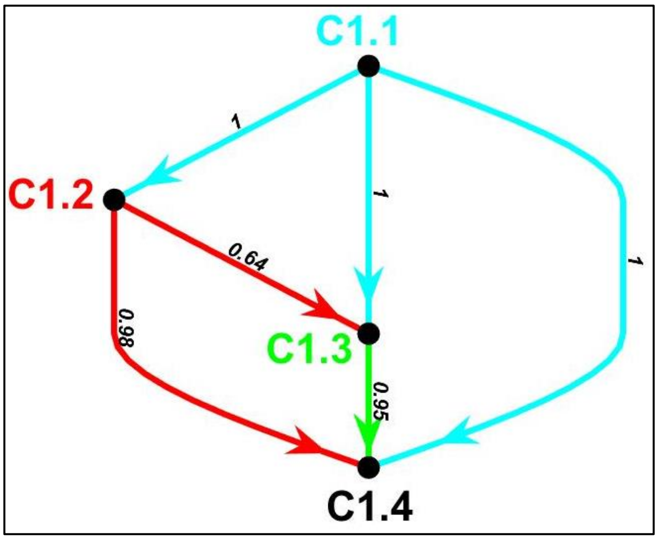

Figure 49: Credal ranking of sub-criteria belonging to the main-criterion C1 from non-users' view of car-sharing services.

In summary, to better understand the standpoint of non-users on the impact of factors on their car-sharing use, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), service availability (C3.1), and travel cost (C2.1), respectively, and the weight of the least important sub-criterion, which is the travel comfort (C2.2), are given in Figure 50.

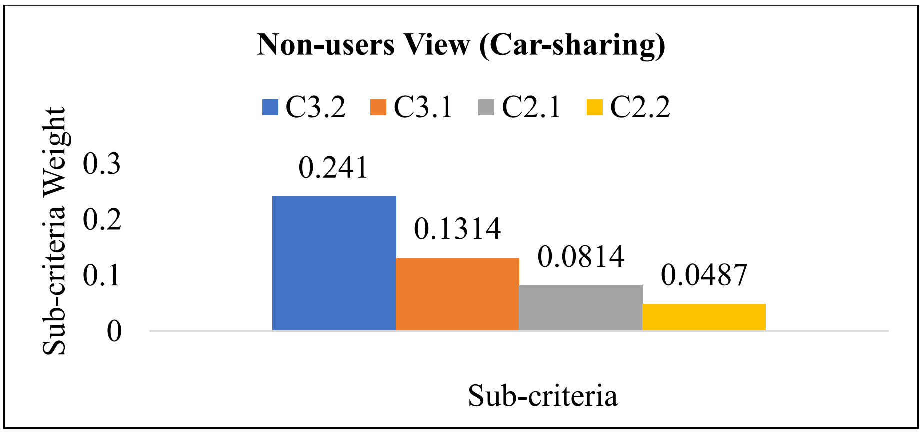

Figure 50: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of non-users of car-sharing).

6.1.1.5 Similarities and differences between the four types of car-sharing stakeholders

In this study, 12 sub-criteria are compared by four different stakeholders to understand their views on the importance of each sub-criterion that people can consider in using car-sharing. Some studies in the literature have only worked on the importance of some of these 12 sub-criteria. However, in this study, all 12 sub-criteria are ranked and compared with each other to determine the importance of each sub-criterion compared with other sub-criteria from each stakeholder's perspective. In addition, most studies have worked on user perspectives only. However, in this study, these sub-criteria are compared by four groups of stakeholders. Therefore, the importance of each sub-criterion can be compared from the perspective of four different stakeholders to distinguish their views on each sub-criterion. This contributes to knowing the perceptions of different groups of car-sharing stakeholders about the importance of one main-criterion/sub-criterion (related to the first research question mentioned in Chapter 1).

One of the significant purposes of this study is to determine the gap between the views of car-sharing stakeholders. In order to designate the difference between the views of stakeholders, Table 51 indicates the ranking of the main-criteria and sub-criteria corresponding to each of the stakeholders.

It is important to note that in the literature, sub-criteria service quality (C2.4) and safety (C2.3), environment-friendly system (C2.5), and user-friendly (C2.6) have not been well studied. Hence, this study also considers these sub-criteria to figure out the stakeholders' views on them.

Table 51: Ranking of the main-criteria and sub-criteria corresponding to car-sharing stakeholders.

Main-criteria	Ranking of main-criteria corresponding with car-sharing stakeholders				Sub-criteria	Ranking of sub-criteria corresponding with car-sharing stakeholders			
	Government members	Operators	Users	Non-users		Government members	Operators	Users	Non-users
C1	2	3	3	3	C1.1. Travel time	4	10	3	4
					C1.2. Travel distance	6	11	4	8
					C1.3. Departure time	5	12	7	9
					C1.4. Trip purpose	3	8	6	11
C2	1	1	2	1	C2.1. Travel cost	2	6	5	3
					C2.2. Travel comfort	8	7	11	12
					C2.3. Safety	10	4	8	6
					C2.4. Service quality	11	5	9	5
					C2.5. Environment-friendly system	9	9	10	10
					C2.6. User-friendly	7	3	12	7
C3	3	2	1	2	C3.1. Service availability	12	2	2	2
					C3.2. Vehicle availability and accessibility	1	1	1	1

As shown in Table 51, operators and non-users have similar views on the importance of the main-criteria. There are also considerable similarities in stakeholders' views on the importance of the sub-criteria. The importance of vehicle availability and accessibility (C3.2) is well-mentioned in the literature (Brook, 2004; Catalano et al., 2008; Stillwater et al., 2008; Zheng et al., 2009; Costain et al., 2012; Kim et al., 2017b; Juschten et al., 2017). As indicated in Table 51, all stakeholders believe that C3.2 is the most important sub-criterion among the 12 sub-criteria individuals consider using car-sharing. In addition, some studies have pointed to the important role of service availability (C3.1) (Millard-Ball, 2005; Shaheen and Rodier, 2005; Burkhardt and Millard-Ball, 2006; Habib et al., 2012; Kortum and Machemehl, 2012; Kopp et al., 2015; Wagner et al.,2016; Becker et al., 2017a; Dias et al., 2017; Hu et al., 2018; Namazu et al., 2018). In this regard, Table 51 shows that in the eyes of users, non-users, and operators, C3.1 is the second most important sub-criterion. Interestingly, government members and non-users alike have similar views on the importance of the sub-criterion user-friendly (C2.6). Also, the environment-friendly system (C2.5) is one of the least important sub-criteria from the point of view of all stakeholders. In addition, non-users and operators alike emphasize the importance of service quality (C2.4).

It is also important to pay attention to important differences in the views of shareholders. As indicated in Table 51, availability and accessibility (C3) is the most important main-criterion from the users' perspective but the least important from the government members' view. Unlike all stakeholders who perceive service availability (C3.1) as the second most important sub-criterion, members of the government consider it the least important sub-criterion. Remarkably, although the sub-criterion user-friendly (C2.6) is the third most important sub-criterion from the operators' perspective, users perceive it as the least important sub-criterion. Besides, compared to government members and users, non-users and operators place more emphasis on the importance of service quality (C2.4). Moreover, unlike government members, non-users do not pay attention to the importance of the sub-criterion trip purpose (C1.4).

Figure 51 and Figure 52 display the weight percentage of the main-criteria and the global weight percentage of the sub-criteria corresponding with the car-sharing stakeholders, respectively. This type of result representation has been used in the study of Liu (2016).

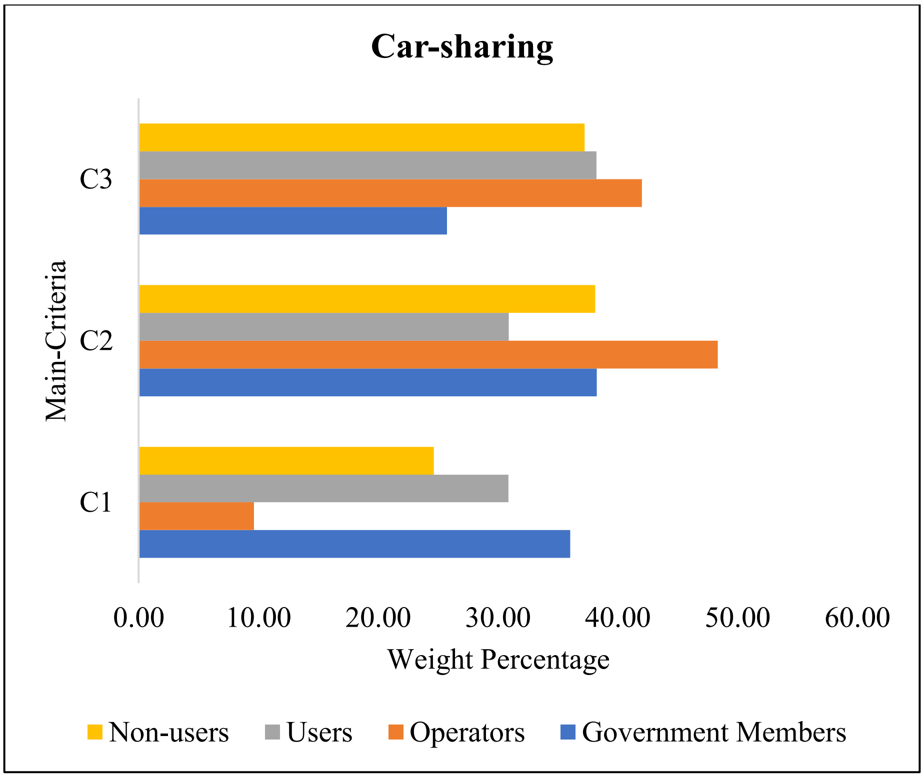

Figure 51: Importance of main-criteria based on different types of stakeholders.

As shown in Figure 51, main-criterion trip-related characteristics (C1) is 3.21 and 2.56 times more valuable to users and non-users, respectively, than operators. On the other hand, in operators' eyes, main-criterion car-sharing characteristics (C2) is 1.57 times and 1.27 times more important than what is mentioned by users and non-users, respectively.

Furthermore, according to Figures 31, 36, 41, and 46, it can be noted that among the main-criteria, main-criterion car-sharing characteristics (C2) is the most important main-criterion for all stakeholders except car-sharing users because they definitely prefer availability and accessibility (C3) over other main-criteria.

It is also worth noting that from the point of view of operators and non-users, the main-criterion car-sharing characteristics (C2) is definitely more important than trip-related characteristics (C1); however, some members of the government prefer C1 to C2.

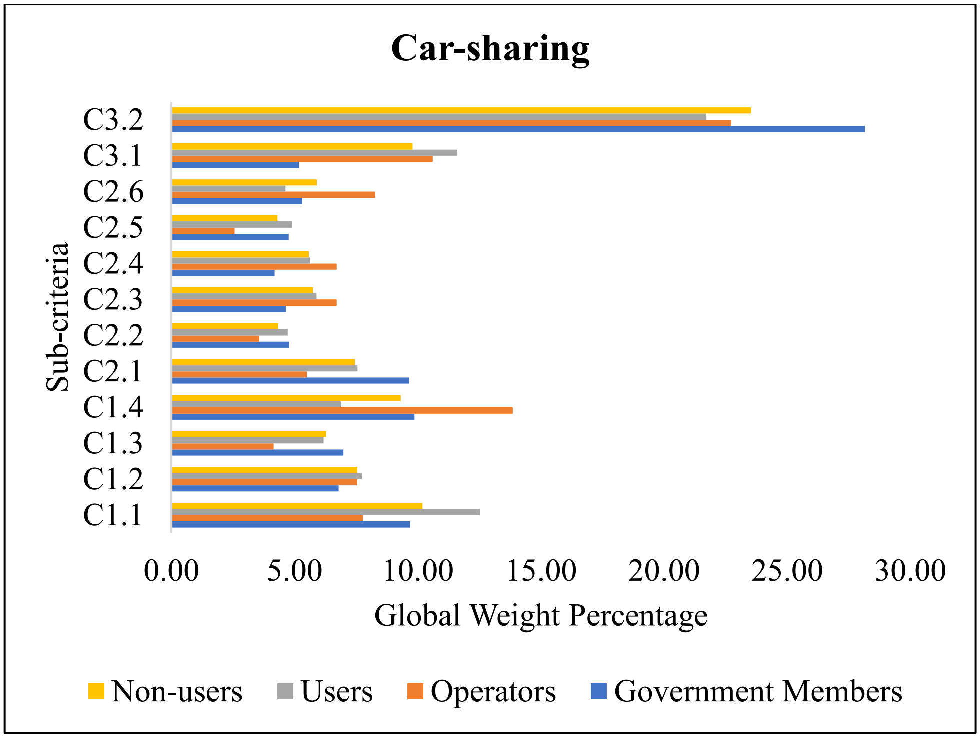

Figure 52: Importance of sub-criteria based on different types of stakeholders.

According to Figure 52, it seems that in some cases, the views of operators on the sub-criteria that people consider in using car-sharing differ from the perspective of users and non-users. Operators pay 2.8 times and 1.94 times more attention to user-friendly (C2.6) than users and non-users, respectively. Besides, it is important to note that non-users pay 1.45 times more attention to C2.6 than users. Also, operators give considerably higher values to sub-criteria service quality (C2.4) and safety (C2.3) than users and non-users. On the other hand, compared operators, users, and non-users give 4.8 times and 4.82 times more value to departure time (C1.3), respectively. Similarly, travel distance (C1.2) and travel time (C1.1) are substantially more important sub-criteria for users and non-users than operators. Furthermore, Figures 33, 38, 44, and 48 show that in the category car-sharing characteristics (C2), travel cost (C2.1) is the most important sub-criteria for all stakeholders except operators since they certainly prefer user-friendly (C2.6) to C2.1. In their view, C2.1 is the fourth most important sub-criterion. It is worth noting that C1.1 is 1.45 times more important to users than non-users.

Furthermore, according to Figures 34 and 39, it can be pointed out that in the category trip-related characteristics (C1), for both government members and operators, sub-criteria trip purpose (C1.4) and travel time (C1.1) are the first and second most important sub-criteria, respectively. It should be noted that some government members believe that C1.1 is more important than C1.4, while for operators, C1.4 is definitely more important than C1.1.

Also, Figure 52 shows that the views of government members are also different from users and non-users. Users and non-users do not value C1.4 as much as government members deem. Compared to users and non-users, government members give 1.67 times and 2.17 times more value to C1.4, respectively. In addition, government members pay considerably more attention to travel cost (C2.1) than users and non-users, respectively. On the other hand, users and non-users assign higher importance to service availability (C3.1) than government members suppose, 3.33 times and 3.29 times higher, respectively. Also, travel distance (C1.2) is the second most important sub-criteria for users and non-users, especially users, because, as shown in Figure 43, they certainly prefer C1.2 over C1.4 (the most important sub-criterion from the perspective of government members in category C1).

6.1.2 Bike-sharing services

In order to determine the priority of each stakeholder of bike-sharing services for the main-criteria and sub-criteria, the group weight of bike-sharing services stakeholders is analyzed.

6.1.2.1 Group weight of government members for bike-sharing services

Table 52 reveals the optimal government members' group weights of the main-criteria for bike-sharing services.

Table 52: Government members' group weights of the main-criteria for bike-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.4345
C2. Bike-sharing characteristics	0.2200
C3. Availability and accessibility	0.3455

Table 52 designates that from the government members' perspective, trip-related characteristics (C1) is the most important main-criterion that individuals could consider in using bike-sharing, with a weight w^{agg} = 0.4345. This implies that from the government members' standpoint, the most important main-criterion that can lead them to use bike-sharing is C1. Figure 53 displays the credal ranking of the main-criteria from the government members' point of view (for bike-sharing services) and the assigned CL. The definition of CL is given in section 3.2.7.6.4 of Chapter 3.

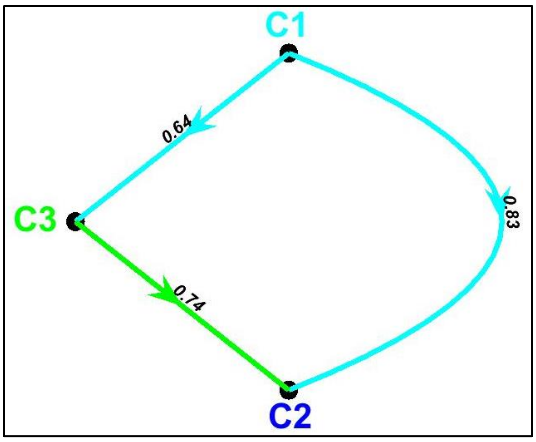

Figure 53: Credal ranking of main-criteria from government members' view for bike-sharing services.

Figure 53 indicates that trip-related characteristics (C1) is the most important main-criterion in this category. It indicates that main-criterion C1 is more important than main-criterion availability and accessibility (C3) (CL=0.64). As mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50 and the CL is around 60 to 80, it can be pointed out that one criterion is more important than the other. Also, when the CL is above 80, it can be noted that one criterion is definitely more important than another. Hence, C1 is definitely more important than bike-sharing characteristics (C2) (CL=0.83).

Table 53 presents the optimal group weights of government members for bike-sharing services. The main-criteria followed by the sub-criteria are given. Moreover, the optimal groups' local weights for each sub-criterion, relevant global weights, and ranking are mentioned.

Table 53: The optimal groups' weights of government members in each sub-criterion for bike-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	**C1.1. Travel time**	0.4351	1	0.1891	2
	C1.2. Travel distance	0.2738	2	0.1190	3
	C1.3. Departure time	0.1584	3	0.0688	5
	C1.4. Trip purpose	0.1327	4	0.0577	6
C2	**C2.1. Travel cost**	0.2223	1	0.0489	7
	C2.2. Travel comfort	0.1007	6	0.0222	12
	C2.3. Safety	0.1784	3	0.0392	9
	C2.4. Service quality	0.2147	2	0.0472	8
	C2.5. Environment-friendly system	0.1117	5	0.0246	11
	C2.6. User-friendly	0.1722	4	0.0379	10
C3	**C3.1. Service availability**	0.3161	2	0.1092	4
	C3.2. Vehicle availability and accessibility	0.6839	1	0.2363	1

Table 53 establishes that in the eyes of government members, vehicle availability and accessibility (C3.2) is the most important sub-criterion that people could consider in bike-sharing usage (w^{agg} = 0.2363) among the 12 identified sub-criteria. The sub-criterion C3.2 is 10.64 times more important than travel comfort (C2.2), the least important sub-criterion. Furthermore, Figure 54 illustrates the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It designates that the sub-criterion C3.2 is definitely more important than the sub-criterion service availability (C3.1), with CL equal to 0.95. This is not surprising since, in the main-criterion C3, all government members chose C3.2 as the most important sub-criterion. Besides, it indicates that the C3.1 is the fourth most important sub-criteria among all 12 sub-criteria (w^{agg} = 0.1092), the local weight of sub-criterion C3.2 is 2.16 times higher than sub-criterion C3.1.

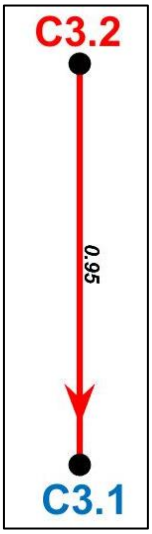

Figure 54: Credal ranking of sub-criteria belonging to the main-criterion C3 from government members' view (bike-sharing services).

Table 53 also determines that among the 12 sub-criteria, travel time (C1.1) is the second most important sub-criterion (w^{agg} = 0.1891). In addition, Figure 55 reveals that C1.1 is absolutely more important than other sub-criteria in the category trip-related characteristics (C1). Similarly, Table 53 shows that in category C1, the local weight of the sub-criterion C1.1 is almost 1.59 to 3.28 times higher than that of other sub-criteria. Additionally, travel distance (C1.2) is the third most important sub-criterion among the 12 sub-criteria, which is in the main-criterion trip-related characteristics (C1).

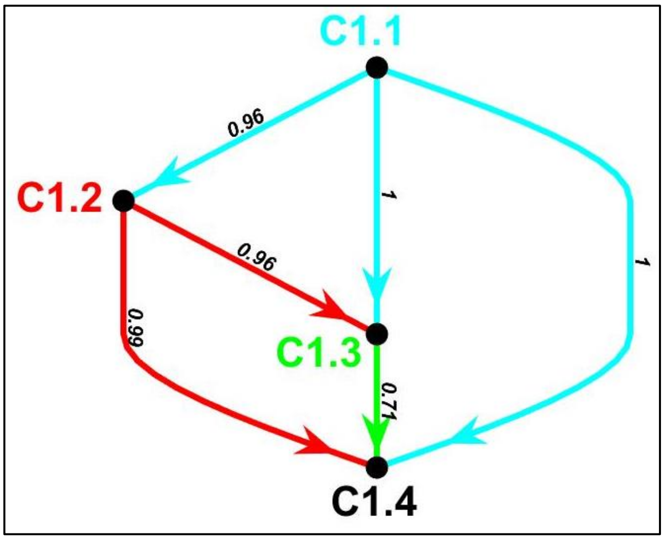

Figure 55: Credal ranking of sub-criteria belonging to the main-criterion C1 from government members' view (bike-sharing services).

As listed in Table 53, according to members of the government, among the 12 sub-criteria, the travel cost (C2.1) is the seventh most important sub-criterion that plays a role in people's bike-sharing use. Also, C2.1 is the most important sub-criterion in the category bike-sharing characteristics (C2). Figure 56 indicates the credal ranking of sub-criteria belonging to the main-criterion C2. Although C2.1 is the most important sub-criterion in category C2, its superiority over C2.4 is not well-established (CL=0.55). As mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50, and the CL is 50 (equal to the threshold value) or slightly higher (from 50 to less than 60), the superiority of one criterion over another is not well established. Similarly, a confidence level of 0.55 between C2.3 and C2.6 indicates that some government members prefer C2.6 to C2.3. Further, the sub-criterion environment-friendly system (C2.5) is more important than travel comfort (C2.2), and other sub-criteria in category C2 are definitely more important than C2.2. In particular, Table 53 determines that among all 12 sub-criteria, government members considered C2.2 as the least important sub-criterion.

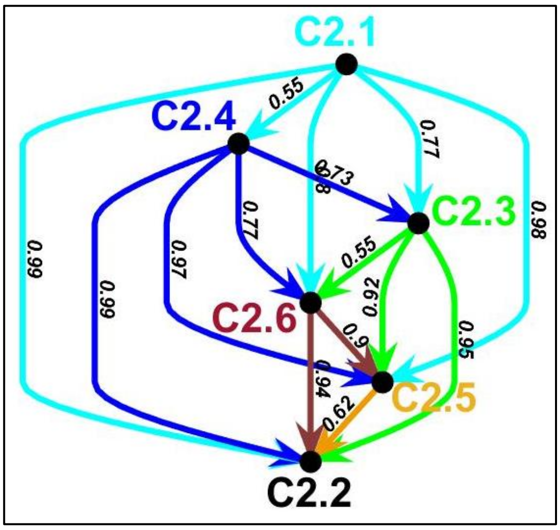

Figure 56: Credal ranking of sub-criteria belonging to the main-criterion C2 from government members' view (bike-sharing services).

In summary, to better understand the standpoint of government members on the impact of factors on their bike-sharing use, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), travel time (C1.1), and travel distance (C1.2), respectively, and the weight of the least important sub-criterion, which is the travel comfort (C2.2), are presented in Figure 57.

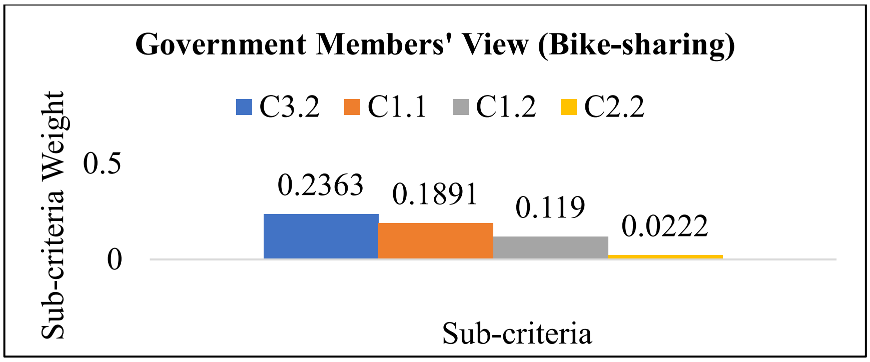

Figure 57: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of government members for bike-sharing choice).

6.1.2.2 Group weight of operators for bike-sharing services

The optimal operators' group weights of the main-criteria for bike-sharing services are mentioned in Table 54.

Table 54: Operators' group weights of the main-criteria for bike-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.0967
C2. Bike-sharing characteristics	0.4372
C3. Availability and accessibility	0.4661

Table 54 indicates that operators consider availability and accessibility (C3) with a weight w^{agg} = 0.4661 as the most important main-criterion that individuals could consider in using bike-sharing. Figure 58 displays the credal ranking of the main-criteria from the operators' point of view (for bike-sharing services) and the assigned CL.

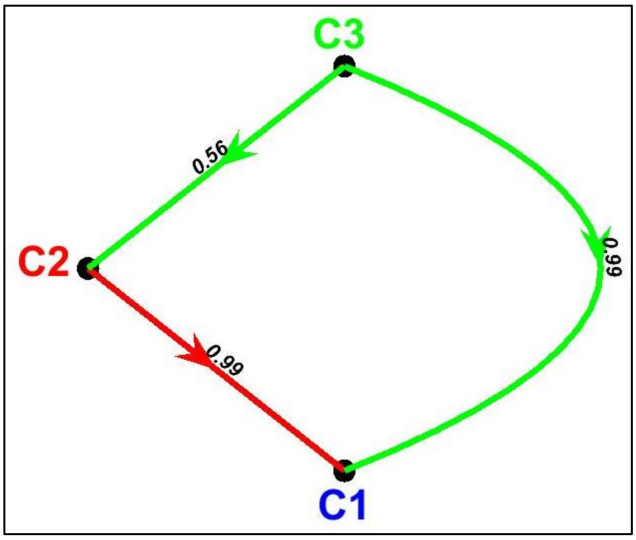

Figure 58: Credal ranking of main-criteria from operators' view for bike-sharing services.

Figure 58 indicates that although the main-criterion availability and accessibility (C3) is the most important sub-criterion, some operators believe that the main-criterion bike-sharing characteristics (C2) is more important (CL=0.56). Also, Table 54 shows that the weight of C3 and C2 is about 4.82 and 4.52 times more than that of trip-related characteristics (C1), respectively.

Table 55 provides the optimal group weights of operators for bike-sharing services. The main-criteria followed by the sub-criteria are mentioned. In addition, the optimal groups' local weights for each sub-criterion and the relevant global weights and their ranking are listed.

Table 55: The optimal groups' weights of operators in each sub-criterion for bike-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	**C1.1. Travel time**	0.2584	2	0.0250	10
	C1.2. Travel distance	0.4307	1	0.0416	9
	C1.3. Departure time	0.1898	3	0.0184	11
	C1.4. Trip purpose	0.1211	4	0.0117	12
C2	**C2.1. Travel cost**	0.1141	6	0.0499	8
	C2.2. Travel comfort	0.1370	5	0.0599	7
	C2.3. Safety	0.1776	2	0.0776	4
	C2.4. Service quality	0.1697	3	0.0742	5
	C2.5. Environment-friendly system	0.2366	1	0.1034	3
	C2.6. User-friendly	0.1651	4	0.0722	6
C3	**C3.1. Service availability**	0.5976	1	0.2785	1
	C3.2. Vehicle availability and accessibility	0.4024	2	0.1876	2

Table 55 reveals that operators believe that service availability (C3.1) is the most important sub-criterion that people consider for using bike-sharing (w^{agg} = 0.2785) among the 12 identified sub-criteria. Also, the local weight of this sub-criterion is about 1.49 times more important than that of the sub-criterion vehicle availability and accessibility (C3.2), which is the second most important sub-criterion among the 12 sub-criteria. Additionally, Figure 59 presents the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It indicates that sub-criterion C3.1 is more important than sub-criterion C3.2, with Cl equal to 0.77.

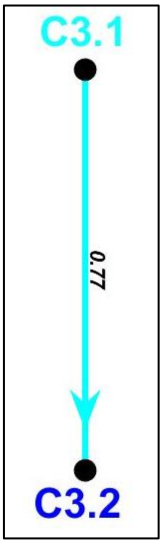

Figure 59: Credal ranking of sub-criteria belonging to the main-criterion C3 from operators' view for bike-sharing services.

Table 55 also establishes that among the 12 sub-criteria, the environment-friendly system (C2.5) is the third most important sub-criterion (w^{agg} = 0.1034). Besides, Figure 60 implies that sub-criterion C2.5 is more important than sub-criterion C2.3 (CL=0.78) and is also absolutely more important than other sub-criteria in the category bike-sharing characteristics (C2). Also, Table 55 presents that the local weight of sub-criterion C2.5 is 2.07 times more important than that of sub-criterion travel cost (C2.1), which is the least important sub-criteria in category C2. As can be seen in Figure 60, although safety (C2.3) is the second most important sub-criterion in the category C2, the confidence of 0.55 between this sub-criterion and sub-criterion service quality (C2.4) implies that some operators believe that sub-criterion C2.4 plays a more important role. Similarly, some operators consider sub-criterion user-friendly (C2.6) more important than sub-criterion C2.3 (CL=0.58).

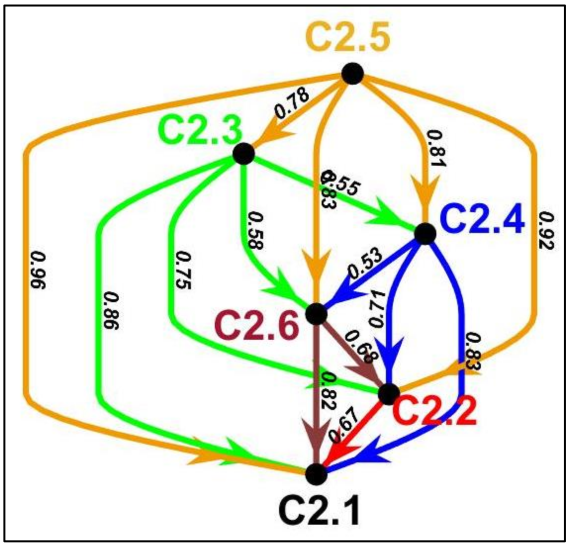

Figure 60: Credal ranking of sub-criteria belonging to the main-criterion C2 from operators' view for bike-sharing services.

Figure 61 indicates the credal ranking of sub-criteria belonging to the main-criterion trip-related characteristics (C1). It demonstrates that sub-criterion travel distance (C1.2) is absolutely more important than other sub-criteria in the category trip-related characteristics (C1). Especially since Table 55 suggests that the local weight of the sub-criterion C1.2 is approximately 3.56 times higher than that of the sub-criterion trip purpose (C1.4).

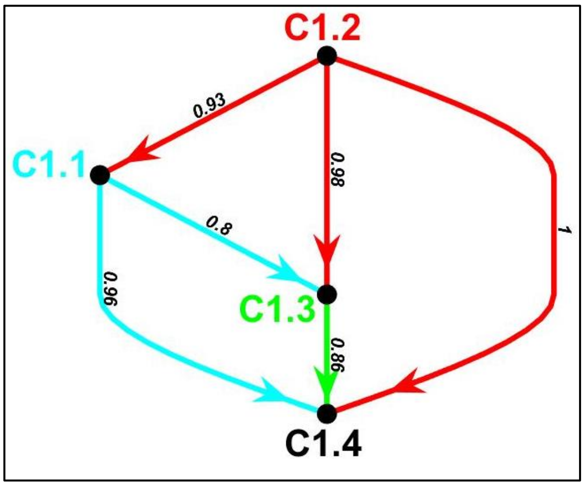

Figure 61: Credal ranking of sub-criteria belonging to the main-criterion C1 from operators' view for bike-sharing services.

In summary, to better understand the perspective of operators on the effect of factors on individuals' bike-sharing use, the weight of the three most important sub-criteria, which are service availability (C3.1), vehicle availability and accessibility (C3.2), and environment-friendly system (C2.5), respectively, and the weight of the least important sub-criterion, which is the trip purpose (C1.4), is offered in Figure 62.

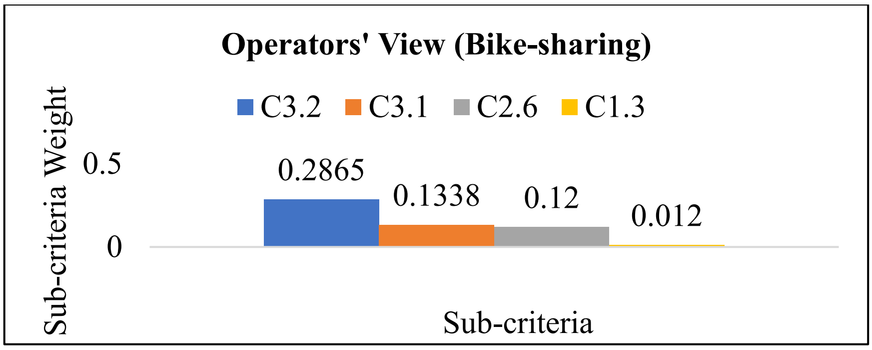

Figure 62: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of bike-sharing operators).

6.1.2.3 Group weight of users for bike-sharing services

The optimal users' group weights of the main-criteria for bike-sharing services are stated in Table 56.

Table 56: Users' group weights of the main-criteria for bike-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.2245
C2. Bike-sharing characteristics	0.3450
C3. Availability and accessibility	0.4305

Table 56 implies that from the perspective of users, the most important main-criterion that they could consider in utilizing bike-sharing is availability and accessibility (C3), with a weight w^{agg}= 0.4305. This indicates that from the users' view, the most important main-criterion that can motivate them to use bike-sharing is C3. Figure 63 demonstrates the credal ranking of the main-criteria from the users' point of view (for bike-sharing services) and the assigned CL. It demonstrates that the main-criterion C3 is certainly the most important main-criterion.

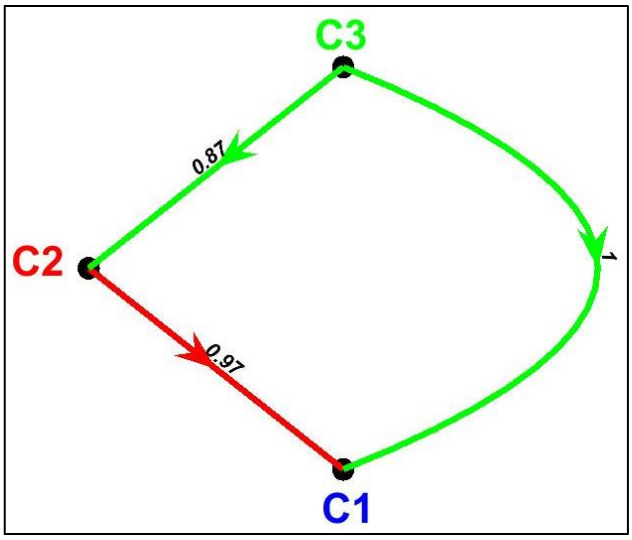

Figure 63: Credal ranking of main-criteria from users' view for bike-sharing services.

Table 57 presents the optimal group weights of users of bike-sharing services. The main-criteria followed by the sub-criteria are presented. Further, the optimal groups' local weights for each sub-criterion and the relevant global weights and their ranking are mentioned.

Table 57: The optimal groups' weights of users in each sub-criterion for bike-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	**C1.1. Travel time**	0.3386	1	0.0760	3
	C1.2. Travel distance	0.2660	2	0.0597	7
	C1.3. Departure time	0.2094	3	0.0470	11
	C1.4. Trip purpose	0.1860	4	0.0418	12
C2	**C2.1. Travel cost**	0.1759	3	0.0607	6
	C2.2. Travel comfort	0.1508	5	0.0520	9
	C2.3. Safety	0.1791	2	0.0618	5
	C2.4. Service quality	0.1831	1	0.0632	4
	C2.5. Environment-friendly system	0.1613	4	0.0556	8
	C2.6. User-friendly	0.1499	6	0.0517	10
C3	**C3.1. Service availability**	0.3877	2	0.1669	2
	C3.2. Vehicle availability and accessibility	0.6123	1	0.2636	1

Table 57 reveals that vehicle availability and accessibility (C3.2) is the most important sub-criterion that users consider in utilizing bike-sharing (w^{agg} = 0.2636) among the 12 identified sub-criteria. Besides, it suggests that although service availability (C3.1) is the second most important sub-criteria among all 12 sub-criteria (w^{agg} =0.1669), the local weight of sub-criterion C3.2 is 1.58 times higher than sub-criterion C3.1. In addition, Figure 64 offers the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It shows that the CL is equal to 099.

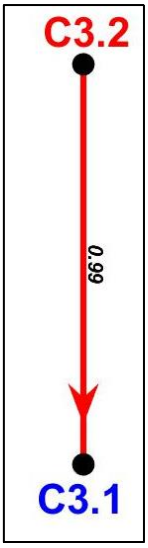

Figure 64: Credal ranking of sub-criteria belonging to the main-criterion C3 from users' view for bike-sharing services.

Table 57 also determines that among the 12 sub-criteria, travel time (C1.1) is the third most important sub-criterion (w^{agg} = 0.0760). Additionally, Figure 65 signifies that C1.1 is definitely more important than other sub-criteria in the trip-related characteristics (C1) category. Also, Table 57 indicates that in category C1, the local weight of the sub-criterion C1.1 is almost 1.27 to 1.82 times higher than that of other sub-criteria. Moreover, Figure 65 establishes that travel distance (C1.2) is the second most important sub-criterion in this category, which is certainly more important than departure time (C1.3). Both of these sub-criteria are absolutely more important than the sub-criterion trip purpose (C1.4).

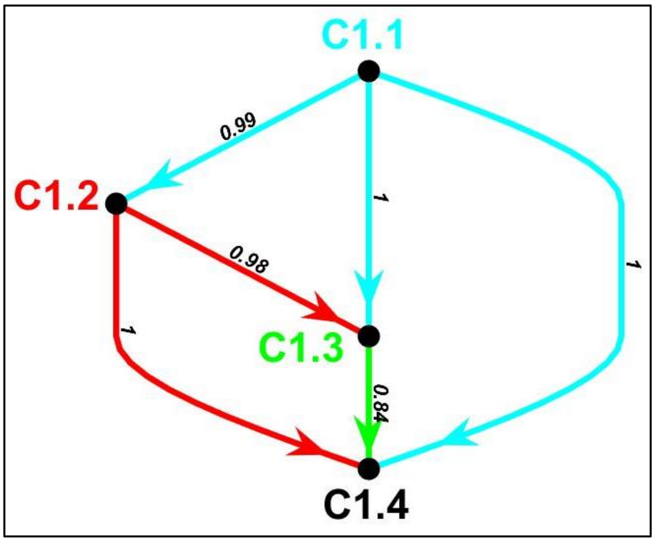

Figure 65: Credal ranking of sub-criteria belonging to the main-criterion C1 from users' view for bike-sharing services.

Figure 66 designates the credal ranking of sub-criteria belonging to the main-criterion bike-sharing characteristics (C2). It exposes that although sub-criterion service quality (C2.4) is the most important sub-criteria in category C2, its superiority over sub-criterion safety (C2.3) is not well established (CL=0.59). Additionally, although Table 57 indicates that the sub-criterion user-friendly (C2.6) is the least important sub-criterion in the category bike-sharing characteristics (C2) (w^{agg} = 0.0517), the confidence of 0.52 between the sub-criteria travel comfort (C2.2) and C2.6, as shown in Figure 66, suggests that some users believe that sub-criterion C2.6 plays a more important role. Therefore, the superiority of the sub-criterion C2.2 over the sub-criterion C2.6 is not well established.

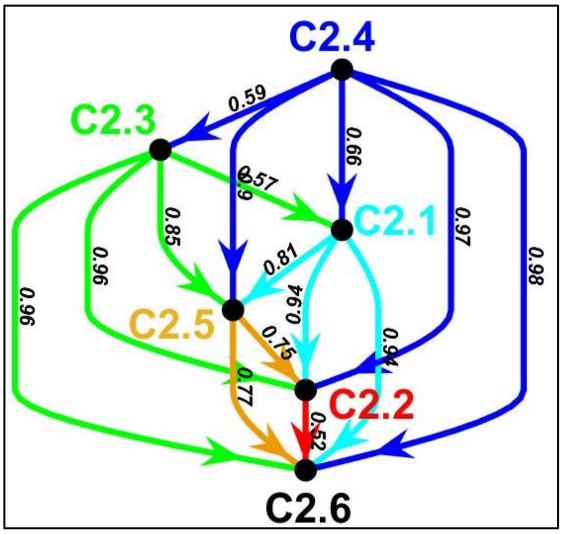

Figure 66: Credal ranking of sub-criteria belonging to the main-criterion C2 from users' view of bike-sharing services.

In summary, to better understand users' standpoint on the impact of factors on their bike-sharing use, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), service availability (C3.1), and travel time (C1.1), respectively, and the weight of the least important sub-criterion, which is the user-friendly (C2.6), are displayed in Figure 67.

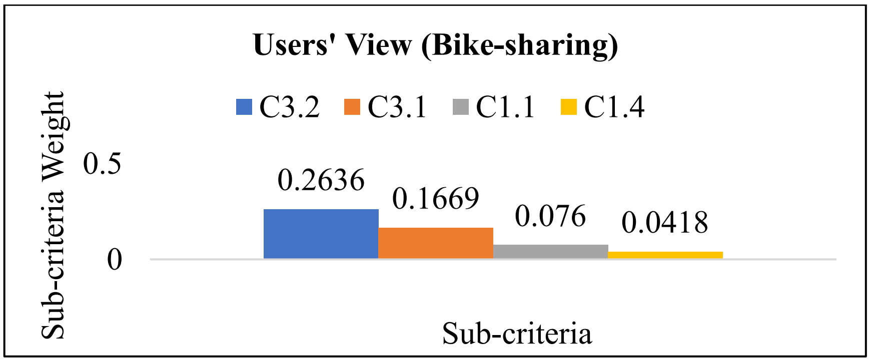

Figure 67: The global weight of the least important sub-criterion and the three most important sub-criteria (from users' perspective of bike-sharing).

6.1.2.4 Group weight of non-users for bike-sharing services

The optimal non-users' group weights of the main-criteria for bike-sharing services are demonstrated in Table 58.

Table 58: Non-users' group weights of the main-criteria for bike-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.3372
C2. Bike-sharing characteristics	0.2798
C3. Availability and accessibility	0.3829

Table 58 indicates that from the non-users view, availability and accessibility (C3) is the most important main-criterion that they could consider in using bike-sharing, with a weight w^{agg} = 0.3829. This establishes that from the non-users perspective, the most important main-criterion that can encourage them to use bike-sharing is C3. Figure 68 illustrates the credal ranking of the main-criteria from the non-users' view (for bike-sharing services) and the assigned CL. Figure 68 reveals that main-criterion C3 is more important than main-criterion trip-related characteristics (C1) (CL=0.78), and both of these main-criteria are certainly more important than main-criterion bike-sharing characteristics (C2).

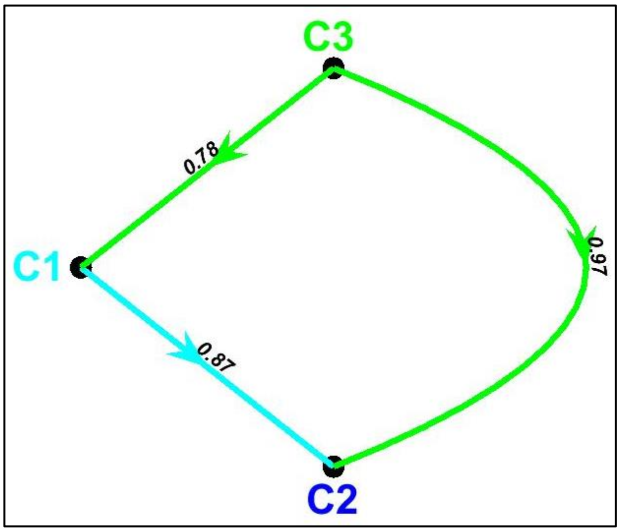

Figure 68: Credal ranking of main-criteria from non-users' view for bike-sharing services.

Table 59 presents the optimal group weights of non-users of bike-sharing services. The main-criteria followed by the sub-criteria are listed. Additionally, the optimal groups' local weights for each sub-criterion, relevant global weights, and ranking are given.

Table 59: The optimal groups' weights of non-users in each sub-criterion for bike-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	C1.1. Travel time	0.3240	1	0.1093	3
	C1.2. Travel distance	0.2608	2	0.0879	4
	C1.3. Departure time	0.1946	4	0.0656	6
	C1.4. Trip purpose	0.2206	3	0.0744	5
C2	C2.1. Travel cost	0.1797	2	0.0503	8
	C2.2. Travel comfort	0.1524	4	0.0426	10
	C2.3. Safety	0.2043	1	0.0572	7
	C2.4. Service quality	0.1669	3	0.0467	9
	C2.5. Environment-friendly system	0.1520	5	0.0425	11
	C2.6. User-friendly	0.1447	6	0.0405	12
C3	C3.1. Service availability	0.3780	1	0.1447	2

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
	C3.2. Vehicle availability and accessibility	0.6220	2	0.2382	1

Table 59 suggests that the sub-criterion vehicle availability and accessibility (C3.2) is the most important sub-criterion that non-users could consider in bike-sharing use (w^{agg} = 0.2382) among the 12 identified sub-criteria. The sub-criterion C3.2 is 5.88 times more important than user-friendly (C2.6), the least important sub-criterion. Besides, it indicates that although service availability (C3.1) is the second most important sub-criteria among all 12 sub-criteria (w^{agg} = 0.1447), the local weight of sub-criterion C3.2 is almost 1.65 times higher than sub-criterion C3.1. In this regard, Figure 69 demonstrates the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It specifies that the sub-criterion C3.2 is definitely more important than the sub-criterion C3.1 with Cl equal to 1.

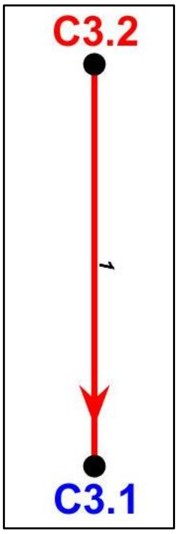

Figure 69: Credal ranking of sub-criteria belonging to the main-criterion C3 from non-users' view of bike-sharing services.

Table 59 also establishes that among the 12 sub-criteria, travel cost (C1.1) is the third most important sub-criterion (w^{agg} = 0.1093). Further, Figure 70 presents the credal ranking of sub-criteria belonging to the main-criterion trip-related characteristics (C1). It shows that sub-criterion travel time (C1.1) is surely more important than other sub-criteria in category C1.

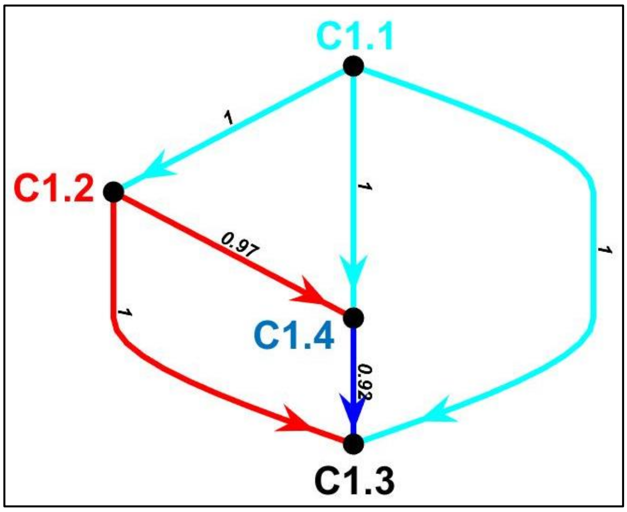

Figure 70: Credal ranking of sub-criteria belonging to the main-criterion C1 from non-users' view of bike-sharing services.

Figure 71 specifies the credal ranking of sub-criteria belonging to the main-criterion bike-sharing characteristics (C2). It reveals that C2.3 is definitely more important than other sub-criteria in category C2. Furthermore, it establishes that although sub-criterion travel comfort (C2.2) is the fourth most important sub-criterion in this category, the confidence of 0.51 between the sub-criteria C2.2 and environment-friendly system (C2.5) indicates that some non-users consider that sub-criterion C2.5 plays a more important role. Therefore, the superiority of the sub-criterion C2.2 over the sub-criterion C2.5 is not well established.

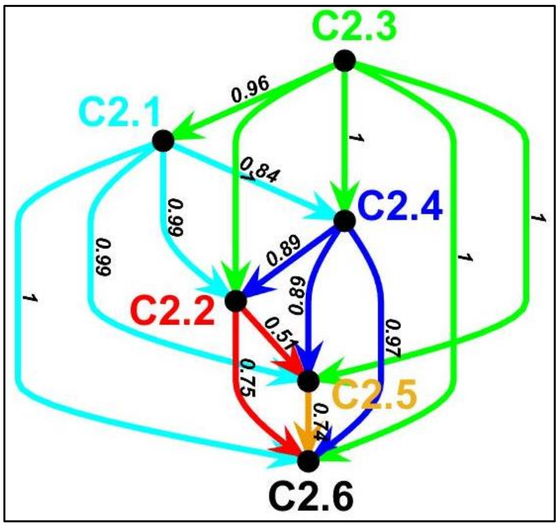

Figure 71: Credal ranking of sub-criteria belonging to the main-criterion C2 from non-users' view of bike-sharing services.

In summary, to better understand the viewpoint of non-users on the impact of factors on their bike-sharing usage, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), service availability (C3.1), and travel time (C1.1), respectively, and the weight of the least important sub-criterion, which is the user-friendly (C2.6), are given in Figure 72.

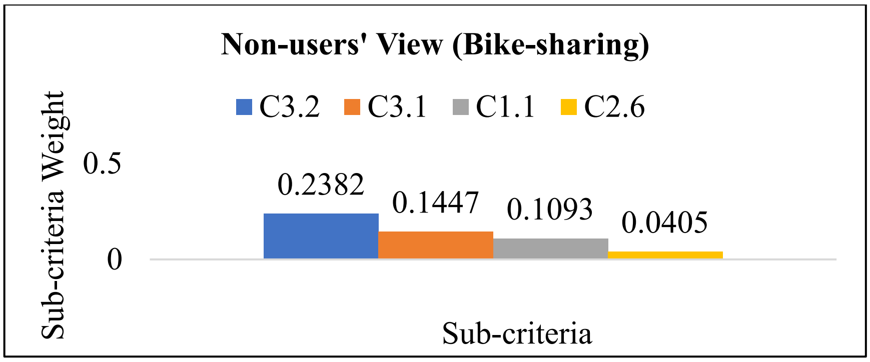

Figure 72: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of non-users of bike-sharing).

6.1.2.5 Similarities and differences between the four types of bike-sharing stakeholders

In this study, 12 sub-criteria are compared by four different stakeholders in order to recognize their viewpoints on the importance of each sub-criterion that individuals can consider in bike-sharing usage. In the literature, some research has only focused on the importance of some of these 12 sub-criteria. However, in this study, all 12 sub-criteria are ranked and compared with each other to specify the importance of each sub-criterion compared with other sub-criteria from each stakeholder's standpoint. Additionally, most studies have worked on user perceptions only. However, in this study, these sub-criteria are compared by four groups of stakeholders. Hence, the importance of each sub-criterion can be compared from the viewpoint of four different stakeholders to distinguish their views on each sub-criterion. This contributes to knowing the perceptions of different groups of bike-sharing stakeholders about the importance of one main-criterion/sub-criterion (related to the first research question mentioned in Chapter 1).

One of the main purposes of this study is to clarify the gap between the point of view of bike-sharing stakeholders. To determine the difference between the perceptions of stakeholders, Table 60 indicates the ranking of the main-criteria and sub-criteria corresponding to each of the stakeholders.

It is important to state that in the literature, sub-criteria service quality (C2.4) and safety (C2.3), environment-friendly system (C2.5), and user-friendly (C2.6) have not been well researched. Therefore, this study also considers these sub-criteria to determine the stakeholders' viewpoints on them.

Table 60: Ranking of the main-criteria and sub-criteria corresponding to bike-sharing stakeholders.

Main-criteria	Ranking of main-criteria corresponding with bike-sharing stakeholders				Sub-criteria	Ranking of sub-criteria corresponding with bike-sharing stakeholders			
	Government Members	Operators	Users	Non-users		Government Members	Operators	Users	Non-users
C1	1	3	3	2	C1.1. Travel time	2	10	3	3
					C1.2. Travel distance	3	9	7	4
					C1.3. Departure time	5	11	11	6
					C1.4. Trip purpose	6	12	12	5
C2	3	2	2	3	C2.1. Travel cost	7	8	6	8

Main-criteria	Ranking of main-criteria corresponding with bike-sharing stakeholders				Sub-criteria	Ranking of sub-criteria corresponding with bike-sharing stakeholders			
	Government Members	Operators	Users	Non-users		Government Members	Operators	Users	Non-users
					C2.2. Travel comfort	12	7	9	10
					C2.3. Safety	9	4	5	7
					C2.4. Service quality	8	5	4	9
					C2.5. Environment-friendly system	11	3	8	11
					C2.6. User-friendly	10	6	10	12
C3	2	1	1	1	C3.1. Service availability	4	1	2	2
					C3.2. Vehicle availability and accessibility	1	2	1	1

As seen in Table 60, operators and users have similar views on the importance of the main-criteria. There are also substantial similarities in stakeholders' views on the importance of the sub-criteria. The importance of vehicle availability and accessibility (C3.2) is stated in the literature (Froehlich et al., 2008’ Dell'Olio, 2011; Lin and Yang, 2011; Shaheen et al., 2011; Vogel and Mattfeld, 2011; Bachand-Marleau et al., 2012; Rixey, 2013; Faghih-Imani and Eluru, 2015; Feng and Li, 2016; Faghih-Imani et al., 2017; Zhang, 2017; Wang and Lindsey, 2019). As specified in Table 60, Government members, users, and non-users believe that C3.2 is the most important sub-criterion among the 12 sub-criteria people consider in bike-sharing usage.

From the operators' point of view, service availability (C3.1) is the most important sub-criterion, the second most important sub-criterion in the eyes of users and non-users. In this regard, some research has pointed to the important role of C3.1 (Vogel et al., 2011; Buck and Buehler, 2012; Hampshire and Marla, 2012; Kim et al., 2012; Croci and Rossi, 2014; Etienne and Latifa, 2014; Noland et al., 2016; Wag et al., 2016; El-Assi et al., 2017; Kutela and Kidando, 2017; Zhang, 2017; Jain et al., 2018; Shen et al., 2018; Duran-Rodas et al., 2019; Zhao et al., 2019; Ji et al., 2020; Lin et al., 2020). It is noteworthy that government members, users, and non-users almost alike value the importance of sub-criterion travel time (C1.1). In the literature, some studies have focused on the importance of this sub-criterion (Krizek et al., 2005; Garrard et al., 2008; Akar et al., 2013; Kamargianni and Polydoropoulou, 2013; Whalen et al., 2013’ Dell'Olio et al., 2014; Kamargiani, 2015). Also, in the eyes of both users and operators, the trip purpose (C1.4) is the least important sub-criterion among the 12 sub-criteria.

There are also important differences in the views of shareholders. In this regard, it should be noted that despite the belief of bike-sharing operators that people value an environment-friendly system (C2.5), this sub-criterion is less important for other stakeholders, especially for government members and non-users. Also, although departure time (C1.3) and trip purpose (C1.4) are among the least important sub-criteria for users and operators, government members and non-users emphasize these sub-criteria. In addition, unlike operators who believe that travel time (C1.1) is less important than most sub-criteria, it is one of the main sub-criteria from the point of view of other stakeholders.

Figure 73 and Figure 74 demonstrate the weight percentage of the main-criteria and the global weight percentage of the sub-criteria corresponding with the bike-sharing stakeholders, respectively.

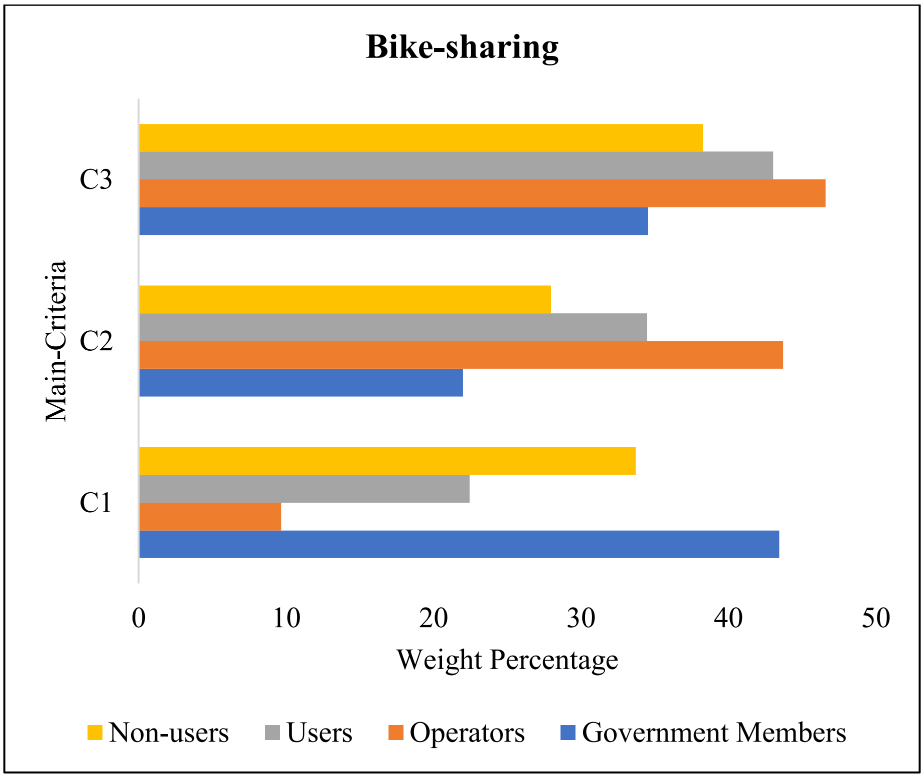

Figure 73: Importance of main-criteria based on different types of stakeholders.

As seen in Figure 73, the importance of main-criterion trip-related characteristics (C1) for government members is about 4.3 and 1.95 times higher than for operators and users, respectively. On the other hand, from the operators' point of view, the importance of main-criterion bike-sharing characteristics (C2) is 2 and 1.57 times greater for them than for government members and non-users, respectively.

It is also worth noting that according to Figures 53, 58, 63, and 68, availability and accessibility of bike-sharing (C3) is the most important main-criterion for all stakeholders except government members who believe C1 is more important than it. Besides, it should be noted that some operators believe that the main-criterion C2 is more important than the main-criterion C3.

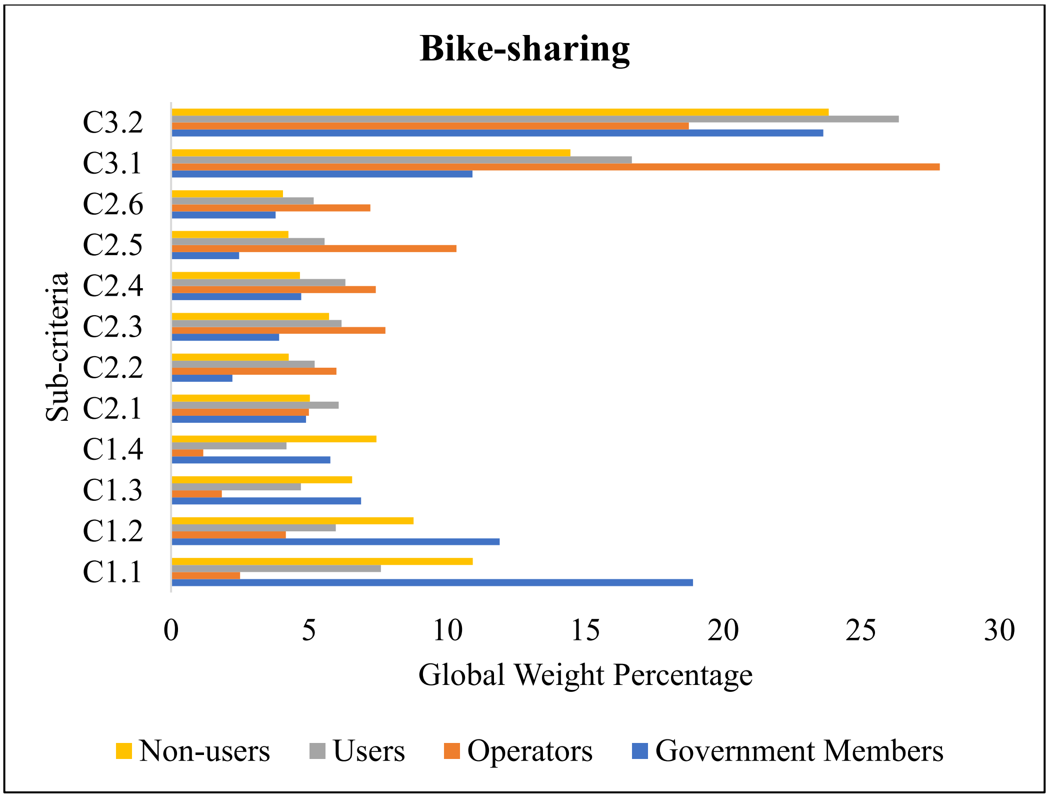

Figure 74: Importance of sub-criteria based on different types of stakeholders.

In accordance with Figure 44, it appears that in some instances, the point of view of operators on the sub-criteria that individuals consider in bike-sharing usage differs from the standpoint of users and non-users. Users and non-users pay roughly 3.57 and 6.36 times more attention to the trip purpose (C1.4) than operators, respectively. Likewise, users and non-users value departure time (C1.3), travel distance (C1.2), and travel time (C1.1) considerably more than operators. On the other hand, the emphasis by operators on the importance of an environment-friendly system (C2.5) is about 1.86 and 2.43 times higher than that of users and non-users, respectively. Besides, according to Figures 25, 31, 35, and 40, the main-criterion C1.1 is absolutely the most important sub-criterion in category C1 from the point of view of all stakeholders, except for operators who believe that C1.2 is definitely more important than C1.1. It should also be noted that according to Figures 24, 29, 34, and 39, it should be mentioned that the sub-criterion vehicle availability and accessibility (C3.2) is definitely more important than the sub-criterion service availability (C3.1) for all stakeholders except for operators who believe that the sub-criterion C3.1 is more important than the sub-criterion C3.2.

In some cases, government members also have different views from users and non-users. Users and non-users pay 2.34 and 1.92 times more attention to travel comfort (C2.2) and 2.26 and 1.73 times more attention to the C2.5 than government members. In contrast, government members place 2.49 and 1.73 times more value on C1.1 than users and non-users.

Finally, it is interesting to note that according to Figures 56, 60, 66, and 71, none of the stakeholders have the same priority over the best sub-criterion in category 2.

6.1.3 Scooter-sharing services

In this section, the group weight of scooter-sharing services stakeholders is analyzed in order to ascertain the priority of each stakeholder of scooter-sharing services for the main-criteria and sub-criteria.

6.1.3.1 Group weight of government members for scooter-sharing services

Table 61 shows the optimal government members' group weights of the main-criteria for scooter-sharing services.

Table 61: Government members' group weights of the main-criteria for scooter-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.1334
C2. Scooter-sharing characteristics	0.6236
C3. Availability and accessibility	0.2430

Table 61 indicates that from the government members' perspective, the main-criterion scooter-sharing characteristics (C2) is the most important main-criterion that people could consider in scooter-sharing usage, with a weight w^{agg} = 0.6236. This suggests that from the government members' viewpoint, the most important main-criterion that can lead them to use scooter-sharing is C2. Figure 75 displays the credal ranking of the main-criteria from the government members' standpoint (for scooter-sharing services) and the assigned CL. The definition of CL is given in section 3.2.7.6.4 of Chapter 3.

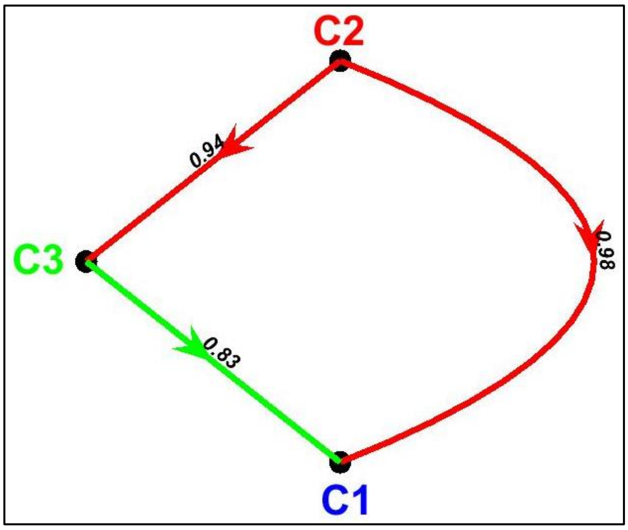

Figure 75: Credal ranking of main-criteria from government members' view for scooter-sharing services.

As described in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50 and CL is above 80, it can be stated that one criterion is certainly more important than another. Figure 75 indicates that the main-criterion scooter-sharing characteristics (C2) is absolutely the most important main-criterion in this category.

Table 62 offers the optimal group weights of government members for scooter-sharing services. The main-criteria followed by the sub-criteria are presented. Moreover, the optimal groups' local weights for each sub-criterion, relevant global weights, and ranking are revealed.

Table 62: The optimal groups' weights of government members in each sub-criterion for scooter-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	**C1.1. Travel time**	0.2828	1	0.0377	9
	C1.2. Travel distance	0.2408	3	0.0321	11
	C1.3. Departure time	0.2122	4	0.0283	12
	C1.4. Trip purpose	0.2643	2	0.0353	10
C2	**C2.1. Travel cost**	0.2029	2	0.1265	3
	C2.2. Travel comfort	0.1104	6	0.0688	8
	C2.3. Safety	0.2235	1	0.1394	1
	C2.4. Service quality	0.1420	5	0.0886	7
	C2.5. Environment-friendly system	0.1506	4	0.0939	6
	C2.6. User-friendly	0.1706	3	0.1064	5
C3	**C3.1. Service availability**	0.4762	2	0.1157	4
	C3.2. Vehicle availability and accessibility	0.5238	1	0.1273	2

Table 62 establishes that safety (C2.3) is the most important sub-criterion that government members believe people could consider in scooter-sharing usage (w^{agg} = 0.1394) among the 12 identified sub-criteria. The sub-criterion C2.3 is approximately 4.93 times more important than the departure time (C1.3), which is the least important sub-criterion (w^{agg} = 0.0283).

As mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50, and the CL is 50 (equal to the threshold value) or slightly higher (from 50 to less than 60), the superiority of one criterion over another is not well established. Figure 76 indicates the credal ranking of sub-criteria belonging to the main-criterion scooter-sharing characteristics (C2). It is important to note that although C2.3 is the most important sub-criterion in the C2 category, its superiority over C2.1 is not well-established (CL=0.58). Also, when the threshold value is 50, and the CL is around 60 or 80, it can be pointed out that one criterion is more important than the other. In this category, all sub-criteria are more important than sub-criterion travel comfort (C2.2), and the local weight of sub-criterion C2.3 is about 2.02 times higher than sub-criterion C2.2.

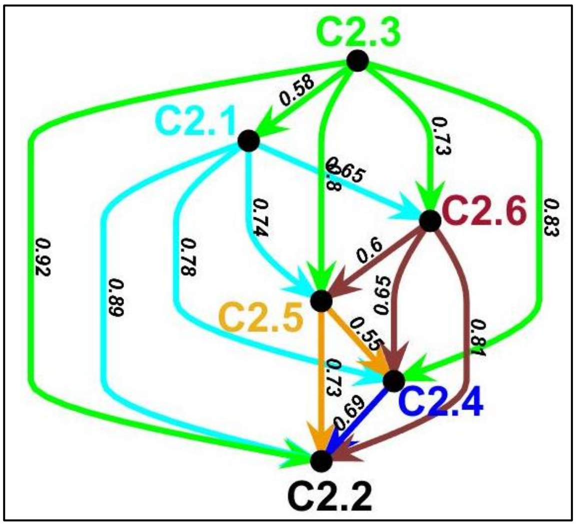

Figure 76: Credal ranking of sub-criteria belonging to the main-criterion C2 from government members' view (scooter-sharing services).

Table 62 also shows that the sub-criterion vehicle availability and accessibility (C3.2) is the second most important sub-criterion among all 12 sub-criteria (w^{agg} = 0.1273). However, as demonstrated in Figure 77, in category availability and accessibility (C3), one cannot comment on the superiority of C3.2 to C3.1 (CL=0.56), which is the fourth most important sub-criteria among all 12 sub-criteria (w^{agg} = 0.1157).

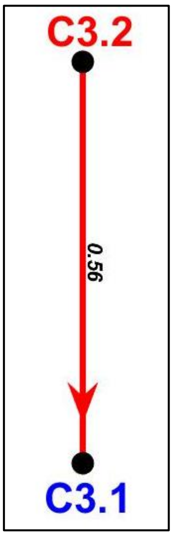

Figure 77: Credal ranking of sub-criteria belonging to the main-criterion C3 from government members' view (scooter-sharing services).

Table 62 also reveals that among the 12 sub-criteria, travel time (C1.1) is the ninth most important sub-criterion (w^{agg} = 0.0377). Additionally, Figure 78 exposes that although C1.1 is the most important sub-criterion in the trip-related characteristics (C1) category, its superiority over sub-criterion trip purpose (C1.4) is not well mentioned (CL= 0.55). Likewise, some government members prefer the sub-criterion travel distance (C1.2) to the sub-criterion C1.4 (CL= 0.56). Some also consider sub-criterion departure time (C1.3) is more important than sub-criterion C1.2 (CL= 0.59).

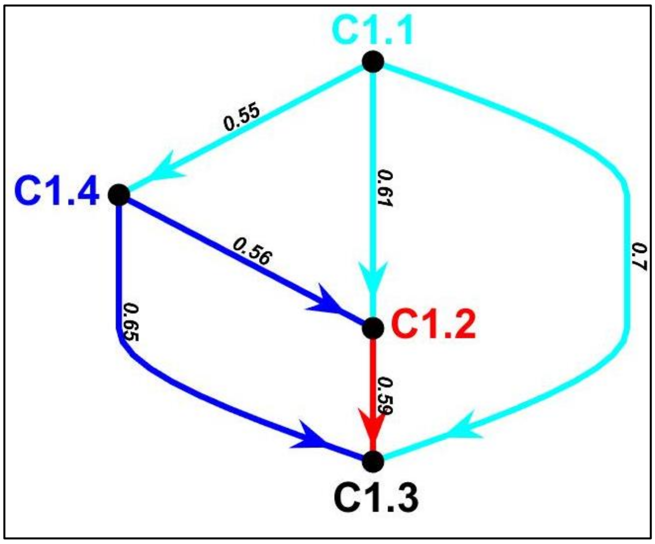

Figure 78: Credal ranking of sub-criteria belonging to the main-criterion C1 from government members' view (scooter-sharing services).

In summary, to better understand the viewpoint of government members on the influence of factors on their scooter-sharing usage, the weight of the three most important sub-criteria, which are safety (C2.3), vehicle availability and accessibility (C3.2), and travel cost (C2.1), respectively, and the weight of the least important sub-criterion, which is the departure time (C1.3), are presented in Figure 79.

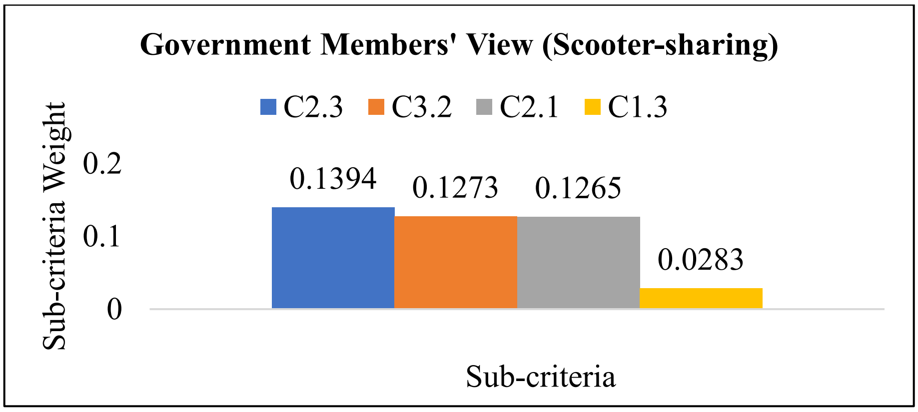

Figure 79: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of government members for scooter-sharing choice).

6.1.3.2 Group weight of operators for scooter-sharing services

The optimal operators' group weights of the main-criteria for scooter-sharing services are listed in Table 63.

Table 63: Operators' group weights of the main-criteria for scooter-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.3333
C2. Scooter-sharing characteristics	0.3333
C3. Availability and accessibility	0.3333

It should be noted that only one scooter-sharing operator's response (out of the response of three scooter-sharing operators) about the main criteria has been used. This operator has considered the importance of these main-criteria equally; the weight of each main-criteria is 0.3333.

Furthermore, it should be mentioned that there is no Figure to display the credal ranking of the main-criteria from the view of scooter-sharing operators because only one scooter-sharing operator's response (out of the response of three scooter-sharing operators) about the main criteria is used.

Table 64 delivers the optimal group weights of operators for scooter-sharing services. The main-criteria followed by the sub-criteria are revealed. Additionally, the optimal groups' local weights for each sub-criterion and the relevant global weights and their ranking are listed.

Table 64: The optimal groups' weights of operators in each sub-criterion for scooter-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	C1.1. Travel time	0.1517	3	0.0506	8
	C1.2. Travel distance	0.4764	1	0.1588	2
	C1.3. Departure time	0.1397	4	0.0466	10
	C1.4. Trip purpose	0.2323	2	0.0774	4
C2	C2.1. Travel cost	0.1526	4	0.0509	7
	C2.2. Travel comfort	0.1050	6	0.0350	12
	C2.3. Safety	0.2616	1	0.0872	3
	C2.4. Service quality	0.1415	5	0.0472	4
	C2.5. Environment-friendly system	0.1758	2	0.0586	5
	C2.6. User-friendly	0.1636	3	0.0545	6
C3	C3.1. Service availability	0.1274	2	0.0425	11
	C3.2. Vehicle availability and accessibility	0.8726	1	0.2908	1

Table 64 establishes that operators believe that vehicle availability and accessibility (C3.2) is the most important sub-criterion that individuals consider for scooter-sharing use (w^{agg}= 0.2908) among the 12 identified sub-criteria. Moreover, the local weight of this sub-criterion is 6.85 times more important than that of the sub-criterion service availability (C3.1), which is the eleventh most important sub-criterion among the 12 sub-criteria. In this regard, Figure 80 gives the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It indicates that the sub-criterion C3.2 is certainly more important than the sub-criterion C3.1 with Cl equal to 1.

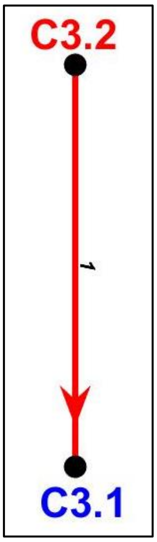

Figure 80: Credal ranking of sub-criteria belonging to the main-criterion C3 from operators' view for scooter-sharing services.

Table 64 also exposes that among the 12 sub-criteria, travel distance (C1.2) is the second most important sub-criterion (w^{agg} = 0.1588).

Figure 81 signifies the credal ranking of sub-criteria belonging to the main-criterion trip-related characteristics (C1). It designates that sub-criterion travel distance (C1.2) is absolutely more important than other sub-criteria in category C1. Especially since Table 64 proposes that the local weight of the sub-criterion C1.2 is nearly 3.41 times higher than that of the sub-criterion departure time (C1.3). As can be seen in Figure 81, although sub-criterion C1.3 is the least important sub-criterion in this category, some operators believe that sub-criterion C1.3 plays a more important role than sub-criterion travel time (C1.1) (CL= 0.56).

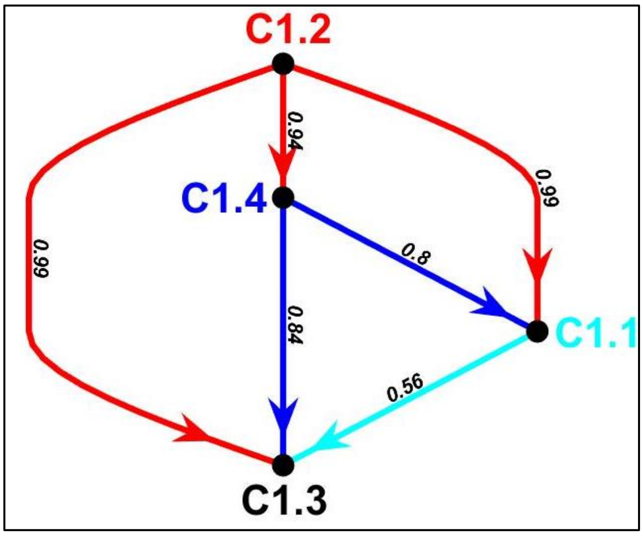

Figure 81: Credal ranking of sub-criteria belonging to the main-criterion C1 from operators' view for scooter-sharing services.

As listed in Table 64, C2.3 is the third most important sub-criteria among all 12 sub-criteria (w^{agg} = 0.0872). Figure 82 indicates the credal ranking of sub-criteria belonging to the main-criterion scooter-sharing characteristics (C2). Figure 82 implies that sub-criterion safety (C2.3) is definitely the most important sub-criterion in category C2. Additionally, Table 64 presents that the local weight of sub-criterion C2.3 is 2.49 times more important than that of sub-criterion travel comfort (C2.2), which is the least important sub-criteria in category C2. As can be realized in Figure 82, although the environment-friendly system (C2.5) is the second most important sub-criterion in category C2, some operators believe that the sub-criterion user-friendly (C2.6) plays a more prominent role (CL= 0.58). Likewise, although the sub-criterion C2.6 is the third most important sub-criterion in this category, the sub-criterion travel cost (C2.1) is more important for some scooter-sharing operators (CL= 0.57). In addition, it is worth noting that for some scooter-sharing operators, the service quality (C2.4) is more important than C2.1 (CL=0.58).

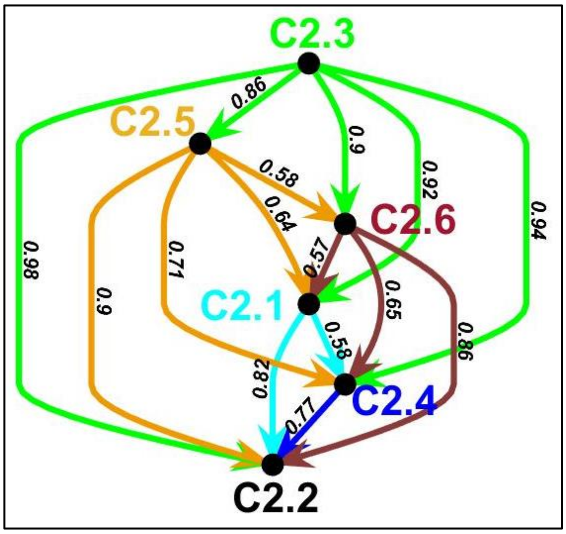

Figure 82: Credal ranking of sub-criteria belonging to the main-criterion C2 from operators' view for scooter-sharing services.

In summary, to better understand the outlook of operators on the effect of factors on individuals' scooter-sharing use, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), travel distance (C1.2), and safety (C2.3) respectively, and the weight of the least important sub-criterion, which is the travel comfort (C2.2), are shown in Figure 83.

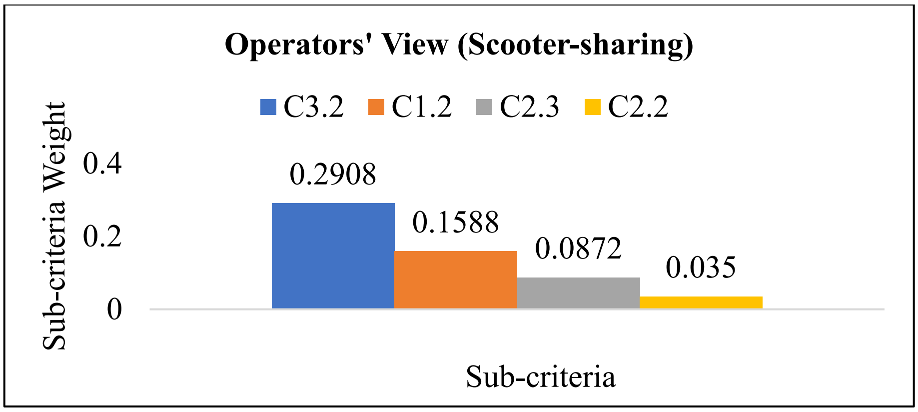

Figure 83: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of scooter-sharing operators).

6.1.3.3 Group weight of users for scooter-sharing services

The optimal users' group weights of the main-criteria for scooter-sharing services are listed in Table 65.

Table 65: Users' group weights of the main-criteria for scooter-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.2493
C2. Scooter-sharing characteristics	0.5002
C3. Availability and accessibility	0.2506

Table 65 suggests that from the viewpoint of users, the most important main-criterion that they could consider in using scooter-sharing is scooter-sharing characteristics (C2), with a weight $w^{agg} = 0.5002$. This implies that from the users' viewpoint, the most important main-criterion that can lead them to use scooter-sharing is C2, especially since this main-criterion is almost twice as important as other main-criteria. Figure 84 appears the credal ranking of the main-criteria from the users' viewpoint (for scooter-sharing services) and the assigned CL.

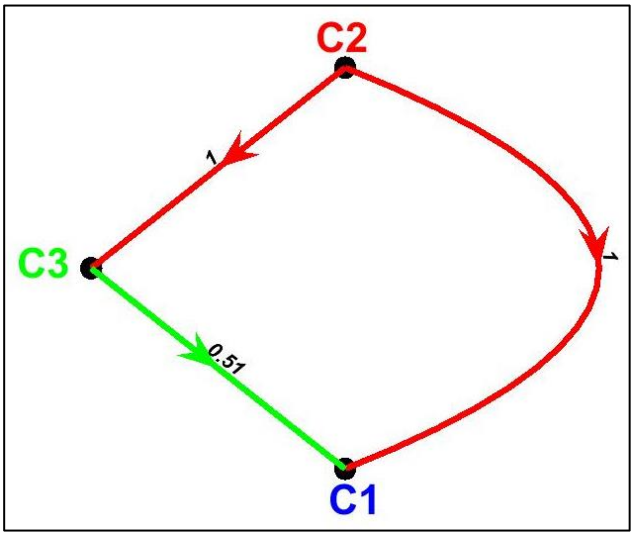

Figure 84: Credal ranking of main-criteria from users' view for scooter-sharing services.

Figure 84 designates that the main-criterion C2 is definitely the most important main-criterion. Additionally, it shows that one cannot comment on the superiority of the main-criterion C3 over the main-criterion C1 with Cl equal to 0.51. Especially, Table 65 indicates that the weights of these two main-criteria are almost equal.

Table 66 determines the optimal group weights of users of scooter-sharing services. The main-criteria followed by the sub-criteria are presented. As well, the optimal groups' local weights for each sub-criterion and the relevant global weights and their ranking are shown.

Table 66: The optimal groups' weights of users in each sub-criterion for scooter-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	C1.1. Travel time	0.3230	1	0.0805	6
	C1.2. Travel distance	0.2658	2	0.0663	9
	C1.3. Departure time	0.2075	3	0.0517	11
	C1.4. Trip purpose	0.2037	4	0.0508	12
C2	C2.1. Travel cost	0.1872	2	0.0936	3
	C2.2. Travel comfort	0.1554	4	0.0777	7
	C2.3. Safety	0.2209	1	0.1105	2
	C2.4. Service quality	0.1620	3	0.0810	5
	C2.5. Environment-friendly system	0.1447	5	0.0724	8
	C2.6. User-friendly	0.1299	6	0.0650	10
C3	C3.1. Service availability	0.3597	2	0.0901	4
	C3.2. Vehicle availability and accessibility	0.6403	1	0.1605	1

Table 66 reveals that vehicle availability and accessibility (C3.2) is the most important sub-criterion that users consider in scooter-sharing use (w^{agg} = 0.1605) among the 12 identified sub-criteria. This sub-criterion is 3.16 times more important than the sub-criterion trip purpose (C1.4), the least important sub-criterion among all 12 sub-criteria. In addition, Figure 85 introduces the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It illustrates that the sub-criterion C3.2 is definitely more important than the C3.1 (CL=1), the fourth most important sub-criterion among all 12 sub-criteria (w^{agg} =

0.0901). In this regard, Table 66 indicates that the local weight of sub-criterion C3.2 is 1.78 times higher than sub-criterion C3.1.

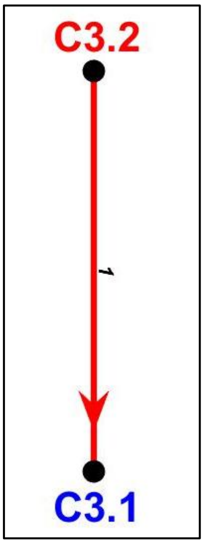

Figure 85: Credal ranking of sub-criteria belonging to the main-criterion C3 from users' view for scooter-sharing services.

As listed in Table 66, safety (C2.3) is the second most important sub-criterion among all 12 sub-criteria (w^{agg} = 0.1105). Figure 86 signifies the credal ranking of sub-criteria belonging to the main-criterion scooter-sharing characteristics (C2). It exposes that sub-criterion safety (C2.3) is certainly more important than other sub-criteria.

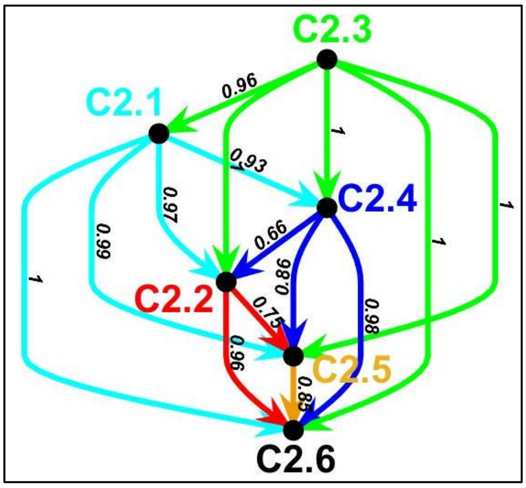

Figure 86: Credal ranking of sub-criteria belonging to the main-criterion C2 from users' view of scooter-sharing services.

Table 66 also establishes that among the 12 sub-criteria, travel time (C1.1) is the sixth most important sub-criterion (w^{agg} = 0.0805). Figure 87 suggests the credal ranking of sub-criteria belonging to the main-criterion trip-related characteristics (C1). Figure 87 reveals that C1.1 is absolutely more important than other sub-criteria in the trip-related characteristics (C1) category. It should be stated that although departure time (C1.3) is the third most important sub-criterion in this category, some users believe that the sub-criterion trip purpose (C1.4) has more effect than the sub-criterion C1.3 (CL= 0.56).

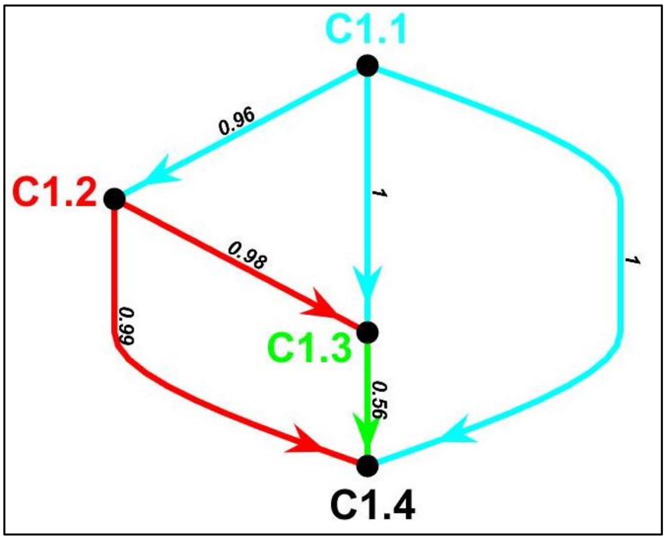

Figure 87: Credal ranking of sub-criteria belonging to the main-criterion C1 from users' view for scooter-sharing services.

In summary, to better understand users' sights on the impact of factors on their scooter-sharing use, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), safety (C2.3), and travel cost (C2.1) respectively, and the weight of the least important sub-criterion, which is the trip purpose (C1.4), are designated in Figure 88.

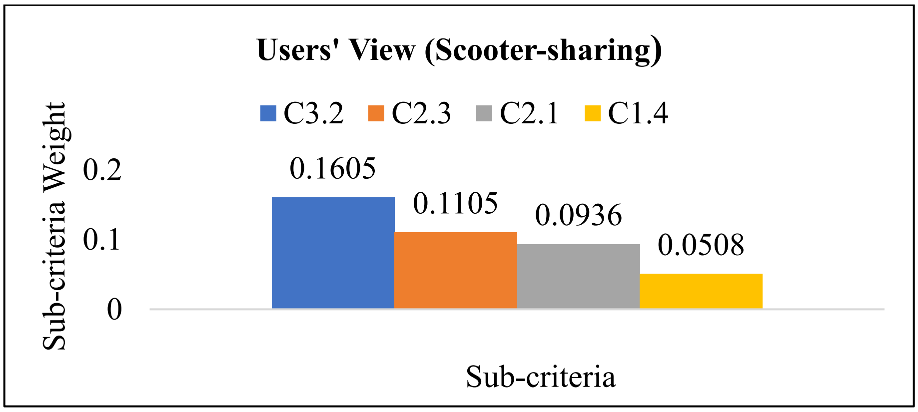

Figure 88: The global weight of the least important sub-criterion and the three most important sub-criteria (from users' perspective of scooter-sharing).

6.1.3.4 Group weight of non-users for scooter-sharing services

The optimal non-users' group weights of the main-criteria for scooter-sharing services are displayed in Table 67.

Table 67: Non-users' group weights of the main-criteria for scooter-sharing services.

Main-criteria	Weights
C1. Trip-related characteristics	0.3399
C2. Scooter-sharing characteristics	0.3372
C3. Availability and accessibility	0.3229

Table 67 reveals that from the non-users perspective, trip-related characteristics (C1) is the most important main-criterion that they could consider in scooter-sharing use, with a weight w^{agg} = 0.3399. This implies that from the non-users perspective, the most important main-criterion that can lead them to use scooter-sharing is C1. Figure 89 exhibits the credal ranking of the main-criteria from the non-users' view (for scooter-sharing services) and the assigned CL.

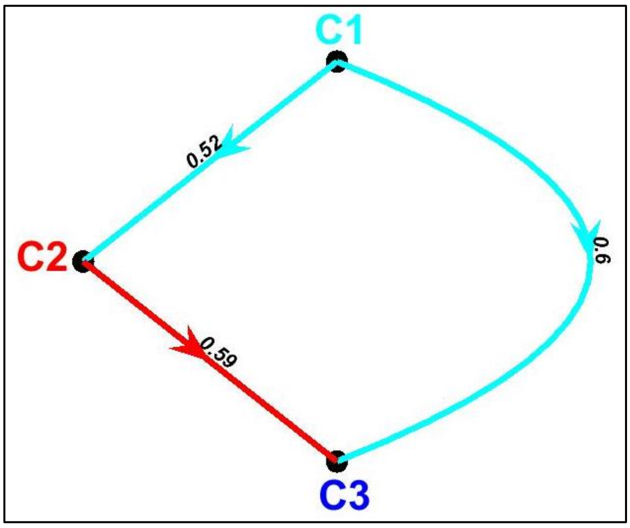

Figure 89: Credal ranking of main-criteria from non-users' view for scooter-sharing services.

Figure 89 suggests that although C1 is the most important main-criterion in this category, one cannot comment on the superiority of the main-criterion C1 over the main-criterion C2 with Cl equal to 0.52.

Table 68 lists the optimal group weights of non-users of scooter-sharing services. The main-criteria followed by the sub-criteria are provided. Also, the optimal groups' local weights for each sub-criterion, relevant global weights, and ranking are stated.

Table 68: The optimal groups' weights of non-users in each sub-criterion for scooter-sharing services.

Main-criteria	Sub-criteria	Local weight per sub-criterion	Ranking within category	Global weight per sub-criterion	Overall ranking of sub-criteria
C1	**C1.1. Travel time**	0.3338	1	0.1135	3
	C1.2. Travel distance	0.2536	2	0.0862	4
	C1.3. Departure time	0.2080	3	0.0707	6
	C1.4. Trip purpose	0.2045	4	0.0695	7
C2	**C2.1. Travel cost**	0.1818	2	0.0613	8
	C2.2. Travel comfort	0.1294	6	0.0436	12
	C2.3. Safety	0.2100	1	0.0708	5
	C2.4. Service quality	0.1717	3	0.0579	9
	C2.5. Environment-friendly system	0.1495	5	0.0504	11
	C2.6. User-friendly	0.1575	4	0.0531	10
C3	**C3.1. Service availability**	0.4061	2	0.1311	2
	C3.2. Vehicle availability and accessibility	0.5939	1	0.1918	1

Table 68 determines that vehicle availability and accessibility (C3.2) is the most important sub-criterion that non-users could consider in scooter-sharing use (w^{agg} = 0.1918) among the 12 identified sub-criteria. The sub-criterion C3.2 is 4.40 times more important than travel comfort (C2.2), the least important sub-criterion.

In addition, it indicates that although service availability (C3.1) is the second most important sub-criteria among all 12 sub-criteria (w^{agg} = 0.1311), the local weight of sub-criterion C3.2 is 1.46 times higher than sub-criterion C3.1. Additionally, Figure 90 demonstrates the credal ranking of the sub-criteria belonging to the main-criterion availability and accessibility (C3). It specifies that the sub-criterion C3.2 is definitely more important than the sub-criterion C3.1 with CL equal to 1.

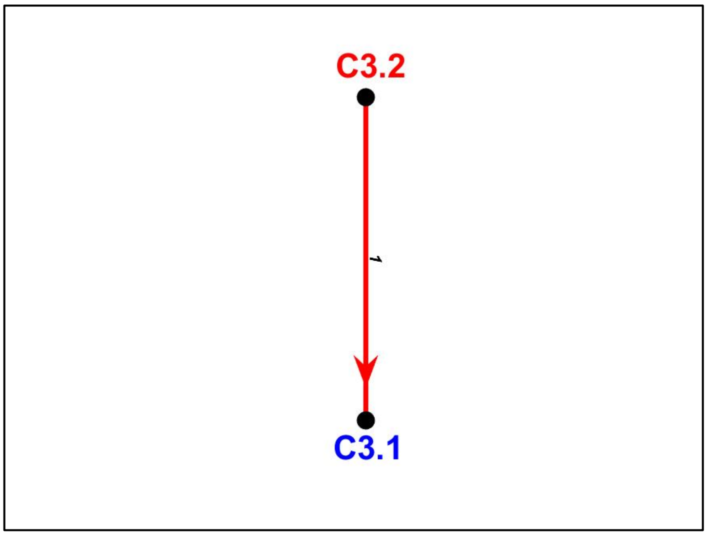

Figure 90: Credal ranking of sub-criteria belonging to the main-criterion C3 from non-users' view of scooter-sharing services.

Figure 91 displays the credal ranking of sub-criteria belonging to the main-criterion trip-related characteristics (C1). It exposes that sub-criterion travel time (C1.1) is surely more important than other sub-criteria. Also, although departure time (C1.3) is the third most important sub-criterion in this category, some non-users believe that sub-criterion trip purpose (C1.4) is more important than sub-criterion C1.3.

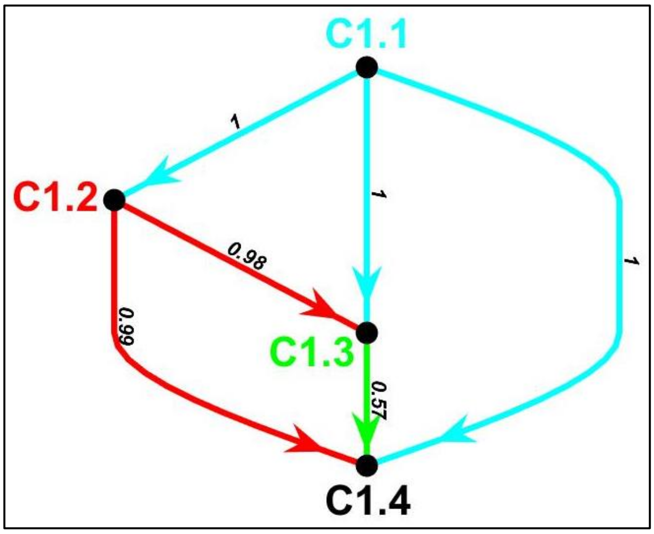

Figure 91: Credal ranking of sub-criteria belonging to the main-criterion C1 from non-users' view of scooter-sharing services.

Table 68 also reveals that among the 12 sub-criteria, safety (C2.3) is the fifth most important sub-criterion (w^{agg} = 0.0708). Figure 92 denotes the credal ranking of sub-criteria belonging to the main-criterion scooter-sharing characteristics (C2). Figure 92 reveals that C2.3 is certainly more important than other sub-criteria in the C2 category.

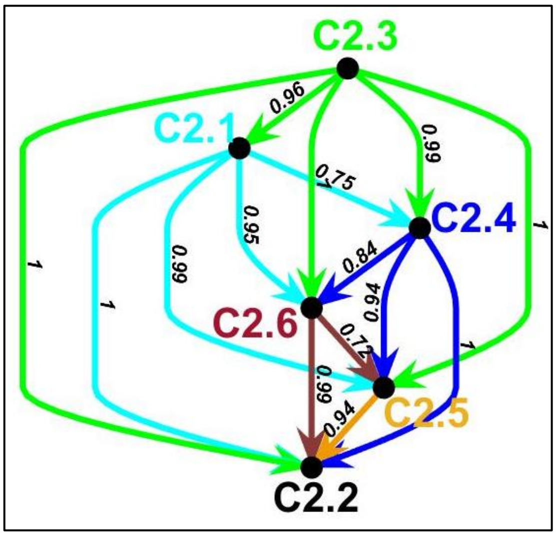

Figure 92: Credal ranking of sub-criteria belonging to the main-criterion C2 from non-users' view of scooter-sharing services.

In summary, to better understand the standpoint of non-users on the impact of factors on their scooter-sharing use, the weight of the three most important sub-criteria, which are vehicle availability and accessibility (C3.2), service availability (C3.1), and travel time (C1.1), respectively, and the weight of the least important sub-criterion, which is the travel comfort (C2.2), are given in Figure 93.

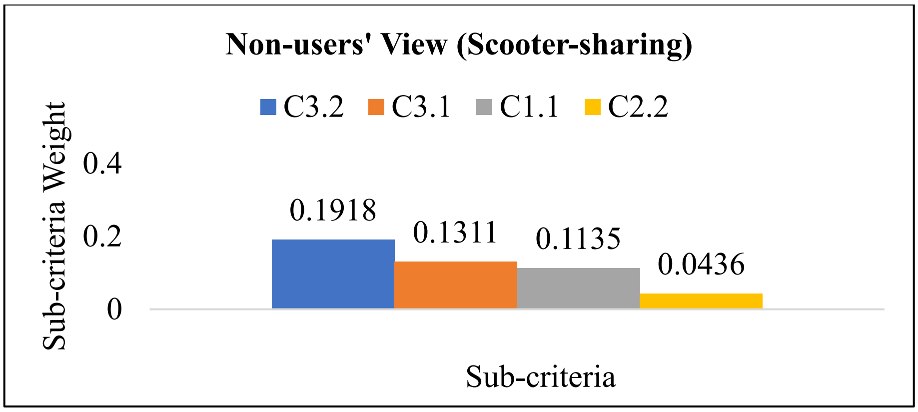

Figure 93: The global weight of the least important sub-criterion and the three most important sub-criteria (from the perspective of non-users of scooter-sharing).

6.1.3.5 Similarities and differences between the four types of scooter-sharing stakeholders

In this study, 12 sub-criteria are compared by four different stakeholders to realize their point of view on the importance of each sub-criterion that individuals can consider in scooter-sharing use. Some studies in the literature have only focused on the importance of some of these 12 sub-criteria. However, in this study, all 12 sub-criteria are ranked and compared with each other to specify the importance of each sub-criterion compared with other sub-criteria from each stakeholder's viewpoint. Besides, most research has studied user perspectives only. However, in this study, these sub-criteria are compared by four groups of stakeholders. This contributes to knowing the perceptions of different groups of scooter-sharing stakeholders about the importance of one main-criterion/sub-criterion (related to the first research question mentioned in Chapter 1).

One of the substantial purposes of this study is to specify the gap between the point of view of scooter-sharing stakeholders. In order to indicate the difference between the viewpoints of stakeholders, Table 69 suggests the ranking of the main-criteria and sub-criteria corresponding to each of the stakeholders.

It is noteworthy that in the literature, sub-criteria service quality (C2.4), environment-friendly system (C2.5), and user-friendly (C2.6) have not been well examined. Thus, this study also considers these sub-criteria to realize the stakeholders' points of view on them.

Table 69: Ranking of the main-criteria and sub-criteria corresponding to scooter-sharing stakeholders.

Main-criteria	Ranking of main-criteria corresponding with scooter-sharing stakeholders				Sub-criteria	Ranking of sub-criteria corresponding with scooter-sharing stakeholders			
	Government members	Operators	Users	Non-users		Government members	Operators	Users	Non-users
C1	3	-	3	1	C1.1. Travel time	9	8	6	3
					C1.2. Travel distance	11	2	9	4
					C1.3. Departure time	12	10	11	6
					C1.4. Trip purpose	10	4	12	7
C2	1	-	1	2	C2.1. Travel cost	3	7	3	8
					C2.2. Travel comfort	8	12	7	12
					C2.3. Safety	1	3	2	5

Main-criteria	Ranking of main-criteria corresponding with scooter-sharing stakeholders				Sub-criteria	Ranking of sub-criteria corresponding with scooter-sharing stakeholders			
	Government members	Operators	Users	Non-users		Government members	Operators	Users	Non-users
					C2.4. Service quality	7	4	5	9
					C2.5. Environment-friendly system	6	5	8	11
					C2.6. User-friendly	5	6	10	10
C3	2	-	2	3	C3.1. Service availability	4	11	4	2
					C3.2. Vehicle availability and accessibility	2	1	1	1

As presented in Table 69, government members and users agree on the importance of the main-criteria. There are also substantial similarities in stakeholders' beliefs about the importance of the sub-criteria. The importance of vehicle availability and accessibility (C3.2) is stated in the literature (Bai and Jiao, 2020; Jiao and Bai, 2020; Popov and Ravi, 2020). As specified in Table 69, C3.2 is the most important sub-criterion among the 12 sub-criteria in the eyes of operators, users, and non-users. Similarly, government members consider it the second most important sub-criterion. It is interesting to mention that C2.6 is one of the least important sub-criterion from the perspective of users and non-users. Also, C2.5 is not an important sub-criterion from the users' point of view compared to other sub-criteria and is one of the least important sub-criteria for non-users.

Safety is one of the most important sub-criterion from the perspective of government members, operators, and especially users. The importance of this sub-criterion is not surprising since the introduction of the e-scooter-sharing service has created a new risk of injury (Beck et al., 2020). The importance of this criterion has been explained in the literature (Anderson-Hall et al., 2019; Berge, 2019; Clewlow, 2019; James et al., 2019; Haworth and Schramm, 2019; Shaheen and Cohen, 2019; Almannaa et al., 2020; Che et al., 2020; Gössling, 2020; Li et al., 2020; Riggs and Kawashima, 2020; Ma et al., 2021). However, non-users pay less attention to this sub-criterion compared to other stakeholders. This could be because they may not have used the scooter-sharing service. However, they consider it an important sub-criterion (ranking 5), which can even be one reason why non-users do not use the scooter-sharing service.

Interestingly, travel comfort (C2.2) is the least important sub-criterion from the views of operators and non-users. Besides, government members, operators, and users agree that departure time (C1.3) is one of the least important sub-criteria. Also, travel distance (C1.2) is one of the least important sub-criteria from the point of view of government members and users. However, on the other hand, this sub-criteria is one of the most important sub-criteria for operators and non-users.

It is also essential to focus on the important differences in the viewpoints of shareholders. As revealed in Table 69, unlike all stakeholders who perceive service availability (C3.1) as one of the most important sub-criteria, operators consider it one of the least important sub-criteria. On the other hand, despite the belief of government members and users that the trip purpose (C1.4) is one of the least important sub-criterion, operators believe that this sub-criterion plays an important role. In addition, although travel time (C1.1) is one of the most effective sub-criteria for non-users, other stakeholders do not have similar considerations.

Figure 94 and Figure 95 present the weight percentage of the main-criteria and the global weight percentage of the sub-criteria corresponding with the scooter-sharing stakeholders, respectively.

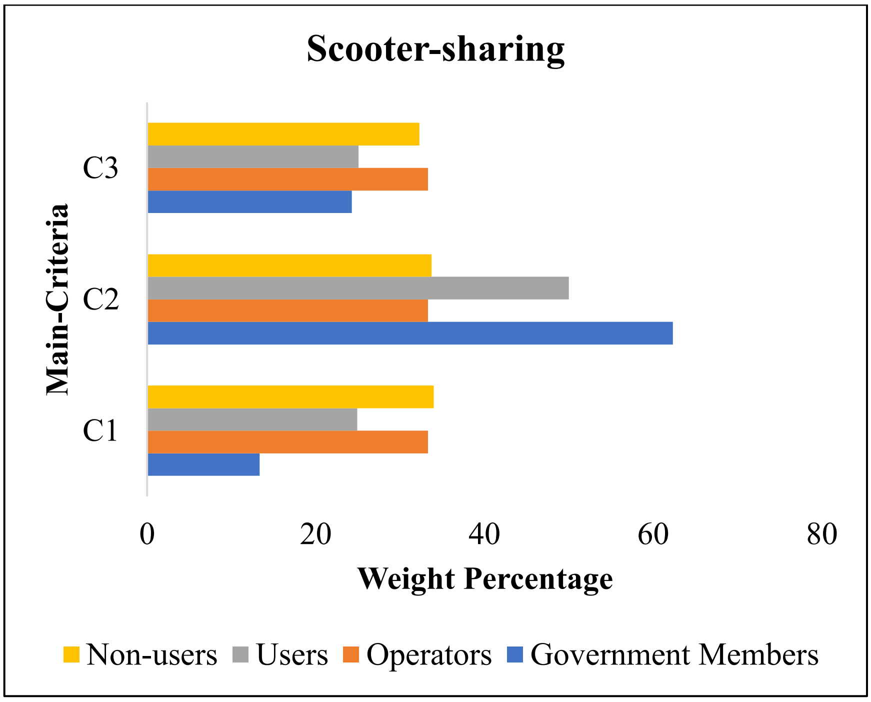

Figure 94: Importance of main-criteria based on different types of stakeholders.

As seen in Figure 94, main-criterion trip-related characteristics (C1) is more than 2.5 times more valuable to operators and non-users than to government members. On the other hand, in the government members' eyes, main-criterion scooter-sharing characteristics (C2) is more than 1.8 times more important than what is mentioned by operators and non-users. Besides, as displayed in Figures 75, 84, and 89, C2 is definitely the most important main-criterion in the eyes of government members and users. For non-users, the most important main-criterion is C1; however, from the perspective of some non-users, C2 is more important than C1.

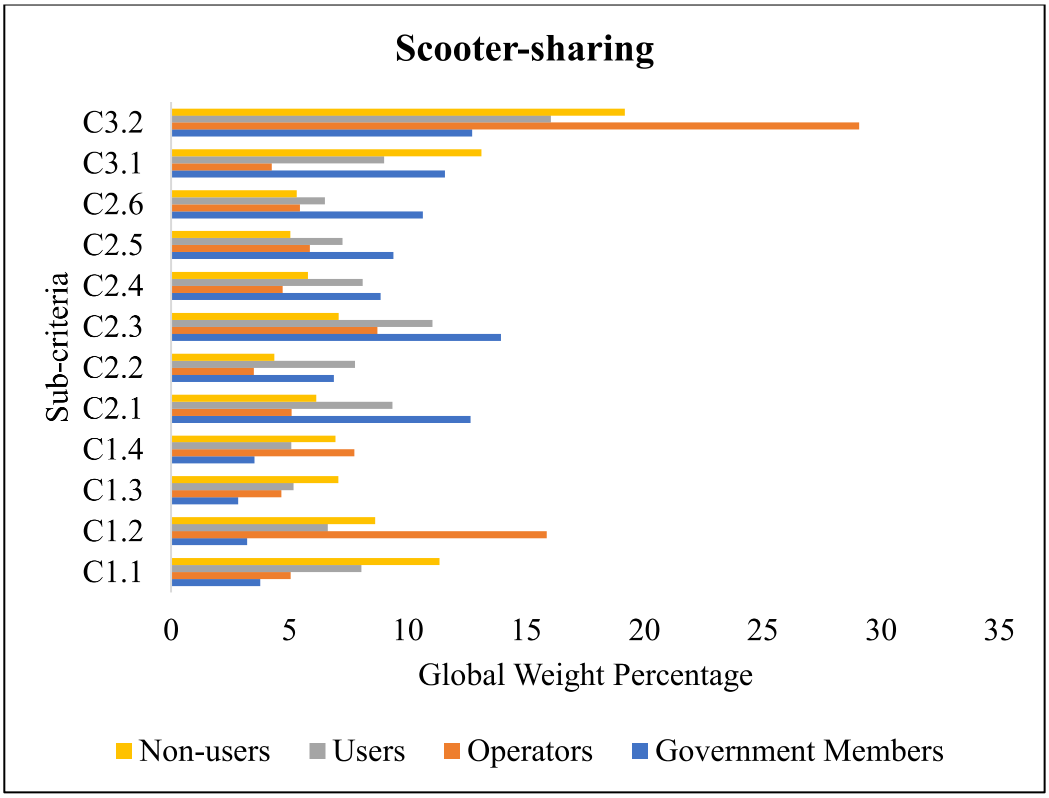

Figure 95: Importance of sub-criteria based on different types of stakeholders.

Based on Figure 95, it can be pointed out that in some cases, the viewpoints of operators on the sub-criteria that individuals consider in scooter-sharing use differ from the perspective of users and non-users. In this regard, it can be stated that operators pay 1.81 and 1.52 times more attention to vehicle availability and accessibility (C3.2) than users and non-users, respectively. On the other hand, users and non-users give 2.12 times and 3.08 times higher values to service availability (C3.1), respectively, than operators. Similarly, users value service quality (C2.4) and travel comfort (C2.2) considerably more than operators. It should also be noted that the C2.2 sub-criterion is 1.78 times more important for users than non-users.

Furthermore, as seen in Figures 76, 82, 87, and 92, safety (C2.3) is definitely the most important sub-criteria from the perspective of operators, users, and non-users. From the point of view of government members, although C2.3 is the most important sub-criterion, some government members believe that the sub-criterion travel cost (C2.1) is more important. Also, C2.1 is the second most important sub-criterion for non-users and definitely for users. However, operators rank it as the fourth most important sub-criterion.

Moreover, as seen in Figure 81, C1.2 is absolutely the most important sub-criterion, and C1.1 is the third most important sub-criterion for operators. Even from the perspective of some operators, sub-criterion C1.3 is more important than sub-criterion C1.1. Also, as seen in Figure 81, C1.2 is absolutely the most important sub-criterion, and C1.1 is the third most important sub-criterion for operators. Even from the perspective of some operators, sub-criterion C1.3 is more important than sub-criterion C1.1. Also, as displayed in Figures 86 and 91, C1.1 is definitely the most important sub-criterion, and C1.2 is certainly the second most important sub-criterion for users and non-users. Therefore, operators should pay more attention to sub-criterion C1.1.

The viewpoints of government members are also different from users and non-users. Users and non-users assign higher importance to sub-criterion travel time (C1.1) than members of government suppose, 2.14 times and 3.01 times more, respectively. Similarly, users and non-users pay remarkably more attention to sub-criteria travel distance (C1.2) and departure time (C1.3) compared to government members. On the other hand, compared to users, government members pay to sub-criteria travel cost (C2.1), safety (C2.3), environment-friendly system (C2.5), and user-friendly (C2.6) 2.06 times, 1.97 times, 1.86 times and two times more attention, respectively. Further, it should be noted that sub-criteria C2.1 and C2.3 are considerably more valuable to users than non-users.

Furthermore, as displayed in Figures 80, 85, and 90, the sub-criterion C3.2 is absolutely more important to operators, users, and non-users than sub-criterion C3.1. However, Figure 77 demonstrates that the superiority of C3.2 over C3.1 has not been well established, and some government members believe sub-criterion C3.1 is more important than C3.2.

6.1.4 Comparing the relative importance of different criteria among the three types of shared mobility services

In this section, the differences in the importance of one main-criterion/sub-criterion across the three types of shared mobility services, including car-sharing, bike-sharing, and scooter-sharing, are examined for each specific type of stakeholder (government members, operators, users, and non-users). This contributes to understanding how one main-criterion/sub-criterion can be of different importance across different shared mobility services (related to the second research question mentioned in Chapter 1). Hence, these differences in the importance of one main-criterion/sub-criterion across the three types of shared mobility services should be considered from each stakeholder's standpoint.

6.1.4.1 From the perspective of government members

The importance (weight percentage) of the main-criteria and sub-criterion based on different shared mobility services from the views of government members is displayed in Figure 96 and Figure 97, respectively. It should be noted that the government members who responded to the car-sharing survey may be different from the government members who responded to the bike-sharing or scooter-sharing survey.

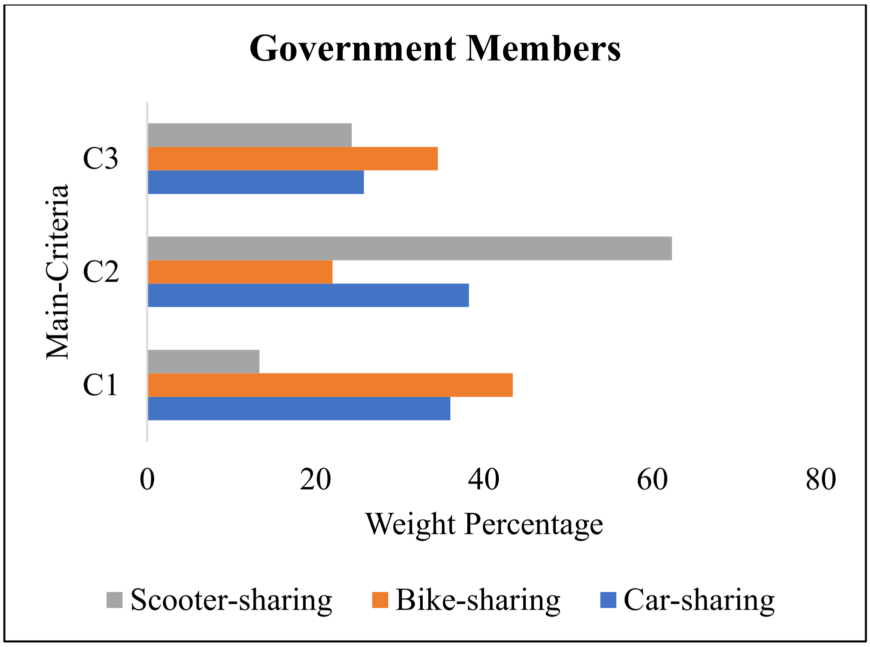

Figure 96: Importance of main-criteria based on different shared mobility services from the government members' views.

As displayed in Figure 96, government members see the main-criterion scooter-sharing characteristics (C2) in scooter-sharing (respondents of the scooter-sharing survey) service as the most important, and the main-criterion trip-related characteristics (C1) in scooter-sharing received (by the respondents of the scooter-sharing survey) the lowest importance. Besides, the importance of the main-criterion C2 in the scooter-sharing service (received by the respondents of the scooter-sharing survey) is approximately 2.83 times greater than its importance in the bike-sharing service (received by the respondents of the bike-sharing survey). On the other hand, the importance of the main-criterion C1 in bike-sharing (received by the respondents of the bike-sharing survey) is almost 3.26 times more than its importance in scooter-sharing (received by the respondents of the scooter-sharing survey).

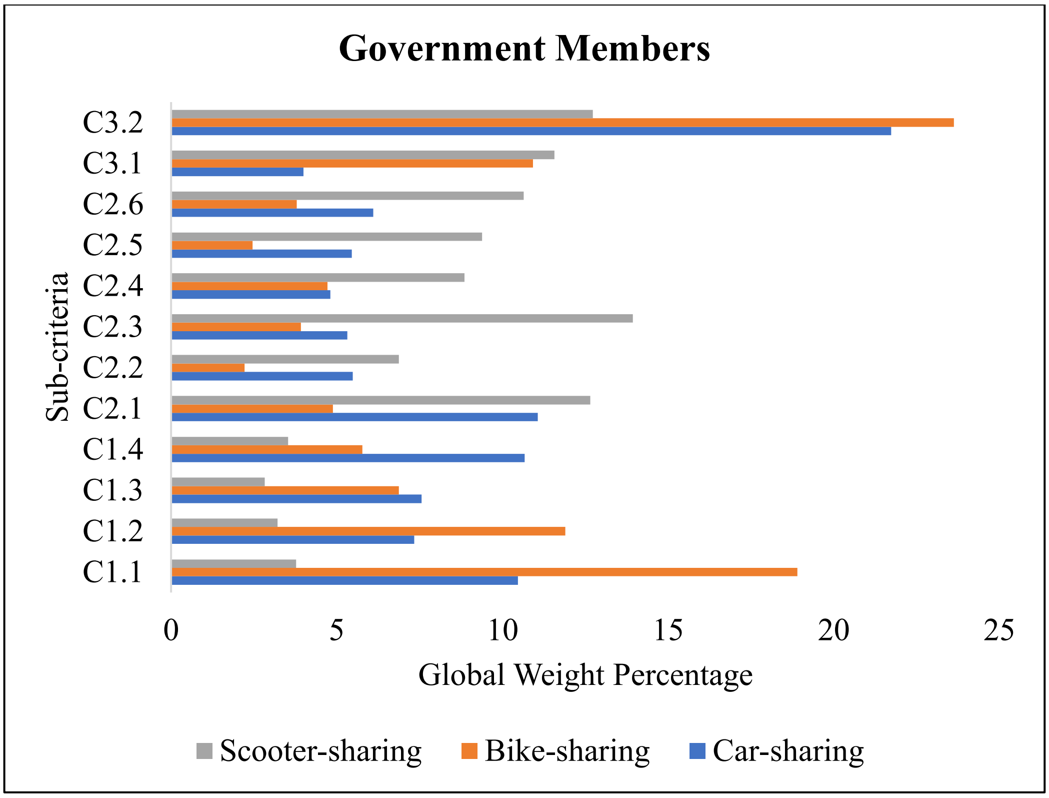

Figure 97: Importance of sub-criteria based on different shared mobility services from the government members' views.

Figure 97 displays that from the government members' view, among the type of shared mobility services, the importance of the sub-criterion vehicle availability and accessibility (C3.2) in bike-sharing (received by the respondents of the bike-sharing survey) is the highest among all sub-criteria. It is 10.64 times more important than the sub-criterion travel comfort (C2.2) in bike-sharing (the least important sub-criterion) (received by the respondents of the bike-sharing survey). When it comes to sub-criterion travel time (C1.1), its importance in bike-sharing (received by the respondents of the bike-sharing survey) is 5.02 times more than that of in scooter-sharing (received by the respondents of the scooter-sharing survey). Similarly, sub-criterion travel distance (C1.2) in bike-sharing (received by the respondents of the bike-sharing survey) is 3.71 times more important than the one in scooter-sharing (received by the respondents of the scooter-sharing survey). On the other hand, the importance of sub-criteria C2.2, safety (C2.3), and environment-friendly system (C2.5) in scooter-sharing (received by the respondents of the scooter-sharing survey) are 3.10, 3.56, and 3.82 times more than their importance in bike-sharing (received by the respondents of the bike-sharing survey), respectively. It is also worth noting that the importance of departure time (C1.4) in car-sharing (received by the respondents of the car-sharing survey) is 3.02 times greater than its importance in scooter-sharing (received by the respondents of the scooter-sharing survey).

6.1.4.2 From the perspective of operators

The importance (weight percentage) of the main-criteria and sub-criterion based on different shared mobility services from the views of different operators is displayed in Figure 98 and

Figure 99, respectively. It is important to note that the operators of each shared mobility service are different from the operators of other shared mobility services.

Regarding figure 98, it is apparent that the importance of the main-criterion C1 in scooter-sharing (received by scooter-sharing operators) is about 3.45 times more than its importance in bike-sharing and car-sharing (received by bike-sharing and car-sharing operators).

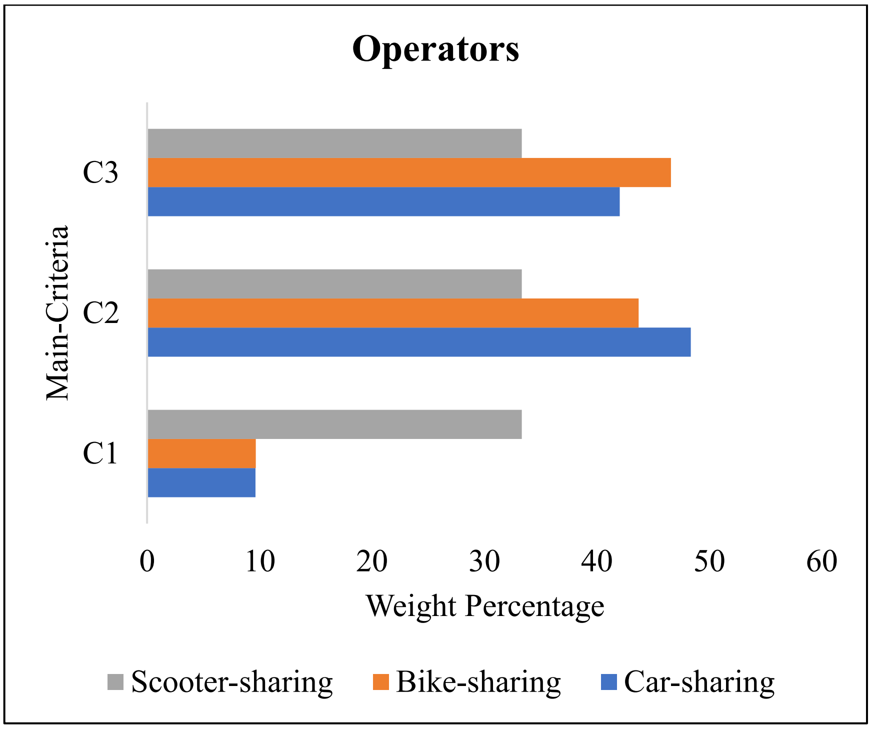

Figure 98: Importance of main-criteria based on different shared mobility services from the operators' views.

Concerning Figure 99, it is noticeable that the importance of the sub-criterion vehicle availability and accessibility (C3.2) in scooter-sharing (received by scooter-sharing operators) is the most among all sub-criteria and types of shared mobility services. It is roughly 24.85 times more than the importance of the sub-criterion trip purpose (C1.4) in bike-sharing (received by bike-sharing operators), which is of the least importance. Also, the importance of sub-criterion C1.4 in scooter-sharing (received by scooter-sharing operators) is about 6.62 times more than its importance in bike-sharing (received by bike-sharing operators). On the other hand, the sub-criterion service availability (C3.1.) in bike-sharing received (by bike-sharing operators) 6.55 times more attention than C3.1 in scooter-sharing (received by scooter-sharing operators). In addition, it should be noted that the sub-criteria travel distance (C1.2) and departure time (C1.3) in scooter-sharing (in the eyes of scooter-sharing operators) are about 7.28 and 3.88 times more important than in car-sharing (in the eyes of car-sharing operators), respectively.

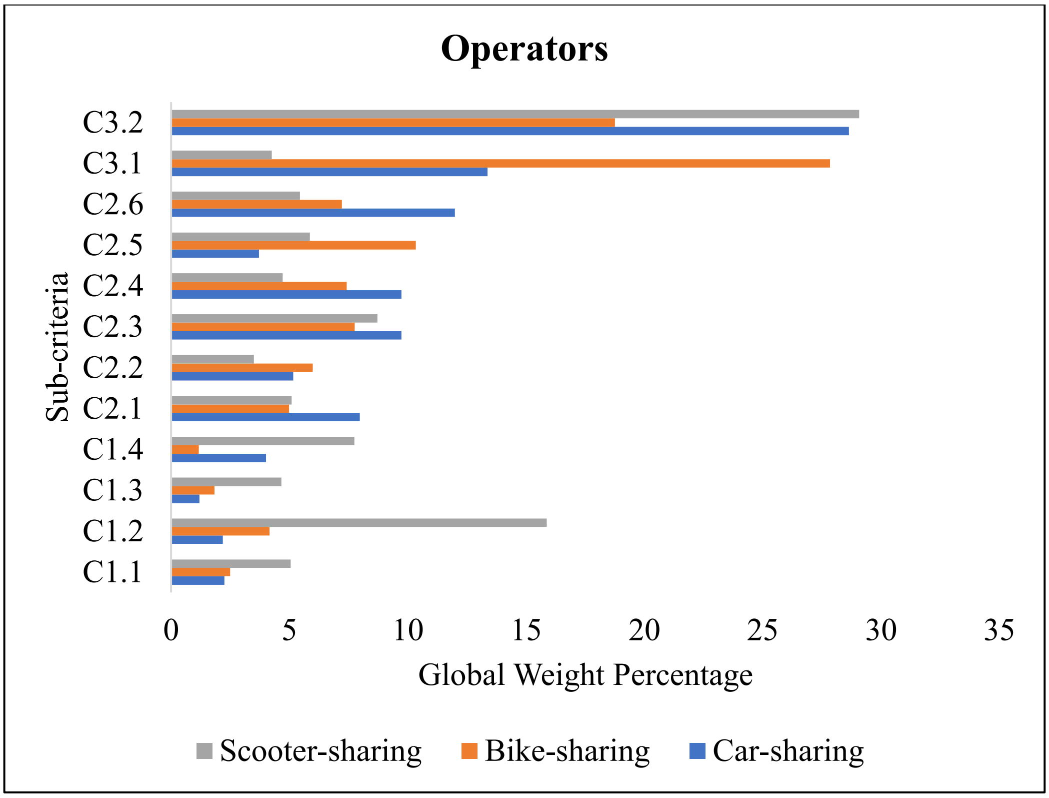

Figure 99: Importance of sub-criteria based on different shared mobility services from the operators' views.

6.1.4.3 From the perspective of users

The importance (weight percentage) of the main-criteria and sub-criterion according to different shared mobility services from the views of their users is displayed in Figure 100 and Figure 101, respectively. It is important to note that users of each shared mobility service can be different from users of other shared mobility services.

In relation to Figure 100, it is noteworthy that among the types of shared mobility service and all the main-criteria, the importance of the main-criterion scooter-sharing characteristics (C2) in scooter-sharing (from the scooter-sharing users' view) (the most important sub-criterion), is 2.24 times more than main-criterion trip-related characteristics (C1) in bike-sharing (from the bike-sharing users' perspective) (the least important sub-criterion).

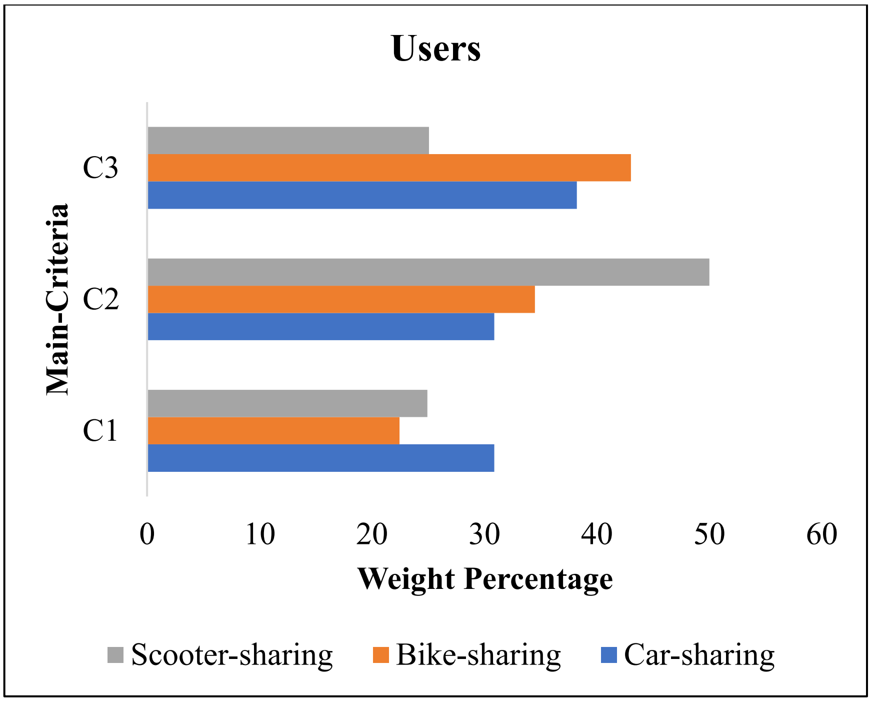

Figure 100: Importance of main-criteria based on different shared mobility services from the users' views.

Given Figure 101, from the perspective of users, it is clear that, in comparison with other sub-criteria in all shared mobility services, the sub-criterion vehicle availability and accessibility (C3.2) always receive the greatest value, regardless of which shared mobility service. Particularly, it attracts the greatest attention in the bike-sharing service (from the bike-sharing users' perspective). Besides, the sub-criterion C3.2 in bike-sharing received (by bike-sharing users) received 6.31 times more attention than the sub-criterion trip purpose (C1.4) in bike-sharing (by bike-sharing users), which is the least important sub-criterion. Moreover, the importance of the sub-criterion safety (C2.3) in scooter-sharing (from the scooter-sharing users' view) is 1.78 and 2 times higher than that of sub-criterion C2.3 in car-sharing and bike-sharing (from the car-sharing and bike-sharing users' views). This may indicate that scooter-sharing users are more concerned about the safety issues of scooter-sharing services.

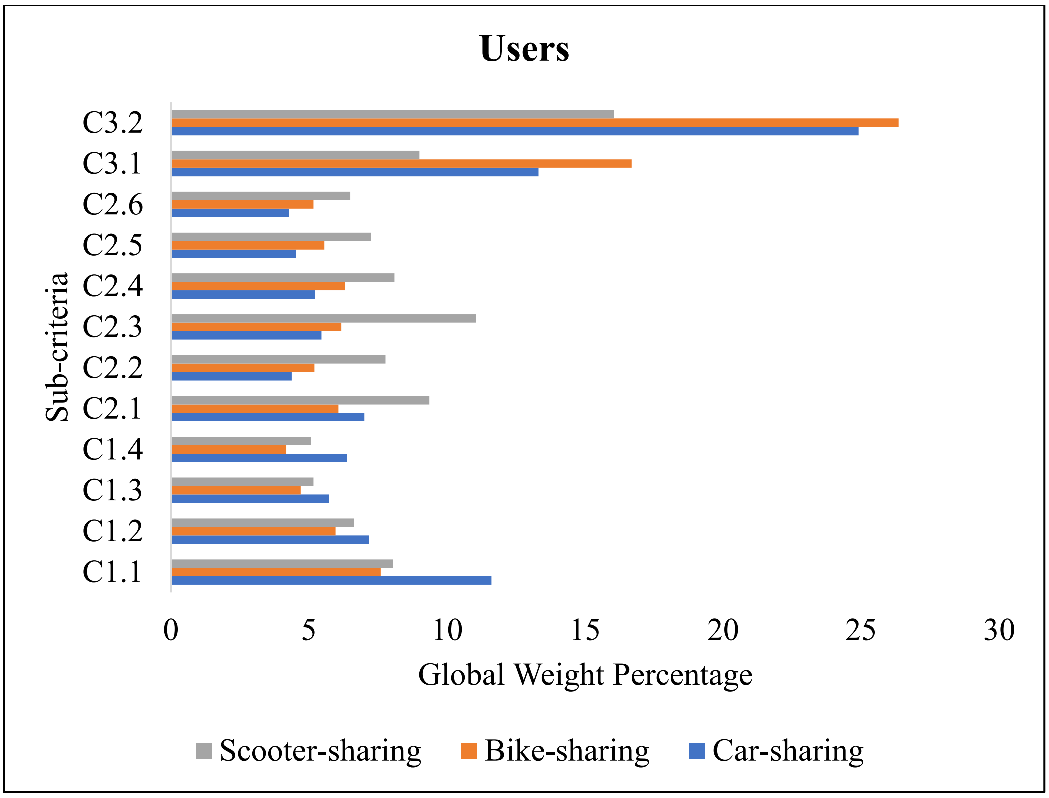

Figure 101: Importance of sub-criteria based on different shared mobility services from the users' views.

6.1.4.4 From the perspective of non-users

The importance (weight percentage) of the main-criteria and sub-criterion according to different shared mobility services from the views of their non-users is displayed in Figure 102 and Figure 103, respectively. It is important to note that non-users of each shared mobility service can be different from non-users of other shared mobility services.

According to Figure 102, it is remarkable that among the types of shared mobility services and all the main-criteria, the main-criterion availability and accessibility (C3) in bike-sharing (from the non-users of the bike-sharing service view) is the most important. It is slightly more important than the car-sharing characteristics (C2) in car-sharing (from the non-users of car-sharing services view).

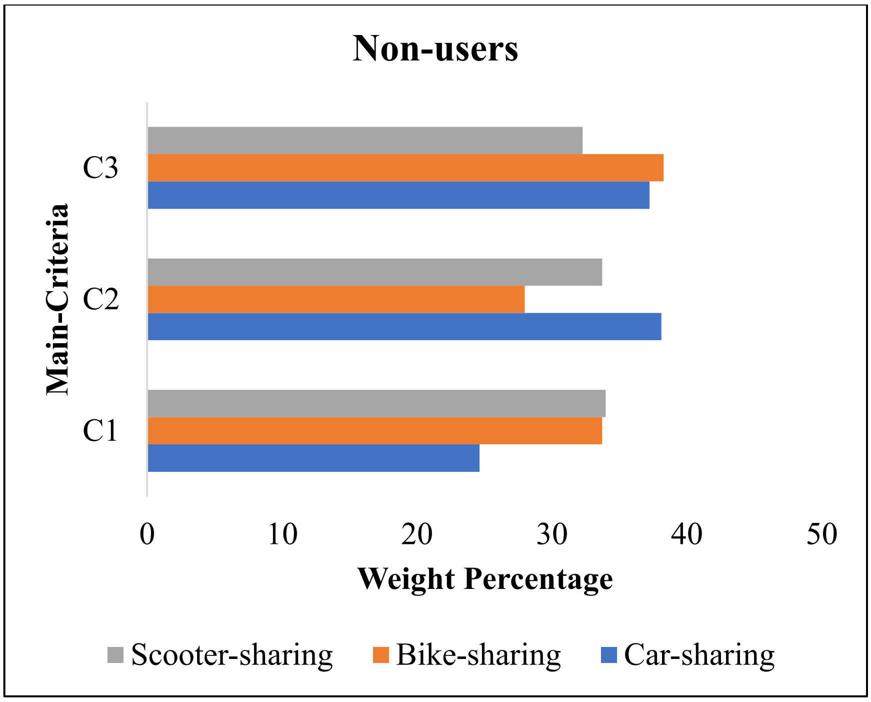

Figure 102: Importance of main-criteria based on different shared mobility services from the non-users' views.

According to Figure 103, it is evident that, from the non-users' point of view, compared to other sub-criteria in all shared mobility services, the sub-criterion vehicle availability and accessibility (C3.2) always receives the highest importance no matter in which shared mobility service. In particular, it received (by the car-sharing non-users view) the greatest attention in the car-sharing service. The sub-criterion C3.2 in car-sharing (from the car-sharing non-users view) is 5.95 times more important than sub-criterion user-friendly (C2.6) in bike-sharing (from the bike-sharing non-users perspective).

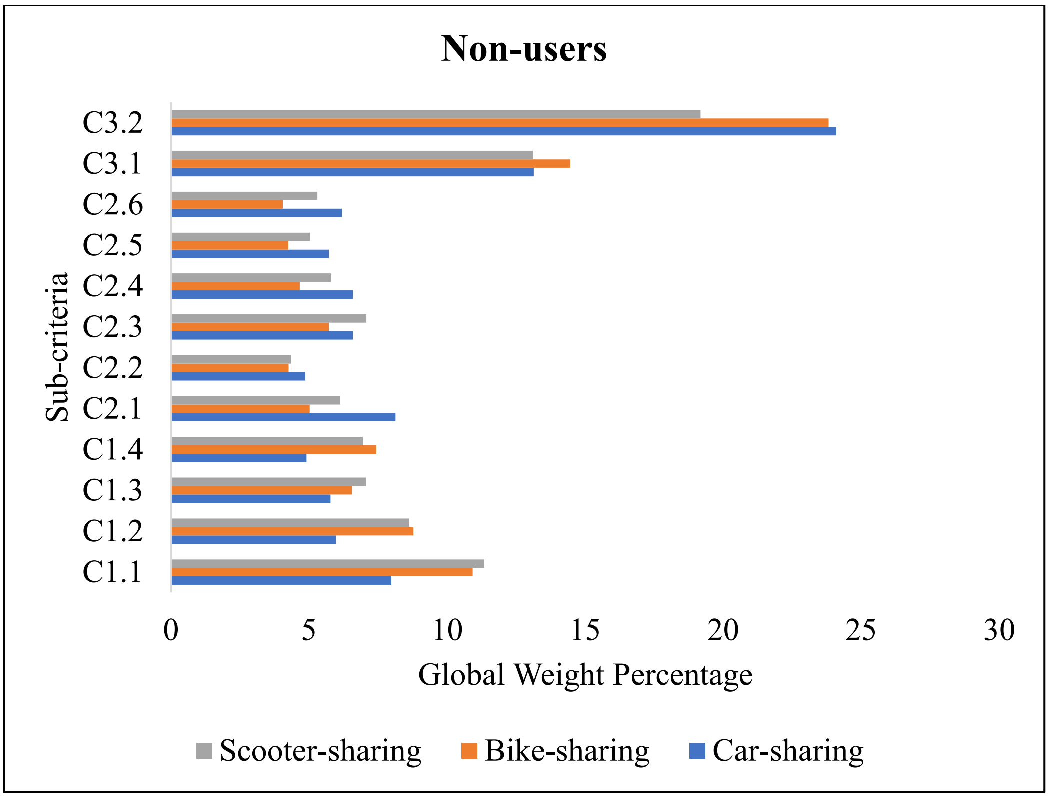

Figure 103: Importance of sub-criteria based on different shared mobility services from the non-users' views.

6.1.4.5 Summary of comparison between the views of the four stakeholders related to different services

This part summarizes the comparisons of the views of the four stakeholders on the main-criteria/sub-criteria related to different services. Concerning car-sharing services, it should be noticed that Figure 96 indicates that from the standpoints of government members (respondents of the car-sharing survey), users, and non-users of car-sharing services, there is no considerable difference in the importance of the main-criteria. However, as indicated in Figure 98, car-sharing operators believe that the main-criteria car-sharing characteristics (C2) and availability and accessibility (C3) receive 5.02 and 4.36 times more attention than the main-criterion trip-related characteristics (C1). Also, as shown in figure 97, government members (respondents of the car-sharing survey) give at least two times more attention to the sub-criteria trip purpose (C1.4), travel cost (C2.1), and vehicle availability and accessibility (C3.2) than the sub-criteria safety (C2.3), service quality (C2.4), and service availability (C.3.1). In addition, Figure 99 indicates that car-sharing operators believe that sub-criteria user-friendly (C2.6), service availability (C3.1), and vehicle availability and accessibility (C3.2) are at least two times more important than the sub-criteria travel time (C1.1), travel distance (C1.2), departure time (C1.3), trip purpose (C1.4), travel comfort (C2.2), and environment-friendly system (C2.5). In addition, Figure 101 illustrates that from the car-sharing users' view, sub-criteria travel time (C1.1), service availability (C3.1), and vehicle availability and accessibility (C3.2) are at least twice as important as sub-criteria departure time (C1.3), travel comfort (C2.2), safety (C2.3), service quality (C2..4), environment-friendly system (C2.5), and user-friendly (C2.6). Additionally, Figure 103 indicates that from the standpoint of non-users of car-sharing, the sub-criteria service availability (C3.1) and vehicle availability and accessibility (C3.2) receive at least two times more attention than sub-criteria travel distance (C1.2), departure time (C1.3), trip purpose (C1.4), travel comfort (C2.2), environment-friendly system (C2.5), and user-friendly (C2.6).

Furthermore, for bike-sharing services, it is important to note that in the eyes of government members (respondents of the bike-sharing survey), the importance of main-criterion trip-related characteristics (C1) is about 1.98 times greater than that of main-criterion car-sharing characteristics (C2), as seen in Figure 96. However, Figure 98 displays that from the point of view of bike-sharing operators, the importance of main-criterion availability and accessibility (C3) and car-sharing characteristics (C2) is 4.82 and 4.52 times more than that of main-criterion trip-related characteristics (C1). Also, Figure 100 suggests that for bike-sharing users, the importance of main-criterion availability and accessibility (C3) is 1.92 times more than main-criterion trip-related characteristics (C1). On the other hand, Figure 102 delivers that for non-users of bike-sharing services, there is not much difference in the importance of the main-criteria. Also, as seen in Figure 97, government members pay at least two times more attention to sub-criteria travel time (C1.1), travel distance (C1.2), service availability (C3.1), and vehicle availability and accessibility (C3.2) than to the sub-criteria travel cost (C2.1), travel comfort (C2.2), safety (C2.3), service quality (C2.4), environment-friendly system (C2.5), and user-friendly (C2.6). Also, as revealed in figure 99, in the eyes of bike-sharing operators, sub-criteria environment-friendly system (C2.5), service availability (C3.1), and vehicle availability and accessibility (C3.2) are at least two times more important than the sub-criteria travel time (C1.1), travel distance (C1.2), departure time (C1.3), trip purpose (C1.4), and travel cost (C2.1). Also, as seen in Figure 101, bike-sharing users believe that sub-criteria service availability (C3.1) and vehicle availability and accessibility (C3.2) are at least two times more important than other sub-criteria. Besides, as shown in Figure 103, bike-sharing non-users pay at least two times more attention to the sub-criteria travel time (C1.1), service availability (C3.1), and vehicle availability and accessibility (C3.2) than the sub-criteria travel cost (C2.1), travel comfort (C2.2), service quality (C2.4), environment-friendly system (C2.5), and user-friendly (C2.6).

Moreover, according to the scooter-sharing services, Figure 96 indicates that government members (respondents of the scooter-sharing survey) pay 4.67 and 2.57 times more attention to the main-criterion car-sharing characteristics (C2) than the main-criteria trip-related characteristics (C1) and availability and accessibility (C3), respectively. Similarly, as shown in Figure 100, scooter-sharing users give almost twice as much importance to the main-criterion car-sharing characteristics (C2) as the main-criteria trip-related characteristics (C1) and availability and accessibility (C3). On the other hand, as demonstrated in Figures 98 and 102, from the point of view of both operators and non-users of scooter-sharing services, the importance of the main-criteria is similar. Besides, as displayed in Figure 97, government members place twice more value on sub-criteria travel cost (C2.1), safety (C2.3), user-friendly (C2.6), service availability (C3.1), and vehicle availability and accessibility (C3.2) than on sub-criteria travel time (C1.1), travel distance (C1.2), departure time (C1.3), and trip purpose (C1.4). Further, Figure 99 suggests that from the scooter-sharing operators' perspective, sub-criteria travel distance (C1.2) and vehicle availability and accessibility (C3.2) are at least two times more important than the sub-criteria travel time (C1.1), departure time (C1.3), trip purpose (C1.4), travel cost (C2.1), travel comfort (C2.2), service quality (C2.4), environment-friendly system (C2.5), user-friendly (C2.6), and service availability (C3.1). Moreover, Figure 101 reveals that in the eyes of scooter-sharing users, the sub-criteria safety (C2.3) and vehicle availability and accessibility (C3.2) receive at least twice more attention than sub-criteria departure time (C1.3) and trip purpose (C1.4). In addition, Figure 103 illustrates that from the non-users of scooter-sharing perspective, sub-criteria travel time (C1.1), service availability (C3.1), and vehicle availability and accessibility (C3.2) have at least two times more value than sub-criteria travel comfort (C2.2), environment-friendly system (C2.5), and user-friendly (C2.6).

Finally, from the point of view of each stakeholder (regardless of the type of shared mobility service), it is worth summarizing which sub-criteria are at least twice as important as the other sub-criteria (if any). Figure 99 indicates that operators of all shared mobility services believe that the sub-criterion vehicle availability and accessibility (C3.2) is at least two times more important than the sub-criteria travel time (C1.1), departure time (C1.3), and trip purpose (C1.4). In addition, Figure 101 illustrates that from the users' view of all shared mobility services, the sub-criteria vehicle availability and accessibility (C3.2) is at least twice as important as the sub-criteria departure time (C1.3). Therefore, operators and users of all shared mobility services agree that the sub-criterion vehicle availability and accessibility (C3.2) is at least twice as important as the sub-criterion departure time (C1.3). Additionally, as shown in Figure 103 indicates that from the standpoint of non-users of all shared mobility services, the sub-criteria service availability (C3.1) and vehicle availability and accessibility (C3.2) receive at least two times more attention than sub-criteria travel comfort (C2.2), environment-friendly system (C2.5), and user-friendly (C2.6).

6.2 Results of the Analysis for Shared Mobility Services (as a whole, not for a specific shared mobility service)

This section aims to determine the perception of four important shared mobility services (as a whole, not for a specific shared mobility service) by different stakeholders (government members, shared mobility operators, shared mobility services users, and non-users). In particular, it is important to determine which factors are the most important criteria that drive government members' choice in deciding on a new shared mobility system to be set up in Turin, Italy. Also, it is important to know which factors are the most important criteria that can drive operators' choices in planning to run their shared mobility system in a city. Further, which factors are the most important criteria that users and non-users could consider when selecting shared mobility to make a trip should be understood. It is important to note that in this section, only the criteria that can be quantified in this study are considered.

Therefore, this section helps to know how different stakeholders score the importance of the comparison factors related to themselves (the third research question mentioned in Chapter 1). Also, it contributes to understanding which shared mobility system is most appropriate to implement according to users' and non-users' perceptions (fourth research question mentioned in Chapter 1). Besides, the same criteria are compared by both users and non-users. Therefore, the importance of these criteria can be compared from the standpoint of both users and non-users to distinguish their perspectives on each criterion. This help to know the perceptions of different groups about the importance of one criterion (related to the first research question mentioned in Chapter 1). In addition, scenarios are presented from the views of users and non-users groups to determine how to increase the use of bike-sharing and scooter-sharing services compared to car-sharing services from users' and non-users' perspectives (related to the fifth research question mentioned in Chapter 1).

In this section, four different parts are presented to analyze the views of each stakeholder (government members, operators, users, and non-users) about shared mobility services (as a whole, not for a specific shared mobility service). Also, subsection 6.2.5 explains the similarities and differences between the four types of stakeholders of shared mobility services (as a whole, not for a specific shared mobility service). Perception analysis (mentioned in section 3 of Chapter 3) (for users' and non-users' perspectives) and sensitivity analysis (for users' and non-users' views) on the former results are finally provided in subsections 6.2.6 and 6.2.7, respectively.

6.2.1 Group weight of government members (shared mobility services as a whole, not for a specific shared mobility service)

The optimal government members' group weights of criteria for shared mobility services are listed in Table 70.

Table 70: Government members' group weights of criteria for shared mobility services.

Criteria	Weights	Ranking of criteria
Cg1. Average number of trips per vehicle per day	0.1488	4
Cg2. Greenhouse gases (GHGs)	0.1528	3
Cg3. Parking issues	0.1372	5
Cg4. Emission of pollutants	0.1996	2
Cg5. Integration of the shared mobility service with public transport	0.2505	1
Cg6. Vehicle fee	0.1111	6

As stated in Table 70, the integration of the shared mobility service with public transport (Cg5) is the most important criterion among the six identified criteria that drives government members' choice in deciding on a new shared mobility system to be set up in Turin, Italy, with a weight w^{agg} = 0.2505. It can be explained that criterion Cg5 represents the complementarity of a shared vehicle for public transport, the integration of which can increase urban mobility. The second most important criterion is the emission of pollutants (Cg4) which is the amount of greenhouse gas emissions by a shared mobility system. The importance of this criterion is about 80% of the importance of the most important criterion, which is a sign of the importance of this criterion for the members of the government. Similarly, the greenhouse gas (GHGs) (Cg2) criterion is remarkable for government members, the third most important criterion. It is not surprising since this criterion shows the pollutants a shared vehicle emits, and governmental members value sustainability and strive for fewer emissions.

The fourth most important criterion is the average number of trips per vehicle per day (Cg1), which provides insight into the efficiency of the vehicle that shows service efficiency. The criterion parking issues (Cg3) is illegal parking of shared vehicles, such as parking in inappropriate places, which is the fifth most important criterion in the eyes of government members. Finally, the least important criterion is the vehicle fee (Cg6), which is the fee that a shared mobility operator may pay to the municipality. For example, car-sharing operators may pay a fee to the municipality that allows their shared cars to go to city centers or places where traffic is restricted. As presented in Table 70, criterion Cg5 is 2.25 times more important than criterion Cg6.

Figure 104 reveals the credal ranking of the criteria from the government members' view (for shared mobility services) and the assigned CL. The definition of CL is given in section 3.2.7.6.4 of Chapter 3.

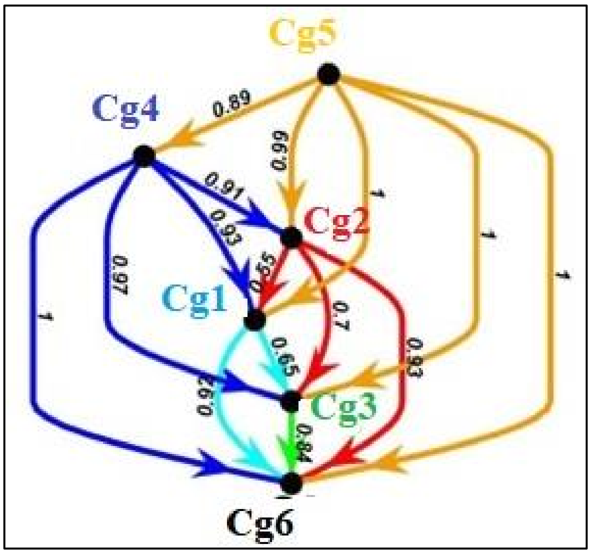

Figure 104: Credal ranking of criteria from government members' view for shared mobility services.

Figure 104 implies that the integration of the shared mobility service with public transport (Cg5) is definitely the most important criterion. As mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50, and the CL is above 80, it can be noted that one criterion is definitely more important than another. Besides, as mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50 and the CL is around 60 to 80, it can be pointed out that one criterion is more important than the other. Hence, it can be mentioned that Cg1 is more important than Cg3 (CL=0.65). Similarly, Cg2 is more important than Cg3 (CL=0.70). However, a confidence level of 0.55 between Cg2 and Cg1 indicates that some government members prefer Cg1 to Cg2. This is because when the threshold value is 50, and the CL is 50 (equal to the threshold value) or slightly higher (from 50 to less than 60), the superiority of one criterion over another is not well established.

In summary, to better understand the standpoint of government members on the impact of factors on their decision to set up a new shared mobility service in Turin, Italy, the weight of the three most important criteria, which are the integration of the shared mobility service with public transport (Cg5), emission of pollutants (Cg4), and greenhouse gases (GHGs) (Cg2), respectively, and the weight of the least important criterion, which is the vehicle fee (Cg6), are offered in Figure 105.

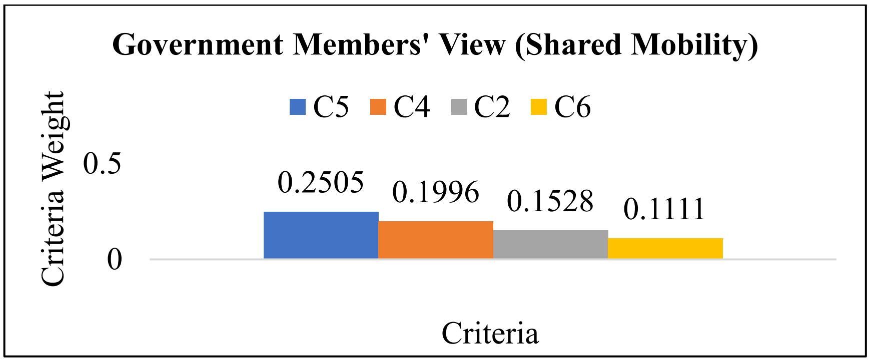

Figure 105: The weight of the least important criterion and the three most important criteria (from the perspective of government members for shared mobility choice).

6.2.2 Group weight of operators of shared mobility services (as a whole, not for a specific shared mobility service)

The optimal operators' group weights of the criteria for shared mobility services are mentioned in Table 71.

Table 71: Operators' group weights of the criteria for shared mobility services.

Criteria	Weights	Ranking of criteria
Co1. Vehicle utilization rate	0.2916	1
Co2. Usage fees	0.2756	2
Co3. Average number of trips per vehicle per day	0.2606	3
Co4. Operational speed	0.0890	4
Co5. The life span of the vehicle	0.0832	5

Table 71 indicates that vehicle utilization rate (Co1) with a weight w^{agg} = 0.2916 is the most important criterion among the five identified criteria that can drive operators' choice in planning to run their shared mobility system in a city. Average usage rate (%) means the total usage time of shared vehicles per day divided by their potential usage time per day in 24 hours. This is not surprising because the vehicle utilization rate is related to the efficiency of their services. Also, the usage fee (Co2) is the operators' second most important criterion. This could be because it affects their earnings. In this analysis, operators were supposed to be free to set the price of their services. Besides, the average number of trips per vehicle per day (Co3) is the third most important criterion for operators that may be because it gives insight into the vehicle's efficiency showing the service's efficiency. One of the criteria that received less importance from operators (the fourth most important criterion) is the operational speed (Co4), which is the average velocity that a shared mobility system overpasses. Also, the criterion life span of the vehicle (Co5) is the least important criterion for operators. The system lifespan can be measured in terms of years and is indicated by the lifespan of vehicles. Moreover, as presented in Table 71, the criterion Co1 is 3.5 times more important than the criterion Co5.

Figure 106 displays the credal ranking of the criteria from the operators' point of view (for shared mobility services) and the assigned CL.

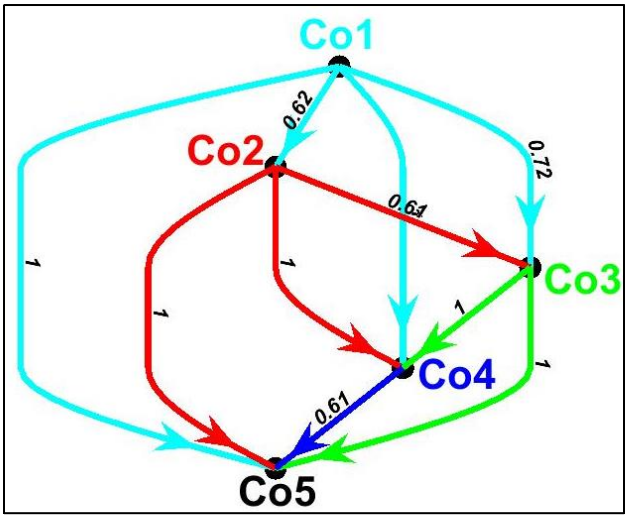

Figure 106: Credal ranking of criteria from operators' view for shared mobility services.

Figure 106 also suggests that the criterion vehicle utilization rate (Co1) is more important than the criteria usage fee (Co2) and the average number of trips per vehicle per day (Co3) and is certainly more important than the criteria operational speed (Co4) and the life span of the vehicle (Co5). As mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50 and the CL is around 60 or 80, it can be pointed out that one criterion is more important than the other. Also, when the threshold value is 50 and the CL is above 80, it can be noted that one criterion is certainly more important than another.

In summary, to better understand the standpoint of operators on the effect of factors that can drive operator's choice in planning to run their shared mobility system in a city, the weight of the three most important criteria, which are vehicle utilization rate (Co1), usage fees (Co2), and the average number of trips per vehicle per day (Co3), respectively, and the weight of the least important criterion, which is the life span of the vehicle (Co5), are presented in Figure 107.

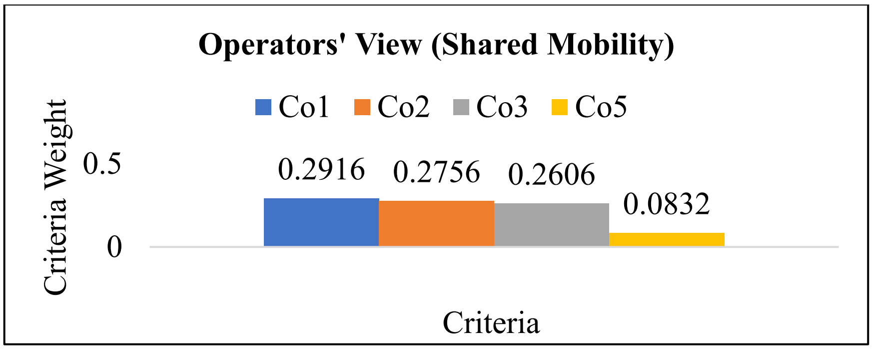

Figure 107: The weight of the least important criterion and the three most important criteria (from the perspective of shared mobility operators).

6.2.3 Group weight of users of shared mobility services (as a whole, not for a specific shared mobility service)

The optimal users' group weights of the criteria for shared mobility services are listed in Table 72.

Table 72: Users' group weights of the criteria for shared mobility services.

Criteria	Weights	Ranking of criteria
Cp1. Traveler safety	0.1781	1
Cp2. Operational speed	0.1229	5
Cp3. Accessibility	0.1385	3
Cp4. User-friendliness	0.1171	6
Cp5. Image	0.0694	8
Cp6. Comfort	0.1260	4
Cp7. Cost	0.1437	2
Cp8. Possibility of carrying items	0.1042	7

Table 72 indicates that traveler safety (Cp1) is the most important criterion among the eight identified criteria that users could consider when selecting shared mobility to make a trip, with a weight w^{agg}= 0.1781. It is not surprising since criterion Cp1 is the level of safety of individuals during the trip, such as the rate of accidents, harassment, assault, and theft. The second most important criterion for users is cost (Cp7), which is the expenses for shared mobility usage. The third most important criterion is accessibility (Cp3), which is the ease of access, the availability of a shared vehicle, and proximity to the location of the parked shared vehicle. Notably, these three criteria are related to the services' operations, which are at least partially under the operator's control. The criterion comfort (Cp6), including the vehicle characteristics that make people feel comfortable during the trip, and the criterion operational speed (Cp2), which is the average velocity a shared mobility system overpasses, are the fourth and fifth most important criteria, respectively. The operational speed is surprisingly less important than all previous criteria. This interesting result questions the standard approach in modeling modal choices whenever such services are considered since one of the key exogenous variables is usually the travel time.

The sixth most important criterion for users is user-friendliness (Cp4), which means being easy for beginners to learn and use and providing travel information in the app. Also, from the users' point of view, the seventh most important criterion is the possibility of carrying items (Cp8), which means carrying luggage or bags or shopping items in a shared vehicle. For instance, people can carry their luggage by shared car, but not by scooter-sharing. The image (Cp5) is the least important criterion for users, which is the image of a shared mobility system in the eyes of the person. Also, Table 72 shows that criterion Cp1 is about 2.57 times more important than criterion Cp5.

Furthermore, Figure 108 demonstrates the credal ranking of the criteria from the users' point of view (for shared mobility services) and the assigned CL. It establishes that Cp1 is certainly the most important criterion. As mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50 and the CL is above 80, it can be stated that one criterion is definitely more important than another. It can be seen that the difference in importance among different criteria is almost always confirmed, with the partial exception of cost versus accessibility, comfort versus speed, and speed versus user friendliness for shared mobility users.

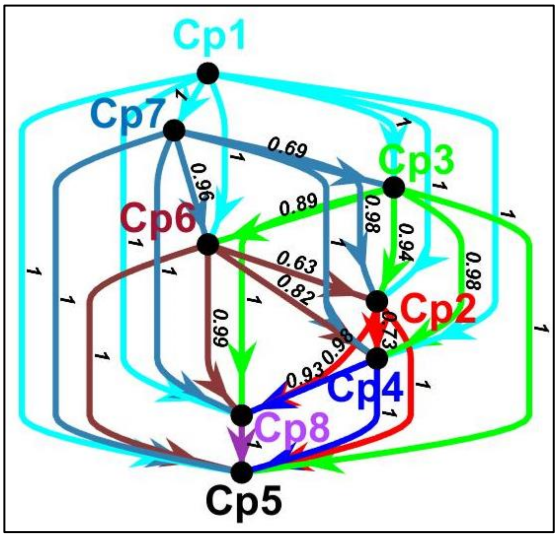

Figure 108: Credal ranking of criteria from users' view for shared mobility services.

In summary, to better understand users' viewpoint on the impact of factors on their shared mobility use, the weight of the three most important criteria, which are traveler safety (Cp1), cost (Cp7), and accessibility (Cp3), respectively, and the weight of the least important criterion, which is the image (Cp5), is demonstrated in Figure 109.

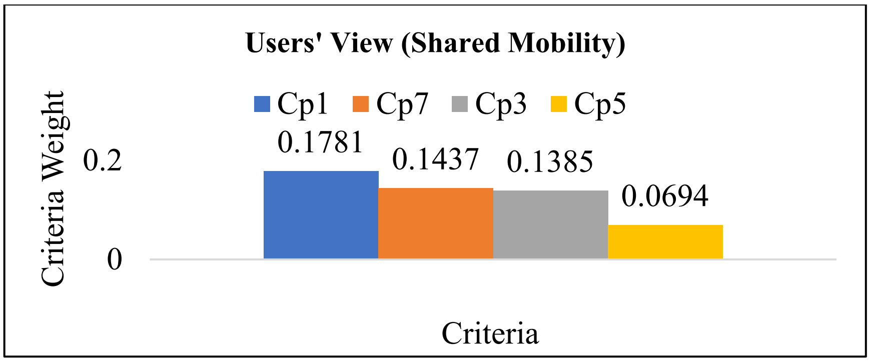

Figure 109: The weight of the least important criterion and the three most important criteria (from users' perspective of shared mobility services).

6.2.4 Group weight of non-users of shared mobility services (as a whole, not for a specific shared mobility service)

The optimal non-users' group weights of the criteria for shared mobility services are determined in Table 73.

Table 73: Non-users' group weights of the criteria for shared mobility services.

Criteria	Weights	Ranking of criteria
Cp1. Traveler safety	0.1802	1
Cp2. Operational speed	0.1205	5
Cp3. Accessibility	0.1303	3
Cp4. User-friendliness	0.1267	4
Cp5. Image	0.0728	8
Cp6. Comfort	0.1179	6
Cp7. Cost	0.1433	2
Cp8. Possibility of carrying items	0.1083	7

Turning the attention to non-users, Table 73 shows that the three most important criteria are still traveler safety, cost, and accessibility. However, user-friendliness is now coming up to the fourth position, which underlines the importance of such a factor to increase the penetration of shared mobility services and, at the same time, identifies the most important barrier to achieving this goal. Conversely, the importance of comfort for non-user is slightly diminished compared to other criteria.

Figure 110 establishes the credal ranking of the criteria from the no'-users' perspective (for shared mobility services) and the assigned CL. It determines that Cp1 is definitely the most important criterion. As mentioned in section 3.2.7.6.4 of Chapter 3, when the threshold value is 50 and the CL is above 80, it can be mentioned that one criterion is absolutely more important than another. It can be stated that the difference in importance between the different criteria is almost always confirmed, with the minor exceptions of accessibility versus user-friendliness, user-friendliness versus speed, and speed versus comfort for non-users.

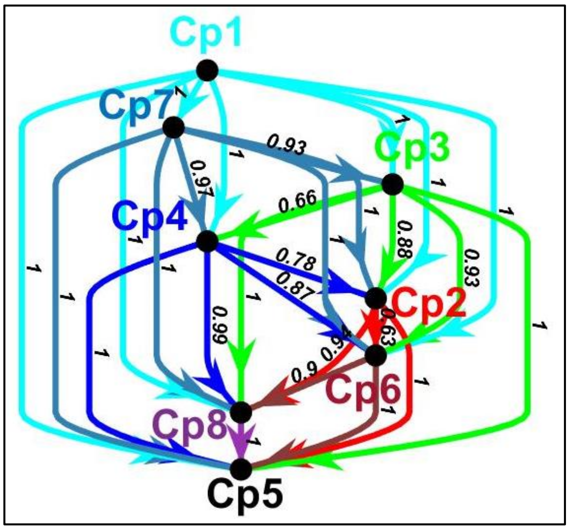

Figure 110: Credal ranking of criteria from non-users' view for shared mobility services.

In summary, to better understand the viewpoint of non-users on the impact of factors on their shared mobility usage, the weight of the three most important criteria, which are traveler safety (Cp1), cost (Cp7), and accessibility (Cp3), respectively, and the weight of the least important criterion, which is the image (Cp5), are given in Figure 111.

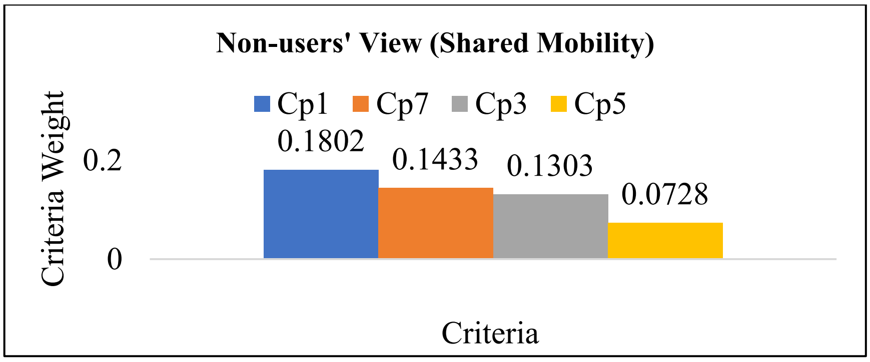

Figure 111: The weight of the least important criterion and the three most important criteria (from the perspective of non-users of shared mobility services).

6.2.5 Similarities and differences between the four types of shared mobility stakeholders (as a whole, not for a specific shared mobility service)

In this study, criteria (specified for each stakeholder) are compared by stakeholders in order to recognize their viewpoints on the importance of each criterion. In the literature, some research has only focused on the importance of some of these criteria. However, in this study, these criteria are ranked and compared with each other to specify the importance of each criterion compared with other criteria from each stakeholder's standpoint. Additionally, most studies have worked on user perceptions only. However, in this research, the criteria related to each of the four stakeholders have been identified. Therefore, this section helps to know how different stakeholders score the importance of the comparison factors related to themselves (the third research question mentioned in Chapter 1).

Also, some criteria are compared by more than one stakeholder. Hence, the importance of those criteria can be compared from the viewpoint of different stakeholders to distinguish their views on each criterion. This contributes to knowing the perceptions of different groups of shared mobility stakeholders about the importance of one criterion (related to the first research question mentioned in Chapter 1).

The main shared mobility services shareholders, their criteria (related to each stakeholder), and their corresponding weight are given in Table 74. This indicates the importance of each criterion (specified for each stakeholder) compared to other criteria determined by each stakeholder. It is important to mention that the corresponding weights of government members, operators, users, and non-users are indicated by the "W_g", "W_o", "W_u" and "W_{non-u}" respectively. Relevant criteria are considered the same for users and non-user stakeholders, so their perceptions can be better compared. Similarly, some criteria are also repeated in other groups. In this regard, the average number of trips per vehicle per day is an important criterion for operators and government members stakeholders. Besides, operational speed is an important criterion for operators, users, and non-users.

Table 74: Stakeholders, criteria, and related weights.

Criteria for government members	W_g	Criteria for operators	W_o	Criteria for users	W_u	Criteria for non-users	W_{non-u}
Cg1. Average number of trips per vehicle per day	0.1488	**Co1. Vehicle utilization rate**	0.2916	**Cp1. Traveler safety**	0.1781	**Cp1. People safety**	0.1802
Cg2. Greenhouse gases (GHGs)	0.1528	**Co2. Usage fees**	0.2756	**Cp2. Operational speed**	0.1229	**Cp2. Operational speed**	0.1205
Cg3. Parking issues	0.1372	**Co3. Average number of trips per vehicle per day**	0.2606	**Cp3. Accessibility**	0.1385	**Cp3. Accessibility**	0.1303
Cg4. Emission of pollutants	0.1996	**Co4. Operational speed**	0.0890	**Cp4. User-friendliness**	0.1171	**Cp4. User-friendliness**	0.1267
Cg5. Integration of the shared mobility service with public transport	0.2505	**Co5. The life span of the vehicle**	0.0832	**Cp5. Image**	0.0694	**Cp5. Image**	0.0728
Cg6. Vehicle fee	0.1111	-	-	**Cp6. Comfort**	0.1260	**Cp6. Comfort**	0.1179
-	-	-	-	**Cp7. Cost**	0.1437	**Cp7. Cost**	0.1433
-	-	-	-	**Cp8. Possibility of carrying items**	0.1042	**Cp8. Possibility of carrying items**	0.1083

As seen in Table 74, the average number of trips per vehicle per day is the government's fourth most important criterion and the third most important one for the operators. In this regard, it is worth stating that the importance of the criterion the average number of trips per vehicle per day is 1.75 times higher for shared mobility operators than for government members. The importance of this factor is more for operators than for government members. Besides, the importance of the criterion operational speed is about 1.37 times higher for shared mobility users and non-users than for operators.

Furthermore, Figure 112 reveals the weight percentage of the criteria corresponding with the users and non-users of shared mobility services, which helps to understand their views better. Interestingly, users and non-users of shared mobility services have a similar view on the importance of all criteria. As listed in Tables 72 and 73, their three most important criteria are traveler safety (Cp1), cost (Cp7), and accessibility (Cp3), respectively. However, as seen in Table 72, the fourth and sixth most important criteria for users are comfort (Cp6) and user-friendliness (Cp4), respectively. Conversely, as shown in Table 73, for non-users, the fourth and sixth most important criteria are Cp4 and Cp6, respectively. Hence, compared to non-users, shared mobility users give more importance to criterion Cp6 and less to criterion Cp4. Finally, it is important to state that the user and non-users pay the least attention to the criterion possibility of carrying items (Cp8) and criterion image (Cp5).

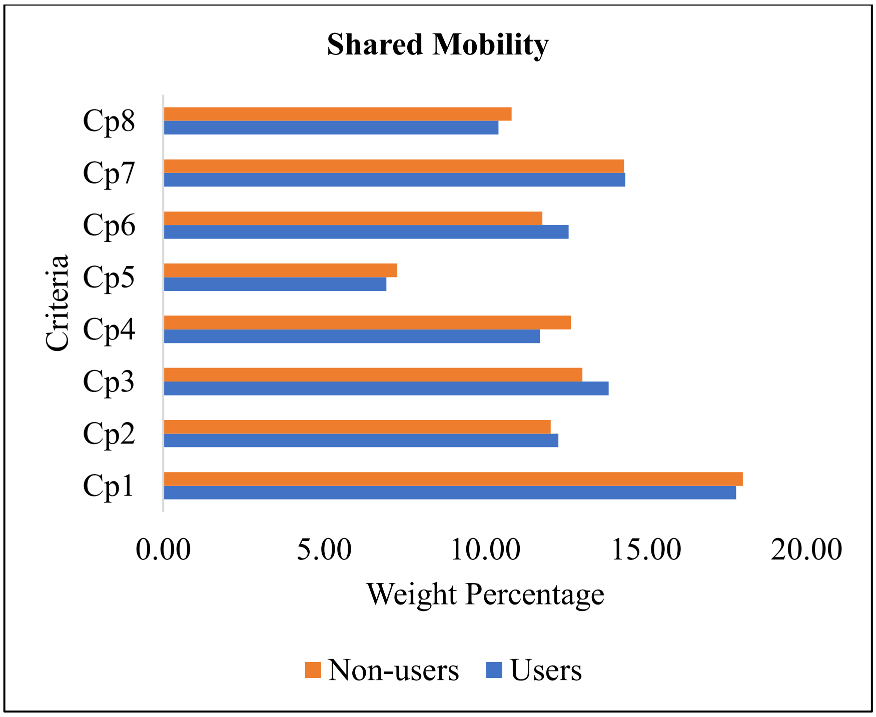

Figure 112: Importance of criteria based on users and non-users stakeholders.

6.2.6 Perception analysis

In this section, each stakeholder's (users and non-users) perception of the overall value of each shared mobility service can be calculated using Eq. (2) presented in section 3 of Chapter 3 since the weight assigned to the criterion and indicator value (score) of each criterion is determined. As shown in Eq.2 in section 3 of Chapter 3, to calculate the stakeholder's perception of the overall value of each shared mobility service, the first step is to multiply each criterion's indicator value (score) by the weight (assigned by the stakeholder) of the criterion. Then it adds all the results together. The higher the stakeholder's perception of the overall value of a type of shared mobility service (compared to other types of shared mobility services), the greater the stakeholder's preference for that type of shared mobility service (compared to other types of shared mobility services). The analysis of the users' and non-users' perceptions of the overall value of each shared mobility service is first reported together in subsection 5.5.6.1 since, as it will be later explained, normalization of the indicator values is not required in these cases, as described in section 3 of Chapter 3.

6.2.6.1 Perception analysis of users and non-users of shared mobility services (as a whole, not for a specific shared mobility service)

Table 75 report the scores p_{ij}, i.e., the indicator values expressed by both users and non-users of each shared mobility service were obtained from the above-described survey. Differences between the two groups are determined as well. All scores are based on a 7-point scale; therefore, the closer any indicator is to 7, the better the related shared mobility service performs on that specific criterion. For instance, for criterion cost, 1 means very expensive, and 7 means very cheap. Also, concerning, i.e., the possibility of carrying items, car-sharing is obviously better assessed than bike-sharing and scooter-sharing. As expected, scores from users are generally higher than the corresponding scores of non-users, with the only exception of the cost of scooter-sharing, which is probably pointing to an underestimation of the monetary costs of using such service by those that have no experience. Interestingly, accessibility and comfort show the widest gap between users and non-users.

Table 75: Scores p_{ij} obtained from users and non-users of each shared mobility service.

Criterion	Car-sharing services			Bike-sharing services			Scooter-sharing services		
	Users	Non-users	Diff.	Users	Non-users	Diff.	Users	Non-users	Diff.
Cp1. Traveler safety	5.40	4.94	0.46	4.31	3.96	0.35	3.18	3.09	0.09
Cp2. Operational speed	5.24	5.04	0.20	4.56	4.29	0.27	4.64	4.05	0.59
Cp3. Accessibility	5.07	4.53	0.54	5.09	4.22	0.87	5.16	4.45	0.71
Cp4. User-friendliness	5.11	4.60	0.51	4.91	4.42	0.49	4.91	4.49	0.42
Cp5. Image	5.38	4.95	0.43	4.82	4.36	0.46	4.69	4.11	0.58
Cp6. Comfort	5.36	4.65	0.71	4.53	3.96	0.57	3.84	3.15	0.69
Cp7. Cost	3.76	3.75	0.01	4.29	4.15	0.14	3.80	3.91	-0.11
Cp8. Possibility of carrying items	5.47	5.20	0.27	3.07	2.71	0.36	2.58	2.16	0.42

The next step is to calculate the perceived value of each alternative according to Eq.2 in section 3 of Chapter 3, multiplying each weight reported in the second columns of Tables 72 and 73 (for users and non-users, respectively) by the corresponding scores reported in Table 75. It should be stated that since all scores from Table 75 have the same unit or scale ([1-7]), there is no need to normalize them, thus $p_{ij}^{norm} = p_{ilj}$, ∀i, ∀j. Results are reported in Tables 76 and 77, respectively, for users and non-users, while the last row of each table represents the overall value of each service V1, V2, and V3. Relative changes in % of the perceived value of bike-sharing and scooter-sharing compared to car-sharing are reported in brackets. The higher the users' or non-users' perceptions of the overall value of a type of shared mobility service (compared to other types of shared mobility services), the greater the users' or non-users' preference for that type of shared mobility service (compared to other types of shared mobility services).

Table 76: Perception of the value of each shared mobility service for users.

Users	Shared mobility services (% change compared to car-sharing)		
	Car-sharing services	Bike-sharing services	Scooter-sharing services
Criterion	**Perceived value**	**Perceived value**	**Perceived value**
Cp1. Traveler safety	0.9617	0.7676 (-20%)	0.5664 (-41%)
Cp2. Operational speed	0.6440	0.5604 (-13%)	0.5703 (-11%)
Cp3. Accessibility	0.7022	0.7050 (0%)	0.7147 (2%)
Cp4. User-friendliness	0.5984	0.5750 (-4%)	0.5750 (-4%)
Cp5. Image	0.3734	0.3345 (-10%)	0.3255 (-13%)
Cp6. Comfort	0.6754	0.5708 (-15%)	0.4838 (-28%)
Cp7. Cost	0.5403	0.6165 (14%)	0.5461 (1%)
Cp8. Possibility of carrying items	0.5700	0.3199 (-44%)	0.2688 (-53%)
V_i	5.0654	4.4497 (-12%)	4.0506 (-20%)

Table 77: Perception of the value of each shared mobility service for non-users.

Non-users	Shared mobility services (% change compared to car-sharing)		
	Car-sharing services	Bike-sharing services	Scooter-sharing services
Criterion	**Perceived value**	**Perceived value**	**Perceived value**
Cp1. Traveler safety	0.8902	0.7136 (-20%)	0.5568 (-37%)
Cp2. Operational speed	0.6073	0.5169 (-15%)	0.4880 (-20%)
Cp3. Accessibility	0.5903	0.5499 (-7%)	0.5798 (-2%)
Cp4. User-friendliness	0.5828	0.5600 (-4%)	0.5689 (-2%)
Cp5. Image	0.3604	0.3174 (-12%)	0.2992 (-17%)
Cp6. Comfort	0.5482	0.4669 (-15%)	0.3714 (-32%)
Cp7. Cost	0.5374	0.5947 (11%)	0.5603 (4%)
Cp8. Possibility of carrying items	0.5632	0.2935 (-48%)	0.2339 (-58%)
V_i	4.6798	4.0129 (-14%)	3.6583 (-22%)

As seen in Table 76, the users' perception of the overall value of car-sharing (5.0654) is higher than their perception of the overall value of bike-sharing (4.4497) and scooter-sharing (4.0506). Similarly, Table 77 shows that the non-users' perception of the overall value of car-sharing (4.6798) is higher than their perception of the overall value of bike-sharing (4.0129) and scooter-sharing (3.6583). Therefore, based on the analysis of the eight criteria examined in this study, car-sharing services are preferred by both users and non-users. Having a closer look at the different patterns related to the contribution of each criterion to the overall value of one alternative, it is not surprising to note that cost is the only one that gives the lowest contribution to choosing car-sharing compared to its influence on choosing usually cheaper scooter-sharing and bike-sharing services (in line with the scores in Table 75), as indicated by the positive percent changes shown in the last two columns of the third last row of Tables 76 and 77. Because on the 7-point survey for criterion cost, 1 means very expensive and 7 means very cheap, car-sharing receives a lower score for this measure than bike-sharing and scooter-sharing, which leads to a lower perceived value for the criterion cost of car-sharing. Also, bike-sharing and scooter-sharing accessibility give a larger contribution to the value of these two services for their users, while the opposite is true for non-users. Finally, scooter-sharing speed is much less appreciated by non-users than by users. Note that this latter gap, embedding the weights of each criterion according to Eq.2 in section 3 of Chapter 3, is relatively wider than the average scores of the two groups related to scooter-sharing speed reported in Table 75.

6.2.7 Sensitivity analysis and scenarios

In this section, some scenarios are carried out to increase the use of bike-sharing and scooter-sharing. In this regard, it is important to increase the motivation of users and non-users to make a trip by bike-sharing and scooter-sharing services (compared to car-sharing services), as mentioned in sub-section 6.2.7.1. Sensitivity analysis can be performed to evaluate the scenarios that achieve this purpose.

6.2.7.1 Sensitivity analysis and scenario for users and non-users of shared mobility services (as a whole, not for a specific shared mobility service)

For users and non-users groups, it should be noted that the indicator value of criterion cost (Cp7) of bike-sharing and scooter-sharing is higher than that of car-sharing services, which shows that from the point of view of users and non-users, the price of using bike-sharing and scooter-sharing services is lower than car-sharing services. Besides, the indicator value of criterion accessibility (Cp3) of bike-sharing and scooter-sharing is higher than that of car-sharing services, which indicates that in the eyes of users, the accessibility of bike-sharing and scooter-sharing is more than car-sharing. In this study, the indicator values of the criteria are changed for both users and non-users so that it will be revealed if there is a difference. Therefore, there is no need to change the indicator value of the criteria Cp7 and Cp3 for bike-sharing and scooter-sharing because bike-sharing and scooter-sharing have a better situation than car-sharing in terms of criterion Cp7 from the users' and non-users' standpoints, and criterion Cp3 from the users' point of view.

It should also be stated that the change in the value of some criteria cannot be easily controlled and analyzed in practice. In this regard, the change in the average velocity that a shared mobility system overpasses (criterion operational speed (Cp2)) cannot be easily controlled. The indicator value of the rest criteria, comprising the criteria user-friendliness (Cp4) and image (Cp5), can be changed and used for the scenario.

6.2.7.1.1 Scenario for users and non-users groups: providing higher safety, higher comfort, more user-friendly systems, a better image in the eyes of the public, and a better possibility to carry items in bike-sharing and scooter-sharing services

In this scenario, bike-sharing and scooter-sharing services can provide higher safety (Cp1), higher comfort (Cp6), more user-friendly systems (Cp4), a better image in the eyes of the public (Cp5), and a better possibility to carry items (Cp8) in a way that users and non-users feel that these features in these services are similar to these features in car-sharing services. To do this, the indicator value of these criteria of bike-sharing and scooter-sharing services is set equal to that of car-sharing services because car-sharing has a better situation than bike-sharing and scooter-sharing in terms of these criteria from the users' and non-users' standpoints.

Tables 78 to 83 show the new calculation for users' and non-users' perceptions of the overall value of each shared mobility service. The criteria (as well as the corresponding numbers) are written in italics, and the bold font in Tables 78 to 83 has been changed compared to Tables 75 to 77.

Table 78: New indicator values for users' perception of the overall value of each shared mobility service.

Users	**Weight**	**Shared mobility services**			**Units**
		Car-sharing services	**Bike-sharing services**	**Scooter-sharing services**	
Criterion		**Indicator value**	**Indicator value**	**Indicator value**	
Cp1. Traveler safety	***0.1781***	***5.40***	***5.40***	***5.40***	***[1-7]***

Cp2. Operational speed	0.1229	5.24	4.56	4.64	[1-7]
Cp3. Accessibility	0.1385	5.07	5.09	5.16	[1-7]
Cp4. User-friendliness	***0.1171***	***5.11***	***5.11***	***5.11***	***[1-7]***
Cp5. Image	***0.0694***	***5.38***	***5.38***	***5.38***	***[1-7]***
Cp6. Comfort	***0.1260***	***5.36***	***5.36***	***5.36***	***[1-7]***
Cp7. Cost	0.1437	3.76	4.29	3.80	[1-7]
Cp8. Possibility of carrying items	***0.1042***	***5.47***	***5.47***	***5.47***	***[1-7]***

Table 79: New indicator values for non-users' perception of the overall value of each shared mobility service.

Non-users	**Weight**	**Shared mobility services**			**Units**
		Car-sharing services	**Bike-sharing services**	**Scooter-sharing services**	
Criterion		**Indicator value**	**Indicator value**	**Indicator value**	
Cp1. Traveler safety	***0.1802***	***4.94***	***4.94***	***4.94***	***[1-7]***
Cp2. Operational speed	0.1205	5.04	4.29	4.05	[1-7]
Cp3. Accessibility	0.1303	4.53	4.22	4.45	[1-7]
Cp4. User-friendliness	***0.1267***	***4.60***	***4.60***	***4.60***	***[1-7]***
Cp5. Image	***0.0728***	***4.95***	***4.95***	***4.95***	***[1-7]***
Cp6. Comfort	***0.1179***	***4.65***	***4.65***	***4.65***	***[1-7]***
Cp7. Cost	0.1433	3.75	4.15	3.91	[1-7]
Cp8. Possibility of carrying items	***0.1083***	***5.20***	***5.20***	***5.20***	***[1-7]***

Table 80: New perception of the overall value of each shared mobility service analysis results for users.

Users	**Shared mobility services (% change compared to car sharing)**		
	Car-sharing services	**Bike-sharing services**	**Scooter-sharing services**
Criterion	**Indicator value**	**Indicator value**	**Indicator value**
Cp1. Traveler safety	***0.9617***	***0.9617 (0%)***	***0.9617 (0%)***
Cp2. Operational speed	0.6440	0.5604 (-13%)	0.5703 (-11%)
Cp3. Accessibility	0.7022	0.7050 (0%)	0.7147 (2%)
Cp4. User-friendliness	***0.5984***	***0.5984 (0%)***	***0.5984 (0%)***
Cp5. Image	***0.3734***	***0.3734 (0%)***	***0.3734 (0%)***
Cp6. Comfort	***0.6754***	***0.6754 (0%)***	***0.6754 (0%)***
Cp7. Cost	0.5403	0.6165 (14%)	0.5461 (1%)
Cp8. Possibility of carrying items	***0.5700***	***0.5700 (0%)***	***0.5700 (0%)***
Sum	5.0653	5.0607 (0%)	5.0098 (-1%)

Table 81: New perception of the overall value of each shared mobility service analysis results for non-users.

Non-users	**Shared mobility services (% change compared to car sharing)**		
	Car-sharing services	**Bike-sharing services**	**Scooter-sharing services**
Criterion	**Indicator value**	**Indicator value**	**Indicator value**
Cp1. Traveler safety	***0.8902***	***0.8902 (0%)***	***0.8902 (0%)***
Cp2. Operational speed	0.6073	0.5169 (-15%)	0.4880 (-20%)
Cp3. Accessibility	0.5903	0.5499 (-7%)	0.5798 (-2%)
Cp4. User-friendliness	***0.5828***	***0.5828 (0%)***	***0.5828 (0%)***
Cp5. Image	***0.3604***	***0.3604 (0%)***	***0.3604 (0%)***
Cp6. Comfort	***0.5482***	***0.5482 (0%)***	***0.5482 (0%)***
Cp7. Cost	0.5374	0.5947 (11%)	0.5603 (4%)
Cp8. Possibility of carrying items	***0.5632***	***0.5632 (0%)***	***0.5632 (0%)***
Sum	4.6797	4.6063 (-2%)	4.5729 (-2%)

As seen in Table 80, increasing the indicator values of traveler safety (Cp1), user-friendliness (Cp4), image (Cp5), comfort (Cp6), and the possibility of carrying items (Cp8) of bike-sharing and scooter-sharing (to be equal to those of car-sharing) leads to a change in user's perception of the overall value of bike-sharing (from -12% (shown in Table 76) to 0%) and scooter-sharing services (from -20% (indicated in Table 77) to -1%) (compared to car-sharing services). Also, Table 81 establishes that raising the indicator values of these criteria of bike-sharing and scooter-sharing (to be equal to those of car-sharing) causes a change in non-users' perception of the overall value of bike-sharing (from -14% (indicated in Table 77) to -2%) and scooter-sharing services (from -22% (shown in Table 77) to -2%) (compared to car-sharing services).

Furthermore, for better understanding, Tables 82 and 83 systematically explore how results are affected when only a subset of the five criteria mentioned above are changed. Therefore, Table 82 lists 83 (number of possible scenarios = 2^n-1=2^5-1=32-1=31, where n is the number of criteria selected to be increased for scenarios, which is 5) possible scenarios for users and non-users groups, respectively, where scenario Cp1_4_5_6_8 (people' safety, user-friendliness, image, comfort, and possibility of carrying items) (increasing indicator value of criterion 1, criterion 4, criterion 5, criterion 6, and criterion 8 of bike-sharing or scooter-sharing services, so that be equal to those of car-sharing services) is the previously considered one. This scenario and its corresponding numbers are in bold and italic font in Tables 82 and 83. Hence, this scenario obviously leads to the best results to increase both uses of bike-sharing and scooter-sharing by both users and non-users compared to the current situation because this scenario includes all the increased criteria. Further, the rank of scenarios in situations where the purpose is to increase the use of bike-sharing (compared to the use of car-sharing) and also the rank of scenarios in cases where the aim is to raise the usage of scooter-sharing (compared to the use of car-sharing) are presented for increasing the use of users and non-users in Table 82 and Table 83, respectively.

Table 82: Current situation and possible scenarios for the users' perception of the overall value of each shared mobility service and the corresponding scenarios ranks (as a whole, not for a specific shared mobility service).

Possible scenarios (changed criteria)	**Users' perception of the overall value of each shared mobility service (% change compared to car sharing)**			**Rank of scenarios (increasing the shared mobility service use of users)**	
	Car-sharing	**Bike-sharing**	**Scooter-sharing**	**Rank of scenarios (increasing bike-sharing use of users)**	**Rank of scenarios (increasing scooter-sharing use of users)**
(Current situation)	5.0653	4.4496 (-12%)	4.0505 (-20%)	-	-
Cp1 (people's safety)	5.0653	4.6437 (-8%)	4.4458 (-12%)	24	20
Cp1_4 (people's safety and user-friendliness)	5.0653	4.6672 (-8%)	4.4693 (-12%)	23	19
Cp1_5 (people's safety and image)	5.0653	4.6826 (-8%)	4.4937 (-11%)	22	18
Cp1_6 (people's safety and comfort)	5.0653	4.7483 (-6%)	4.6374 (-8%)	17	12
Cp1_8 (traveler safety and possibility of carrying items)	5.0653	4.8938 (-3%)	4.7470 (-6%)	8	8
Cp1_4_5 (people's safety, user-friendliness, and image)	5.0653	4.7060 (-7%)	4.5171 (-11%)	20	17
Cp1_4_6 (people's safety, user-friendliness, and comfort)	5.0653	4.7717 (-6%)	4.6608 (-8%)	15	11
Cp1_4_8 (people's safety, user-friendliness, and possibility of carrying items)	5.0653	4.9172 (-3%)	4.7704 (-6%)	7	7
Cp1_4_5_6 (people's safety, user-friendliness, image, and comfort)	5.0653	4.8106 (-5%)	4.7087 (-7%)	12	9

Possible scenarios (changed criteria)	Users' perception of the overall value of each shared mobility service (% change compared to car sharing)			Rank of scenarios (increasing the shared mobility service use of users)	
	Car-sharing	Bike-sharing	Scooter-sharing	Rank of scenarios (increasing bike-sharing use of users)	Rank of scenarios (increasing scooter-sharing use of users)
Cp1_4_5_8 (people's safety, user-friendliness, image, and possibility of carrying items)	5.0653	4.9561 (-2%)	4.8183 (-5%)	5	5
Cp1_4_6_8 (people's safety, user-friendliness, comfort, and possibility of carrying items)	5.0653	5.0218 (-1%)	4.9619 (-2%)	3	3
Cp1_5_6 (people's safety, image, and comfort)	5.0653	4.7872 (-5%)	4.6852 (-8%)	14	10
Cp1_5_8 (people's safety, image, and possibility of carrying items)	5.0653	4.9327 (-3%)	4.7949 (-5%)	6	6
Cp1_5_6_8 (people's safety, image, comfort, and possibility of carrying items)	5.0653	5.0373 (-1%)	4.9864 (-2%)	2	2
Cp1_6_8 (people's safety, comfort, and possibility of carrying items)	5.0653	4.9984 (-1%)	4.9385 (-3%)	4	4
Cp1_4_5_6_8 (people's safety, user-friendliness, image, comfort, and possibility of carrying items)	***5.0653***	***5.0607 (0%)***	***5.0098 (-1%)***	***1***	***1***
Cp4 (user-friendliness)	5.0653	4.4730 (-12%)	4.0739 (-20%)	31	31
Cp4_5 (user-friendliness and image)	5.0653	4.5119 (-11%)	4.1218 (-19%)	29	29
Cp4_6 (user-friendliness and comfort)	5.0653	4.5776 (-10%)	4.2654 (-16%)	27	27
Cp4_8 (user-friendliness and possibility of carrying items)	5.0653	4.7231 (-7%)	4.3750 (-14%)	19	23
Cp4_5_6 (user-friendliness, image, and comfort)	5.0653	4.6165 (-9%)	4.3133 (-15%)	25	25
Cp4_5_8 (user-friendliness, image, and possibility of carrying items)	5.0653	4.7620 (-6%)	4.4229 (-13%)	16	21
Cp4_6_8 (user-friendliness, comfort, and possibility of carrying items)	5.0653	4.8277 (-5%)	4.5665 (-10%)	11	15
Cp4_5_6_8 (user-friendliness, image, comfort, and possibility of carrying items)	5.0653	4.8666 (-4%)	4.6144 (-9%)	9	13
Cp5 (image)	5.0653	4.4885 (-11%)	4.0983 (-19%)	30	30
Cp5_6 (image and comfort)	5.0653	4.5931 (-9%)	4.2899 (-15%)	26	26
Cp4_8 (image and possibility of carrying items)	5.0653	4.7386 (-6%)	4.3995 (-13%)	18	22
Cp4_5_8 (image, comfort, and possibility of carrying items)	5.0653	4.8431 (-4%)	4.5910 (-9%)	10	14
Cp6 (comfort)	5.0653	4.5542 (-10%)	4.2420 (-16%)	28	28
Cp6_8 (comfort and possibility of carrying items)	5.0653	4.8043 (-5%)	4.5431 (-10%)	13	16
Cp8 (possibility of carrying items)	5.0653	4.6997 (-7%)	4.3516 (-14%)	21	24

Table 83: Current situation and possible scenarios for the non-users' perception of the overall value of each shared mobility service and the corresponding scenarios ranks (as a whole, not for a specific shared mobility service).

Possible scenarios (changed criteria)	Non-users perception of the overall value of each shared mobility service (% change compared to car sharing)			Rank of scenarios (increasing the shared mobility service use of non-users)	
	Car-sharing	Bike-sharing	Scooter-sharing	Rank of scenarios (increasing bike-sharing use of non-users)	Rank of scenarios (increasing scooter-sharing use of non-users)
(Current situation)	4.6797	4.0129 (-14%)	3.6584 (-22%)	-	-
Cp1 (people's safety)	4.6797	4.1895 (-10%)	3.9918 (-15%)	24	23

Possible scenarios (changed criteria)	Non-users perception of the overall value of each shared mobility service (% change compared to car sharing)			Rank of scenarios (increasing the shared mobility service use of non-users)	
	Car-sharing	Bike-sharing	Scooter-sharing	Rank of scenarios (increasing bike-sharing use of non-users)	Rank of scenarios (increasing scooter-sharing use of non-users)
Cp1_4 (people's safety and user-friendliness)	4.6797	4.2123 (-10%)	4.0057 (-14%)	23	21
Cp1_5 (people's safety and image)	4.6797	4.2324 (-10%)	4.0529 (-13%)	22	19
Cp1_6 (people's safety and comfort)	4.6797	4.2708 (-9%)	4.1686 (-11%)	20	15
Cp1_8 (traveler safety and possibility of carrying items)	4.6797	4.4592 (-5%)	4.3210 (-8%)	8	8
Cp1_4_5 (people's safety, user-friendliness, and image)	4.6797	4.2553 (-9%)	4.0668 (-13%)	21	17
Cp1_4_6 (people's safety, user-friendliness, and comfort)	4.6797	4.2937 (-8%)	4.1825 (-11%)	18	13
Cp1_4_8 (people's safety, user-friendliness, and possibility of carrying items)	4.6797	4.4820 (-4%)	4.3349 (-7%)	7	7
Cp1_4_5_6 (people's safety, user-friendliness, image, and comfort)	4.6797	4.3366 (-7%)	4.2437 (-9%)	14	9
Cp1_4_5_8 (people's safety, user-friendliness, image, and possibility of carrying items)	4.6797	4.5249 (-3%)	4.3961 (-6%)	5	5
Cp1_4_6_8 (people's safety, user-friendliness, comfort, and possibility of carrying items)	4.6797	4.5633 (-2%)	4.5118 (-4%)	3	3
Cp1_5_6 (people's safety, image, and comfort)	4.6797	4.3138 (-8%)	4.2298 (-10%)	16	11
Cp1_5_8 (people's safety, image, and possibility of carrying items)	4.6797	4.5021 (-4%)	4.3821 (-6%)	6	6
Cp1_5_6_8 (people's safety, image, comfort, and possibility of carrying items)	4.6797	4.5835 (-2%)	4.5590 (-3%)	2	2
Cp1_6_8 (people's safety, comfort, and possibility of carrying items)	4.6797	4.5405 (-3%)	4.4978 (-4%)	4	4
Cp1_4_5_6_8 (people's safety, user-friendliness, image, comfort, and possibility of carrying items)	***4.6797***	***4.6063 (-2%)***	***4.5729 (-2%)***	***1***	***1***
Cp4 (user-friendliness)	4.6797	4.0357 (-14%)	3.6723 (-22%)	31	31
Cp4_5 (user-friendliness and image)	4.6797	4.0787 (-13%)	3.7335 (-20%)	29	29
Cp4_6 (user-friendliness and comfort)	4.6797	4.1171 (-12%)	3.8492 (-18%)	27	27
Cp4_8 (user-friendliness and possibility of carrying items)	4.6797	4.3054 (-8%)	4.0016 (-14%)	17	22
Cp4_5_6 (user-friendliness, image, and comfort)	4.6797	4.1600 (-11%)	3.9103 (-16%)	25	25
Cp4_5_8 (user-friendliness, image, and possibility of carrying items)	4.6797	4.3483 (-7%)	4.0627 (-13%)	13	18
Cp4_6_8 (user-friendliness, comfort, and possibility of carrying items)	4.6797	4.3867 (-6%)	4.1784 (-11%)	11	14
Cp4_5_6_8 (user-friendliness, image, comfort, and possibility of carrying items)	4.6797	4.4297 (-5%)	4.2396 (-9%)	9	10
Cp5 (image)	4.6797	4.0558 (-13%)	3.7195 (-21%)	30	30
Cp5_6 (image and comfort)	4.6797	4.1372 (-12%)	3.8964 (-17%)	26	26
Cp4_8 (image and possibility of carrying items)	4.6797	4.3255 (-8%)	4.0488 (-13%)	15	20

Possible scenarios (changed criteria)	Non-users perception of the overall value of each shared mobility service (% change compared to car sharing)			Rank of scenarios (increasing the shared mobility service use of non-users)	
	Car-sharing	Bike-sharing	Scooter-sharing	Rank of scenarios (increasing bike-sharing use of non-users)	Rank of scenarios (increasing scooter-sharing use of non-users)
Cp4_5_8 (image, comfort, and possibility of carrying items)	4.6797	4.4069 (-6%)	4.2256 (-10%)	10	12
Cp6 (comfort)	4.6797	4.0942 (-13%)	3.8352 (-18%)	28	28
Cp6_8 (comfort and possibility of carrying items)	4.6797	4.3639 (-7%)	4.1645 (-11%)	12	16
Cp8 (possibility of carrying items)	4.6797	4.2826 (-8%)	3.9876 (-15%)	19	24

As can be seen in Tables 82 and 83, it is interesting that from the perspective of both users and non-users, the best scenario (highest usage increase) for both bike-sharing and scooter-sharing is scenario Cp1_4_5_6_8 (people's safety, user-friendliness, image, comfort, and possibility of carrying items), followed by scenarios Cp1_5_6_8 (people' safety, image, comfort, and possibility of carrying items), Cp1_4_6_8 (people' safety, user-friendliness, comfort, and possibility of carrying items), Cp1_6_8 (people' safety, comfort, and possibility of carrying items), Cp1_4_5_8 (people' safety, user-friendliness, image, and possibility of carrying items), Cp1_5_8 (people' safety, image, and possibility of carrying items), Cp1_4_8, and Cp1_8 (traveler safety and possibility of carrying items). On the other hand, from the point of view of both users and non-users, the worst scenario (least usage increase) for both bike-sharing and scooter-sharing is scenario Cp4 (user-friendliness), followed by scenarios, Cp6 (comfort), Cp4_5 (user-friendliness and image), Cp5 (image), Cp4_6 (user-friendliness and comfort), Cp5_6 (image, and comfort), and Cp4_5_6 (user-friendliness, image, and comfort).

Chapter 7

Conclusions

This study aims to identify the gap between the needs, expectations, and views of different stakeholders in car-sharing, bike-sharing, and scooter-sharing systems. To do this, this study has two different parts. These parts are the analysis of each shared mobility service (separately) and the analysis of shared mobility services (as a whole, not for a specific shared mobility service). Analyses were carried out through the use of the Bayesian Best-Worst-Method (Bayesian BWM), the state-of-the-art method in multi-criteria analyses.

In the analysis of each shared mobility service (separately), 12 sub-criteria are compared by four different groups of stakeholders in order to understand their views on the importance of each sub-criterion that people can consider in their decisions to use each shared mobility service. Also, in the analysis of shared mobility services (as a whole, not for a specific shared mobility service), each stakeholder rated the importance of specific criteria associated with their specific role in shared mobility service. Hence, government members, operators, and users/non-users rated three partially different sets of criteria. However, users and non-users rated the same criteria to understand the gap between their perceptions.

This experimental design allowed some original contributions to the field of multi-criteria analyses and Bayesian BWM applications. More in detail:

- Some studies in the literature have only worked on the importance of some of these 12 sub-criteria. However, in this study, all 12 sub-criteria are ranked and compared with each other to determine their relative importance from each stakeholder's perspective.
- Three different shared mobility services are considered: car-sharing, bike-sharing, and scooter-sharing. Therefore, this study helps to understand how one main-criterion/sub-criterion can be of different importance across different shared mobility services.
- Most studies have worked on user perspectives only. However, in this study, these sub-criteria are compared by four groups of stakeholders. Therefore, the importance of each sub-criterion can be compared from the perspective of these four different stakeholders to distinguish their views on each sub-criterion.

- It is also important to note that in the literature, sub-criteria service quality and safety, environment-friendly system, and user-friendly have not been well studied. Hence, this study also considers these sub-criteria to determine the stakeholders' views on them.
- By analyzing and comparing the similarities and differences (gaps) in the perspectives of each shared mobility service stakeholder, suggestions for government members and each shared mobility service operator are given to attract more users and non-users.
- Additionally, most studies have worked on users' perceptions only. In contrast, the criteria of this study encompass additional evaluation dimensions, including factors associated with the role of operators and government members as stakeholders of shared mobility services. Also, the perception of non-users is studied to determine the difference between their views compared to users. Therefore, our results help to know how different stakeholders score the importance of the comparison factors associated with their role as shared mobility service stakeholders.
- More than one stakeholder assesses some criteria. Hence, the importance of those criteria can be compared from the viewpoint of different stakeholders to distinguish their views on each criterion. This contributes to knowing the perceptions of different groups of shared mobility stakeholders about the importance of one criterion. Besides, this study help to understand which shared mobility system is most appropriate to implement according to users' and non-users' perceptions. Also, this study contributes to presenting scenarios from the views of users and non-users groups to determine how to increase the use of bike-sharing and scooter-sharing services compared to car-sharing services from users' and non-users' perspectives.

Furthermore, the following two points can be mentioned for the methodological contribution of this research.

- Joint consideration of Multi-Actor Multi-Criteria Analysis (MAMCA) and Bayesian Best-Worst Method (BWM) for Perception-Based Analysis (PBA)
- Introducing the Confidence Level (CL) classification in the Credal Ranking (Bayesian BWM) based on previous literature

From a methodological viewpoint, the above-mentioned Bayesian BWM is framed within a Multi-Actor Multi-Criteria Analysis (MAMCA) since the latter is an appropriate method when different stakeholders are involved. More specifically, the third step of the MAMCA is to determine the main criteria and weights, which is done through a Perception-Based Analysis (PBA) that implements a Bayesian BWM in the present research. This method is chosen since it is the only one ensuring a very high quality of the computed weights while requiring a small amount of data. This aspect is very important because some of the shareholders are members of the government and operators, which are few in number. Other advantages of this method include the combination of weight quality, fewer inconsistencies between criteria, fewer data required to obtain highly reliable results, low equalizing bias, and average transparency of the method.

Before calculating the optimal group weights by Bayesian BWM, the consistency of the respondents was examined using the input-based approach, and acceptable ones (their obtained global input-based consistency ratio is less than the input-based consistency ratio thresholds) were considered. After eliminating pairwise comparisons with unacceptable consistency ratios, different sample sizes can be obtained and utilized for different levels of the model. Also, it is important to note that Bayesian BWM can provide much more information than the original BWM. For example, Bayesian BWM can provide the credal ranking and confidence level in the weight-directed graph. This helps to understand the importance perceived by stakeholders of one criterion over other criteria.

In order to gather the required data, nine different surveys have been designed and administered in our study area, namely the Turin metropolitan area in Italy. Data on operators and government members were collected through phone calls to targeted contact points, whereas for users and non-users, it was possible to resort to a panel maintained by a survey company to have a representative sample of the population in the study area. In addition, online surveys were administered to the panel members. Survey data are used to calculate the criteria and sub-criteria weights to determine how the comparative criteria are rated in terms of importance by different stakeholders of different shared mobility services. Hence, surveys help to gain insights into how specific individuals or groups perceive specific aspects. In those surveys administered to users and non-users of each shared mobility service, in addition to BWM-related questions, questions about their routines, daily travel views, and socio-demographic characteristics were asked as well.

The obtained data associated with the views of operators and members of the government regarding some of the travel routines of users of each of the shared transportation services shows that from the perspective of at least half of car-sharing users and government members (who responded to the car-sharing survey), short-time trips (less than 30 min) can induce people to use (or use more) car-sharing. However, trips beyond 30 min cannot do that. On the other hand, none of the car-sharing operators agrees with the statement. This is an example of the gap between the views of car-sharing operators, car-sharing users, and government members (who responded to the car-sharing survey) about the effect of short-time trips on car-sharing demand. More detailed results are in the remainder.

Key conclusions from the descriptive statistics of the collected data

Some of the important results obtained from the collected data associated with the routines and daily travel views of users and non-users are as follows.

- The most common use of car-sharing is to perform a work-related activity in the city center. However, most people are likely to use bike-sharing and scooter-sharing for weekend activities.
- Concerning temporal patterns, car-sharing is mainly preferred during the off-peak hours; however, bike-sharing and scooter-sharing are mostly preferred for peak hours.
- Non-users of car-sharing are not paying much attention to the potentialities of this service for leisure travel. On the other hand, non-users of bike-sharing do not consider the capacity of this service for non-recreational trips. Regarding scooter-sharing, it can be mentioned that it has the potential to be used for both travel purposes.

- Increased comfort during travel is more important to male bike-sharing users than to female users. On the other hand, the availability of the service near the user's home/work and avoiding responsibilities related to maintenance and repairs are more important for females than males as a motivation to use bike-sharing.
- Compared to female car-sharing users, male car-sharing users are more interested in using the service only for non-leisure (going to work/school) trips. However, compared to female bike-sharing users, male bike-sharing users are more inclined to use the service only for leisure (e.g., visiting friends or shopping) trips. Concerning leisure-only travel (e.g., visiting friends or shopping), female scooter-sharing users are keener than male users.

The models' results can be divided into two parts: the conclusions from the analysis for each shared mobility service (separately) and for shared mobility services (as a whole, not for a specific shared mobility service). All results are reported concerning the main-criteria and sub-criteria, introduced in Tables 33 to 36 of Chapter 4.

Key conclusions from the analysis results for each shared mobility service (separately): car sharing

Some suggestions and policies derived from the similarities and differences between the four types of car-sharing stakeholders are given as follows.

- Car-sharing operators should pay more attention to trip-related characteristics instead of car-sharing characteristics in order to attract more users and non-users.
- Car-sharing operators and government members should pay attention to availability and accessibility to satisfy car-sharing service users; government members should pay more attention since they believe that availability and accessibility are the least important criterion.
- Car-sharing operators can focus less on user-friendliness, service quality, and safety (minimum safety required) to attract users and non-users.
- Operators should place more value on travel costs in their policies. Correspondingly, operators can reduce the cost of car-sharing services to the public to attract non-users and satisfy users. Also, due to more and easier access to free-floating car-sharing services than one-way or two-way car-sharing services, the travel time and travel distance of people traveling by free-floating car-sharing services can be less. Hence, operators can offer free-floating car-sharing to attract non-users and encourage users to use it more.
- Government members should note that they underestimate the importance of the availability of car-sharing services and travel distance in car-sharing demand. However, on the other hand, they overestimate the importance of the cost of car-sharing and trip purposes in car-sharing demand.

Key conclusions from the analysis results for each shared mobility service (separately): bike-sharing

Some suggestions and policies derived from the similarities and differences between the four types of stakeholders of bike-sharing are presented as follows.

- Bike-sharing operators should place more value on trip-related characteristics instead of bike-sharing characteristics to attract more individuals, especially non-users.
- Government members should be aware that they underestimate the importance of bike-sharing characteristics, availability, and accessibility compared to people, especially users. On the other hand, they overestimate the importance of trip-related characteristics.
- Bike-sharing operators can pay less attention to environment-friendly issues and place more value on trip-related characteristics, especially trip purpose and travel time, to attract users and non-users.
- Bike-sharing operators should pay more attention to vehicle availability and accessibility. In this regard, by switching from station-based bike-sharing to free-floating bike-sharing, operators may attract more users and non-users because people may have easier access to bike-sharing. Also, they do not need to ride a bike to reach a particular station. Hence, their travel time and distance can be shorter, leading to more bike-sharing users.
- Government members should be aware that they are underestimating the role of comfort and environmental-friendly system in demand for bike-sharing. However, on the other hand, they overestimate the role of travel time.
- Government members should realize that they underestimate the importance of safety compared to non-users, and bike-sharing operators should pay more attention to service quality to encourage users.

Key conclusions from the analysis results for each shared mobility service (separately): scooter-sharing

Some suggestions and policies are offered from the similarities and differences between the four types of scooter-sharing stakeholders.

- Government members should know that they underestimate trip-related characteristics compared to non-users. However, on the other hand, they overestimate scooter-sharing characteristics.
- More attention is required by scooter-sharing operators to scooter-sharing characteristics to attract more users and non-users.
- Scooter-sharing operators can pay more attention to service availability than vehicle availability and accessibility to encourage people to use scooter-sharing, especially non-users.
- To attract more users, scooter-sharing operators need to focus more on travel comfort and service quality.
- Scooter-sharing operators should pay more attention to travel costs, especially to raise user engagement.
- In general, scooter-sharing operators should offer more comfort services and high-quality scooter-sharing in high-demand locations at lower prices to increase demand.

- Government members should be aware that they underestimate travel time, travel distance, departure time, and vehicle availability and accessibility compared to people, especially users of scooter-sharing. However, on the other hand, they overestimate travel costs, safety, environment-friendly system, and user-friendly.

Tables 84 and 85 summarize the above-listed suggestions for government members and operators to pay more attention (+) (because they underestimate) or less attention (-) (because they overestimate compared to users/non-users) to the main-criteria and sub-criteria, respectively. For instance, Table 85 shows that because government members overestimate the importance of travel time (compared to users/non-users), they can pay less attention (-) to it (compared to now (if it has a role in their policy-making)). On the other hand, since bike-sharing operators underestimate the importance of travel time (compared to users/non-users), they should pay more attention (+) to it (compared to now).

Table 84: Suggestions for government members and operators to pay more attention (+) (because they underestimate) or less attention (-) (because they overestimate) to the importance of the main-criteria.

Shared Mobility Services	Main-criteria	Government members	Operators
Car-sharing	Trip-related Characteristics		(+)
	Car-sharing characteristics		(-)
Bike-sharing	Trip-related Characteristics	(-)	(+)
	Bike-sharing characteristics	(+)	(-)
	Availability and accessibility	(+)	
Scooter-sharing	Trip-related Characteristics	(+)	
	Scooter-sharing characteristics	(-)	(+)

Table 85: Suggestions for government members and operators to pay more attention (+) (because they underestimate) or less attention (-) (because they overestimate) to the importance of sub-criteria.

Shared mobility services	Sub-criteria	Government members	Operators
Car-sharing	Travel distance	(+)	
	Trip purpose	(-)	
	Travel cost	(-)	(+)
	Safety		(-)
	Service quality		(-)
	User-friendly		(-)
	Service availability	(+)	
	Vehicle availability and accessibility	(+)	(+)
Bike-sharing	Travel time	(-)	(+)
	Trip purpose		(+)
	Travel comfort	(+)	
	Safety	(+)	
	Service quality		(+)
	Environment-friendly system	(+)	(-)
Scooter-sharing	Travel time	(+)	
	Travel distance	(+)	
	Departure time	(+)	
	Travel cost	(-)	(+)
	Travel comfort		(+)
	Safety	(-)	
	Service quality		(+)
	Environment-friendly system	(-)	
	User-friendly	(-)	
	Service availability		(+)
	Vehicle availability and accessibility	(+)	(-)

Key conclusions from the analysis results for each shared mobility service (separately): Views of the four stakeholders related to different services

Some conclusions from the comparison between the views of the four stakeholders related to different services are delivered as follows.

- Government members consider that trip purpose, travel cost, and vehicle availability and accessibility are twice as important as some of the other criteria concerning car-sharing services, whereas travel time, travel distance, service availability, and vehicle availability and accessibility are prominent for them when dealing with scooter-sharing services.
- Car-sharing operators consider that user-friendliness, service availability, and vehicle availability and accessibility are twice as important as some other car-sharing criteria. For the bike-sharing operator, environment-friendly systems, service availability, vehicle availability, and accessibility are prominent.
- Car-sharing users believe that travel time, service availability, and vehicle availability and accessibility are at least twice as important as some other car-sharing criteria. Also, bike-sharing users believe that service availability, vehicle availability, and accessibility are at least twice as important as some other bike-sharing criteria. In this regard, scooter-sharing users believe that safety, vehicle availability, and accessibility are at least twice as important as some other criteria concerning scooter-sharing. Besides, users of all shared mobility services consider that vehicle availability and accessibility factor is at least twice as important as the departure time.
- Non-users of car-sharing consider that service availability, vehicle availability, and accessibility are at least twice more important than some other criteria. Also, both bike-sharing and scooter-sharing non-users believe that travel time, service availability, and vehicle availability and accessibility are at least twice more important than some of the other criteria. Further, non-users of all shared mobility services consider service availability, vehicle availability, and accessibility at least twice as important as travel comfort, environment-friendly system, and user-friendliness.

Key conclusions from MAMCA analysis for shared mobility services (as a whole)

From the analysis of the weights, it was concluded that the average number of trips per vehicle per day is more important for operators than for government members. Also, operational speed is more important for users and non-users than for operators. Besides, in the eyes of users and non-users, the shared mobility system should be (in order of importance): safe, low-cost, and highly accessible to both attract non-users and encourage more users to use it. Moreover, the scores (of the criteria) given by users are generally higher than those of non-users except for the cost of scooter-sharing, which may indicate that non-users underestimate the travel cost of scooter-sharing services. Finally, it is worth mentioning that the two least important criteria affecting the choice of shared mobility service from both users' and non-users' points of view are (in order of importance) the possibility of carrying items and the image.

Furthermore, from the perception analysis, it is clear that based on the analysis of the eight criteria examined in this study, car-sharing services (compared to bike-sharing services and scooter-sharing services) were preferred by users and non-users of shared transportation services in Turin, Italy. Besides, the cost is the only criterion with the least contribution to the choice of car-sharing services (compared to the other two shared mobility services) by both users and non-users. This result is different from the results obtained from the analysis of weights, from which it was concluded that the cost of travel is the second most important criterion in choosing a shared transportation service. As people have stated in their scoring, car-sharing services cost more than bike-sharing and scooter-sharing services, which makes up the difference because car-sharing receives a lower score, leading to a lower perceived value for this criterion.

It should be pointed out that the scooter-sharing service has the lowest priority among the three shared transportation services for users and non-users. The most important reason is that carrying fewer items with this service than car-sharing, and the service is also less safe and comfortable. Besides, from the standpoint of users and non-users, bike-sharing services are less preferred than car-sharing services due to less possibility of carrying items, safety, and comfort. On the other hand, from the analysis of the weights, it was concluded that the possibility of carrying items is one of the least important criteria. As users and non-users have noted in their scoring, both scooter-sharing and bike-sharing have less possibility to carry things than car-sharing, which causes the difference between the results of the weights analysis and perception analysis. Besides, it should be stated that the lower operational speed of bike-sharing (compared to car-sharing) contributes to its low preference, especially in the eyes of non-users. In addition, it is interesting to mention that the criteria accessibility and comfort show the greatest perception gap between users and non-users. Also, bike-sharing and scooter-sharing accessibility can contribute more to the value of these two services for their users, while the opposite is true for non-users. Finally, the speed of scooter-sharing is much less appreciated by non-users than by users. Note that this gap, embedding the weights of each criterion, is relatively wider compared to the average scores of the two groups related to scooter-sharing speed. The sensitivity analysis and scenario for users and non-users of shared mobility services (as a whole, not for a specific shared mobility service) demonstrate that from the perspective of both users and non-users, the best scenario to have the greatest increase in use for both bike-sharing and scooter-sharing is a scenario in which people's safety, user-friendliness, image, comfort, and the possibility of carrying items are increased.

This study provides suggestions to operators and government members to show how the importance of sub-criteria and main-criteria can increase users' engagement and attract non-users to services. Also, it contributes to knowing how different stakeholders score the importance of the comparison factors associated with their roles as stakeholders of shared mobility services. Besides, these results shed light on the relative importance of a set of criteria in choosing different mobility-sharing services for both its users and non-users. However, results are not necessarily correlated to the actual market share of the service. Indeed, car-sharing has the overall best value, but it serves fewer trips compared to bike-sharing in Turin. This is because different considerations might arise when making the final choice at the trip level. In other words, the above-presented methodology is not a tool to forecast travel behaviors or market shares of different services but rather to gain a deeper understanding of the factors that are stronger drivers of the choices, including those that cannot easily or readily be captured by observed or even latent variables or psychological constructs.

Considering the limitations of this study and recommendations for future studies, the data collection process could be done face-to-face with respondents in future research. In that case, the input-based approach can be performed during the meeting so that respondents can modify their answers instantly, leading to less excluded data. Also, a new combination of BWM with other appropriate methods, such as the fuzzy best-worst multi-criteria group decision-making method for the third step of MAMCA, can be used to compare related results with those of this study. In addition, to determine the overall importance of each criterion from the point of view of all stakeholders (simultaneously), stakeholders can be assigned weights (in the third stage of MAMCA). This was not done in this study because it was not our aim. This can indicate the importance of stakeholders in the decision-making process. Also, a hierarchical criteria tree (in the third stage of MAMCA) can be prepared to show the stakeholders involved with their goals and objectives. In this study, the criteria selection is based on the objectives of the stakeholders involved and the considered alternatives (car-sharing, bike-sharing, and scooter-sharing).

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Appendix 1

Appendix 1: Details on the methodology of the review of the socio-demographic factors for car-sharing and previous reviews in the same area[16]

This section details the methodological steps of reviewing the socio-demographic factors that can affect demand for different car-sharing forms presented in chapter 2. Similar steps have also been taken to review those factors influencing bike-sharing and scooter-sharing usage.

Previous work has already reviewed these factors. Jorge and Correia (2013) examined research that developed models to describe car-sharing demand and focused on solving the problem of vehicle imbalance. Ferrero et al. (2018) categorized the research, identified mainstream, and studied trends and perspectives. Illgen and H¨ock (2019) reviewed the papers that provided solutions to car-sharing relocation problems in the networks. Besides, Liao and Correia (2020) reviewed the publications that focused on demand estimation, use patterns, and potential impacts of Electric Car-Sharing (E-Car-Sharing). Unlike many previous studies that often did not explicitly consider different car-sharing variants, it is explicitly acknowledged that the operational scheme can profoundly impact the targeted travel demand segment. Therefore, an effort is made in the following analysis to distinguish the impacts of passengers' socio-demographic characteristics on different shared car schemes.

The following are the steps taken in this study to complete the review, mainly based on the method presented in similar studies (Akter et al., 2021; Eren and Uz, 2020; Nguyen et al., 2021; Rand and Fleming, 2019; Sadri et al., 2021). For a review, four databases, including

[16] Most of the contents of the present appendix have been published in Amirnazmiafshar, E., & Diana, M. (2022). A review of the socio-demographic characteristics affecting the demand for different car-sharing operational schemes. Transportation Research Interdisciplinary Perspectives, 14, 100616.

Google Scholar, TRID (https://trid.trb.org/), Scopus, and Web of Science, were used to evaluate recent papers on the car-sharing system according to a keywords-based process. During this process, no lower bounds on the publication date of reviewed papers are considered. The upper bound is December 22, 2020.

Several searches are performed in the mentioned databases by combining the keywords related to shared car systems like socio-demographic characteristics, demand for car-sharing, and car-sharing programs. These keywords were combined to form the set of strings used in the search, as listed by rows in Table A1.

Table A1: Number of selected articles by each keyword in each database.

String of Keywords	Google Scholar	TRID	Scopus	Web of Science	Total (With Duplicates)
Impacts of carsharing	44	9	4	31	88
Carsharing demand	43	3	13	30	89
Carsharing use	54	7	8	28	97
Gender effect on carsharing use	52	1	-	1	54
Sociodemographic factors' effects on carsharing	33	-	-	-	33
Users' behavior of a carsharing	31	10	-	26	67
Carsharing attraction	28	-	-	1	29
Carsharing adoption	19	6	6	11	42
Total (with duplicates)	304	36	31	128	499

For each keyword, the title of the first 100 articles (if any) of each database was reviewed, totaling 1979 articles. As indicated in Table A1, 499 articles were selected based on titles that, at first glance, seemed relevant to the purpose of the study. After eliminating duplicates (354 articles), 145 articles remained. An additional set of 23 articles was reviewed, including articles cited in the articles obtained by keywords, articles selected based on the author's knowledge, and articles used to explain the methodology of this article. These additional articles were not among the 499 articles because they did not contain the abovementioned keywords. Therefore, this initial pool of published papers consisted of 145 + 23 = 168 articles.

This pool was then scanned to select those focusing on different car-sharing systems' features and important factors influencing the service demand. Hence, 64 articles were not considered in this study since they mainly covered topics such as the benefits of the shared car, history and car-sharing trends, car-sharing classification, interaction with other modes of transport, and re-balancing issues. Therefore, 104 articles were left. Additionally, 13 articles not significantly dealing with the socio-demographic effects on demand for car-sharing services were discarded. These features included the trip purpose (2 articles), trip distance (2 articles), travel time (1 article), travel distance (1 article), Provision of Electric Vehicles (1 article), land use (2 articles), accessibility, and fleet size (3 articles), travel cost (1 article) that were omitted. Six of these 13 discarded articles focused on more than one non-socio-demographic feature.

In total, 91 articles have then been considered in this review paper coming from 25 different journals, two different conference proceedings, and four from research or educational reports. Among these articles, 59 directly mentioned the socio-demographic characteristics influencing car-sharing demand. The other 32 articles were not discarded and were used to cover other sections of the article, such as the introduction and method.

Given the uneven attention that previous research has paid to different characteristics, the conclusions or claims of the present review are based on only a few studies in some cases, while several studies have been reviewed for other claims. Figure A1 illustrates the number of studies examined for each of the eight socio-demographic characteristics according to the type of car-sharing services. Therefore, it helps to analyze and understand the degree of support for some of the results. It should be noted that the "station-based (type is not specified)" in Figure A1 refers to articles that did not explicitly state whether the authors worked on round-trip station-based car-sharing or one-way station-based car-sharing. It is only mentioned that they have worked on station-based car-sharing. "round-trip" in Figure A1 refers to articles working on home zone-based round-trip car-sharing or station-based round-trip car-sharing. Obviously, also differences in findings among studies on the same issue should be considered to assess if such findings are well established.

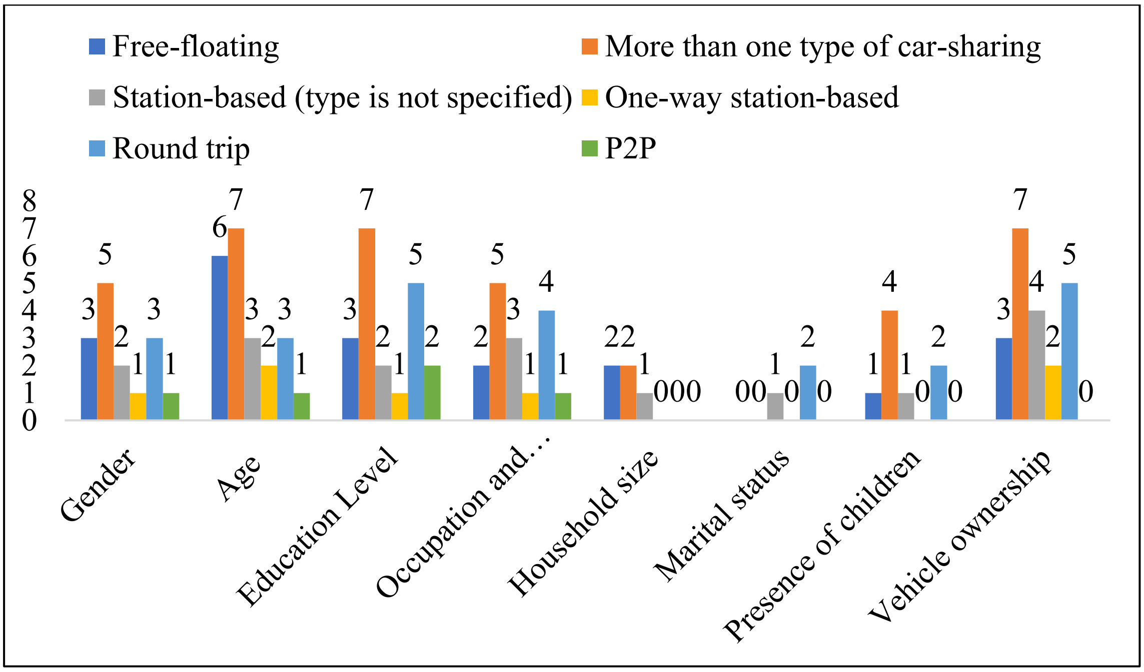

Figure A1: The number of studies reviewed for each socio-demographic characteristic according to the type of car-sharing service.

Appendix 2

Appendix 2: Survey questionnaires

In this study, nine surveys are used to understand the perspectives of four stakeholders of three shared mobility services, including car-sharing, bike-sharing, and scooter-sharing (individually), as well as shared mobility services (as a whole, not for a specific shared mobility service). These nine surveys, numbered from 1 to 9, are listed as follows.

- Survey 1: users and non-users of car-sharing services
- Survey 2: users and non-users of bike-sharing services
- Survey 3: users and non-users of scooter-sharing services
- Survey 4: government members and operators of car-sharing services
- Survey 5: government members and operators of bike-sharing services
- Survey 6: government members and operators of scooter-sharing services
- Survey 7: users and non-users of shared mobility services (as a whole, not for a specific shared mobility service)
- Survey 8: government members who respond to the shared mobility services (as a whole, not for a specific shared mobility service) surveys
- Survey 9: operators of shared mobility services (as a whole, not for a specific shared mobility service).

In these surveys, additional explanations are written in italics for the company conducting the survey. Also, the question filters (for example, if question "1" is yes, then answer this question) are written in italics. It is important to note that surveys (surveys 1 to 3) of users and non-users were the same. Also, government members (surveys 4 to 6) and operators (surveys 4 to 6) answered identical surveys for each shared mobility service. For the four stakeholders, the BWM-related questions (question set A in surveys 1 to 6) were the same (to understand the difference in their views on the same factors). Still, the rest of the questions users and non-users asked differed from those of government members and operators. In the surveys of car-sharing, bike-sharing, and scooter-sharing (surveys 1 to 6), the three different variants in the wording of some questions are reported as "{car, bike, scooter}-sharing". Also, there is a slight difference in the options of some of the questions for different shared mobility services (car-sharing, bike-sharing, and scooter-sharing), which are marked, for example, as follows: "•{Car-sharing questionnaire only: Driver}". Therefore, in sub-section A2.1 and A2.2, two surveys are presented separately for users and non-users stakeholders (surveys 1 to 3) and the government members and operators stakeholders (surveys 4 to 6), respectively.

Furthermore, the type of surveys conducted among government members (survey 8) and operators (survey 9) for shared transportation services (as a whole, not for a specific shared mobility service) was different because the purpose was to understand the importance of factors related to their decision, which were different for these two groups (question set A). Hence, three surveys for users/non-users (survey 7), government members (survey 8), and operators (survey 9) of shared mobility services (as a whole, not for a specific shared mobility service) are presented separately in the following three subsections A2.3, A2.4, and A2.5, respectively. It should be noted that all surveys (surveys 1 to 9) were administered in Italian, even if an English translation is reported here.

A2.1 Questionnaires for users and non-users of each shared mobility service (surveys 1 to 3)

This type of survey (1 to 3) is designed for users and non-users of car sharing, bike-sharing, and scooter-sharing services, and it includes two parts. In the first part, there are questions related to BWM analysis. In the second part, there are questions relevant to the routines, daily travel views, and socio-economic situation of respondents.

Dear Ms./Mr.

We are conducting a study at Politecnico di Torino. We aim to understand better your views on the importance of different characteristics in {car, bike, scooter}-sharing, to know your mobility routines and your daily travels. We assure you that all information you provide will be treated with the utmost confidentiality and will be completely anonymous. Your participation is a valuable contribution to this study, and we thank you for your cooperation.

Please read the {car, bike, scooter}-sharing definition first.

{car, bike, scooter}-sharing definition: People can use {car, bike, scooter}-sharing in many cities and communities. As a user, you have access to bookable {car, bike, scooter}-sharing vehicles. The vehicles are available 24 hours a day, 7 days a week, and available through self-service. It is important to note that a trip through {car, bike, scooter}-sharing is not shared with other users, but it is only the vehicles that are shared with others who use them at other times.

Please answer the following questions (question set A).

B1. There are several trip-related characteristics that could be considered in selecting {car, bike, scooter}-sharing to make a trip. These characteristics are listed below.

- **Travel time**: the time it takes with a given means to travel from origin to destination.
- **Travel distance**: the distance between origin and destination.
- **Departure time**: the trip's start time, such as in the morning or evening, on weekends, or on weekdays, during peak or off-peak hours.
- **Trip purpose**: the purpose of the trip, such as traveling to work, school, shopping, or meeting a friend.

In your opinion, what is the MOST IMPORTANT, and what is the LEAST IMPORTANT trip-related characteristic among the above four that could drive your choice?

Trip-related characteristics	Select the most important characteristic in the cell below	Select the least important characteristic in the cell below
Travel time		
Travel distance		
Departure time		
Trip purpose		

*"4*2=8 radio buttons in the above table are needed to make the selections".*

B2. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other three characteristics?

*The respondent should see the following table, where the characteristic which is selected as the most important factor and the other three should be mentioned in the first column according to the template below. 9*3 = 27 radio buttons should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.*

To which extent MOST IMPORTANT is more important than…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
LEAST IMPORTANT									
Characteristic 2									
Characteristic 3									

B3. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other two characteristics more important than *LEAST_IMPORTANT*?

*The respondent should see the following table. The other two characteristics, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the template below. 9*2 = 18 radio buttons should appear in the table.*

To which extent…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Characteristic 2 is more important than LEAST IMPORTANT									
Characteristic 3 is more important than LEAST IMPORTANT									

B4. Now, let us examine the relative importance of some {car, bike, scooter}-sharing characteristics. These characteristics are listed below.

- **Cost**: expenses for {car, bike, scooter}-sharing usage such as service subscription fees or usage fees.
- **Comfort**: vehicle characteristics that make you feel comfortable during the trip.
- **Safety**: The level of safety of the people during the trip, such as the rate of accidents, harassment, assault, and theft.
- **Service quality**: Quality of the {car, bike, scooter}-sharing system and given services.
- **Environment-friendly system**: a system that is reducing environmental impacts.
- **User-friendliness**: easy for beginners to learn, easy to use, and provide travel information in the app.

In your opinion, what is the MOST IMPORTANT, and what is the LEAST IMPORTANT {car, bike, scooter}-sharing characteristic among the above six that could drive your choice?

{Car, bike, scooter}-sharing characteristics	Select the most important characteristic in the cell below	Select the least important characteristic in the cell below
Travel cost		
Travel comfort		
Safety		
Service quality		
Environment-friendly system		
User-friendly		

*"6*2=12 radio buttons in the above table are needed to make the selections*

B5. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other five characteristics?

*The respondent should see the following table, where the characteristic which is selected as the most important and the other five should be mentioned in the first column according to the template below. 9*5 = 45 radio buttons should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.*

To which extent MOST IMPORTANT is more important than…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Least important)									
Characteristic 2									
Characteristic 3									
Characteristic 4									
Characteristic 5									

B6. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other four characteristics more important than *LEAST_IMPORTANT*?

*The respondent should see the following table. The other four characteristics, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the template below. 9*4 = 36 radio buttons should appear in the table.*

To which extent…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Characteristic 2 is more important than LEAST IMPORTANT									
Characteristic 3 is more important than LEAST IMPORTANT									
Characteristic 4 is more important than LEAST IMPORTANT									
Characteristic 5 is more important than LEAST IMPORTANT									

B7. Finally, let us consider the following two characteristics related to where shared cars are actually available:

- **Service availability**: Availability of {car, bike, scooter}-sharing services around shopping malls, colleges, transportation centers, city centers, and densely populated areas.
- **Vehicle availability and accessibility**: Availability of the vehicle where I need it, easiness to reach and access the vehicle, proximity to the location of the parked vehicle from my starting point.

In your opinion, what is the MOST IMPORTANT factor between these two?

- Service availability
- Vehicle availability and accessibility

B8. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than *LEAST IMPORTANT*?

*The respondent should see the following table, where the characteristic which is selected as the most important and the other one should be mentioned in the first column according to the template below. 9*1 = 9 radio buttons should appear in the table.*

To which extent MOST IMPORTANT is more important than…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
LEAST IMPORTANT									

B9. Now, let us jointly consider trip-related characteristics, {car, bike, scooter}-sharing characteristics, and availability & accessibility that you separately assessed in the previous questions. In your opinion, which of these three sets of characteristics is overall the MOST IMPORTANT, and which is the LEAST IMPORTANT when considering selecting {car, bike, scooter}-sharing to make a trip?

Characteristics	Select the most important characteristic in the cell below	Select the least important characteristic in the cell below

Trip-related characteristics (travel time, travel distance, departure time, trip purpose)	
{car, bike, scooter}-sharing characteristics (Cost, comfort, safety, service quality, environment-friendly system, user-friendliness)	
Availability and accessibility (Service availability, vehicle availability and accessibility)	

*3*2=6 radio buttons in the above table are needed to make the selections.*

B10. In the above question, you have chosen *MOST_IMPORTANT* as the most important set of characteristics. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other two sets?

*The respondent should see the following table, where the characteristic which is selected as the most important and the other two should be mentioned in the first column according to the template below. 9*2 = 18 radio buttons should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.*

To which extent MOST IMPORTANT is more important than…	**Equal importance 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Extremely more important 9**
Least important)									
Characteristic 2									

B11. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other characteristic more important than *LEAST_IMPORTANT*?

*The respondent should see the following table, where the other characteristic, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the below template. 9*1 = 9 radio buttons should appear in the table.*

To which extent…	**Equal Importance 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Extremely more important 9**
Characteristic 2 is more important than LEAST IMPORTANT									

The following questions are about your routines and your daily travel views (question set B).

Q1. Do you have a driving license?

- Yes
- No

Q2. Do you have any experience with {car, bike, scooter}-sharing services?

1. Yes, I am currently using {car, bike, scooter}-sharing services.
2. Yes, I used {car, bike, scooter}-sharing in the past, but I no longer use it.
3. No, I never used {car, bike, scooter}-sharing, but I know what it is.
4. I am not familiar with the concept of {car, bike, scooter}-sharing.

If 1, 2, or 3 in Q2

Q3. To what extent are you familiar with {car, bike, scooter}-sharing? (Membership terms, how to book, price levels, etc.)

- 1 (Slightly familiar)
- 2
- 3
- 4
- 5 (Very Familiar)

If 1 in Q2

Q4. Which {car, bike, scooter}-sharing services do you use? *(Show list of {car, bike, scooter}-sharing operators in Turin) (Respondents can choose more than one option at a time)*

- {Car-sharing questionnaire only: Enjoy}
- {Car-sharing questionnaire only: Car2go (Share Now)}
- {Car-sharing questionnaire only: BlueTorino}
- {Bike-sharing questionnaire only: TOBike}
- {Bike-sharing questionnaire only: Mobike}
- {Scooter-sharing questionnaire only: Bird}
- {Scooter-sharing questionnaire only: BIT mobility}
- {Scooter-sharing questionnaire only: Dott}
- {Scooter-sharing questionnaire only: Helbiz An}
- {Scooter-sharing questionnaire only: Circ}
- {Scooter-sharing questionnaire only: Lime}
- {Scooter-sharing questionnaire only: Wind}
- {Scooter-sharing questionnaire only: Link}
- {Scooter-sharing questionnaire only: Vo i}
- Other (please specify)……

If 1, 2, or 3 in Q2

Q5. Are there any {car, bike, scooter}-sharing pick-up locations near your home, or is your home within an operational area of at least one {car, bike, scooter}-sharing service?

- Yes
- No
- I do not know.

If 1, 2, or 3 in Q2

Q6. Are there any {car, bike, scooter}-sharing pick-up locations near the most frequent destination of your trips (e.g., workplace, the place where you study or go for shopping), or is a such destination within the operational area of at least one {car, bike, scooter}-sharing service?

- Yes,
- No
- I do not know.

Q7. If you think about your daily travel at this time of the year (for work, study, food purchase, etc.), how often do you use the following transport modes?

(If yes in Q1) Q7.1. Private car as a driver.

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.2. Private car as a passenger.

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.3. Car-sharing (either as a driver or as a passenger).

- Daily

- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.4. Public Transport (train, intercity, or urban services).

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.5. Motorcycle/scooter.

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.6. Taxi.

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.7. Personal bike

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.8. Bike-sharing

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.9. Scooter-sharing

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q7.10. Walking.

- Daily
- 4-6 days a week
- 1-3 days a week
- Once/a few times a month
- Rarely
- Never

Q8. Some activities are listed below. Which transport mode are you most likely to use in such situations? Please select only one option (the first that comes to mind).

Q8.1. Going to work or school.

- *(If yes in Q1)* Private car as a driver
- Private car as a passenger
- Car-sharing
- Public transport
- Moto/Scooter
- Taxi
- Personal bike
- Bike-sharing
- Scooter-sharing
- Walking
- Other

Q8.2. Visiting a close relative / friends / relatives / family.

- *(If yes in Q1)* Private car as a driver
- Private car as a passenger
- Car-sharing
- Public transport
- Moto/Scooter
- Taxi
- Personal bike
- Bike-sharing
- Scooter-sharing
- Walking
- Other

Q8.3. Running an errand in the city center.

- *(If yes in Q1)* Private car as a driver
- Private car as a passenger
- Car-sharing
- Public transport
- Moto/Scooter
- Taxi
- Personal bike
- Bike-sharing
- Scooter-sharing
- Walking
- Other

Q8.4. Going out for dinner.

- *(If yes in Q1)* Private car as a driver
- Private car as a passenger
- Car-sharing
- Public transport
- Moto/Scooter
- Taxi

- Personal bike
- Bike-sharing
- Scooter-sharing
- Walking
- Other

Q8.5. Taking an excursion in nice weather.

- *(If yes in Q1)* Private car as a driver
- Private car as a passenger
- Car-sharing
- Public transport
- Moto/Scooter
- Taxi
- Personal bike
- Bike-sharing
- Scooter-sharing
- Walking
- Other

Q8.6. Visiting a shopping center.

- *(If yes in Q1)* Private car as a driver
- Private car as a passenger
- Car-sharing
- Public transport
- Moto/Scooter
- Taxi
- Personal bike
- Bike-sharing
- Scooter-sharing
- Walking
- Other

Q8.7. Going to smaller shops.

- *(If yes in Q1)* Private car as a driver
- Private car as a passenger
- Car-sharing
- Public transport
- Moto/Scooter
- Taxi
- Personal bike
- Bike-sharing
- Scooter-sharing
- Walking
- Other

Q8.8. Weekend activities.

- *(If yes in Q1)* Private car as a driver
- Private car as a passenger
- Car-sharing
- Public transport
- Moto/Scooter
- Taxi
- Personal bike
- Bike-sharing
- Scooter-sharing
- Walking

- Other

Q9. In your opinion, which of the following advantages might induce you to use (or use more) {car, bike, scooter}-sharing? Multiple answers are possible (maximum 3).

Respondents can choose up to 3 options at a time.

- Availability of shared cars near my home/workplace.
- To reduce expenses, such as maintenance and insurance
- To travel more sustainably.
- Increased comfort when traveling.
- The convenience of having a car only when I need it.
- To avoid responsibilities with maintenance and repairs of my own car.
- {Bike-sharing and scooter-sharing questionnaire only: Smooth track without slope}.

If 1, 2, or 3 in Q2

Q10. In your opinion, which of the following weather conditions can make you use the {car, bike, scooter}-sharing service more than other modes of transportation? Multiple answers are possible (maximum 3).

Respondents can choose up to 3 options at a time.

- Bad weather (e.g., rainy or snowy weather).
- Good weather (e.g., sunny weather).
- Scorching weather.
- Favorable air temperature.
- Freezing weather.
- High humidity level.
- Favorable humidity level.
- High air pollution.
- Low air pollution.
- In winter.
- In spring.
- In summer.
- In autumn.

Q11. In your opinion, which of the following situations might induce you to use (or use more) {car, bike, scooter}-sharing?

- Travel less than 5 km
- Travel 5 km or more
- Both

Q12. In your opinion, which of the following situations might induce you to use (or use more) {car, bike, scooter}-sharing?

- Travel less than 30 min
- Travel 30 min or more
- Both

Q13. In your opinion, which of the following situations might induce you to use (or use more) {car, bike, scooter}-sharing?

- Travel during peak hours
- Travel during off-peak hours
- Both

Q14. In your opinion, which of the following situations might induce you to use (or use more) {car, bike, scooter}-sharing? (Multiple answers are possible (maximum 3).

Respondents can choose up to 3 options at a time.

- Travel on a weekday morning

- Travel on a weekend morning
- Travel on a weekday evening
- Travel on a weekend evening

Q15. In your opinion, which of the following situations might induce you to use (or use more) {car, bike, scooter}-sharing?

- Travel for leisure (e.g., vising friends or shopping)
- Travel for non-leisure (going to work/school)
- Both

If 1 or 2 in Q2

Q16. The following statements are about your perceptions of {car, bike, scooter}-sharing use. Note that there are no right or wrong answers for these. However, we are interested in your impressions on this topic. Please, indicate to what extent you agree or disagree with the following statements.

Q16.1. It is possible for me to use {car, bike, scooter}-sharing for my regular trips.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q16.2. I am sure I can choose {car, bike, scooter}-sharing for my regular trips during the next week.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q16.3. The {car, bike, scooter}-sharing service is a useful mode of transport.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q16.4. {car, bike, scooter}-sharing helps me to accomplish activities that are important to me.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q16.5. Learning how to use {car, bike, scooter}-sharing was easy for me.

- 1 (Strongly disagree)
- 2
- 3

- 4
- 5
- 6
- 7 (Strongly agree)

Q16.6. I find {car, bike, scooter}-sharing easy to use.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q16.7. It is difficult to book a car at the {car, bike, scooter}-sharing website/app.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

If 1 or 2 in Q2

Q17. Now there are some statements about your social network. To what extent do you agree or disagree with the following statements?

Q17.1. People who are important to me think I should use {car, bike, scooter}-sharing more often instead of other modes of transportation.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q17.2. People who are important to me like that I use {car, bike, scooter}-sharing.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q17.3. People who are important to me agree with my use of {car, bike, scooter}-sharing.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

If 3 in Q2

Q18. Now there are some statements about your social network. To what extent do you agree or disagree with the following statements?
Q18.1. People who are important to me think I should use {car, bike, scooter}-sharing.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q18.2. People who are important to me would like me to use {car, bike, scooter}-sharing.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q18.3. People who are important to me would agree if I used {car, bike, scooter}-sharing.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

If 1, 2, or 3 in Q2

Q19. The following statements are about {car, bike, scooter}-sharing. Please, indicate the extension of your opinions.

Q19.1. My support for the implementation of {car, bike, scooter}-sharing in society is

- 1 (Very low)
- 2
- 3
- 4
- 5
- 6
- 7 (Very high)

Q19.2. Overall, my view of {car, bike, scooter}-sharing is

- 1 (Very negative)
- 2
- 3
- 4
- 5
- 6
- 7 (Positive)

If 1 or 2 in Q2

Q20. The following statements are about {car, bike, scooter}-sharing. Please, indicate the extension of your opinions.

Q20.1. Using {car, bike, scooter}-sharing is relatively enjoyable.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q20.2. Using {car, bike, scooter}-sharing is relatively environmentally friendly.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q20.3. The impact of health concerns due to the Covid-19 pandemic has reduced my use of {car, bike, scooter}-sharing.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

If 1 or 2 in Q2

Q21. Based on your previous experience with {car, bike, scooter}-sharing, answer the following questions.

Q21.1. I know {car, bike, scooter}-sharing provides good service.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q21.2. I know it is predictable.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q21.3. I know it is trustworthy.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5

- 6
- 7 (Strongly agree)

If 3 in Q2

Q22. The following statements are about your perceptions of {car, bike, scooter}-sharing use. Note that there are no right or wrong answers for these. However, we are interested in your impressions on this topic. Please, indicate to what extent you agree or disagree with the following statements.

Q22.1. It would be possible for me to use {car, bike, scooter}-sharing for my regular trips.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q22.2. I am sure I can choose the {car, bike, scooter}-sharing for my regular trips during the next week.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q22.3. Using {car, bike, scooter}-sharing services would be a useful mode of transport.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q22.4. Using {car, bike, scooter}-sharing would help me to accomplish activities that are important to me.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q22.5. Learning how to use {car, bike, scooter}-sharing would be easy for me.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q22.6. I would find {car, bike, scooter}-sharing easy to use.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5

- 6
- 7 (Strongly agree)

Q22.7. It would be difficult to book a car at the {car, bike, scooter}-sharing website/app.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

If 3 in Q2

Q23.The following statements are about {car, bike, scooter}-sharing. Please, indicate the extension of your opinions.

Q23.1. Using {car, bike, scooter}-sharing services would be enjoyable.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q23.2. I think {car, bike, scooter}-sharing services are environmentally friendly.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

If 3 in Q2

Q24. Answer the following questions according to your knowledge of {car, bike, scooter}-sharing.

Q24.1. I think it provides good service.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q24.2. I think it is predictable.
- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q24.3. I think it is trustworthy.
- 1 (Strongly disagree)
- 2

- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q25. The following statements are about the environmental impacts of travel. Indicate to what extent you agree or not.

Q25.1. The urgent need to reduce ecological destruction caused by using cars has been overestimated.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q25.2. I believe that using a car causes many environmental problems.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q26. The following statements are about the environmental impact of your personal daily travels. To which extent do you agree or disagree with them?

Q26.1. I feel morally obliged to reduce the environmental impact due to my travel patterns.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q26.2. I would feel guilty if I did not reduce the environmental impact of my travel patterns.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q26.3. I would feel good if I traveled more sustainably.

- 1 (Strongly disagree)
- 2
- 3
- 4
- 5
- 6
- 7 (Strongly agree)

Q27. Political issues are sometimes referred to on a green environmental scale. Where would you place yourself on such a green scale?

- 1 (Not green)
- 2
- 3
- 4
- 5
- 6
- 7 (Very green)

Q28. Political issues are sometimes also referred to as "left" and "right". Where would you place your views on this scale?

- Far to the left
- Left
- Quite left
- Neither to the left nor the right
- Quite right
- Right
- Far to the right

Final questions about yourself (question set C)

Q29. What is your gender?

- Male
- Female
- Other

Q30. In which year were you born?
Select the year.

Q31. What is your marital status?

- Single
- Married or domestic partnership

Q32. What is your business or professional status?

- Entrepreneur/freelancer
- Officer/manager
- Clerk/trade employee
- Worker
- Teacher
- Representative
- Craftsman / trader / operator
- Student
- Housewife
- Retired
- Waiting for first job / never worked
- Unemployed / lost his/her job.
- Other

Q33. What is the highest level of education you have?

- Not completed primary school
- Elementary school
- Upper secondary school or equivalent shorter than 3 years
- Upper secondary school or equivalent 3 years or more
- Post-secondary education, not college, less than 3 years

- Post-secondary education, not college 3 years or more
- University less than 3 years
- University 3 years or more
- Degree from postgraduate studies

Q34. Please, select the municipality where you live.

…………

Q35. How many people, including yourself, live in your household?

- 1
- 2
- 3
- 4
- 5 or more

Q36. How many drivers, including yourself, are there in your household?

- 0
- 1
- 2
- More than 2

Q37. Do you have children living in your household?

- Yes
- No

If yes, in Q37

Q38. How old are your children? (You can select more than one option)

Respondents can choose more than one option.

- 0-3 years old
- 4-6 years old
- 7-15 years old
- 16 years old or older

Q39. How many cars are available in your household? (Please also count company cars you have received from your employer that are authorized for personal use).

- No car
- One car
- Two cars
- Three or more cars

Q40_01. Approximately what is your personal monthly income after taxes?

- Up to 500Euro
- 501Euro - 1000Euro
- 1001Euro - 1500Euro
- 1501Euro - 2000Euro
- 2001Euro - 2500Euro
- 2501Euro - 3000Euro
- 3001Euro - 4000Euro
- 4001Euro - 5000Euro
- 5001Euro - 6000Euro
- € 6001 - € 10,000
- More than 10.001 Euros

Q40_02. Approximately what is your monthly household income after taxes? You can answer this question even if you are unsure of the exact amount.

- Up to 500Euro
- 501Euro - 1000Euro
- 1001Euro - 1500Euro
- 1501Euro - 2000Euro
- 2001Euro - 2500Euro
- 2501Euro - 3000Euro
- 3001Euro - 4000Euro
- 4001Euro - 5000Euro
- 5001Euro - 6000Euro
- € 6001 - € 10,000
- More than 10.001 Euros

Q41. How do you manage your expenses with your current income?

- Very good
- Fairly good
- Neither good nor bad
- Pretty bad
- Very bad

A2.2 Questionnaires for government members and operators of each shared mobility service (surveys 4 to 6)

This type of survey (4 to 6) is designed for government members and operators of car sharing, bike-sharing, and scooter-sharing services, and it includes two parts. In the first part, there are questions related to BWM analysis. In the second part, questions are relevant to the respondent's opinion about some of the characteristics that might induce people to use (or use more) {car, bike, scooter}-sharing.

Dear Ms./Mr.

We are conducting a study at Politecnico di Torino. We aim to understand better individuals' views on the importance of different characteristics in {car, bike, scooter}-sharing, to know their mobility routines and daily travels. We assure you that all information you provide will be treated with the utmost confidentiality and will be completely anonymous. Your participation is a valuable contribution to this study, and we thank you for your cooperation.

Please answer the following questions (question set A).

B1. There are several trip-related characteristics that could be considered by individuals in selecting {car, bike, scooter}-sharing to make a trip. These characteristics are listed below.

- **Travel time**: the time it takes with a given means to travel from origin to destination.
- **Travel distance**: the distance between origin and destination.
- **Departure time**: the trip's start time, such as in the morning or evening, on weekends, or on weekdays, during peak or off-peak hours.
- **Trip purpose**: the purpose of the trip, such as traveling to work, school, shopping, or meeting a friend.

In your opinion, what is the MOST IMPORTANT, and what is the LEAST IMPORTANT trip-related characteristic among the above four that could drive individuals' choice?

Trip-related characteristics	Select the most important characteristic in the cell below	Select the least important characteristic in the cell below
Travel time		
Travel distance		

Departure time	
Trip purpose	

*"4*2=8 radio buttons in the above table are needed to make the selections".*

B2. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other three characteristics?

*The respondent should see the following table, where the characteristic which is selected as the most important, and the other three should be mentioned in the first column according to the template below. 9*3 = 27 radio buttons should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.*

To which extent MOST IMPORTANT is more important than…	**Equal importance 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Extremely more important 9**
LEAST IMPORTANT									
Characteristic 2									
Characteristic 3									

B3. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other two characteristics more important than *LEAST_IMPORTANT*?

*The respondent should see the following table. The other two characteristics, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the template below. 9*2 = 18 radio buttons should appear in the table.*

To which extent…	**Equal importance 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Extremely more important 9**
Characteristic 2 is more important than LEAST IMPORTANT									
Characteristic 3 is more important than LEAST IMPORTANT									

B4. Now, let us examine the relative importance of some {car, bike, scooter}-sharing characteristics. These characteristics are listed below.

- **Cost**: expenses for {car, bike, scooter}-sharing usage such as service subscription fees or usage fees.
- **Comfort**: vehicle characteristics that make you feel comfortable during the trip.
- **Safety**: The level of safety of the individual during the trip, such as the rate of accidents, harassment, assault, and theft.
- **Service quality**: Quality of the {car, bike, scooter}-sharing system and given services.
- **Environment-friendly system**: a system that is reducing environmental impacts.
- **User-friendliness**: easy for beginners to learn, easy to use, and provide travel information in the app.

In your opinion, what is the MOST IMPORTANT, and what is the LEAST IMPORTANT {car, bike, scooter}-sharing characteristic among the above six that could drive individuals' choice?

{Car, bike, scooter}-sharing characteristics	**Select the most important characteristic in the cell below**	**Select the least important characteristic in the cell below**
Travel cost		
Travel comfort		
Safety		
Service quality		
Environment-friendly system		
User-friendly		

*"6*2=12 radio buttons in the above table are needed to make the selections*

B5. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other five characteristics?

*The respondent should see the following table, where the characteristic which is selected as the most important and the other five should be mentioned in the first column according to the template below. 9*5 = 45 radio buttons* *should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.*

To which extent MOST IMPORTANT is more important than…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Least important)									
Characteristic 2									
Characteristic 3									
Characteristic 4									
Characteristic 5									

B6. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other four characteristics more important than *LEAST_IMPORTANT*?

*The respondent should see the following table. The other four characteristics, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the template below. 9*4 = 36 radio buttons should appear in the table.*

To which extent…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Characteristic 2 is more important than LEAST IMPORTANT									
Characteristic 3 is more important than LEAST IMPORTANT									
Characteristic 4 is more important than LEAST IMPORTANT									
Characteristic 5 is more important than LEAST IMPORTANT									

B7. Finally, let us consider the following two characteristics related to where shared cars are actually available:

- **Service availability**: Availability of {car, bike, scooter}-sharing services around shopping malls, colleges, transportation centers, city centers, and densely populated areas.
- **Vehicle availability and accessibility**: Availability of the vehicle where I need it, easiness to reach and access the vehicle, proximity to the location of the parked vehicle from my starting point.

In your opinion, what is the MOST IMPORTANT factor between these two?

- Service availability
- Vehicle availability and accessibility

B8. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than *LEAST IMPORTANT*?

*The respondent should see the following table, where the characteristic which is selected as the most important and the other one should be mentioned in the first column according to the template below. 9*1 = 9 radio buttons should appear in the table.*

To which extent MOST IMPORTANT is more important than…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
LEAST IMPORTANT									

B9. Now, let us jointly consider trip-related characteristics, {car, bike, scooter}-sharing characteristics, and availability & accessibility that you separately assessed in the previous questions. In your opinion, which of these three sets of characteristics is overall the MOST IMPORTANT, and which is the LEAST IMPORTANT when individuals are considering to choose {car, bike, scooter}-sharing to make a trip?

Characteristics	Select the most important characteristic in the cell below	Select the least important characteristic in the cell below

Trip-related characteristics (travel time, travel distance, departure time, trip purpose)	
{car, bike, scooter}-sharing characteristics (Cost, comfort, safety, service quality, environment-friendly system, user-friendliness)	
Availability and accessibility (Service availability, vehicle availability and accessibility)	

*3*2=6 radio buttons in the above table are needed to make the selections.*

B10. In the above question, you have chosen *MOST_IMPORTANT* as the most important set of characteristics. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other two sets?

*The respondent should see the following table, where the characteristic which is selected as the most important and the other two should be mentioned in the first column according to the template below. 9*2 = 18 radio buttons should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.*

To which extent MOST IMPORTANT is more important than…	**Equal importance 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Extremely more important 9**
Least important)									
Characteristic 2									

B11. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other characteristic more important than *LEAST_IMPORTANT*?

*The respondent should see the following table, where the other characteristic, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the below template. 9*1 = 9 radio buttons should appear in the table.*

To which extent…	**Equal importance 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Extremely more important 9**
Characteristic 2 is more important than LEAST IMPORTANT									

Please answer the following questions to determine your opinion about some of the characteristics that might induce people to use (or use more) {car, bike, scooter}-sharing (question set D)

Q1. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing?

- Short-distance trips (less than 5 km)
- Long-distance trips (beyond 5 km)
- Both

Q2. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing?

- Short-time trips (less than 30 min)
- Long-distance trips (beyond 30 min)
- Both

Q3. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing?

- During peak hours
- During off-peak hours

- Both

Q4. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing? (Multiple answers are possible (maximum 3).

Respondents can choose up to 3 options at a time.

- On weekday morning
- On weekend morning
- On weekday evening
- On weekend evening

Q5. In your opinion, which of the following characteristics might induce people to use (or use more) {car, bike, scooter}-sharing?

- For leisure trips (e.g., vising friends or shopping)
- For non-leisure trips (going to work/school)
- Both

A2.3 Questionnaires for users and non-users of shared mobility services (as a whole, not for a specific shared mobility service) (survey 7)

This type of survey (survey 7) is designed for users and non-users of shared mobility services (as a whole, not for a specific shared mobility service), and it includes two parts. In the first part, there are questions related to BWM analysis. In the second part, questions are relevant to the respondent's opinions on characteristics affecting car-sharing, bike-sharing, and scooter-sharing use.

Dear Ms./Mr.

We are conducting a study at Politecnico di Torino. We aim to understand better your views on the importance of different characteristics in shared mobility and to know your mobility routines and your daily travels. We assure you that all information you provide will be treated with the utmost confidentiality and will be completely anonymous. Your participation is a valuable contribution to this study, and we thank you for your cooperation.

Please read the shared mobility definition first.

Shared mobility definition: shared mobility is a shared vehicle that people can use in many cities and communities. As a user, you have access to bookable shared vehicles. The vehicles are available 24 hours a day, 7 days a week, and available through self-service. It is important to note that a trip through shared mobility is not shared with other users, but it is only the vehicles that are shared with others who use them at other times.

Please answer the following questions (question set A).

B1. There are several characteristics that could be considered in selecting shared mobility to make a trip. These characteristics are listed below.

- **People's Safety**: The level of safety of the individuals during the trip, such as the rate of accidents, harassment, assault, and theft.
- **Operational speed**: the average velocity that a shared mobility system overpasses.
- **Accessibility:** Ease of access, availability of a shared vehicle, proximity to the location of the parked shared vehicle.
- **User-friendliness**: easy for beginners to learn, easy to use, and provide travel information in the app.
- **Image**: The image of a shared mobility system in the eyes of you.
- **Comfort**: Vehicle characteristics that make you feel comfortable during the trip
- **Cost**: Expenses for shared mobility usage, such as service subscription fees or usage fees.
- **Possibility of carrying items**: Possibility of carrying luggage or bags or shopping items in the shared vehicle. For instance, people can carry their luggage by shared car, but not by scooter-sharing.

In your opinion, what is the MOST IMPORTANT and what is the LEAST IMPORTANT characteristic among the above eight that could drive your choice?

Characteristics	Select the most important Characteristic in the cell below	Select the least important Characteristic in the cell below
People's safety		
Operational speed		
Accessibility		
User-friendliness		
Image		
Comfort		
Cost		
Possibility of carrying items		

*"8*2=16 radio buttons in the above table are needed to make the selections".*

B2. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other seven characteristics?

*The respondent should see the following table, where the characteristic which is selected as the most important, and the other seven should be mentioned in the first column according to the template below. 9*7 = 63 radio buttons should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.*

To which extent MOST IMPORTANT is more important than…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
LEAST IMPORTANT									
Characteristic 2									
Characteristic 3									
Characteristic 4									
Characteristic 5									
Characteristic 6									
Characteristic 7									

B3. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other six characteristics more important than *LEAST_IMPORTANT*?

*The respondent should see the following table. The other six characteristics, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the template below. 9*6 = 54 radio buttons should appear in the table.*

To which extent…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Characteristic 2 is more important than LEAST IMPORTANT									
Characteristic 3 is more important than LEAST IMPORTANT									
Characteristic 4 is more important than LEAST IMPORTANT									
Characteristic 5 is more important than LEAST IMPORTANT									
Characteristic 6 is more important than LEAST IMPORTANT									
Characteristic 7 is more important than LEAST IMPORTANT									

Please answer the following questions to determine your opinion on characteristics affecting car-sharing, bike-sharing, and scooter-sharing use (question set E).

Q1. How safe do you feel on car-sharing trips?

- 1 (Very unsafe)
- 2

- 3
- 4
- 5
- 6
- 7 (Very safe)

Q2. How safe do you feel on bike-sharing trips?

- 1 (Very unsafe)
- 2
- 3
- 4
- 5
- 6
- 7 (Very safe)

Q3. How safe do you feel on scooter-sharing trips?

- 1 (Very unsafe)
- 2
- 3
- 4
- 5
- 6
- 7 (Very safe)

Q4. How would you rate the travel speed of a car-sharing service?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q5. How would you rate the travel speed of a bike-sharing service?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q6. How would you rate the travel speed of the scooter-sharing service?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q7. How easy or difficult is it to access car-sharing?

- 1 (Very difficult)
- 2
- 3

- 4
- 5
- 6
- 7 (Very easy)

Q8. How easy or difficult is it to access bike-sharing?

- 1 (Very difficult)
- 2
- 3
- 4
- 5
- 6
- 7 (Very easy)

Q9. How easy or difficult is it to access scooter-sharing?

- 1 (Very difficult)
- 2
- 3
- 4
- 5
- 6
- 7 (Very easy)

Q10. How would you rate the user-friendliness of car-sharing services?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q11. How would you rate the user-friendliness of bike-sharing services?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q12. How would you rate the user-friendliness of the scooter-sharing services?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q13. How would you rate car-sharing service overall?

- 1 (Very poor)
- 2
- 3
- 4

- 5
- 6
- 7 (Very good)

Q14. How would you rate bike-sharing service overall?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q15. How would you rate the scooter-sharing service overall?

- 1 (Very poor)
- 2
- 3
- 4
- 5
- 6
- 7 (Very good)

Q16. How comfortable do you feel on car-sharing trips?

- 1 (Very uncomfortable)
- 2
- 3
- 4
- 5
- 6
- 7 (Very comfortable)

Q17. How comfortable do you feel on bike-sharing trips?

- 1 (Very uncomfortable)
- 2
- 3
- 4
- 5
- 6
- 7 (Very comfortable)

Q18. How comfortable do you feel on scooter-sharing trips?

- 1 (Very uncomfortable)
- 2
- 3
- 4
- 5
- 6
- 7 (Very comfortable)

Q19. How would you rate the usage or membership fees of car-sharing services?

- 1 (Very expensive)
- 2
- 3
- 4
- 5

- 6
- 7 (Very cheap)

Q20. How would you rate the usage or membership fees of bike-sharing services?

- 1 (Very expensive)
- 2
- 3
- 4
- 5
- 6
- 7 (Very cheap)

Q21. How would you rate the usage or membership fees of scooter-sharing services?

- 1 (Very expensive)
- 2
- 3
- 4
- 5
- 6
- 7 (Very cheap)

Q22. Is it difficult or easy to carry your belongings when using car-sharing?

- 1 (Very difficult)
- 2
- 3
- 4
- 5
- 6
- 7 (Very easy)

Q23. Is it difficult or easy to carry your belongings when using bike-sharing?

- 1 (Very difficult)
- 2
- 3
- 4
- 5
- 6
- 7 (Very easy)

Q24. Is it difficult or easy to carry your belongings when using scooter-sharing?

- 1 (Very difficult)
- 2
- 3
- 4
- 5
- 6
- 7 (Very easy)

A2.4 Questionnaire for government members about shared mobility services (as a whole, not for a specific shared mobility service) (surveys 8)

This type of survey (survey 8) is designed for government members and is about shared mobility services (as a whole, not for a specific shared mobility service). In this survey, there are questions related to BWM analysis.

Dear Ms./Mr.

We are conducting a study at Politecnico di Torino. We aim to understand better individuals' views on the importance of different characteristics in shared mobility, to know their mobility routines and their daily travels. We assure you that all information you provide will be treated with the utmost confidentiality and will be completely anonymous. Your participation is a valuable contribution to this study, and we thank you for your cooperation.

Please briefly state your role in your Administration. [*Open Question*]

Question set A:

Suppose, as a government member, you want to decide on a new shared mobility system to be set up in Turin, Italy. The following characteristics are considered to select the most appropriate system among the following three: car-sharing, bike-sharing, and scooter-sharing. You could make your decision based on the following characteristics.

- **The number of trips per vehicle per day**: it gives insight into the efficiency of the vehicle that shows the efficiency of the service.
- **Greenhouse gases (GHGs):** the amount of greenhouse gas emissions by a shared mobility system.
- **Parking issues:** illegal parking of shared vehicles like parking in inappropriate places.
- **Emission of pollutants:** pollutants emitted by a shared vehicle.
- **Integration of the shared mobility service with public transport:** Complementarity of a shared vehicle for public transport. Their integration can increase urban mobility**.**
- **Vehicle fee:** the fee that a shared mobility operator may pay to the municipality. For example, car-sharing operators pay a fee to the municipality, which allows their shared cars to go to city centers or places where traffic is restricted.

Please Answer the following questions.

Do you think something is missing from the list above? The above characteristics are important criteria that make it possible to compare shared mobility modes (car-sharing, bike-sharing, scooter-sharing). What do you think about this list? Are there any unmentioned or unclear criteria? Do you have anything to add?

B1. In your opinion, what is the MOST IMPORTANT, and what is the LEAST IMPORTANT characteristic among the above six that could drive your choice?

Characteristics	Select the most important characteristic in the cell below	Select the least important characteristic in the cell below
The number of trips per vehicle per day		
Greenhouse gases (GHGs)		
Parking issues		
Emission of pollutants		
Integration of the shared mobility service with public transport		
Vehicle fee		

*"6*2=12 radio buttons in the above table are needed to make the selections".*

B2. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other five characteristics?

*The respondent should see the following table, where the characteristic which is selected as the most important and the other five should be mentioned in the first column according to the template below. 9*5 = 45 radio buttons should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.*

To which extent MOST IMPORTANT is more important than…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
LEAST IMPORTANT									
Characteristic 2									
Characteristic 3									
Characteristic 4									
Characteristic 5									

B3. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other four characteristics more important than *LEAST_IMPORTANT*?

*The respondent should see the following table. The other four characteristics, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the template below. 9*4 = 36 radio buttons should appear in the table.*

To which extent…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Characteristic 2 is more important than LEAST IMPORTANT									
Characteristic 3 is more important than LEAST IMPORTANT									
Characteristic 4 is more important than LEAST IMPORTANT									
Characteristic 5 is more important than LEAST IMPORTANT									

A2.5 Questionnaire for operators of shared mobility services (as a whole, not for a specific shared mobility service) (survey 9)

This type of survey (survey 9) is designed for operators of shared mobility services (as a whole, not for a specific shared mobility service). In this survey, there are questions related to BWM analysis.

Dear Ms./Mr.

We are conducting a study at Politecnico di Torino. We aim to understand better individuals' views on the importance of different characteristics in shared mobility, to know their mobility routines and their daily travels. We assure you that all information you provide will be treated with the utmost confidentiality and will be completely anonymous. Your participation is a valuable contribution to this study, and we thank you for your cooperation.

Which kind of shared mobility service is offered by your company? (You can choose more than one option)

- Free-floating car-sharing
- Station-based car-sharing
- Free-floating bike-sharing
- Station-based bike-sharing
- Scooter-sharing

Please briefly state your role in your company. [*Open Question*]

Question set A:

As a shared mobility operator, suppose you plan to run your own shared mobility system in a city. The following characteristics are already known as important elements for system implementation.

- **Vehicle utilization rate (%)**: total time (minutes) that all shared vehicles are used each day divided by the time they can potentially be used per day in 24 hours, which shows the efficiency of the service.
- **Usage fees (membership fees) (€)**: Operators can experience higher revenue with higher usage fees (membership fees), and it affects earnings. Suppose you are free to set the price of your services.
- **The average number of trips per vehicle per day**: it gives insight into the efficiency of the vehicle that shows the efficiency of the service.
- **Operational speed (Km/h)**: the average velocity a shared mobility system overpasses.

- **The Lifespan of vehicle (year)**: system lifespan is measured in years and is indicated by the lifespan of vehicles.

Please Answer the following questions.

Do you think something is missing from the list above? The above factors are important criteria that make it possible to compare shared mobility modes (car-sharing, bike-sharing, scooter-sharing). What do you think about this list? Are there any unmentioned or unclear criteria? Do you have anything to add?

B1. In your opinion, what is the MOST IMPORTANT and what is the LEAST IMPORTANT characteristic among the above five that could drive your choice?

Characteristics	Select the most important Characteristic in the cell below	Select the least important Characteristic in the cell below
Utilization rate		
Usage fees		
The number of trips per vehicle per day		
Operational speed		
The life span of the vehicle		

5*2=10 radio buttons in the above table are needed to make the selections".

B2. In the above question, you have chosen *MOST_IMPORTANT* as the most important characteristic. Could you please rate to which extent you consider *MOST_IMPORTANT* more important than the other four characteristics?

The respondent should see the following table, where the characteristic which is selected as the most important and the other four should be mentioned in the first column according to the template below. 9*4 = 36 radio buttons should appear in the table. Characteristic 1 is always "the least important characteristic" the respondent selected in the previous step.

To which extent MOST IMPORTANT is more important than…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
LEAST IMPORTANT									
Characteristic 2									
Characteristic 3									
Characteristic 4									

B3. Also, you have chosen *LEAST_IMPORTANT* as the least important characteristic. Could you please rate to which extent you consider the other three characteristics more important than *LEAST_IMPORTANT*?

The respondent should see the following table. The other three characteristics, neither MOST IMPORTANT nor LEAST IMPORTANT, should be mentioned in the first column according to the template below. 9*3 = 27 radio buttons should appear in the table.

To which extent…	Equal importance 1	2	3	4	5	6	7	8	Extremely more important 9
Characteristic 2 is more important than LEAST IMPORTANT									
Characteristic 3 is more important than LEAST IMPORTANT									
Characteristic 4 is more important than LEAST IMPORTANT									

Appendix 3

Appendix 3: Codebook

Codebooks contribute to describing the data collection's contents, structure, and layout. In this study, there are nine different surveys whose questions are reported in appendix 2, leading to nine different codebooks. Since car-sharing, bike-sharing, and scooter-sharing codebooks are similar, one general codebook is provided. In this regard, instead of specifying the type of service in the general codebook, it is written as "{car, bike, scooter}-sharing}," meaning that this general codebook can be used for each of these three shared mobility services. Besides, three different codebooks are provided separately for users/non-users, government members, and operators of shared mobility services (as a whole). It is important to note that since the surveys were conducted in Italian, the codebooks are also in Italian and are presented in A3.1 to A3.5. Also, in this section, the job positions of government members and operators are listed according to the type of shared transportation service in section A3.6. This list has been translated into English because this list is the answers of people to the survey questions. In this study, the individuals' responses to the survey questions have been translated into English.

A3.1 The codebook for users and non-users of {car, bike, scooter}-sharing (general codebook) (surveys 1 to 3)

This codebook is designed for users and non-users of car-sharing, bike-sharing, and scooter-sharing services. This type of general codebook is presented as follows.

B1

	Valore
Etichetta	B1. Ci sono diverse caratteristiche relative agli spostamenti che potrebbero essere considerate nella scelta del {car, bike, scooter}-sharing per effettuare uno spostamento.

B1_01

	Valore

Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Tempo di percorrenza	
	1	Selezioni la caratteristica PIU' importante nella casella qui sotto
	2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_02

		Valore
Etichetta		B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Distanza da percorrere
	1	Selezioni la caratteristica PIU' importante nella casella qui sotto
	2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_03

		Valore
Etichetta		B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Orario di partenza
	1	Selezioni la caratteristica PIU' importante nella casella qui sotto
	2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_04

		Valore
Etichetta		B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Scopo del viaggio
	1	Selezioni la caratteristica PIU' importante nella casella qui sotto
	2	Selezioni la caratteristica MENO importante nella casella qui sotto

B2_01

		Valore
Etichetta		B2. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE come caratteristica più importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9 Estremamentepiu' importante

B2_02

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE come caratteristica più importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B2_03

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE come caratteristica più importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B3_01

	Valore
Etichetta	B3. Inoltre, lei ha scelto MENO_IMPORTANTE come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B3_02

	Valore

Etichetta	B3. Inoltre, lei ha scelto MENO_IMPORTANTE come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?	
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9 Estremamentepiu' importante

B4

	Valore
Etichetta	B4. Ora, esaminiamo l'importanza relativa di alcune caratteristiche del {car, bike, scooter}-sharing.

B4_01

	Valore
Etichetta	B4. Secondo lei, tra le sei caratteristiche del {car, bike, scooter}-sharing sopra menzionate che potrebbero influenzare la sua scelta, qual è la caratteristica PIÙ IMPORTANTE e qual è quella MENO IMPORTANTE? Costo del viaggio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_02

	Valore
Etichetta	B4. Secondo lei, tra le sei caratteristiche del {car, bike, scooter}-sharing sopra menzionate che potrebbero influenzare la sua scelta, qual è la caratteristica PIÙ IMPORTANTE e qual è quella MENO IMPORTANTE? Comfort del viaggio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_03

	Valore
Etichetta	B4. Secondo lei, tra le sei caratteristiche del {car, bike, scooter}-sharing sopra menzionate che potrebbero influenzare la sua scelta, qual è la caratteristica PIÙ IMPORTANTE e qual è quella MENO IMPORTANTE? Sicurezza
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_04

	Valore
Etichetta	B4. Secondo lei, tra le sei caratteristiche del {car, bike, scooter}-sharing sopra menzionate che potrebbero influenzare la sua scelta, qual è la caratteristica PIÙ IMPORTANTE e qual è quella MENO IMPORTANTE? Qualità del servizio

	1	Selezioni la caratteristica PIU' importante nella casella qui sotto
	2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_05

		Valore
	Etichetta	B4. Secondo lei, tra le sei caratteristiche del {car, bike, scooter}-sharing sopra menzionate che potrebbero influenzare la sua scelta, qual è la caratteristica PIÙ IMPORTANTE e qual è quella MENO IMPORTANTE? Sistema rispettoso dell'ambiente
	1	Selezioni la caratteristica PIU' importante nella casella qui sotto
	2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_06

		Valore
	Etichetta	B4. Secondo lei, tra le sei caratteristiche del {car, bike, scooter}-sharing sopra menzionate che potrebbero influenzare la sua scelta, qual è la caratteristica PIÙ IMPORTANTE e qual è quella MENO IMPORTANTE? Facilità di utilizzo
	1	Selezioni la caratteristica PIU' importante nella casella qui sotto
	2	Selezioni la caratteristica MENO importante nella casella qui sotto

B5_01

		Valore
	Etichetta	B5. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE come caratteristica più importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9 Estremamentepiu' importante

B5_02

		Valore
	Etichetta	B5. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE come caratteristica più importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7

	8	8
	9	9 Estremamentepiu' importante

B5_03

		Valore
	Etichetta	B5. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE come caratteristica più importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9 Estremamentepiu' importante

B5_04

		Valore
	Etichetta	B5. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE come caratteristica più importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9 Estremamentepiu' importante

B5_05

		Valore
	Etichetta	B5. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE come caratteristica più importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8

	9	9 Estremamentepiu' importante

B6_01

		Valore
	Etichetta	B6. Inoltre, lei ha scelto MENO_IMPORTANTE come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre quattro caratteristiche più importanti di quella MENO_IMPORTANTE?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9 Estremamentepiu' importante

B6_02

		Valore
	Etichetta	B6. Inoltre, lei ha scelto MENO_IMPORTANTE come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre quattro caratteristiche più importanti di quella MENO_IMPORTANTE?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9 Estremamentepiu' importante

B6_03

		Valore
	Etichetta	B6. Inoltre, lei ha scelto MENO_IMPORTANTE come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre quattro caratteristiche più importanti di quella MENO_IMPORTANTE?
	1	1 Uguale importanza
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9 Estremamentepiu' importante

B6_04

	Valore
Etichetta	B6. Inoltre, lei ha scelto MENO_IMPORTANTE come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre quattro caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B7

	Valore
Etichetta	B7. Infine, consideriamo le seguenti due caratteristiche relative al luogo in cui le auto condivise sono effettivamente disponibili. Secondo lei, qual tra questi due è il fattore PIÙ IMPORTANTE?
1	Disponibilita' del servizio
2	Disponibilita' e accessibilita' del veicolo

B8

	Valore
Etichetta	B8. Alla domanda precedente, lei ha scelto PIU'_IMPORTANTE quale caratteristica più importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE di quella MENO IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B9

	Valore
Etichetta	B9. Ora, consideriamo insieme le caratteristiche relative allo spostamento, le caratteristiche del car sharing e la disponibilità e l'accessibilità che ha valutato separatamente nelle domande precedenti.

B9_01

	Valore

Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento? Caratteristiche relative al viaggio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B9_02

	Valore
Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento?
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B9_03

	Valore
Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento? Caratteristiche del {car, bike, scooter}-sharing
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B9_04

	Valore
Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento?
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B9_05

	Valore
Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento? Disponibilità ed accessibilità
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B10_01

	Valore
Etichetta	B10. Alla domanda precedente, lei ha scelto il gruppo PIU'_IMPORTANTE come gruppo di caratteristiche più importanti. Potrebbe per favore valutare fino a che punto considera il gruppo PIU'_IMPORTANTE più importante degli altri due gruppi?
1	1 Uguale importanza
2	2
3	3

4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B10_02

	Valore
Etichetta	B10. Alla domanda precedente, lei ha scelto il gruppo PIU'_IMPORTANTE come gruppo di caratteristiche più importanti. Potrebbe per favore valutare fino a che punto considera il gruppo PIU'_IMPORTANTE più importante degli altri due gruppi?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B11

	Valore
Etichetta	B11. Inoltre, lei ha scelto MENO_IMPORTANTE come caratteristica meno importante. Potrebbe per favore valutare in che misura considera l'altra caratteristica più importante di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

INTRO

	Valore
Etichetta	Le seguenti domande riguardano le sue abitudini quotidiane e opinioni di viaggio.
1	Explanation

D1

	Valore
Etichetta	D1. Ha una patente di guida?
1	Si'
2	No

D2

		Valore
	Etichetta	D2. Ha qualche esperienza di servizi di {car, bike, scooter}-sharing?
	1	Si', attualmente uso i servizi di {car, bike, scooter}-sharing
	2	Si', ho usato il {car, bike, scooter}-sharing in passato, ma non lo uso più
	3	No, non ho mai usato il {car, bike, scooter}-sharing, ma so cos'e'
	4	Non ho familiarita' con il concetto di {car, bike, scooter}-sharing

Users

		Valore
	Etichetta	Utilizzo
	1	users
	2	non-users

D3

		Valore
	Etichetta	D3. Quanto conosce il {car, bike, scooter}-sharing? (Termini di adesione, come prenotare, livelli di prezzo, ecc.)
	1	1 (Poco)
	2	2
	3	3
	4	4
	5	5 (Molto)

D4_01

		Valore
	Etichetta	(Scelta 1)D4. Quali servizi di {car, bike, scooter}-sharing utilizza?
	1	Enjoy
	2	Car2go (Share Now)
	3	BlueTorino
	4	Helbiz An
	5	Circ
	6	Lime
	7	Wind
	8	Link
	9	Vo i
	10	Altro (specificare)

D4_02

		Valore
	Etichetta	(Scelta 2)D4. Quali servizi di {car, bike, scooter}-sharing utilizza?
	1	Enjoy
	2	Car2go (Share Now)
	3	BlueTorino
	4	Helbiz An
	5	Circ

	6	Lime
	7	Wind
	8	Link
	9	Vo i
	10	Altro (specificare)

D4_03

		Valore
	Etichetta	(Scelta 3)D4. Quali servizi di {car, bike, scooter}-sharing utilizza?
	1	Enjoy
	2	Car2go (Share Now)
	3	BlueTorino
	4	Helbiz An
	5	Circ
	6	Lime
	7	Wind
	8	Link
	9	Vo i
	10	Altro (specificare)

D4_04

		Valore
	Etichetta	(Scelta 4)D4. Quali servizi di {car, bike, scooter}-sharing utilizza?
	1	Enjoy
	2	Car2go (Share Now)
	3	BlueTorino
	4	Helbiz An
	5	Circ
	6	Lime
	7	Wind
	8	Link
	9	Vo i
	10	Altro (specificare)

D4_text

		Valore
	Etichetta	D4. Quali servizi di {car, bike, scooter}-sharing utilizza?
Valori validi		
	MIMOTO	
	Share now	

D5

		Valore
	Etichetta	D5. Ci sono punti di ritiro del {car, bike, scooter}-sharing vicino a casa sua, o la sua casa si trova in un'area operativa di almeno un servizio di {car, bike, scooter}-sharing?
	1	Si'
	2	No

	3	Non lo so

D6

		Valore
	Etichetta	D6. Ci sono punti di ritiro del car sharing vicino alla destinazione più frequente dei suoi spostamenti (ad esempio, il posto di lavoro, il luogo dove studia o va a fare shopping), o tale destinazione si trova all'interno dell'area operativa di almeno un
	1	Si'
	2	No
	3	Non lo so

D7_01

		Valore
	Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.1. Auto privata come autista
	1	Tutti i giorni
	2	4-6 giorni a settimana
	3	1-3 giorni a settimana
	4	Una volta/alcune volte al mese
	5	Raramente
	6	Mai

D7_02

		Valore
	Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.2. Auto privata come passeggero
	1	Tutti i giorni
	2	4-6 giorni a settimana
	3	1-3 giorni a settimana
	4	Una volta/alcune volte al mese
	5	Raramente
	6	Mai

D7_03

		Valore
	Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.3. {car, bike, scooter}-sharing (sia come autista che come passeggero)
	1	Tutti i giorni
	2	4-6 giorni a settimana
	3	1-3 giorni a settimana
	4	Una volta/alcune volte al mese
	5	Raramente
	6	Mai

D7_04

		Valore
	Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.4. Trasporto pubblico (treno, intercity o servizi urbani)
	1	Tutti i giorni
	2	4-6 giorni a settimana
	3	1-3 giorni a settimana
	4	Una volta/alcune volte al mese
	5	Raramente
	6	Mai

D7_05

		Valore
	Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.5. Moto/scooter
	1	Tutti i giorni
	2	4-6 giorni a settimana
	3	1-3 giorni a settimana
	4	Una volta/alcune volte al mese
	5	Raramente
	6	Mai

D7_06

		Valore
	Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.6. Taxi
	1	Tutti i giorni
	2	4-6 giorni a settimana
	3	1-3 giorni a settimana
	4	Una volta/alcune volte al mese
	5	Raramente
	6	Mai

D7_07

		Valore
	Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.7. Bicicletta personale
	1	Tutti i giorni
	2	4-6 giorni a settimana
	3	1-3 giorni a settimana
	4	Una volta/alcune volte al mese
	5	Raramente
	6	Mai

D7_08

		Valore

Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.8. Bike-sharing
1	Tutti i giorni
2	4-6 giorni a settimana
3	1-3 giorni a settimana
4	Una volta/alcune volte al mese
5	Raramente
6	Mai

D7_09

	Valore
Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.9. Monopattino in condivisione
1	Tutti i giorni
2	4-6 giorni a settimana
3	1-3 giorni a settimana
4	Una volta/alcune volte al mese
5	Raramente
6	Mai

D7_10

	Valore
Etichetta	D7. Se pensa ai suoi spostamenti quotidiani in questo periodo dell'anno (per lavoro, studio, acquisto di cibo, ecc.), quanto spesso usa le seguenti modalita' di trasporto? : D7.10. Camminare a piedi
1	Tutti i giorni
2	4-6 giorni a settimana
3	1-3 giorni a settimana
4	Una volta/alcune volte al mese
5	Raramente
6	Mai

D8_01

	Valore
Etichetta	D8. Qui di seguito sono elencate alcune attivita'. Quale modalita' di trasporto e' piu' probabile che lei usi in queste situazioni? Per favore, selezioni solo un'opzione (la prima che le viene in mente).: D8.1. Andare al lavoro o a scuola
1	Auto privata come autista
2	Auto privata come passeggero
3	{car, bike, scooter}-sharing(sia come autista che come passeggero)
4	Trasporto pubblico
5	Moto/Scooter
6	Taxi
7	Bicicletta personale
8	Bike-sharing
9	Monopattino in condivisione

	10	A piedi
	11	Altro

D8_02

		Valore
	Etichetta	D8. Qui di seguito sono elencate alcune attivita'. Quale modalita' di trasporto e' piu' probabile che lei usi in queste situazioni? Per favore, selezioni solo un'opzione (la prima che le viene in mente).: D8.2. Visitare un parente stretto/amici/altri pare
	1	Auto privata come autista
	2	Auto privata come passeggero
	3	{car, bike, scooter}-sharing(sia come autista che come passeggero)
	4	Trasporto pubblico
	5	Moto/Scooter
	6	Taxi
	7	Bicicletta personale
	8	Bike-sharing
	9	Monopattino in condivisione
	10	A piedi
	11	Altro

D8_03

		Valore
	Etichetta	D8. Qui di seguito sono elencate alcune attivita'. Quale modalita' di trasporto e' piu' probabile che lei usi in queste situazioni? Per favore, selezioni solo un'opzione (la prima che le viene in mente).: D8.3. Fare una commissione in centro citta'
	1	Auto privata come autista
	2	Auto privata come passeggero
	3	{car, bike, scooter}-sharing(sia come autista che come passeggero)
	4	Trasporto pubblico
	5	Moto/Scooter
	6	Taxi
	7	Bicicletta personale
	8	Bike-sharing
	9	Monopattino in condivisione
	10	A piedi
	11	Altro

D8_04

		Valore
	Etichetta	D8. Qui di seguito sono elencate alcune attivita'. Quale modalita' di trasporto e' piu' probabile che lei usi in queste situazioni? Per favore, selezioni solo un'opzione (la prima che le viene in mente).: D8.4. Andare fuori a cena
	1	Auto privata come autista
	2	Auto privata come passeggero
	3	{car, bike, scooter}-sharing(sia come autista che come passeggero)
	4	Trasporto pubblico

5	Moto/Scooter
6	Taxi
7	Bicicletta personale
8	Bike-sharing
9	Monopattino in condivisione
10	A piedi
11	Altro

D8_05

		Valore
	Etichetta	D8. Qui di seguito sono elencate alcune attivita'. Quale modalita' di trasporto e' piu' probabile che lei usi in queste situazioni? Per favore, selezioni solo un'opzione (la prima che le viene in mente).: D8.5. Fare un'escursione con il bel tempo.
	1	Auto privata come autista
	2	Auto privata come passeggero
	3	{car, bike, scooter}-sharing(sia come autista che come passeggero)
	4	Trasporto pubblico
	5	Moto/Scooter
	6	Taxi
	7	Bicicletta personale
	8	Bike-sharing
	9	Monopattino in condivisione
	10	A piedi
	11	Altro

D8_06

		Valore
	Etichetta	D8. Qui di seguito sono elencate alcune attivita'. Quale modalita' di trasporto e' piu' probabile che lei usi in queste situazioni? Per favore, selezioni solo un'opzione (la prima che le viene in mente).: D8.6. Andare ad un centro commerciale.
	1	Auto privata come autista
	2	Auto privata come passeggero
	3	{car, bike, scooter}-sharing(sia come autista che come passeggero)
	4	Trasporto pubblico
	5	Moto/Scooter
	6	Taxi
	7	Bicicletta personale
	8	Bike-sharing
	9	Monopattino in condivisione
	10	A piedi
	11	Altro

D8_07

		Valore

Etichetta	D8. Qui di seguito sono elencate alcune attivita'. Quale modalita' di trasporto e' piu' probabile che lei usi in queste situazioni? Per favore, selezioni solo un'opzione (la prima che le viene in mente).: D8.7. Andare in negozi piu' piccoli.
	1	Auto privata come autista
	2	Auto privata come passeggero
	3	{car, bike, scooter}-sharing(sia come autista che come passeggero)
	4	Trasporto pubblico
	5	Moto/Scooter
	6	Taxi
	7	Bicicletta personale
	8	Bike-sharing
	9	Monopattino in condivisione
	10	A piedi
	11	Altro

D8_08

		Valore
Etichetta	D8. Qui di seguito sono elencate alcune attivita'. Quale modalita' di trasporto e' piu' probabile che lei usi in queste situazioni? Per favore, selezioni solo un'opzione (la prima che le viene in mente).: D8.8. Attivita' nel fine settimana.	
	1	Auto privata come autista
	2	Auto privata come passeggero
	3	{car, bike, scooter}-sharing(sia come autista che come passeggero)
	4	Trasporto pubblico
	5	Moto/Scooter
	6	Taxi
	7	Bicicletta personale
	8	Bike-sharing
	9	Monopattino in condivisione
	10	A piedi
	11	Altro

D9_01

		Valore
Etichetta	(Scelta 1)D9. Secondo lei, quali dei seguenti vantaggi potrebbero indurla ad utilizzare (o usare maggiormente) il {car, bike, scooter}-sharing?	
	1	Disponibilita' di auto condivise vicino alla mia casa/luogo di lavoro
	2	Per ridurre le spese, quali la manutenzione e l'assicurazione
	3	Per viaggiare in modo piu' sostenibile.
	4	Maggiore comodita' quando si viaggia.
	5	La comodita' di avere una macchina solo quando ne ho bisogno.
	6	Evitare le responsabilita' della manutenzione e delle riparazioni della mia auto

D9_02

		Valore
Etichetta	(Scelta 2)D9. Secondo lei, quali dei seguenti vantaggi potrebbero indurla ad utilizzare (o usare maggiormente) il {car, bike, scooter}-sharing?	

1	Disponibilita' di auto condivise vicino alla mia casa/luogo di lavoro
2	Per ridurre le spese, quali la manutenzione e l'assicurazione
3	Per viaggiare in modo piu' sostenibile.
4	Maggiore comodita' quando si viaggia.
5	La comodita' di avere una macchina solo quando ne ho bisogno.
6	Evitare le responsabilita' della manutenzione e delle riparazioni della mia auto

D9_03

		Valore
	Etichetta	(Scelta 3)D9. Secondo lei, quali dei seguenti vantaggi potrebbero indurla ad utilizzare (o usare maggiormente) il {car, bike, scooter}-sharing?
	1	Disponibilita' di auto condivise vicino alla mia casa/luogo di lavoro
	2	Per ridurre le spese, quali la manutenzione e l'assicurazione
	3	Per viaggiare in modo piu' sostenibile.
	4	Maggiore comodita' quando si viaggia.
	5	La comodita' di avere una macchina solo quando ne ho bisogno.
	6	Evitare le responsabilita' della manutenzione e delle riparazioni della mia auto

D10_01

		Valore
	Etichetta	(Scelta 1)D10. Secondo lei, quali delle seguenti condizioni meteorologiche possono farle utilizzare il servizio di {car, bike, scooter}-sharing più di altri mezzi di traspoto?
	1	Cattivo tempo (ad esempio, pioggia o neve).
	2	Bel tempo (ad esempio, tempo soleggiato).
	3	Tempo torrido.
	4	Temperatura dell'aria favorevole.
	5	Tempo gelido.
	6	Alto livello di umidita'.
	7	Livello di umidita' favorevole.
	8	Alto inquinamento dell'aria.
	9	Basso inquinamento dell'aria.
	10	In inverno.
	11	In primavera.
	12	In estate.
	13	In autunno.

D10_02

		Valore
	Etichetta	(Scelta 2)D10. Secondo lei, quali delle seguenti condizioni meteorologiche possono farle utilizzare il servizio di {car, bike, scooter}-sharing più di altri mezzi di traspoto?
	1	Cattivo tempo (ad esempio, pioggia o neve).
	2	Bel tempo (ad esempio, tempo soleggiato).
	3	Tempo torrido.
	4	Temperatura dell'aria favorevole.
	5	Tempo gelido.

	6	Alto livello di umidita'.
	7	Livello di umidita' favorevole.
	8	Alto inquinamento dell'aria.
	9	Basso inquinamento dell'aria.
	10	In inverno.
	11	In primavera.
	12	In estate.
	13	In autunno.

D10_03

		Valore
	Etichetta	(Scelta 3)D10. Secondo lei, quali delle seguenti condizioni meteorologiche possono farle utilizzare il servizio di {car, bike, scooter}-sharing più di altri mezzi di traspoto?
	1	Cattivo tempo (ad esempio, pioggia o neve).
	2	Bel tempo (ad esempio, tempo soleggiato).
	3	Tempo torrido.
	4	Temperatura dell'aria favorevole.
	5	Tempo gelido.
	6	Alto livello di umidita'.
	7	Livello di umidita' favorevole.
	8	Alto inquinamento dell'aria.
	9	Basso inquinamento dell'aria.
	10	In inverno.
	11	In primavera.
	12	In estate.
	13	In autunno.

D11

		Valore
	Etichetta	D11. Secondo lei, quale delle seguenti situazioni potrebbe indurla ad utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
	1	Uno spostamento inferiore ai 5 km
	2	Uno spostamento di 5 km o piu'
	3	Entrambi

D12

		Valore
	Etichetta	D12. Secondo lei, quale delle seguenti situazioni potrebbe indurla ad utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
	1	Un tempo di viaggio inferiore ai 30 min
	2	Un tempo di viaggio di 30 min o piu'
	3	Entrambi

D13

		Valore
	Etichetta	D13. Secondo lei, quale delle seguenti situazioni potrebbe indurla a utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
	1	Viaggiare durante le ore di punta

	2	Viaggiare durante le ore non di punta
	3	Entrambi

D14_01

		Valore
Etichetta		(Scelta 1)D14. Secondo lei, quale delle seguenti situazioni potrebbe indurla ad utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
	1	Viaggiare la mattina dei giorni feriali
	2	Viaggiare la mattina del fine settimana
	3	Viaggiare la sera dei giorni feriali
	4	Viaggiare la sera del fine settimana

D14_02

		Valore
Etichetta		(Scelta 2)D14. Secondo lei, quale delle seguenti situazioni potrebbe indurla ad utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
	1	Viaggiare la mattina dei giorni feriali
	2	Viaggiare la mattina del fine settimana
	3	Viaggiare la sera dei giorni feriali
	4	Viaggiare la sera del fine settimana

D14_03

		Valore
Etichetta		(Scelta 3)D14. Secondo lei, quale delle seguenti situazioni potrebbe indurla ad utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
	1	Viaggiare la mattina dei giorni feriali
	2	Viaggiare la mattina del fine settimana
	3	Viaggiare la sera dei giorni feriali
	4	Viaggiare la sera del fine settimana

D15

		Valore
Etichetta		D15. Secondo lei, quale delle seguenti situazioni potrebbe indurla ad utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
	1	Viaggi di piacere (per esempio, andare a trovare gli amici o fare shopping)
	2	Viaggi non di piacere (andare al lavoro o a scuola)
	3	Entrambi

D16

		Valore
Etichetta		Le seguenti affermazioni riguardano la sua percezione dell'utilizzo del {car, bike, scooter}-sharing. Non ci sono risposte giuste o sbagliate per queste affermazioni. Siamo interessati al suo punto di vista su questo argomento. Per favore, indichi in che misura lei è d'ac

D16_01

		Valore
Etichetta		D16. È possibile che io utilizzi il {car, bike, scooter}-sharing per i miei viaggi abituali.
	1	1 (Fortemente in disaccordo)

	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D16_02

		Valore
	Etichetta	D16. Sono sicuro di poter scegliere il {car, bike, scooter}-sharing per i miei viaggi abituali durante la prossima settimana.
	1	1 (Fortemente in disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D16_03

		Valore
	Etichetta	D16. Il servizio di {car, bike, scooter}-sharing è un utile mezzo di trasporto.
	1	1 (Fortemente in disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D16_04

		Valore
	Etichetta	D16. Il {car, bike, scooter}-sharing mi aiuta a realizzare attività che sono importanti per me.
	1	1 (Fortemente in disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D16_05

		Valore
	Etichetta	D16. Imparare ad usare il {car, bike, scooter}-sharing è stato facile per me.
	1	1 (Fortemente in disaccordo)
	2	2

	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D16_06

		Valore
	Etichetta	D16. Trovo il {car, bike, scooter}-sharing facile da usare.
	1	1 (Fortemente in disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D16_07

		Valore
	Etichetta	D16. E' difficile prenotare un'auto sul sito web/app del car sharing.
	1	1 (Fortemente in disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D17_01

		Valore
	Etichetta	D17. Quelle che seguono sono alcune affermazioni sui social network. In che misura e' d'accordo o in disaccordo con queste affermazioni?: D17.1. Le persone che sono importanti per me pensano che dovrei usare più spesso il {car, bike, scooter}-sharing invece di altri mezzi
	1	1 (Fortemente in disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D17_02

		Valore
	Etichetta	D17. Quelle che seguono sono alcune affermazioni sui social network. In che misura e' d'accordo o in disaccordo con queste affermazioni?: D17.2. Alle persone importanti per me piace che io usi il {car, bike, scooter}-sharing.
	1	1 (Fortemente in disaccordo)

2	2
3	3
4	4
5	5
6	6
7	7 (Fortemente d'accordo)

D17_03

	Valore
Etichetta	D17. Quelle che seguono sono alcune affermazioni sui social network. In che misura e' d'accordo o in disaccordo con queste affermazioni?: D17.3. Le persone importanti per me sono d'accordo con il mio uso del {car, bike, scooter}-sharing.
1	1 (Fortemente in disaccordo)
2	2
3	3
4	4
5	5
6	6
7	7 (Fortemente d'accordo)

D18_01

	Valore
Etichetta	D18. Quelle che seguono sono alcune affermazioni sui social network. In che misura e' d'accordo o in disaccordo con queste affermazioni?: D18.1. Le persone importanti per me pensano che dovrei usare il {car, bike, scooter}-sharing.
1	1 (Fortemente in disaccordo)
2	2
3	3
4	4
5	5
6	6
7	7 (Fortemente d'accordo)

D18_02

	Valore
Etichetta	D18. Quelle che seguono sono alcune affermazioni sui social network. In che misura e' d'accordo o in disaccordo con queste affermazioni?: D18.2. Le persone importanti per me vorrebbero che io usassi il {car, bike, scooter}-sharing.
1	1 (Fortemente in disaccordo)
2	2
3	3
4	4
5	5
6	6
7	7 (Fortemente d'accordo)

D18_03

		Valore
	Etichetta	D18. Quelle che seguono sono alcune affermazioni sui social network. In che misura e' d'accordo o in disaccordo con queste affermazioni?: D18.3. Le persone importanti per me sarebbero d'accordo se usassi il {car, bike, scooter}-sharing.
	1	1 (Fortemente in disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Fortemente d'accordo)

D19

		Valore
	Etichetta	D19. Le seguenti affermazioni riguardano il {car, bike, scooter}-sharing. Per favore, indichi in che misura corrispondono alle sue opinioni.
	1	Explanation

D19.1

		Valore
	Etichetta	D19.1. Il mio sostegno all'attuazione del {car, bike, scooter}-sharing nella società è
	1	1 (Molto basso)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Molto alto)

D19.2

		Valore
	Etichetta	D19.2. Nel complesso, la mia opinione sul {car, bike, scooter}-sharing è
	1	1 (Molto negativa)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Positiva)

D20_01

		Valore
	Etichetta	D20. Le seguenti affermazioni riguardano il {car, bike, scooter}-sharing. Per favore, indichi in che misura corrispondono alle sue opinioni. Usare il {car, bike, scooter}-sharing è relativamente piacevole.
	1	1(Fortementein disaccordo)
	2	2

3	3
4	4
5	5
6	6
7	7(Fortemented'accordo)

D20_02

		Valore
	Etichetta	D20. Le seguenti affermazioni riguardano il {car, bike, scooter}-sharing. Per favore, indichi in che misura corrispondono alle sue opinioni. L’utilizzo del {car, bike, scooter}-sharing è relativamente rispettoso dell'ambiente.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D20_03

		Valore
	Etichetta	D20.Le seguenti affermazioni riguardano il {car, bike, scooter}-sharing. Per favore, indichi in che misura corrispondono alle sue opinioni. L'impatto delle preoccupazioni sanitarie dovute alla pandemia di Covid-19 ha ridotto il mio uso del {car, bike, scooter}-sharing.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D21_01

		Valore
	Etichetta	D21. In base alla sua precedente esperienza con il {car, bike, scooter}-sharing, risponda alle seguenti domande. So che il {car, bike, scooter}-sharing fornisce un buon servizio.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D21_02

		Valore

	Etichetta	D21. In base alla sua precedente esperienza con il {car, bike, scooter}-sharing, risponda alle seguenti domande. So che è prevedibile.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D21_03

		Valore
	Etichetta	D21. In base alla sua precedente esperienza con il {car, bike, scooter}-sharing, risponda alle seguenti domande. So che è affidabile.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D22

		Valore
	Etichetta	D22. Le seguenti affermazioni riguardano la sua percezione dell'uso del {car, bike, scooter}-sharing. Non ci sono risposte giuste o sbagliate per queste affermazioni. Siamo interessati al suo punto di vista su questo argomento. Per favore, indichi in che misura è d'accord

D22_01

		Valore
	Etichetta	D22. Sarebbe possibile per me utilizzare il {car, bike, scooter}-sharing per i miei spostamenti abituali.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D22_02

		Valore
	Etichetta	D22. Sono sicuro di poter scegliere il {car, bike, scooter}-sharing per i miei spostamenti abituali durante la prossima settimana.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4

	5	5
	6	6
	7	7(Fortemented'accordo)

D22_03

		Valore
	Etichetta	D22. Usare i servizi di {car, bike, scooter}-sharing sarebbe un modo di trasporto utile.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D22_04

		Valore
	Etichetta	D22. Usare il {car, bike, scooter}-sharing mi aiuterebbe a realizzare attività che sono importanti per me.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D22_05

		Valore
	Etichetta	D22. Imparare ad usare il {car, bike, scooter}-sharing sarebbe facile per me.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D22_06

		Valore
	Etichetta	D22. Troverei il {car, bike, scooter}-sharing facile da usare.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6

	7	7(Fortemented'accordo)

D22_07

		Valore
	Etichetta	D22. Sarebbe difficile prenotare un'auto sul sito web/app del car sharing.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D23_01

		Valore
	Etichetta	D23.Le seguenti affermazioni riguardano il {car, bike, scooter}-sharing. Per favore, indichi fino a che punto è d'accordo con esse. Usare i servizi di {car, bike, scooter}-sharing sarebbe piacevole.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D23_02

		Valore
	Etichetta	D23.Le seguenti affermazioni riguardano il {car, bike, scooter}-sharing. Per favore, indichi fino a che punto è d'accordo con esse. Penso che i servizi di {car, bike, scooter}-sharing siano rispettosi dell'ambiente.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D24_01

		Valore
	Etichetta	D24. Risponda alle seguenti domande in base alla sua conoscenza del {car, bike, scooter}-sharing. Penso che fornisca un buon servizio.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5

	6	6
	7	7(Fortemented'accordo)

D24_02

		Valore
	Etichetta	D24. Risponda alle seguenti domande in base alla sua conoscenza del {car, bike, scooter}-sharing. Penso che sia prevedibile.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D24_03

		Valore
	Etichetta	D24. Risponda alle seguenti domande in base alla sua conoscenza del {car, bike, scooter}-sharing. Penso che sia affidabile.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D25_01

		Valore
	Etichetta	D25. Le seguenti affermazioni riguardano l'impatto ambientale degli spostamenti. Indichi in che misura e' d'accordo o in disaccordo. : D25.1. L'urgente necessita' di ridurre la distruzione ecologica causata dall'uso dell'automobile e' stata sopravvalutata
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D25_02

		Valore
	Etichetta	D25. Le seguenti affermazioni riguardano l'impatto ambientale degli spostamenti. Indichi in che misura e' d'accordo o in disaccordo. : D25.2. Credo che l'uso dell'auto causi molti problemi ambientali.
	1	1(Fortementein disaccordo)
	2	2
	3	3

	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D26_01

		Valore
	Etichetta	D26. Le seguenti affermazioni riguardano l'impatto ambientale dei suoi spostamenti personali quotidiani. In che misura e' d'accordo o in disaccordo con esse?: D26.1. Mi sento moralmente obbligato a ridurre l'impatto ambientale dovuto alle mie abitudini di
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D26_02

		Valore
	Etichetta	D26. Le seguenti affermazioni riguardano l'impatto ambientale dei suoi spostamenti personali quotidiani. In che misura e' d'accordo o in disaccordo con esse?: D26.2. Mi sentirei in colpa se non riducessi l'impatto ambientale delle mie abitudini di viaggio
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D26_03

		Valore
	Etichetta	D26. Le seguenti affermazioni riguardano l'impatto ambientale dei suoi spostamenti personali quotidiani. In che misura e' d'accordo o in disaccordo con esse?: D26.3. Mi sentirei bene se viaggiassi in modo piu' sostenibile.
	1	1(Fortementein disaccordo)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7(Fortemented'accordo)

D27

		Valore

	Etichetta	D27. Le questioni politiche sono a volte misurate su una scala ambientale verde. Dove si collocherebbe lei su questa scala verde?
	1	1 (Non verde)
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7 (Molto verde)

D28

		Valore
	Etichetta	D28. Le questioni politiche sono talvolta indicate come di 'sinistra' e di 'destra'. Dove collocherebbe le sue opinioni su questa scala?
	1	Molto a sinistra
	2	A sinistra
	3	Abbastanza a sinistra
	4	Ne' a sinistra ne' a destra
	5	Abbastanza a destra
	6	A destra
	7	Molto a destra

D29

		Valore
	Etichetta	D29. Di che genere e' lei?
	1	Maschio
	2	Femmina
	3	Altro

D30

		Valore
	Etichetta	D30. In quale anno e' nato?
Valori validi	1934	
	1938	
	1942	
	1944	
	1945	
	1948	
	1949	
	1950	
	1952	
	1953	
	1954	
	1955	
	1956	
	1957	
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	1997
	1998
	1999
	2000

D31

		Valore
	Etichetta	D31. Qual e' il suo stato civile?
	1	Celibe/nubile
	2	Sposato o convivente

D32

		Valore
	Etichetta	D32. Qual e' il suo status commerciale o professionale?
	1	Imprenditore/libero professionista
	2	Funzionario/dirigente
	3	Impiegato/ operaio specializzato
	4	Operaio
	5	Insegnante
	6	Rappresentante
	7	Artigiano / commerciante / operatore
	8	Studente
	9	Casalinga
	10	In pensione
	11	In attesa del primo lavoro / mai lavorato
	12	Disoccupato / ha perso il lavoro
	13	Altro

D33

		Valore
	Etichetta	D33. Qual e' il livello di istruzione piu' alto che ha conseguito?
	1	Non ha completato la scuola elementare
	2	Scuola elementare
	3	Scuola secondaria superiore o equivalente inferiore ai 3 anni
	4	Scuola secondaria superiore o equivalente 3 anni o piu'
	5	Istruzione post-secondaria, non universitaria inferiore ai 3 anni
	6	Istruzione post-secondaria, non universitaria 3 anni o piu'
	7	Universita' inferiore ai 3 anni
	8	Universita' 3 anni o piu'
	9	Diploma da studi post-laurea

D35

		Valore
	Etichetta	D35. Quante persone, compreso lei, vivono nel suo nucleo familiare?
	1	1
	2	2
	3	3
	4	4
	5	5 o piu'

D36

		Valore
	Etichetta	D36. Quanti guidatori, incluso lei, ci sono nella sua famiglia?
	0	0
	1	1
	2	2
	3	Piu' di 2

D37

		Valore
	Etichetta	D37. Ha figli conviventi in famiglia?
	1	Si'
	2	No

D38_01

		Valore
	Etichetta	(Scelta 1)D38. Quanti anni hanno i suoi figli? (Puo' selezionare piu' di un'opzione) Gli intervistati possono scegliere piu' di un'opzione.
	1	0-3 anni
	2	4-6 anni
	3	7-15 anni
	4	16 anni o piu'

D38_02

		Valore
	Etichetta	(Scelta 2)D38. Quanti anni hanno i suoi figli? (Puo' selezionare piu' di un'opzione) Gli intervistati possono scegliere piu' di un'opzione.
	1	0-3 anni
	2	4-6 anni
	3	7-15 anni
	4	16 anni o piu'

D38_03

		Valore
	Etichetta	(Scelta 3)D38. Quanti anni hanno i suoi figli? (Puo' selezionare piu' di un'opzione) Gli intervistati possono scegliere piu' di un'opzione.
	1	0-3 anni
	2	4-6 anni
	3	7-15 anni
	4	16 anni o piu'

D38_04

		Valore
	Etichetta	(Scelta 4)D38. Quanti anni hanno i suoi figli? (Puo' selezionare piu' di un'opzione) Gli intervistati possono scegliere piu' di un'opzione.
	1	0-3 anni
	2	4-6 anni
	3	7-15 anni
	4	16 anni o piu'

D39

		Valore
	Etichetta	D39. Quante auto sono disponibili nella sua famiglia? (Per favore, includa anche le auto aziendali che ha ricevuto dal suo datore di lavoro e che sono autorizzate per uso personale)
	1	Nessuna auto
	2	Una auto

	3	Due auto
	4	Tre o piu' auto

D40_01

		Valore
	Etichetta	D40_1. Approssimativamente, qual e' il suo reddito personale mensile al netto delle tasse?
	1	Fino a 500Euro
	2	501Euro - 1000Euro
	3	1001Euro - 1500Euro
	4	1501Euro - 2000Euro
	5	2001Euro - 2500Euro
	6	2501Euro - 3000Euro
	7	3001Euro - 4000Euro
	8	4001Euro - 5000Euro
	9	5001Euro - 6000Euro
	10	6001Euro - 10.000 Euro
	11	Piu di 10.001 Euro

D40_02

		Valore
	Etichetta	D40_2. Approssimativamente, qual e' il reddito mensile della sua famiglia al netto delle tasse? Puo' rispondere a questa domanda anche se non e' sicuro dell'importo esatto.
	1	Fino a 500Euro
	2	501Euro - 1000Euro
	3	1001Euro - 1500Euro
	4	1501Euro - 2000Euro
	5	2001Euro - 2500Euro
	6	2501Euro - 3000Euro
	7	3001Euro - 4000Euro
	8	4001Euro - 5000Euro
	9	5001Euro - 6000Euro
	10	6001Euro - 10.000 Euro
	11	Piu di 10.001 Euro

D41

		Valore
	Etichetta	D41. Come gestisce le sue spese con il suo attuale reddito?
	1	Molto bene
	2	Abbastanza bene
	3	Ne' bene ne' male
	4	Abbastanza male
	5	Molto male

A3.2 The codebook for government members and operators {car, bike, scooter}-sharing (general codebook) (surveys 4 to 6)

This type of codebook is designed for government members and operators of car sharing, bike-sharing, and scooter-sharing services. This type of general codebook is presented as follows.

SERVIZIO

	Valore
Etichetta	Scelta
1	bike-sharing
2	{car, bike, scooter}-sharing
3	monopattino in condivisione

B1

	Valore
Etichetta	Ci sono diverse caratteristiche relative agli spostamenti che potrebbero essere considerate nella scelta del **bike-sharing** per effettuare uno spostamento.

B1_01

	Valore
Etichetta	B1. Qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la scelta delle persone? Tempo di percorrenza
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_02

	Valore
Etichetta	B1. Qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la scelta delle persone? Distanza da percorrere
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_03

	Valore
Etichetta	B1. Qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la scelta delle persone? Orario di partenza
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_04

	Valore
Etichetta	B1. Qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la scelta delle persone? Scopo del viaggio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B2_01

	Valore

Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_02

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_03

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B3_01

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica MENO importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza

2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B3_02

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica MENO importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B4

	Valore
Etichetta	Ora, esaminiamo l'importanza relativa di alcune caratteristiche del {car, bike, scooter}-sharing. Secondo lei, tra le sei caratteristiche del {car, bike, scooter}-sharing sopra menzionate che potrebbero influenzare la scelta delle persone,qual è la caratteristica PIÙ IMPORTANTE e MENO

B4_01

	Valore
Etichetta	B4. Costo del viaggio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_02

	Valore
Etichetta	B4. Comfort del viaggio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_03

	Valore
Etichetta	B4. Sicurezza
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_04

	Valore
Etichetta	B4. Qualità del servizio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_05

	Valore
Etichetta	B4. Sistema rispettoso dell'ambiente
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B4_06

	Valore
Etichetta	B4. Facilità di utilizzo
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B5_01

	Valore
Etichetta	B5. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
1	1 Ugualeimportanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B5_02

	Valore
Etichetta	B5. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
1	1 Ugualeimportanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B5_03

	Valore
Etichetta	B5. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
1	1 Ugualeimportanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B5_04

	Valore
Etichetta	B5. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
1	1 Ugualeimportanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B5_05

	Valore
Etichetta	B5. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare in che misura considera PIÙ_IMPORTANTE questa caratteristica rispetto alle altre cinque caratteristiche?
1	1 Ugualeimportanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B6_01

	Valore

Etichetta	B6. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre quattro caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B6_02

	Valore
Etichetta	B6. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre quattro caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B6_03

	Valore
Etichetta	B6. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre quattro caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B6_04

	Valore
Etichetta	B6. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre quattro caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza

2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B7

	Valore
Etichetta	B7. Infine, consideriamo le seguenti due caratteristiche relative al luogo in cui le auto condivise sono effettivamente disponibili. Secondo lei, qual tra questi due è il fattore PIÙ IMPORTANTE?
1	Disponibilita' del servizio
2	Disponibilita' e accessibilita' del veicolo

B8

	Valore
Etichetta	B8. Alla domanda precedente, lei ha scelto ...quale caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE di quella MENO IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B9

	Valore
Etichetta	Ora, consideriamo insieme le caratteristiche relative allo spostamento, le caratteristiche del car sharing e la disponibilità e l'accessibilità che ha valutato separatamente nelle domande precedenti.

B9_01

	Valore
Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento? Caratteristiche relative al viaggio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B9_02

	Valore

Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento?
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B9_03

	Valore
Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento? Caratteristiche del {car, bike, scooter}-sharing
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B9_04

	Valore
Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento?
1	Disponibilita' del servizio
2	Disponibilita' e accessibilita' del veicolo

B9_05

	Valore
Etichetta	B9. Secondo lei, quale di questi tre gruppi di caratteristiche è complessivamente il PIÙ IMPORTANTE, e quale è il MENO IMPORTANTE quando si considera di scegliere il {car, bike, scooter}-sharing per uno spostamento? Disponibilità ed accessibilità
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B10_01

	Valore
Etichetta	B10. Alla domanda precedente, lei ha scelto il gruppo ...come gruppo di caratteristiche piu' importanti. Potrebbe per favore valutare fino a che punto considera il gruppo PIU'_IMPORTANTE più importante degli altri due gruppi?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8

9	9 Estremamente piu' importante

B10_02

	Valore
Etichetta	B10. Alla domanda precedente, lei ha scelto il gruppo ...come gruppo di caratteristiche piu' importanti. Potrebbe per favore valutare fino a che punto considera il gruppo PIU'_IMPORTANTE più importante degli altri due gruppi?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B11

	Valore
Etichetta	B11. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera l'altra caratteristica più importante di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

D1

	Valore
Etichetta	D1. Secondo la sua opinione, quale delle seguenti caratteristiche potrebbe indurre le persone a utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
1	Tragitti di breve distanza (meno di 5 km)
2	Tragitti di lunga distanza (oltre 5 km)
3	Entrambi

D2

	Valore
Etichetta	D2. Secondo lei, quale delle seguenti caratteristiche potrebbe indurre le persone a utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
1	Spostamenti di breve durata (meno di 30 minuti)
2	Spostamenti di lunga distanza (oltre 30 min)
3	Entrambi

D3

	Valore
Etichetta	D3. Secondo lei, quale delle seguenti caratteristiche potrebbe indurre le persone a utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
1	Durante le ore di punta
2	Durante le ore non di punta
3	Entrambi

D4_01

	Valore
Etichetta	(Scelta 1)D4. Secondo lei, quale delle seguenti caratteristiche potrebbe indurre le persone a utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
1	Mattina dei giorni feriali
2	Mattina del fine settimana
3	Sera dei giorni feriali
4	Sera del fine settimana

D4_02

	Valore
Etichetta	(Scelta 2)D4. Secondo lei, quale delle seguenti caratteristiche potrebbe indurre le persone a utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
1	Mattina dei giorni feriali
2	Mattina del fine settimana
3	Sera dei giorni feriali
4	Sera del fine settimana

D4_03

	Valore
Etichetta	(Scelta 3)D4. Secondo lei, quale delle seguenti caratteristiche potrebbe indurre le persone a utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
1	Mattina dei giorni feriali
2	Mattina del fine settimana
3	Sera dei giorni feriali
4	Sera del fine settimana

D5

	Valore
Etichetta	D5. Secondo lei, quale delle seguenti caratteristiche potrebbe indurre le persone a utilizzare (o utilizzare maggiormente) il {car, bike, scooter}-sharing?
1	Per viaggi di piacere (ad esempio, far visita ad amici o fare shopping)
2	Per viaggi non di piacere (andare al lavoro/scuola)
3	Entrambi

A3.3. The codebook for users and non-users of shared mobility services (as a whole) (survey 7)

This type of codebook is designed for users and non-users of shared mobility services (as a whole). This type of codebook is offered as follows.

Genere

	Valore
Etichetta	Lei e'
1	Uomo
2	Donna

Comune

	Valore
Etichetta	In quale Comune risiedi?
2	Baldissero Torinese
3	Beinasco
4	Borgaro Torinese
5	Cambiano
6	Candiolo
7	Carignano
8	Caselle Torinese
9	Chieri
10	Collegno
11	Druento
12	Grugliasco
13	La Loggia
14	Leini
15	Mappano
16	Moncalieri
17	Nichelino
18	Orbassano
19	Pecetto Torinese
20	Pianezza
21	Pino Torinese
22	Piobesi Torinese
23	Piossasco
24	Rivalta di Torino
25	Rivoli
26	San Mauro Torinese
27	Santena
28	Settimo Torinese
29	Trofarello
30	Venaria Reale
31	Vinovo
32	Volpiano
33	Torino
34	altro

Users_Nonusers

	Valore
Etichetta	Tipo
1	users

2	Non-users

B1

	Valore
Etichetta	B1. Ci sono diverse caratteristiche relative agli spostamenti che potrebbero essere considerate nella scelta della shared-mobility per effettuare uno spostamento.

B1_01

	Valore
Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Sicurezza delle persone
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_02

	Valore
Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Velocità operativa
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_03

	Valore
Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Accessibilità
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_04

	Valore
Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Facilità d'uso
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_05

	Valore
Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Immagine
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_06

	Valore
Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Comfort
1	Selezioni la caratteristica PIU' importante nella casella qui sotto

2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_07

	Valore
Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Costo
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_08

	Valore
Etichetta	B1. Secondo lei, tra le quattro caratteristiche sopra citate, qual è la caratteristica PIÙ IMPORTANTE del viaggio e qual è quella MENO IMPORTANTE che potrebbe influenzare la sua scelta? Possibilità di trasportare oggetti
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B2_01

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B2_02

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B2_03

	Valore

Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B2_04

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B2_05

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B2_06

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2

3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B2_07

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ...come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre tre caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B3_01

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B3_02

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6

7	7
8	8
9	9 Estremamentepiu' importante

B3_03

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B3_04

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B3_05

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

B3_06

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamentepiu' importante

Intro

	Valore
Etichetta	Per favore, risponda alle seguenti domande per determinare la sua opinione sulle caratteristiche che influenzano l'uso del car-sharing, del bike-sharing e dello scooter-sharing (monopattino in condivisione).
1	Explanation

Q1

	Valore
Etichetta	Q1. Quanto si sente sicuro durante i viaggi in car-sharing?
1	1 (Molto insicuro)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto sicuro)

Q2

	Valore
Etichetta	Q2. Quanto si sente sicuro nei viaggi in bike-sharing?
1	1 (Molto insicuro)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto sicuro)

Q3

	Valore
Etichetta	Q3. Quanto si sente sicuro durante i viaggi in scooter-sharing (monopattino in condivisione)?
1	1 (Molto insicuro)

2	2
3	3
4	4
5	5
6	6
7	7 (Molto sicuro)

Q4

	Valore
Etichetta	Q4. Come valuterebbe la velocita' di viaggio del servizio di car-sharing?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto buona)

Q5

	Valore
Etichetta	Q5. Come valuterebbe la velocita' di viaggio del servizio di bike-sharing?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto buona)

Q6

	Valore
Etichetta	Q6. Come valuterebbe la velocita' di viaggio del servizio di scooter-sharing (monopattino in condivisione)?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto buona)

Q7

	Valore
Etichetta	Q7. Quanto e' facile o difficile accedere al car-sharing?
1	1 (Molto difficile)
2	2
3	3

4	4
5	5
6	6
7	7 (Molto facile)

Q8

	Valore
Etichetta	Q8. Quanto e' facile o difficile accedere al bike-sharing?
1	1 (Molto difficile)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto facile)

Q9

	Valore
Etichetta	Q9. Quanto e' facile o difficile accedere allo scooter-sharing (monopattino in condivisione)?
1	1 (Molto difficile)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto facile)

Q10

	Valore
Etichetta	Q10. Come valuterebbe la facilita' d'uso dei servizi di car-sharing?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto buona)

Q11

	Valore
Etichetta	Q11. Come valuterebbe la facilita' d'uso dei servizi di bike sharing?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5

6	6
7	7 (Molto buona)

Q12

	Valore
Etichetta	Q12. Come valuterebbe la facilita' d'uso dei servizi di scooter-sharing (monopattino in condivisione)?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto buona)

Q13

	Valore
Etichetta	Q13. Come valuterebbe il servizio di car-sharing nel complesso?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto buona)

Q14

	Valore
Etichetta	Q14. Come valuterebbe il servizio di bike-sharing nel complesso?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto buona)

Q15

	Valore
Etichetta	Q15. Come valuterebbe il servizio di scooter-sharing (monopattino in condivisione) nel complesso?
1	1 (Molto scarsa)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto buona)

Q16

	Valore
Etichetta	Q16. Quanto si sente a suo agio nei viaggi in car-sharing?
1	1 (Molto a disagio)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto a mio agio)

Q17

	Valore
Etichetta	Q17. Quanto si sente a suo agio nei viaggi in bike-sharing?
1	1 (Molto a disagio)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto a mio agio)

Q18

	Valore
Etichetta	Q18. Quanto si sente a suo agio nei viaggi in scooter-sharing (monopattino in condivisione)?
1	1 (Molto a disagio)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto a mio agio)

Q19

	Valore
Etichetta	Q19. Come valuterebbe i costi di utilizzo o di iscrizione ai servizi di car-sharing?
1	1 (Molto costoso)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto economico)

Q20

	Valore
Etichetta	Q20. Come valuterebbe i costi di utilizzo o di iscrizione ai servizi di bike-sharing?
1	1 (Molto costoso)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto economico)

Q21

	Valore
Etichetta	Q21. Come valuterebbe i costi di utilizzo o di iscrizione ai servizi di scooter-sharing (monopattino in condivisione)?
1	1 (Molto costoso)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto economico)

Q22

	Valore
Etichetta	Q22. E' difficile o facile trasportare le sue cose quando usa il car-sharing?
1	1 (Molto difficile)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto facile)

Q23

	Valore
Etichetta	Q23. E' difficile o facile trasportare le sue cose quando usa il bike-sharing?
1	1 (Molto difficile)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto facile)

Q24

	Valore
Etichetta	Q24. E' difficile o facile trasportare le sue cose quando usa lo scooter-sharing (monopattino in condivisione)?

1	1 (Molto difficile)
2	2
3	3
4	4
5	5
6	6
7	7 (Molto facile)

A3.4 The codebook for government members about shared mobility services (as a whole) (survey 8)

This type of codebook is designed for government members and is for shared mobility services (as a whole). This type of codebook is provided as follows.

B1_01

	Valore
Etichetta	B1 Secondo lei, tra le sei caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Il numero di viaggi per veicolo al giorno
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_02

	Valore
Etichetta	B1 Secondo lei, tra le sei caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Gas serra (GHG)
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_03

	Valore
Etichetta	B1 Secondo lei, tra le sei caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Problemi di parcheggio
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_04

	Valore
Etichetta	B1 Secondo lei, tra le sei caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Emissione di sostanze inquinanti
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_05

	Valore

Etichetta	B1 Secondo lei, tra le sei caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Integrazione del servizio di mobilita' condivisa con il trasporto pubblico
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_06

	Valore
Etichetta	B1 Secondo lei, tra le sei caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Tassa sul veicolo
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B2_01

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica PIU' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre cinque caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_02

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica PIU' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre cinque caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_03

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica PIU' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre cinque caratteristiche?

1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_04

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica PIU' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre cinque caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_05

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica PIU' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre cinque caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B3_01

	Valore
Etichetta	B3. Inoltre, lei ha scelto ...come caratteristica MENO importante.Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4

5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B3_02

	Valore
Etichetta	B3. Inoltre, lei ha scelto ...come caratteristica MENO importante.Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B3_03

	Valore
Etichetta	B3. Inoltre, lei ha scelto ...come caratteristica MENO importante.Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B3_04

	Valore
Etichetta	B3. Inoltre, lei ha scelto ...come caratteristica MENO importante.Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8

9	9 Estremamente piu' importante

A3.5 The codebook for operators of shared mobility services (as a whole) (survey 9)

This type of codebook is designed for operators of shared mobility services (as a whole). This type of codebook is presented as follows.

B_pre_01

	Valore
Etichetta	(Scelta 1)Che tipo di servizio di mobilita' condivisa viene offerto dalla sua azienda?
1	Car-sharing a flusso libero
2	Car-sharing a prenotazione
3	Bike-sharing a flusso libero
4	Bike-sharing a prenotazione
5	monopattino in condivisione

B_pre_02

	Valore
Etichetta	(Scelta 2)Che tipo di servizio di mobilita' condivisa viene offerto dalla sua azienda?
1	Car-sharing a flusso libero
2	Car-sharing a prenotazione
3	Bike-sharing a flusso libero
4	Bike-sharing a prenotazione
5	monopattino in condivisione

B_pre_03

	Valore
Etichetta	(Scelta 3)Che tipo di servizio di mobilita' condivisa viene offerto dalla sua azienda?
1	Car-sharing a flusso libero
2	Car-sharing a prenotazione
3	Bike-sharing a flusso libero
4	Bike-sharing a prenotazione
5	monopattino in condivisione

B_pre_04

	Valore
Etichetta	(Scelta 4)Che tipo di servizio di mobilita' condivisa viene offerto dalla sua azienda?
1	Car-sharing a flusso libero
2	Car-sharing a prenotazione
3	Bike-sharing a flusso libero
4	Bike-sharing a prenotazione
5	monopattino in condivisione

B_pre_05

	Valore
Etichetta	(Scelta 5)Che tipo di servizio di mobilita' condivisa viene offerto dalla sua azienda?
1	Car-sharing a flusso libero
2	Car-sharing a prenotazione
3	Bike-sharing a flusso libero
4	Bike-sharing a prenotazione
5	monopattino in condivisione

B1_01

	Valore
Etichetta	B1 Secondo lei, tra le cinque caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Tasso di utilizzo
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_02

	Valore
Etichetta	B1 Secondo lei, tra le cinque caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Costi di utilizzo
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_03

	Valore
Etichetta	B1 Secondo lei, tra le cinque caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Numero di viaggi per veicolo al giorno
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_04

	Valore
Etichetta	B1 Secondo lei, tra le cinque caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Velocita' operativa
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B1_05

	Valore

Etichetta	B1 Secondo lei, tra le cinque caratteristiche sopra citate, qual e' la caratteristica PIU' IMPORTANTE e qual e' quella MENO IMPORTANTE che potrebbe influenzare la sua scelta?: Vita media del veicolo
1	Selezioni la caratteristica PIU' importante nella casella qui sotto
2	Selezioni la caratteristica MENO importante nella casella qui sotto

B2_01

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre quattro caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_02

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre quattro caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_03

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre quattro caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5

6	6
7	7
8	8
9	9 Estremamente piu' importante

B2_04

	Valore
Etichetta	B2. Alla domanda precedente, lei ha scelto ... come caratteristica piu' importante. Potrebbe per favore valutare fino a che punto considera questa caratteristica PIÙ IMPORTANTE delle altre quattro caratteristiche?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B3_01

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

B3_02

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8

9	9 Estremamente piu' importante

B3_03

	Valore
Etichetta	B3. Inoltre, lei ha scelto ... come caratteristica meno importante. Potrebbe per favore valutare in che misura considera le altre due caratteristiche più importanti di quella MENO_IMPORTANTE?
1	1 Uguale importanza
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9 Estremamente piu' importante

A3.6 Job positions of government members and operators (surveys 4, 5, 6, 8, and 9)

To better understand the perspectives of government members and operators, it is important to understand their job position. In this regard, Tables A2 to A9 show the job positions of government members (surveys 4, 5, 6, and 8) and operators (surveys 4, 5, 6, and 9) according to the type of shared mobility service.

Table A2: Job position of government members who responded to a survey on shared mobility services (survey 8).

Shared mobility services (government members)	
Respondent ID	**The role of government members**
IDU_003	Councilor of ecological and digital transition innovation, mobility, and transport
IDU_004	Regional manager for transport and infrastructure investments
IDU_008	Transport and infrastructure planning and programming sector manager
IDU_012	Responsible for European sustainable mobility projects
IDU_013	District president 4 TO
IDU_014	Planning officer
IDU_015	European designer

Table A3: Job position of operators of shared mobility services and their type of shared mobility service (survey 9).

Shared mobility services (Operators)		
Respondent ID	**Type of Shared Mobility**	**The role of operators**
IDU_009	Free-floating bike-sharing	Manager of technological services for mobility in one mid/sized city in the Lombardy region
IDU_010	Scooter-sharing	Managing director of micro-mobility through shared scooters
IDU_011	Scooter-sharing	General manager for Italy and expansion marketing operations for shared scooters in Stockholm, Milan, Turin, and other cities
IDU_016	Free-floating bike-sharing	Operations manager
IDU_017	Station-based bike-sharing	Project manager
IDU_018	Free-floating car-sharing	Responsible for smart mobility
IDU_019	Station-based car-sharing, Free-floating car-sharing	Operational office employee
IDU_020	Free-floating car-sharing	Developer of a rental car-sharing business
IDU_021	Scooter-sharing	Regional general manager southern Europe

Table A4: Job position of government members who responded to a survey on car-sharing services (survey 4).

Car-sharing services (government members)	
Respondent ID	**The role of government members**
IDU_001	Technical manager for European mobility projects
IDU_006	Municipal advisor of the environment commission
IDU_007	Turin council councilor
IDU_008	Transport and infrastructure planning and programming sector manager

Table A5: Job position of operators of car-sharing services and their type of car-sharing service (survey 4).

Car-sharing services (operators)		
Respondent ID	**Type of car-sharing**	**The role of operators**
IDU_018	Free-floating car-sharing	Responsible for smart mobility
IDU_019	Station-based car-sharing	Operational office employee
IDU_020	Free-floating car-sharing	Developer of a rental car-sharing business

Table A6: Job position of government members who responded to a survey on bike-sharing services (survey 5).

Bike-sharing services (government members)	
Respondent ID	**The role of government members**
IDU_002	Director of the transport staff of a metropolitan city in Northern Italy
IDU_005	Officer for mobility, logistics, and citizen services
IDU_012	Responsible for European sustainable mobility projects
IDU_013	District president 4 TO
IDU_014	Planning officer

Table A7: Job position of operators of bike-sharing services and their type of bike-sharing service (survey 5).

Bike-sharing services (operators)		
Respondent ID	**Type of bike-sharing**	**The role of operators**
IDU_009	Free-floating bike-sharing	Manager of technological services for mobility in one mid/sized city in the Lombardy region
IDU_016	Free-floating bike-sharing	Operations manager
IDU_017	Station-based bike-sharing	Project manager

Table A8: Job position of government members who responded to a survey on scooter-sharing services (survey 6).

Scooter-sharing services (government members)	
Respondent ID	**The role of government members**
IDU_003	Councilor of ecological and digital transition innovation, mobility, and transport
IDU_004	Regional manager for transport and infrastructure investments
IDU_015	European designer

Table A 9: Job position of operators of scooter-sharing services and their type of scooter-sharing service (survey 6).

Scooter-sharing services (operators)		
Respondent ID	**Type of scooter-sharing**	**The role of operators**
IDU_010	Scooter-sharing	Managing director of micro-mobility through shared scooters
IDU_011	Scooter-sharing	General manager for Italy and expansion marketing operations for shared scooters in Stockholm, Milan, Turin, and other cities
IDU_021	Scooter-sharing	Regional general manager southern Europe

Appendix 4

Appendix 4: Descriptive statistics of the data set

A4.1 Socio-demographic characteristics of users and non-users of each of the shared mobility services

The socio-demographic characteristics of survey respondents who are users and non-users of car-sharing, bike-sharing, and scooter-sharing services are listed in Table A10 (question set C in surveys 1 to 3).

Table A10: Socio-demographic characteristics of survey respondents (users and non-users separately) associated with each shared mobility service (question set C in surveys 1 to 3).

Socio-demographic factors		Shared mobility services					
		Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	Non-users (n=126)	Users (n=75)	Non-users (n=127)	Users (n=77)	Non-users (n=126)
Gender	**Male**	37 (48.68%)	64 (50.79%)	49 (65.33%)	60 (47.24%)	44 (57.14%)	51 (40.48%)
	Female	39 (51.32%)	62 (49.21%)	26 (34.67%)	67 (52.67%)	33 (42.86%)	75 (59.52%)
Age	**18-24**	3 (3.95%)	9 (7.14%)	-	4 (3.15%)	3 (3.90%)	4 (3.17%)
	25-34	20 (26.32%)	24 (19.05%)	24 (32.00%)	15 (11.81%)	19 (24.68%)	14 (11.11%)
	35-44	21 (27.63%)	13 (10.32%)	20 (26.67%)	26 (20.47%)	17 (22.08%)	34 (26.98%)
	45-54	21 (27.63%)	26 (20.63%)	10 (13.33%)	37 (29.13%)	4 (5.19%)	43 (34.13%)
	55-64	8 (10.53%)	32 (25.40%)	14 (18.67%)	19 (14.96%)	20 (25.97%)	25 (19.84%)
	> 64	3 (3.95%)	22 (17.46%)	7 (9.33%)	26 (20.47%)	14 (18.18%)	6 (4.76%)
Education level	**Not completed primary school**	-	-	-	-	-	-
	Elementary school	-	1 (0.79%)	-	3 (2.36%)	1 (1.30%)	-

Socio-demographic factors		Shared mobility services					
		Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	Non-users (n=126)	Users (n=75)	Non-users (n=127)	Users (n=77)	Non-users (n=126)
	Upper secondary school or equivalent shorter than three years	1 (1.32%)	12 (9.52%)	2 (2.67%)	9 (7.09%)	4 (5.19%)	10 (7.94%)
	Upper secondary school or equivalent three years or more	23 (30.26%)	50 (39.68%)	22 (29.33%)	48 (37.80%)	26 (33.77%)	37 (29.37%)
	Post-secondary education, not college, less than three years	6 (7.89%)	4 (3.17%)	2 (2.67%)	9 (7.09%)	4 (5.19%)	7 (5.56%)
	Post-secondary education, not college, three years or more	4 (5.26%)	10 (7.94%)	6 (8.00%)	7 (5.51%)	5 (6.49%)	12 (9.52%)
	University less than three years	3 (3.95%)	4 (3.17%)	-	9 (7.09%)	4 (5.19%)	8 (6.35%)
	University 3 years or more	29 (38.16%)	38 (30.16%)	26 (34.67%)	31 (24.41%)	25 (32.47%)	42 (33.33%)
	Degree from postgraduate studies	10 (13.16%)	7 (5.56%)	17 (22.67%)	11 (8.66%)	8 (10.39%)	10 (7.94%)
Marital status	Single	30 (39.47%)	51 (40.48%)	23 (30.67%)	34 (26.77%)	24 (31.17%)	46 (36.51%)
	Married or domestic partnership	46 (60.53%)	75 (59.52%)	52 (69.33%)	93 (73.23%)	53 (68.83%)	80 (63.49%)
Business or professional status	Entrepreneur/freelancer	7 (9.21%)	5 (3.97%)	14 (18.67%)	11 (8.66%)	6 (7.79%)	9 (7.14%)
	Officer/manager	8 (10.53%)	4 (3.17%)	8 (10.67%)	6 (4.72%)	11 (14.29%)	8 (6.35%)
	Clerk/trade employee	34 (44.74%)	42 (33.33%)	20 (26.67%)	43 (33.86%)	22 (28.57%)	60 (47.62%)
	Worker	4 (5.26%)	8 (6.35%)	7 (9.33%)	8 (6.30%)	2 (2.60%)	10 (7.94%)
	Teacher	3 (3.95%)	6 (4.76%)	5 (6.67%)	7 (5.51%)	1 (1.30%)	5 (3.97%)
	Representative	1 (1.32%)	2 (1.59%)	2 (2.67%)	1 (0.79%)	1 (1.30%)	1 (0.79%)
	Craftsman / trader / operator	3 (3.95%)	2 (1.59%)	3 (4.00%)	2 (1.57%)	6 (7.79%)	2 (1.59%)
	Student	4 (5.26%)	11 (8.73%)	2 (2.67%)	4 (3.15%)	7 (9.09%)	6 (4.76%)
	Housewife	4 (5.26%)	8 (6.35%)	4 (5.33%)	10 (7.87%)	3 (3.90%)	7 (5.56%)
	Retired	2 (2.63%)	24 (19.05%)	3 (4.00%)	19 (14.96%)	16 (20.78%)	5 (3.97%)
	Waiting for first job / never worked	1 (1.32%)	3 (2.38%)	-	2 (1.57%)	-	1 (0.79%)
	Unemployed / lost his/her job	2 (2.63%)	6 (4.76%)	5 (6.67%)	13 (10.24%)	-	5 (3.97%)
	Other	3 (3.95%)	5 (3.97%)	2 (2.67%)	1 (0.79%)	2 (2.60%)	7 (5.56%)
Number of people, including respondents, living in the home	One person	10 (13.16%)	21 (16.67%)	18 (24.00%)	16 (12.60%)	15 (19.48%)	24 (19.05%)
	Two people	23 (30.26%)	41 (32.54%)	23 (30.67%)	51 (40.16%)	30 (38.96%)	47 (37.30%)
	Three people	25 (32.89%)	41 (32.54%)	17 (22.67%)	36 (28.35%)	17 (22.08%)	25 (19.84%)
	Four people	13 (17.11%)	21 (16.67%)	13 (17.33%)	23 (18.11%)	12 (15.58%)	28 (22.22%)
	Five or more people	5 (6.58%)	2 (1.59%)	4 (5.33%)	1 (0.79%)	3 (3.90%)	2 (1.59%)
Number of drivers, including respondents, living in the home	0	-	1 (0.79%)	-	1 (0.79%)	7 (9.09%)	8 (6.35%)
	1	21 (27.63%)	38 (30.16%)	36 (48.00%)	36 (28.35%)	22 (28.57%)	35 (27.78%)
	2	38 (50.00%)	63 (50.00%)	28 (37.33%)	75 (59.06%)	30 (38.96%)	70 (55.56%)
	More than 2	17 (22.37%)	24 (19.05%)	11 (14.67%)	15 (11.81%)	18 (23.38%)	13 (10.32%)
Presence of children at home	Yes	34 (44.74%)	47 (37.30%)	27 (36.00%)	50 (39.37%)	22 (28.57%)	47 (37.30%)

Socio-demographic factors		Shared mobility services					
		Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	Non-users (n=126)	Users (n=75)	Non-users (n=127)	Users (n=77)	Non-users (n=126)
	No	42 (55.26%)	79 (62.70%)	48 (64.00%)	77 (60.63%)	55 (71.43%)	79 (62.70%)
The age of the respondent's child/children	**0-3 years old**	9[17]	5*	7*	9*	2*	6*
	4-6 years old	6*	6*	7*	15*	4*	6*
	7-15 years old	10*	17*	11*	14*	6*	25*
	16 years or more	13*	26*	14*	19*	14*	20*
Number of cars available for use in respondent's home	**No car**	7 (9.21%)	6 (4.76%)	8 (10.67%)	10 (7.87%)	7 (9.09%)	14 (11.11%)
	One car	31 (40.79%)	61 (48.41%)	41 (54.67%)	61 (48.03%)	38 (49.35%)	58 (46.03%)
	Two cars	33 (43.42%)	51 (40.48%)	22 (29.33%)	51 (40.16%)	24 (31.17%)	49 (38.89%)
	Three cars or more	5 (6.58%)	8 (6.35%)	4 (5.33%)	5 (3.94%)	8 (10.39%)	5 (3.97%)
Monthly income of the respondent after tax	**Up to 500 Euros**	3 (3.95%)	17 (13.49%)	7 (9.33%)	20 (15.75%)	5 (6.49%)	16 (12.70%)
	501 Euros - 1000 Euros	4 (5.26%)	12 (9.52%)	10 (13.33%)	18 (14.17%)	5 (6.49%)	13 (10.32%)
	1001 Euros - 1500 Euros	30 (39.47%)	26 (20.63%)	14 (18.67%)	23 (18.11%)	12 (15.58%)	29 (23.02%)
	1501 Euros - 2000 Euros	16 (21.05%)	36 (28.57%)	15 (20.00%)	28 (22.05%)	19 (24.68%)	35 (27.78%)
	2001 Euros - 2500 Euros	6 (7.89%)	16 (12.70%)	8 (10.67%)	18 (14.17%)	13 (16.88%)	12 (9.52%)
	2501 Euros - 3000 Euros	8 (10.53%)	11 (8.73%)	7 (9.33%)	10 (7.87%)	13 (16.88%)	11 (8.73%)
	3001 Euros - 4000 Euros	4 (5.26%)	3 (2.38%)	6 (8.00%)	7 (5.51%)	5 (6.49%)	6 (4.76%)
	4001 Euros - 5000 Euros	2 (2.63%)	3 (2.38%)	4 (5.33%)	1 (0.79%)	3 (3.90%)	3 (2.38%)
	5001 Euros - 6000 Euros	-	-	2 (2.67%)	1 (0.79%)	1 (1.30%)	1 (0.79%)
	6001 Euros - 10000 Euros	2 (2.63%)	-	1 (1.33%)	-	1 (1.30%)	-
	More than 10,001 Euros	1 (1.32%)	2 (1.59%)	1 (1.33%)	1 (0.79%)	-	-
Respondent's household monthly income after tax	**Up to 500 Euros**	-	4 (3.17%)	4 (5.33%)	7 (5.51%)	1 (1.30%)	7 (5.56%)
	501 Euros - 1000 Euros	1 (1.32%)	8 (6.35%)	6 (8.00%)	9 (7.09%)	2 (2.60%)	6 (4.76%)
	1001 Euros - 1500 Euros	11 (14.47%)	15 (11.90%)	11 (14.67%)	20 (15.75%)	8 (10.39%)	17 (13.49%)
	1501 Euros - 2000 Euros	15 (19.74%)	28 (22.22%)	10 (13.33%)	15 (11.81%)	11 (14.29%)	24 (19.05%)
	2001 Euros - 2500 Euros	13 (17.11%)	24 (19.05%)	11 (14.67%)	20 (15.75%)	14 (18.18%)	13 (10.32%)
	2501 Euros - 3000 Euros	12 (15.79%)	18 (14.29%)	7 (9.33%)	24 (18.90%)	14 (18.18%)	24 (19.05%)
	3001 Euros - 4000 Euros	11 (14.47%)	19 (15.08%)	10 (13.33%)	25 (19.69%)	14 (18.18%)	20 (15.87%)
	4001 Euros - 5000 Euros	6 (7.89%)	5 (3.97%)	8 (10.67%)	2 (1.57%)	5 (6.49%)	12 (9.52%)
	5001 Euros - 6000 Euros	1 (1.32%)	3 (2.38%)	5 (6.67%)	4 (3.15%)	2 (2.60%)	1 (0.79%)
	6001 Euros - 10000 Euros	4 (5.26%)	-	2 (2.67%)	-	5 (6.49%)	2 (1.59%)

[17] Respondents could select more than one option, up to three options.

Socio-demographic factors		Shared mobility services					
		Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	Non-users (n=126)	Users (n=75)	Non-users (n=127)	Users (n=77)	Non-users (n=126)
	More than 10,001 Euros	2 (2.63%)	2 (1.59%)	1 (1.33%)	1 (0.79%)	1 (1.30%)	-
How respondents manage their expenses with their current income	Very good	12 (15.79%)	5 (3.97%)	2 (2.67%)	8 (6.30%)	12 (15.58%)	6 (4.76%)
	Fairly good	30 (39.47%)	53 (42.06%)	35 (46.67%)	56 (44.09%)	32 (41.56%)	49 (38.89%)
	Neither good nor bad	25 (32.89%)	45 (35.71%)	22 (29.33%)	39 (30.71%)	24 (31.17%)	45 (35.71%)
	Pretty bad	9 (11.84%)	15 (11.90%)	13 (17.33%)	15 (11.81%)	7 (9.09%)	22 (17.46%)
	Very bad	-	8 (6.35%)	3 (%4.00)	9 (7.09%)	2 (2.60%)	4 (3.17%)
The municipality where the respondents live	Grugliasco	2 (2.63%)	3 (2.38%)	-	-	-	2 (1.59%)
	Collegno	5 (6.58%)	3 (2.38%)	4 (5.33%)	-	2 (2.60%)	2 (1.59%)
	Venaria Reale	2 (2.63%)	1 (0.79%)	2 (2.67%)	1 (0.79%)	2 (2.60%)	2 (1.59%)
	Borgaro Torinese	-	1 (0.79%)	-	1 (0.79%)	-	1 (0.79%)
	Settimo Torinese	1 (1.32%)	2 (1.59%)	-	2 (1.57%)	-	-
	San Mauro Torinese	1 (1.32%)	-	1 (1.33%)	2 (1.57%)	-	2 (1.59%)
	Pino Torinese	-	-	-	1 (0.79%)	2 (2.60%)	-
	Moncalieri	1 (1.32%)	9 (7.14%)	1 (1.33%)	6 (4.72%)	1 (1.30%)	7 (5.56%)
	Pecetto Torinese	-	1 (0.79%)	1 (1.33%)	-	-	-
	Nichelino	-	2 (1.59%)	-	2 (1.57%)	1 (1.30%)	2 (1.59%)
	Candiolo	-	-	-	-	-	1 (0.79%)
	Beinasco	1 (1.32%)	3 (2.38%)	1 (1.33%)	2 (1.57%)	-	2 (1.59%)
	Orbassano	-	2 (1.59%)	-	1 (0.79%)	3 (3.90%)	3 (2.38%)
	Rivalta di Torino	-	3 (2.38%)	-	1 (0.79%)	1 (1.30%)	2 (1.59%)
	Rivoli	3 (3.95%)	-	-	3 (2.36%)	1 (1.30%)	2 (1.59%)
	Alpignano	-	-	-	-	-	1 (0.79%)
	Pianezza [protetta]	-	3 (2.38%)	-	-	-	1 (0.79%)
	Druento	-	-	-	2 (1.57%)	-	1 (0.79%)
	Leini	-	2 (1.59%)	-	-	-	1 (0.79%)
	Chieri	-	4 (3.17%)	-	1 (0.79%)	2 (2.60%)	4 (3.17%)
	Trofarello	-	5 (3.97%)	-	3 (2.36%)	1 (1.30%)	2 (1.59%)
	Cambiano	-	2 (1.59%)	-	-	-	-
	Santena	-	-	-	1 (0.79%)	-	-
	Caselle Torinese	-	1 (0.79%)	-	2 (1.57%)	-	1 (0.79%)
	Volpiano	1 (1.32%)	-	-	1 (0.79%)	-	-
	Baldissero Torinese	-	-	-	-	-	-
	La Loggia	-	-	-	-	-	-
	Carignano	-	-	-	-	-	2 (1.59%)
	Vinovo	-	-	1 (1.33%)	1 (0.79%)	2 (2.60%)	2 (1.59%)
	Piobesi Torinese	-	1 (0.79%)	-	-	-	-
	Piossasco	-	3 (2.38%)	-	2 (1.57%)	-	1 (0.79%)

Socio-demographic factors		Shared mobility services					
		Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	Non-users (n=126)	Users (n=75)	Non-users (n=127)	Users (n=77)	Non-users (n=126)
	Torino	59 (77.63%)	75 (59.52%)	64 (85.33%)	92 (72.44%)	59 (76.62%)	82 (65.08%)
	Others	-	-	-	-	-	-

A4.2 Routines and daily travel views of users and non-users of each of the shared mobility services

The routines and daily travel views of survey respondents who are users and non-users of car-sharing, bike-sharing, and scooter-sharing services are listed in Table A11 (question set B in surveys 1 to 3).

Table A11: Routines and daily travel views of users and non-users of each shared mobility service (question set B in surveys 1 to 3).

People's routines and experiences of using shared mobility service		Shared mobility services					
		Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	Non-users (n=126)	Users (n=75)	Non-users (n=127)	Users (n=77)	Non-users (n=126)
Having a driving license	**Yes**	76 (100.00%)	118 (93.65%)	72 (96.00%)	116 (91.34%)	72 (93.51%)	118 (93.65%)
	No	-	8 (6.35%)	3 (4.00%)	11 (8.66%)	5 (6.49%)	8 (6.35%)
Experience using	**Currently using**	76 (100.00%)	-	75 (100.00%%)	-	77 (100.00%)	-
	Used to use it in the past but not anymore	-	9 (7.14%)	-	5 (3.94%)	-	18 (14.29%)
	Never used it but being familiar with it	-	102 (80.95%)	-	106 (83.46%)	-	64 (50.79%)
	Not familiar with its concept	-	15 (11.90%)	-	16 (12.60%)	-	44 (34.92%)
The level of people's familiarity with the service (only people who are at least familiar with it)	**1(slightly Familiar)**	2 (2.63%)	32 (28.83%)	-	34 (30.63%)	20 (25.97%)	21 (25.61%)
	2	1 (1.32%)	27 (24.32%)	2 (2.67%)	30 (27.03%)	12 (15.58%)	15 (18.29%)
	3	21 (27.63%)	34 (30.63%)	20 (26.67%)	27 (24.32%)	18 (23.38%)	30 (36.59%)
	4	32 (42.11%)	16 (14.41%)	41 (54.67%)	15 (13.51%)	13 (16.88%)	12 (14.63%)
	5 (Very Familiar)	20 (26.32%)	2 (1.80%)	12 (16.00%)	5 (4.50%)	14 (18.18%)	4 (4.88%)
The name of the service provider company (answers only belong to people who are currently using this service)	**Enjoy**	34[18]	-	-	-	-	-
	Car2go (Share Now)	47*	-	-	-	-	-
	BlueTorino	21[19]	-	-	-	-	-
	TOBike	-	-	51*	-	-	-
	Mobike	-	-	30*	-	-	-
	Bird	-	-	-	-	23*	-
	BIT mobility	-	-	-	-	39*	-
	Dott	-	-	-	-	20*	-
	Helbiz An	-	-	-	-	6*	-
	Circ	-	-	-	-	-	-
	Lime	-	-	-	-	4*	-
	Wind	-	-	-	-	11*	-
	Link	-	-	-	-	5*	-
	Vo i	-	-	-	-	1*	-

[18] Respondents could select more than one option, up to three options.
[19] Respondents could select more than one option, up to three options.

People's routines and experiences of using shared mobility service		Shared mobility services: Car-sharing Users (n=76)	Car-sharing Non-users (n=126)	Bike-sharing Users (n=75)	Bike-sharing Non-users (n=127)	Scooter-sharing Users (n=77)	Scooter-sharing Non-users (n=126)
	Others	0 (0.00%)	-	0 (0.00%)	-	0 (0.00%)	-
Pick-up locations near home, or home being in an operational area (answers only belong to people who are at least familiar with the service)	**Yes**	50 (65.79%)	43 (38.74%)	55 (73.33%)	47 (42.34%)	44 (57.14%)	41 (50.00%)
	No	20 (26.32%)	38 (34.23%)	15 (20.00%)	45 (40.54%)	21 (27.27%)	27 (32.93%)
	Not knowing	6 (7.89%)	30 (27.03%)	5 (6.67%)	19 (17.12%)	12 (15.58%)	14 (17.07%)
Pick-up locations near the most frequent destination of the trips or destination within the operational area (answers only belong to people who are at least familiar with the service)	**Yes**	48 (63.16%)	34 (30.63%)	48 (64.00%)	47 (42.34%)	42 (54.55%)	38 (46.34%)
	No	16 (21.05%)	31 (27.93%)	19 (25.33%)	33 (29.73%)	22 (28.57%)	22 (26.83%)
	Not knowing	12 (15.79%)	46 (41.44%)	8 (10.67%)	31 (27.93%)	13 (16.88%)	22 (26.83%)
The amount of use of a private car as a driver (answers only belong to people who have a driving license)	**Daily**	25 (32.89%)	42 (35.59%)	12 (16.67%)	46 (39.66%)	25 (34.72%)	38 (32.20%)
	4-6 days a week	13 (17.11%)	17 (14.41%)	14 (19.44%)	17 (14.66%)	12 (16.67%)	20 (16.95%)
	1-3 days a week	17 (22.37%)	20 (16.95%)	22 (30.56%)	20 (17.24%)	17 (23.61%)	24 (20.34%)
	Once/a few times a month	9 (11.84%)	12 (10.17%)	6 (8.33%)	10 (8.62%)	7 (9.72%)	7 (5.93%)
	Rarely	6 (7.89%)	9 (7.63%)	6 (8.33%)	6 (5.17%)	6 (8.33%)	7 (5.93%)
	Never	6 (7.89%)	18 (15.25%)	12 (16.67%)	17 (14.66%)	5 (6.94%)	22 (18.64%)
The amount of use of a private car as a passenger	**Daily**	3 (3.95%)	4 (3.17%)	2 (2.67%)	5 (3.94%)	3 (3.90%)	2 (1.59%)
	4-6 days a week	8 (10.53%)	8 (6.35%)	5 (6.67%)	14 (11.02%)	7 (9.09%)	6 (4.76%)
	1-3 days a week	19 (25.00%)	38 (30.16%)	25 (33.33%)	35 (27.56%)	20 (25.97%)	39 (30.95%)
	Once/a few times a month	21 (27.63%)	26 (20.63%)	14 (18.67%)	23 (18.11%)	17 (22.08%)	21 (16.67%)
	Rarely	16 (21.05%)	31 (24.60%)	22 (29.33%)	33 (25.98%)	19 (24.68%)	29 (23.02%)
	Never	9 (11.84%)	19 (15.08%)	7 (9.33%)	17 (13.39%)	11 (14.29%)	29 (23.02%)
The amount of use of car-sharing	**Daily**	-	-	-	2 (1.57%)	-	-
	4-6 days a week	9 (11.84%)	-	6 (8.00%)	-	5 (6.49%)	1 (0.79%)
	1-3 days a week	17 (22.37%)	-	12 (16.00%)	5 (3.94%)	14 (18.18%)	6 (4.76%)
	Once/a few times a month	26 (34.21%)	2 (1.59%)	13 (17.33%)	8 (6.30%)	10 (12.99%)	9 (7.14%)
	Rarely	24 (31.58%)	7 (5.56%)	15 (20.00%)	27 (21.26%)	15 (19.48%)	25 (19.84%)
	Never	-	117 (92.86%)	29 (38.67%)	85 (66.93%)	33 (42.86%)	85 (67.46%)
The amount of use of public transport	**Daily**	3 (3.95%)	11 (8.73%)	5 (6.67%)	11 (8.66%)	8 (10.39%)	11 (8.73%)
	4-6 days a week	9 (11.84%)	9 (7.14%)	12 (16.00%)	6 (4.72%)	13 (16.88%)	18 (14.29%)
	1-3 days a week	14 (18.42%)	15 (11.90%)	20 (26.67%)	12 (9.45%)	16 (20.78%)	12 (9.52%)
	Once/a few times a month	22 (28.95%)	15 (11.90%)	16 (21.33%)	26 (20.47%)	18 (23.38%)	27 (21.43%)
	Rarely	19 (25.00%)	40 (31.75%)	19 (25.33%)	43 (33.86%)	17 (22.08%)	37 (29.37%)
	Never	9 (11.84%)	36 (28.57%)	3 (4.00%)	29 (22.83%)	5 (6.49%)	21 (16.67%)
The amount of use of motorcycles/scooters	**Daily**	3 (3.95%)	-	2 (2.67%)	4 (3.15%)	4 (5.19%)	1 (0.79%)
	4-6 days a week	3 (3.95%)	1 (0.79%)	4 (5.33%)	1 (0.79%)	5 (6.49%)	4 (3.17%)
	1-3 days a week	4 (5.26%)	4 (3.17%)	8 (10.67%)	4 (3.15%)	13 (16.88%)	4 (3.17%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Car-sharing Non-users (n=126)	Bike-sharing Users (n=75)	Bike-sharing Non-users (n=127)	Scooter-sharing Users (n=77)	Scooter-sharing Non-users (n=126)
	Once/a few times a month	7 (9.21%)	10 (7.94%)	8 (10.67%)	5 (3.94%)	7 (9.09%)	6 (4.76%)
	Rarely	11 (14.47%)	12 (9.52%)	8 (10.67%)	12 (9.45%)	8 (10.39%)	17 (13.49%)
	Never	48 (63.16%)	99 (78.57%)	45 (60.00%)	101 (79.53%)	40 (51.95%)	94 (74.60%)
The amount of use of a taxi	Daily	-	-	1 (1.33%)	2 (1.57%)	-	-
	4-6 days a week	1 (1.32%)	2 (1.59%)	3 (4.00%)	1 (0.79%)	3 (3.90%)	2 (1.59%)
	1-3 days a week	4 (5.26%)	4 (3.17%)	6 (8.00%)	3 (2.36%)	11 (14.29%)	5 (3.97%)
	Once/a few times a month	12 (15.79%)	9 (7.14%)	15 (20.00%)	7 (5.51%)	10 (12.99%)	13 (10.32%)
	Rarely	23 (30.26%)	40 (31.75%)	24 (32.00%)	49 (38.58%)	28 (36.36%)	43 (34.13%)
	Never	36 (47.37%)	71 (56.35%)	26 (34.67%)	65 (51.18%)	25 (32.47%)	63 (50.00%)
The amount of use of a personal bike	Daily	7 (9.21%)	1 (0.79%)	7 (9.33%)	4 (3.15%)	1 (1.30%)	5 (3.97%)
	4-6 days a week	7 (9.21%)	7 (5.56%)	3 (4.00%)	2 (1.57%)	11 (14.29%)	5 (3.97%)
	1-3 days a week	15 (19.74%)	12 (9.52%)	17 (22.67%)	11 (8.66%)	11 (14.29%)	7 (5.56%)
	Once/a few times a month	14 (18.42%)	24 (19.05%)	15 (20.00%)	20 (15.75%)	13 (16.88%)	17 (13.49%)
	Rarely	10 (13.16%)	29 (23.02%)	14 (18.67%)	30 (23.62%)	13 (16.88%)	34 (26.98%)
	Never	23 (30.26%)	53 (42.06%)	19 (25.33%)	60 (47.24%)	28 (36.36%)	58 (46.03%)
The amount of use of bike-sharing	Daily	1 (1.32%)	1 (0.79%)	5 (6.67%)	-	1 (1.30%)	-
	4-6 days a week	3 (3.95%)	2 (1.59%)	8 (10.67%)	2 (1.57%)	2 (2.60%)	3 (2.38%)
	1-3 days a week	2 (2.63%)	4 (3.17%)	24 (32.00%)	2 (1.57%)	14 (18.18%)	1 (0.79%)
	Once/a few times a month	15 (19.74%)	9 (7.14%)	16 (21.33%)	3 (2.36%)	7 (9.09%)	4 (3.17%)
	Rarely	11 (14.47%)	10 (7.94%)	22 (29.33%)	15 (11.81%)	10 (12.99%)	21 (16.67%)
	Never	44 (57.89%)	100 (79.37%)	-	105 (82.68%)	43 (55.84%)	97 (76.98%)
The amount of use of scooter-sharing	Daily	-	-	2 (2.67%)	1 (0.79%)	2 (2.60%)	-
	4-6 days a week	-	7 (5.56%)	5 (6.67%)	-	6 (7.79%)	-
	1-3 days a week	8 (10.53%)	2 (1.59%)	11 (14.67%)	1 (0.79%)	11 (14.29%)	-
	Once/a few times a month	11 (14.47%)	8 (6.35%)	6 (8.00%)	6 (4.72%)	31 (40.26%)	-
	Rarely	7 (9.21%)	8 (6.35%)	6 (8.00%)	12 (9.45%)	27 (35.06%)	-
	Never	50 (65.79%)	101 (80.16%)	45 (60.00%)	107 (84.25%)	-	126 (100.00%)
The amount of use of walking	Daily	38 (50.00%)	48 (38.10%)	43 (57.33%)	56 (44.09%)	37 (48.05%)	62 (49.21%)
	4-6 days a week	9 (11.84%)	19 (15.08%)	10 (13.33%)	17 (13.39%)	15 (19.48%)	16 (12.70%)
	1-3 days a week	17 (22.37%)	29 (23.02%)	12 (16.00%)	31 (24.41%)	14 (18.18%)	21 (16.67%)
	Once/a few times a month	8 (10.53%)	14 (11.11%)	7 (9.33%)	8 (6.30%)	7 (9.09%)	14 (11.11%)
	Rarely	3 (3.95%)	8 (6.35%)	2 (2.67%)	10 (7.87%)	2 (2.60%)	8 (6.35%)
	Never	1 (1.32%)	8 (6.35%)	1 (1.33%)	5 (3.94%)	2 (2.60%)	5 (3.97%)
	Private car as a driver	36 (47.37%)	62 (49.21%)	21 (28.00%)	58 (45.67%)	33 (42.86%)	61 (48.41%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	Non-users (n=126)	Users (n=75)	Non-users (n=127)	Users (n=77)	Non-users (n=126)
The mode of transportation most likely to be used to go to work or school	**Private car as a passenger**	2 (2.63%)	5 (3.97%)	5 (6.67%)	6 (4.72%)	6 (7.79%)	4 (3.17%)
	Car-sharing	4 (5.26%)	3 (2.38%)	5 (6.67%)	-	3 (3.90%)	1 (0.79%)
	Public transport	12 (15.79%)	26 (20.63%)	11 (14.67%)	27 (21.26%)	18 (23.38%)	27 (21.43%)
	Moto/Scooter	4 (5.26%)	2 (1.59%)	4 (5.33%)	4 (3.15%)	4 (5.19%)	3 (2.38%)
	Taxi	1 (1.32%)	2 (1.59%)	1 (1.33%)	1 (0.79%)	-	-
	Personal bike	9 (11.84%)	3 (2.38%)	7 (9.33%)	4 (3.15%)	1 (1.30%)	5 (3.97%)
	Bike-sharing	-	-	1 (1.33%)	-	-	-
	Scooter-sharing	-	-	-	-	2 (2.60%)	1 (0.79%)
	Walking	6 (7.89%)	15 (11.90%)	19 (25.33%)	14 (11.02%)	5 (6.49%)	18 (14.29%)
	Other	2 (2.63%)	8 (6.35%)	1 (1.33%)	13 (10.24%)	5 (6.49%)	6 (4.76%)
The mode of transportation most likely to be used to visit a close relative/friends/, relatives/family	**Private car as a driver**	39 (51.32%)	66 (52.38%)	26 (34.67%)	68 (53.54%)	36 (46.75%)	65 (51.59%)
	Private car as a passenger	12 (15.79%)	25 (19.84%)	14 (18.67%)	30 (23.62%)	14 (18.18%)	24 (19.05%)
	Car-sharing	1 (1.32%)	3 (2.38%)	4 (5.33%)	-	3 (3.90%)	3 (2.38%)
	Public transport	8 (10.53%)	18 (14.29%)	11 (14.67%)	6 (4.72%)	13 (16.88%)	13 (10.32%)
	Moto/Scooter	4 (5.26%)	2 (1.59%)	2 (2.67%)	4 (3.15%)	3 (3.90%)	1 (0.79%)
	Taxi	-	-	1 (1.33%)	1 (0.79%)	1 (1.30%)	2 (1.59%)
	Personal bike	5 (6.58%)	3 (2.38%)	4 (5.33%)	2 (1.57%)	2 (2.60%)	3 (2.38%)
	Bike-sharing	-	-	3 (4.00%)	1 (0.79%)	-	1 (0.79%)
	Scooter-sharing	-	-	-	-	1 (1.30%)	-
	Walking	7 (9.21%)	8 (6.35%)	9 (12.00%)	14 (11.02%)	4 (5.19%)	11 (8.73%)
	Other	-	1 (0.79%)	1 (1.33%)	1 (0.79%)	-	3 (2.38%)
The mode of transport most likely to be used to run an errand in the city center	**Private car as a driver**	14 (18.42%)	50 (39.68%)	10 (13.33%)	39 (30.71%)	15 (19.48%)	34 (26.98%)
	Private car as a passenger	1 (1.32%)	8 (6.35%)	6 (8.00%)	14 (11.02%)	4 (5.19%)	5 (3.97%)
	Car-sharing	12 (15.79%)	1 (0.79%)	8 (10.67%)	2 (1.57%)	9 (11.69%)	3 (2.38%)
	Public transport	26 (34.21%)	39 (30.95%)	16 (21.33%)	40 (31.50%)	28 (36.36%)	52 (41.27%)
	Moto/Scooter	3 (3.95%)	5 (3.97%)	2 (2.67%)	5 (3.94%)	2 (2.60%)	5 (3.97%)
	Taxi	2 (2.63%)	2 (1.59%)	-	3 (2.36%)	-	-
	Personal bike	6 (7.89%)	4 (3.17%)	5 (6.67%)	3 (2.36%)	7 (9.09%)	2 (1.59%)
	Bike-sharing	1 (1.32%)	2 (1.59%)	6 (8.00%)	1 (0.79%)	-	-
	Scooter-sharing	2 (2.63%)	2 (1.59%)	2 (2.67%)	-	4 (5.19%)	-
	Walking	9 (11.84%)	12 (9.52%)	20 (26.67%)	17 (13.39%)	8 (10.39%)	23 (18.25%)
	Other	-	1 (0.79%)	-	3 (2.36%)	-	2 (1.59%)
The mode of transport most likely to be used to go out for dinner	**Private car as a driver**	31 (40.79%)	58 (46.03%)	26 (34.67%)	60 (47.24%)	37 (48.05%)	58 (46.03%)
	Private car as a passenger	14 (18.42%)	32 (25.40%)	12 (16.00%)	40 (31.50%)	14 (18.18%)	30 (23.81%)
	Car-sharing	8 (10.53%)	3 (2.38%)	8 (10.67%)	-	3 (3.90%)	6 (4.76%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Car-sharing Non-users (n=126)	Bike-sharing Users (n=75)	Bike-sharing Non-users (n=127)	Scooter-sharing Users (n=77)	Scooter-sharing Non-users (n=126)
	Public transport	9 (11.84%)	15 (11.90%)	7 (9.33%)	7 (5.51%)	9 (11.69%)	8 (6.35%)
	Moto/Scooter	-	3 (2.38%)	2 (2.67%)	6 (4.72%)	3 (3.90%)	5 (3.97%)
	Taxi	4 (5.26%)	4 (3.17%)	2 (2.67%)	1 (0.79%)	3 (3.90%)	3 (2.38%)
	Personal bike	2 (2.63%)	4 (3.17%)	2 (2.67%)	2 (1.57%)	-	-
	Bike-sharing	1 (1.32%)	-	4 (5.33%)	-	1 (1.30%)	-
	Scooter-sharing	2 (2.63%)	-	-	-	2 (2.60%)	-
	Walking	45 (6.58%)	3 (2..38%)	12 (16.00%)	7 (5.51%)	5 (6.49%)	12 (9.25%)
	Other	-	4 (3.17%)	-	4 (3.15%)	-	4 (3.17%)
The mode of transport most likely to be used to take an excursion in nice weather	**Private car as a driver**	33 (43.42%)	57 (45.24%)	24 (32.00%)	53 (41.73%)	28 (36.36%)	48 (38.10%)
	Private car as a passenger	14 (18.42%)	30 (23.81%)	13 (17.33%)	33 (25.98%)	16 (20.78%)	29 (23.02%)
	Car-sharing	4 (5.26%)	2 (1.59%)	3 (4.00%)	1 (0.79%)	3 (3.90%)	2 (1.59%)
	Public transport	10 (13.16%)	8 (6.35%)	5 (6.67%)	5 (3.94%)	4 (5.19%)	6 (4.76%)
	Moto/Scooter	6 (7.89%)	2 (1.59%)	5 (6.67%)	3 (2.36%)	3 (3.90%)	7 (5.56%)
	Taxi	-	3 (2.38%)	1 (1.33%)	1 (0.79%)	-	-
	Personal bike	3 (3.95%)	7 (5.56%)	9 (12.00%)	8 (6.30%)	6 (7.79%)	9 (7.14%)
	Bike-sharing	1 (1.32%)	1 (0.79%)	4 (5.33%)	2 (1.57%)	3 (3.90%)	-
	Scooter-sharing	-	-	-	-	3 (3.90%)	1 (0.79%)
	Walking	5 (6.58%)	15 (11.90%)	11 (14.67%)	19 (14.96%)	11 (14.29%)	21 (16.67%)
	Other	-	1 (0.79%)	-	2 (1.57%)	-	3 (2.38%)
The mode of transport most likely to be used to visit a shopping center	**Private car as a driver**	41 (53.95%)	71 (56.35%)	32 (42.67%)	67 (52.76%)	40 (51.95%)	74 (58.73%)
	Private car as a passenger	6 (7.89%)	20 (15.87%)	9 (12.00%)	29 (22.83%)	11 (14.29%)	13 (10.32%)
	Car-sharing	7 (9.21%)	2 (1.59%)	5 (6.67%)	-	3 (3.90%)	3 (2.38%)
	Public transport	13 (17.11%)	19 (15.08%)	10 (13.33%)	12 (9.45%)	10 (12.99%)	21 (16.67%)
	Moto/Scooter	-	1 (0.79%)	5 (6.67%)	3 (2.36%)	2 (2.60%)	4 (3.17%)
	Taxi	3 (3.95%)	4 (3.17%)	4 (5.33%)	1 (0.79%)	-	-
	Personal bike	3 (3.95%)	4 (3.17%)	1 (1.33%)	3 (2.36%)	4 (5.19%)	1 (0.79%)
	Bike-sharing	-	-	4 (5.33%)	1 (0.79%)	2 (2.60%)	1 (0.79%)
	Scooter-sharing	1 (1.32%)	1 (0.79%)	-	-	-	-
	Walking	1 (1.32%)	2 (1.59%)	2 (2.67%)	8 (6.30%)	5 (6.49%)	5 (3.97%)
	Other	1 (1.32%)	2 (1.59%)	3 (4.00%)	3 (2.36%)	-	4 (3.17%)
The mode of transport most likely to be used to go to smaller shops	**Private car as a driver**	18 (23.68%)	35 (27.78%)	11 (14.67%)	34 (26.77%)	18 (23.38%)	32 (25.40%)
	Private car as a passenger	-	12 (9.52%)	2 (2.67%)	12 (9.45%)	6 (7.79%)	5 (3.97%)
	Car-sharing	6 (7.89%)	-	3 (4.00%)	3 (2.36%)	4 (5.19%)	3 (2.38%)
	Public transport	10 (13.16%)	15 (11.90%)	12 (16.00%)	4 (3.15%)	13 (16.88%)	23 (18.25%)
	Moto/Scooter	3 (3.95%)	2 (1.59%)	5 (6.67%)	6 (4.72%)	3 (3.90%)	3 (2.38%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Non-users (n=126)	Bike-sharing Users (n=75)	Non-users (n=127)	Scooter-sharing Users (n=77)	Non-users (n=126)
	Taxi	2 (2.63%)	2 (1.59%)	-	1 (0.79%)	1 (1.30%)	-
	Personal bike	6 (7.89%)	11 (8.73%)	4 (5.33%)	3 (2.36%)	4 (5.19%)	2 (1.59%)
	Bike-sharing	-	2 (1.59%)	6 (8.00%)	1 (0.79%)	-	1 (0.79%)
	Scooter-sharing	3 (3.95%)	1 (0.79%)	2 (2.67%)	-	2 (2.60%)	-
	Walking	27 (35.53%)	46 (36.51%)	30 (40.00%)	62 (48.82%)	26 (33.77%)	55 (43.65%)
	Other	1 (1.32%)	-	-	1 (0.79%)	-	2 (1.59%)
The mode of transport most likely to be used for weekend activities	Private car as a driver	33 (43.42%)	57 (45.24%)	23 (30.67%)	51 (40.16%)	31 (40.26%)	56 (44.44%)
	Private car as a passenger	12 (15.79%)	23 (18.25%)	9 (12.00%)	35 (27.56%)	8 (10.39%)	23 (18.25%)
	Car-sharing	3 (3.95%)	3 (2.38%)	6 (8.00%)	1 (0.79%)	6 (7.79%)	2 (1.59%)
	Public transport	7 (9.21%)	10 (7.94%)	8 (10.67%)	2 (1.57%)	10 (12.99%)	15 (11.90%)
	Moto/Scooter	1 (1.32%)	-	3 (4.00%)	5 (3.94%)	3 (3.90%)	5 (3.97%)
	Taxi	1 (1.32%)	2 (1.59%)	2 (2.67%)	1 (0.79%)	-	-
	Personal bike	6 (7.89%)	8 (6.35%)	2 (2.67%)	7 (5.51%)	2 (2.60%)	6 (4.76%)
	Bike-sharing	4 (5.26%)	-	8 (10.67%)	-	-	-
	Scooter-sharing	2 (2.63%)	2 (1.59%)	1 (1.33%)	-	5 (6.49%)	-
	Walking	5 (6.58%)	18 (14.29%)	13 (17.33%)	22 (17.32%)	12 (15.58%)	15 (11.90%)
	Other	2 (2.63%)	3 (2.38%)	-	3 (2.36%)	-	4 (3.17%)
The incentive to use car-sharing (or more use)	Availability near my home/work	37*	43*	-	-	-	-
	Reduction in costs	38*	54*	-	-	-	-
	More sustainable travel	23*	32*	-	-	-	-
	Increased comfort during travel	12*	16*	-	-	-	-
	The convenience of having it only when needed	22*	49*	-	-	-	-
	Avoiding responsibilities related to maintenance and repairs	16*	50*	-	-	-	-
The incentive to use bike-sharing/scooter-sharing (or more use)	Availability near my home/work	-	-	40*	49*	36*	44*
	Reduction in costs	-	-	25*	31*	25*	41*
	More sustainable travel	-	-	26*	45*	21*	32*
	Increased comfort during travel	-	-	16*	16*	13*	14*
	The convenience of having it only when needed	-	-	26*	52*	28*	41*
	Avoiding responsibilities related to	-	-	14*	28*	18*	38*

People's routines and experiences of using shared mobility service		Shared mobility services: Car-sharing Users (n=76)	Car-sharing Non-users (n=126)	Bike-sharing Users (n=75)	Bike-sharing Non-users (n=127)	Scooter-sharing Users (n=77)	Scooter-sharing Non-users (n=126)
	maintenance and repairs						
	Smooth track without slope	-	-	1*	2*	9*	4*
Weather conditions that lead to car-sharing/bike-sharing/scooter-sharing use (answers only belong to people who are at least familiar with the service)	Bad weather (e.g., rainy or snowy weather)	43[20]	48*	2*	3*	3*	2*
	Good weather (e.g., sunny weather)	8*	5*	44*	75*	47*	53*
	Scorching weather	6*	6*	7*	3*	12*	4*
	Favorable air temperature	6*	4*	30*	40*	26*	27*
	Freezing weather	19*	27*	6*	9*	5*	2*
	High humidity level	7*	5*	2*	1*	2*	3*
	Favorable humidity level	43[21]	2*	2*	5*	5*	2*
	High air pollution	5*	37*	7*	5*	5*	5*
	Low air pollution	4*	5*	20*	21*	11*	14*
	In winter	27*	33*	1*	2*	2*	1*
	In spring	4*	11*	32*	56*	26*	32*
	In summer	7*	8*	27*	30*	24*	36*
	In autumn	6*	12*	1*	9*	3*	2*
Travel distance that may cause the use of the service	Travel less than 5 km	25 (32.89%)	32 (25.40%)	42 (56.00%)	89 (70.08%)	53 (68.83%)	90 (71.43%)
	Travel 5 km or more	28 (36.84%)	44 (34.92%)	12 (16.00%)	9 (7.09%)	9 (11.69%)	14 (11.11%)
	Both	23 (30.26%)	50 (39.68%)	21 (28.00%)	29 (22.83%)	15 (19.48%)	22 (17.46%)
Travel time that may cause the use of the service	Travel less than 30 min	43 (56.58%)	46 (36.51%)	50 (66.67%)	92 (72.44%)	59 (76.62%)	100 (79.37%)
	Travel 30 min or more	16 (21.05%)	35 (27.78%)	10 (13.33%)	16 (12.60%)	6 (7.79%)	7 (5.56%)
	Both	17 (22.37%)	45 (35.71%)	15 (20.00%)	19 (14.96%)	12 (15.58%)	19 (15.08%)
Departure time (hour) that may cause the use of the service	Travel during peak hours	16 (21.05%)	43 (34.13%)	29 (38.67%)	48 (37.80%)	36 (46.75%)	50 (39.68%)
	Travel during off-peak hours	33 (43.42%)	36 (28.57%)	21 (28.00%)	43 (33.86%)	24 (31.17%)	28 (22.22%)
	Both	27 (35.53%)	47 (37.30%)	25 (33.33%)	36 (28.35%)	17 (22.08%)	48 (38.10%)
Departure time (day) that may cause the use of the service	Travel on a weekday morning	30*	61*	43*	68*	44*	80*
	Travel on a weekend morning	25*	32*	31*	71*	39*	47*
	Travel on a weekday evening	30*	46*	17*	25*	15*	28*
	Travel on a weekend evening	30*	36*	12*	15*	12*	18*
The trip purpose that may cause the use of the service	Travel for leisure (e.g., vising friends or shopping)	19 (25.00%)	36 (28.57%)	24 (32.00%)	55 (43.31%)	31 (40.26%)	31 (24.60%)
	Travel for non-leisure (going to work/school)	27 (35.53%)	52 (41.27%)	23 (30.67%)	36 (28.35%)	20 (25.97%)	55 (43.65%)

[20] Respondents could select more than one option, up to three options.

[21] Respondents could select more than one option, up to three options.

People's routines and experiences of using shared mobility service		Shared mobility services					
		Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	Non-users (n=126)	Users (n=75)	Non-users (n=127)	Users (n=77)	Non-users (n=126)
	Both	30 (39.47%)	38 (30.16%)	28 (37.33%)	36 (28.35%)	26 (33.77%)	40 (31.75%)
It is possible for me to use car-sharing/bike-sharing/scooter-sharing for my regular trips (According to perceptions of respondents) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	10 (13.16%)	3 (33.33%)	6 (8.00%)	1 (20.00%)	3 (3.90%)	-
	2	13 (17.11%)	-	16 (21.33%)	1 (20.00%)	10 (12.99%)	-
	3	9 (11.84%)	1 (11.11%)	5 (6.67%)	-	16 (20.78%)	3 (16.67%)
	4	15 (19.74%)	1 (11.11%)	15 (20.00%)	1 (20.00%)	19 (24.68%)	4 (22.22%)
	5	18 (23.68%)	1 (11.11%)	18 (24.00%)	2 (40.00%)	17 (22.08%)	5 (27.78%)
	6	5 (6.58%)	2 (22.22%)	8 (10.67%)	-	9 (11.69%)	4 (22.22%)
	7 (Strongly agree)	6 (7.89%)	1 (11.11%)	7 (9.33%)	-	3 (3.90%)	2 (11.11%)
I am sure I can choose car-sharing/bike-sharing/scooter-sharing for my regular trips during the next week (According to perceptions of respondents) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	20 (26.32%)	3 (33.33%)	18 (24.00%)	2 (40.00%)	10 (12.99%)	1 (5.56%)
	2	6 (7.89%)	-	16 (21.33%)	2 (40.00%)	7 (9.09%)	-
	3	15 (19.74%)	2 (22.22%)	7 (9.33%)	-	6 (7.79%)	3 (16.67%)
	4	9 (11.84%)	1 (11.11%)	11 (14.67%)	-	15 (19.48%)	4 (22.22%)
	5	16 (21.05%)	3 (33.33%)	12 (16.00%)	-	19 (24.68%)	4 (22.22%)
	6	7 (9.21%)	-	5 (6.67%)	-	20 (25.97%)	5 (27.78%)
	7 (Strongly agree)	3 (3.95%)	-	6 (8.00%)	1 (20.00%)	-	1 (5.56%)
The car-sharing/bike-sharing/scooter-sharing service is a useful mode of transport (According to perceptions of respondents) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	-	1 (11.11%)	1 (1.33%)	-	2 (2.60%)	-
	2	1 (1.32%)	-	6 (8.00%)	-	1 (1.30%)	-
	3	7 (9.21%)	-	4 (5.33%)	1 (20.00%)	4 (5.19%)	1 (5.56%)
	4	14 (18.42%)	4 (44.44%)	16 (21.33%)	-	16 (20.78%)	4 (22.22%)
	5	12 (15.79%)	-	24 (32.00%)	-	22 (28.57%)	4 (22.22%)
	6	20 (26.32%)	2 (22.22%)	11 (14.67%)	1 (20.00%)	25 (32.47%)	5 (27.78%)
	7 (Strongly agree)	22 (28.95%)	2 (22.22%)	13 (17.33%)	3 (60.00%)	7 (9.09%)	4 (22.22%)
Car-sharing/bike-sharing/scooter-sharing helps me to accomplish activities that are important to me (According to perceptions of respondents) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	4 (5.26%)	3 (33.33%)	7 (9.33%)	1 (20.00%)	4 (5.19%)	7 (38.89%)
	2	11 (14.47%)	-	11 (14.67%)	1 (20.00%)	14 (18,18%)	8 (44.44%)
	3	9 (11.84%)	1 (11.11%)	11 (14.67%)	1 (20.00%)	19 (24.68%)	3 (16.67%)
	4	16 (21.05%)	3 (33.33%)	18 (24.00%)	-	18 (23.38%)	-
	5	19 (25.00%)	2 (22.22%)	15 (20.00%)	1 (20.00%)	16 (20.78%)	-
	6	11 (14.47%)	-	9 (12.00%)	1 (20.00%)	5 (6.49%)	-
	7 (Strongly agree)	6 (7.89%)	-	4 (5.33%)	-	1 (1.30%)	-
Learning how to use car-sharing/bike-sharing/scooter-sharing was easy for me (According to perceptions of respondents) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	1 (1.32%)	1 (11.11%)	3 (4.00%)	1 (20.00%)	4 (5.19%)	2 (11.11%)
	2	5 (6.58%)	-	3 (4.00%)	-	4 (5.19%)	-
	3	6 (7.89%)	-	8 (10.67%)	-	17 (22.08%)	2 (11.11%)
	4	11 (14.47%)	1 (11.11%)	18 (24.00%)	1 (20.00%)	17 (22.08%)	2 (11.11%)
	5	20 (26.32%)	2 (22.22%)	15 (20.00%)	1 (20.00%)	15 (19.48%)	4 (22.22%)
	6	14 (18.42%)	4 (44.44%)	14 (18.67%)	1 (20.00%)	12 (15.58%)	5 (27.78%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Car-sharing Non-users (n=126)	Bike-sharing Users (n=75)	Bike-sharing Non-users (n=127)	Scooter-sharing Users (n=77)	Scooter-sharing Non-users (n=126)
	7 (Strongly agree)	19 (25.00%)	1 (11.11%)	14 (18.67%)	1 (20.00%)	8 (10.39%)	3 (16.67%)
I find car-sharing/bike-sharing/scooter-sharing easy to use (According to perceptions of respondents) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	2 (2.63%)	-	5 (6.67%)	-	-	1 (5.56%)
	2	1 (1.32%)	-	2 (2.67%)	-	2 (2.60%)	2 (11.11%)
	3	9 (11.84%)	-	5 (6.675)	-	6 (7.79%)	7 (38.89%)
	4	14 (18.42%)	4 (44.44%)	17 (22.67%)	2 (40.00%)	18 (23.38%)	4 (22.22%)
	5	16 (21.05%)	1 (11.11%)	15 (20.00%)	2 (40.00%)	21 (27.27%)	2 (11.11%)
	6	18 (23.68%)	3 (33.33%)	20 (26.67%)	-	22 (28.57%)	1 (5.56%)
	7 (Strongly agree)	16 (21.05%)	1 (11.11%)	11 (14.67%)	1 (20.00%)	8 (10.39%)	1 (5.56%)
It is difficult to book a car/bike/scooter at the car-sharing/bike-sharing/scooter-sharing website/app (According to perceptions of respondents) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	17 (22.37%)	3 (33.33%)	9 (12.00%)	2 (40.00%)	8 (10.39%)	-
	2	16 (21.05%)	1 (11.11%)	14 (18.67%)	1 (20.00%)	14 (18.18%)	4 (22.22%)
	3	10 (13.16%)	-	7 (9.33%)	1 (20.00%)	15 (19.48%)	7 (38.89%)
	4	10 (13.16%)	2 (22.22%)	20 (26.67%)	-	12 (15.58%)	6 (33.33%)
	5	11 (14.47%)	1 (11.11%)	14 (18.67%)	-	17 (22.08%)	1 (5.56%)
	6	8 (10.53%)	2 (22.22%)	7 (9.33%)	-	9 (11.69%)	-
	7 (Strongly agree)	4 (5.26%)	-	4 (5.33%)	1 (20.00%)	2 (2.60%)	-
People who are important to me think that I should use it more often instead of other modes of transportation (answers only belong to people who have experience with the service)	1 (Strongly disagree)	18 (23.68%)	4 (44.44%)	17 (22.67%)	2 (40.00%)	14 (18.18%)	3 (16.67%)
	2	11 (14.47%)	1 (11.11%)	10 (13.33%)	-	4 (5.19%)	1 (5.56%)
	3	11 (14.47%)	1 (11.11%)	6 (8.00%)	1 (20.00%)	19 (24.68%)	2 (11.11%)
	4	17 (22.37%)	2 (22.22%)	23 (30.67%)	-	8 (10.39%)	4 (22.22%)
	5	7 (9.21%)	-	12 (16.00%)	1 (20.00%)	10 (12.99%)	3 (16.67%)
	6	7 (9.21%)	1 (11.11%)	5 (6.67%)	1 (20.00%)	17 (22.08%)	4 (22.22%)
	7 (Strongly agree)	5 (6.58%)	-	2 (2.67%)	-	5 (6.49%)	1 (5.56%)
People who are important to me like that I use it (answers only belong to people who have experience with the service)	1 (Strongly disagree)	13 (17.11%)	3 (33.33%)	9 (12.00%)	1 (20.00%)	11 (14.29%)	2 (11.11%)
	2	6 (7.89%)	-	6 (8.00%)	-	8 (10.39%)	-
	3	12 (15.79%)	2 (22.22%)	7 (9.33%)	-	9 (11.69%)	2 (11.11%)
	4	16 (21.05%)	1 (11.11%)	15 (20.00%)	1 (20.00%)	22 (28.57%)	3 (16.67%)
	5	19 (25.00%)	1 (11.11%)	21 (28.00%)	1 (20.00%)	17 (22.08%)	4 (22.22%)
	6	7 (9.21%)	2 (22.22%)	10 (13.33%)	2 (40.00%)	9 (11.69%)	6 (33.33%)
	7 (Strongly agree)	3 (3.95%)	-	7 (9.33%)	-	1 (1.30%)	1 (5.56%)
People who are important to me agree with my use of it (answers only belong to people who have experience with the service)	1 (Strongly disagree)	11 (14.47%)	2 (22.22%)	6 (8.00%)	-	7 (9.09%)	-
	2	3 (3.95%)	-	7 (9.33%)	1 (20.00%)	1 (1.30%)	1 (5.56%)
	3	11 (14.47%)	-	5 (6.67%)	0 (20.00%)	4 (5.19%)	2 (11.11%)
	4	17 (22.37%)	3 (33.33%)	19 (25.33%)	3 (60.00%)	20 (25.97%)	5 (27.78%)
	5	16 (21.05%)	3 (33.33%)	19 (25.33%)	1 (20.00%)	24 (31.17%)	3 (16.67%)

People's routines and experiences of using shared mobility service		**Shared mobility services** **Car-sharing**		**Bike-sharing**		**Scooter-sharing**	
		Users (n=76)	**Non-users (n=126)**	**Users (n=75)**	**Non-users (n=127)**	**Users (n=77)**	**Non-users (n=126)**
	6	13 (17.11%)	-	9 (12.00%)	-	15 (19.48%)	5 (27.78%)
	7 (Strongly agree)	5 (6.58%)	1 (11.11%)	10 (13.33%)	-	6 (7.79%)	2 (11.11%)
People who are important to me think that I should use it (answers only belong to people who do not have experience with the service but are familiar)	**1 (Strongly disagree)**	-	34 (33.33%)	-	46 (43.40%)	-	27 (42.19%)
	2	-	18 (17.65%)	-	13 (12.26%)	-	6 (9.38%)
	3	-	7 (6.86%)	-	12 (11.32%)	-	10 (15.63%)
	4	-	29 (28.43%)	-	20 (18.87%)	-	12 (18.75%)
	5	-	9 (8.82%)	-	13 (12.26%)	-	4 (6.25%)
	6	-	3 (2.94%)	-	-	-	5 (7.81%)
	7 (Strongly agree)	-	2 (1.96%)	-	2 (1.89%)	-	-
People who are important to me would like me to use it (answers only belong to people who do not have experience with the service but are familiar)	**1 (Strongly disagree)**	-	37 (36.27%)	-	51 (48.11%)	-	25 (39.06%)
	2	-	16 (15.69%)	-	12 (11.32%)	-	8 (12.50%)
	3	-	10 (9.80%)	-	8 (7.55%)	-	9 (14.06%)
	4	-	23 (22.25%)	-	19 (17.92%)	-	14 (21.88%)
	5	-	9 (8.82%)	-	11 (10.38%)	-	2 (3.13%)
	6	-	5 (4.90%)	-	4 (3.77%)	-	4 (6.25%)
	7 (Strongly agree)	-	2 (1.96%)	-	1 (0.94%)	-	2 (3.13%)
People who are important to me would agree if I used it (answers only belong to people who do not have experience with the service but are familiar)	**1 (Strongly disagree)**	-	20 (19.61%)	-	28 (26.42%)	-	15 (23.44%)
	2	-	11 (10.78%)	-	6 (5.66%)	-	6 (9.38%)
	3	-	9 (8.82%)	-	7 (6.60%)	-	10 (15.63%)
	4	-	24 (23.53%)	-	30 (28.30%)	-	15 (23.44%)
	5	-	22 (21.57%)	-	17 (16.04%)	-	6 (9.38%)
	6	-	8 (7.84%)	-	8 (7.55%)	-	7 (10.94%)
	7 (Strongly agree)	-	8 (7.84%)	-	10 (9.43%)	-	5 (7.81%)
My support for the implementation of it in society (answers only belong to people who are at least familiar with the service)	**1 (Very low)**	3 (3.95%)	36 (32.43%)	6 (8.00%)	24 (21.62%)	15 (19.48%)	17 (20.73%)
	2	9 (11.84%)	14 (12.61%)	1 (13.33%)	22 (19.82%)	5 (6.49%)	13 (15.85%)
	3	9 (11.84%)	6 (5.41%)	6 (8.00%)	14 (12.61%)	9 (11.69%)	12 (14.63%)
	4	17 (22.37%)	20 (18.02%)	12 (16.00%)	12 (10.81%)	17 (22..08%)	13 (15.85%)
	5	20 (26.32%)	20 (18.02%)	16 (21.33%)	19 (17.12%)	11 (14.29%)	15 (18.29%)
	6	9 (11.84%)	11 (9.91%)	12 (16.00%)	11 (9.91%)	14 (18.18%)	11 (13.41%)
	7 (Very high)	9 (11.84%)	4 (3.60%)	13 (17.33%)	9 (8.11%)	6 (7.79%)	1 (1.22%)
Overall, my view of it (answers only belong to people who are at least familiar with the service)	**1 (Very negative)**	1 (1.32%)	12 (10.81%)	3 (4.00%)	2 (1.80%)	12 (15.58%)	8 (9.76%)
	2	4 (5.26%)	4 (3.60%)	5 (6.67%)	5 (4.50%)	2 (2.60%)	9 (10.98%)
	3	4 (5.26%)	7 (6.31%)	1 (1.33%)	17 (15.32%)	10 (12.99%)	15 (18.29%)
	4	14 (18.42%)	32 (28.83%)	12 (16.00%)	20 (18.02%)	13 (16.88%)	17 (20.73%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Car-sharing Non-users (n=126)	Bike-sharing Users (n=75)	Bike-sharing Non-users (n=127)	Scooter-sharing Users (n=77)	Scooter-sharing Non-users (n=126)
	5	16 (21.05%)	28 (25.23%)	18 (24.00%)	30 (27.03%)	20 (25.97%)	17 (20.73%)
	6	19 (25%)	17 (15.32%)	19 (25.33%)	14 (12.61%)	10 (12.99%)	10 (12.20%)
	7 (Very positive)	18 (23.68%)	11 (9.91%)	17 (22.67%)	23 (20.72%)	10 (12.99%)	6 (7.32%)
Using it is relatively enjoyable (answers only belong to people who have experience with the service)	1 (Strongly disagree)	1 (1.64%)	-	2 (3.33%)	-	3 (4.84%)	-
	2	3 (4.92%)	-	4 (6.67%)	1 (20.00%)	1 (1.61%)	-
	3	5 (8.20%)	1 (14.29%)	5 (8.33%)	-	5 (8.06%)	-
	4	17 (27.87%)	2 (28.57%)	13 (21.67%)	-	12 (19.35%)	-
	5	10 (16.39%)	2 (28.57%)	15 (25.00%)	2 (40.00%)	20 (32.26%)	4 (23.53%)
	6	13 (21.31%)	2 (28.57%)	14 (23.33%)	2 (40.00%)	14 (22.58%)	7 (41.18%)
	7 (Strongly agree)	12 (19.67%)	0 (0.00)	7 (11.67%)	-	7 (11.29%)	6 (35.29%)
Using it is relatively environmentally friendly (answers only belong to people who have experience with the service)	1 (Strongly disagree)	-	0.0-	-	0 (0..00%)	2 (3.23%)	-
	2	1 (1.64%)	0.0-	4 (6.67%)	-	-	-
	3	4 (6.56%)	0.0-	4 (6.67%)	1 (20.00%)	7 (11.29%)	-
	4	14 (22.95%)	2 (28.57%)	11 (18.33%)	-	6 (9.68%)	-
	5	14 (22.95%)	3 (42.86%)	11 (18.33%)	-	18 (29.03%)	5 (29.41%)
	6	20 (32.79%)	-	13 (21.67%)	1 (20.00%)	21 (33.87%)	7 (41.18%)
	7 (Strongly agree)	8 (13.11%)	2 (28.57%)	17 (28.33%)	3 (60.00%)	8 (12.90%)	5 (29.41%)
The impact of health concerns due to the Covid-19 pandemic has reduced my use (answers only belong to people who have experience with the service)	1 (Strongly disagree)	16 (26.23%)	3 (42.86%)	15 (25.00%)	1 (20.00%)	9 (14.52%)	-
	2	4 (6.56%)	1 (14.29%)	6 (10.00%)	2 (40.00%)	12 (19.35%)	1 (5.88%)
	3	4 (6.56%)	-	3 (5.00%)	1 (20.00%)	4 (6.45%)	5 (29.41%)
	4	13 (21.31%)	1 (14.29%)	15 (25.00%)	-	11 (17.74%)	7 (41.18%)
	5	9 (14.75%)	-	12 (20.00%)	-	11 (17.74%)	4 (23.53%)
	6	4 (6.56%)	1 (14.29%)	7 (11.67%)	-	10 (16.13%)	-
	7 (Strongly agree)	11 (18.03%)	1 (14.29%)	2 (3.33%)	1 (20.00%)	5 (8.06%)	-
I know car-sharing/bike-sharing/scooter-sharing provides good service (according to the respondents' previous experience) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	3 (4.92%)	-	7 (11.67%)	1 (20.00%)	6 (9.68%)	-
	2	1 (1.64%)	-	2 (3.33%)	2 (40.00%)	4 (6.45%)	-
	3	6 (9.84%)	2 (28.57%)	12 (20.00%)	-	6 (9.68%)	1 (5.58%)
	4	9 (14.75%)	1 (14.29%)	10 (16.67%)	-	10 (16.13%)	6 (35.29%)
	5	13 (21.31%)	3 (42.86%)	17 (28.33%)	1 (20.00%)	13 (20.97%)	6 (35.29%)
	6	15 (24.59%)	-	8 (13.33%)	1 (20.00%)	17 (27.42%)	3 (17.65%)
	7 (Strongly agree)	14 (22.95%)	1 (14.29%)	4 (6.67%)	-	6 (9.68%)	1 (5.88%)
I know it is predictable (according to the respondents' previous experience) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	1 (1.64%)	-	6 (10.00%)	1 (20.00%)	2 (3.23%)	-
	2	3 (4.92%)	1 (14.29%)	3 (5.00%)	-	6 (9.68%)	3 (17.65%)
	3	8 (13.11%)	-	9 (15.00%)	2 (40.00%)	7 (11.29%)	6 (35.29%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Non-users (n=126)	Bike-sharing Users (n=75)	Non-users (n=127)	Scooter-sharing Users (n=77)	Non-users (n=126)
	4	10 (16.39%)	3 (42.86%)	14 (23.33%)	1 (20.00%)	18 (29.03%)	6 (35.29%)
	5	17 (27.87%)	2 (28.57%)	17 (28.33%)	-	17 (27.42%)	2 (11.76%)
	6	10 (16.39%)	-	8 (13.33%)	1 (20.00%)	9 (14.52%)	-
	7 (Strongly agree)	12 (19.67%)	1 (14.29%)	3 (5.00%)	-	3 (4.84%)	-
I know it is trustworthy (according to the respondents' previous experience) (answers only belong to people who have experience with the service)	1 (Strongly disagree)	2 (3.28%)	-	6 (10.00%)	1 (20.00%)	5 (8.06%)	2 (11.76%)
	2	1 (1.64%)	1 (14.29%)	4 (6.67%)	1 (20.00%)	3 (4.84%)	3 (17.65%)
	3	5 (8.20%)	-	8 (13.33%)	-	12 (19.35%)	3 (17.65%)
	4	10 (16.39%)	2 (28.57%)	16 (26.67%)	2 (40.00%)	15 (24.19%)	4 (23.53%)
	5	14 (22.95%)	2 (28.57%)	11 (18.33%)	-	16 (25.81%)	3 (17.65%)
	6	16 (26.23%)	1 (14.29%)	11 (18.33%)	1 (20.00%)	8 (12.90%)	2 (11.76%)
	7 (Strongly agree)	13 (21.31%)	1 (14.29%)	4 (6.67%)	-	3 (4.84%)	-
It would be possible for me to use it for my regular trips (According to perceptions of respondents) (answers only belong to people who do not have experience with the service but are familiar)	1 (Strongly disagree)	-	19 (21.11%)	-	17 (18.28%)	-	7 (12.96%)
	2	-	17 (18.89%)	-	14 (15.05%)	-	9 (16.67%)
	3	-	13 (14.44%)	-	18 (19.35%)	-	10 (18.52%)
	4	-	17 (18.89%)	-	19 (20.43%)	-	13 (24.07%)
	5	-	14 (15.56%)	-	17 (18.28%)	-	10 (18.52%)
	6	-	6 (6.67%)	-	3 (3.23%)	-	3 (5.56%)
	7 (Strongly agree)	-	4 (4.44%)	-	5 (5.38%)	-	2 (3.70%)
I am sure that I can choose it for my regular trips during the next week (According to perceptions of respondents) (answers only belong to people who do not have experience with the service but are familiar)	1 (Strongly disagree)	-	37 (41.11%)	-	43 (46.24%)	-	19 (35.19%)
	2	-	12 (13.33%)	-	16 (17.20%)	-	7 (12.96%)
	3	-	7 (7.78%)	-	10 (10.75%)	-	3 (5.56%)
	4	-	15 (16.67%)	-	9 (9.68%)	-	9 (16.67%)
	5	-	12 (13.33%)	-	11 (11.83%)	-	11 (20.37%)
	6	-	6 (6.67%)	-	3 (3.23%)	-	3 (5.56%)
	7 (Strongly agree)	-	1 (1.11%)	-	1 (1.08%)	-	2 (3.70%)
Using it would be a useful mode of transport (According to perceptions of respondents) (answers only belong to people who do not have experience with the service but are familiar)	1 (Strongly disagree)	-	12 (13.33%)	-	7 (7.53%)	-	3 (5.56%)
	2	-	9 (10.00%)	-	13 (13.98%)	-	7 (12.96%)
	3	-	10 (11.11%)	-	8 (8.60%)	-	4 (7.41%)
	4	-	22 (24.44%)	-	20 (21.51%)	-	16 (29.63%)
	5	-	15 (16.67%)	-	20 (21.51%)	-	13 (24.07%)
	6	-	12 (13.33%)	-	13 (13.98%)	-	4 (7.41%)
	7 (Strongly agree)	-	10 (11.11%)	-	12 (12.90%)	-	7 (12.96%)
Using it would help me to accomplish activities that are important to me (According to perceptions of respondents)	1 (Strongly disagree)	-	26 (28.89%)	-	18 (19.35%)	-	10 (18.52%)
	2	-	10 (11.11%)	-	20 (21.51%)	-	12 (22.222%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Non-users (n=126)	Bike-sharing Users (n=75)	Non-users (n=127)	Scooter-sharing Users (n=77)	Non-users (n=126)
(answers only belong to people who do not have experience with the service but are familiar)	3	-	12 (13.33%)	-	11 (11.83%)	-	3 (5.56%)
	4	-	20 (22.22%)	-	17 (18.28%)	-	17 (31.48%)
	5	-	12 (13.33%)	-	19 (20.43%)	-	7 (12.96%)
	6	-	6 (6.67%)	-	4 (4.30%)	-	5 (9.26%)
	7 (Strongly agree)	-	4 (4.44%)	-	4 (4.30%)	-	-
Learning how to use it would be easy for me (According to perceptions of respondents) (answers only belong to people who do not have experience with the service but are familiar)	1 (Strongly disagree)	-	9 (10.00%)	-	8 (8.60%)	-	3 (5.56%)
	2	-	7 (7.78%)	-	9 (9.68%)	-	7 (12.96%)
	3	-	4 (4.44%)	-	9 (9.68%)	-	4 (7.41%)
	4	-	17 (18.89%)	-	14 (15.05%)	-	12 (22.22%)
	5	-	24 (26.67%)	-	20 (21.51%)	-	11 (20.37%)
	6	-	20 (22.22%)	-	14 (15.05%)	-	10 (18.52%)
	7 (Strongly agree)	-	9 (10.00%)	-	19 (20.43%)	-	7 (12.96%)
I would find it easy to use (According to perceptions of respondents) (answers only belong to people who do not have experience with the service but are familiar)	1 (Strongly disagree)	-	9 (10.00%)	-	9 (9.68%)	-	3 (5.56%)
	2	-	3 (3.33%)	-	7 (7.53%)	-	5 (9.26%)
	3	-	5 (5.56%)	-	9 (9.68%)	-	9 (16.67%)
	4	-	26 (28.89%)	-	19 (20.43%)	-	13 (24.07%)
	5	-	22 (24.44%)	-	15 (16.13%)	-	13 (24.07%)
	6	-	18 (20.00%)	-	17 (18.28%)	-	9 (16.67%)
	7 (Strongly agree)	-	7 (7.78%)	-	17 (18.28%)	-	2 (3.70%)
It would be difficult to book it on the website/app (According to perceptions of respondents) (answers only belong to people who do not have experience with the service but are familiar)	1 (Strongly disagree)	-	30 (33.33%)	-	25 (26.88%)	-	16 (29.63%)
	2	-	13 (14.44%)	-	17 (18.28%)	-	7 (12.96%)
	3	-	9 (10.00%)	-	10 (10.75%)	-	6 (11.11%)
	4	-	15 (16.67%)	-	15 (16.13%)	-	9 (16.67%)
	5	-	15 (16.67%)	-	11 (11.83%)	-	11 (20.37%)
	6	-	6 (6.67%)	-	11 (11.83%)	-	2 (3.70%)
	7 (Strongly agree)	-	2 (2.22%)	-	4 (4.30%)	-	3 (5.56%)
Using it would be enjoyable (answers only belong to people who are at least familiar with the service)	1 (Strongly disagree)	-	8 (8.89%)	-	5 (5.38%)	-	3 (5.56%)
	2	-	7 (7.78%)	-	8 (8.60%)	-	8 (14.81%)
	3	-	9 (10.00%)	-	13 (13.98%)	-	6 (11.11%)
	4	-	29 (32.22%)	-	22 (23.66%)	-	15 (27.78%)
	5	-	18 (20.00%)	-	21 (22.58%)	-	16 (29.63%)
	6	-	13 (14.44%)	-	15 (6.13%)	-	5 (9.26%)
	7 (Strongly agree)	-	6 (6.67%)	-	9 (9.68%)	-	1 (1.85%)
I think that it is environmentally friendly	1 (Strongly disagree)	-	8 (8.89%)	-	1 (1.08%)	-	1 (1.85%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing		Bike-sharing		Scooter-sharing	
		Users (n=76)	**Non-users (n=126)**	**Users (n=75)**	**Non-users (n=127)**	**Users (n=77)**	**Non-users (n=126)**
(answers only belong to people who are at least familiar with the service)	**2**	-	4 (4.44%)	-	1 (1.08%)	-	-
	3	-	6 (6.67%)	-	3 (3.23%)	-	4 (7.41%)
	4	-	26 (28.89%)	-	9 (9.68%)	-	9 (16.67%)
	5	-	16 (17.78%)	-	21 (22.58%)	-	15 (27.78%)
	6	-	20 (22.22%)	-	23 (24.73%)	-	19 (35.19%)
	7 (Strongly agree)	-	10 (11.11%)	-	35 (37.63%)	-	6 (11.11%)
I think it provides good service (According to the respondent's knowledge) (answers only belong to people who are at least familiar with the service)	**1 (Strongly disagree)**	-	4 (4.44%)	-	2 (2.15%)	-	-
	2	-	3 (3.33%)	-	6 (6.45%)	-	2 (3.70%)
	3	-	9 (10.00%)	-	12 (12.90%)	-	6 (11.11%)
	4	-	28 (31.11%)	-	19 (20.43%)	-	15 (27.78%)
	5	-	27 (30.00%)	-	25 (26.88%)	-	19 (35.19%)
	6	-	12 (13.33%)	-	19 (20.43%)	-	12 (22.22%)
	7 (Strongly agree)	-	7 (7.78%)	-	10 (10.75%)	-	-
I think it is predictable (According to the respondent's knowledge) (answers only belong to people who are at least familiar with the service)	**1 (Strongly disagree)**	-	5 (5.56%)	-	3 (3.23%)	-	3 (5.56%)
	2	-	4 (4.44%)	-	4 (4.30%)	-	2 (3.70%)
	3	-	11 (12.22%)	-	9 (9.68%)	-	8 (14.81%)
	4	-	37 (41.11%)	-	27 (29.03%)	-	19 (35.19%)
	5	-	20 (22.22%)	-	31 (33.33%)	-	14 (25.93%)
	6	-	10 (11.11%)	-	10 (10.75%)	-	8 (14.81%)
	7 (Strongly agree)	-	3 (3.33%)	-	9 (9.68%)	-	-
I think it is trustworthy (According to the respondent's knowledge) (answers only belong to people who are at least familiar with the service)	**1 (Strongly disagree)**	-	6 (6.67%)	-	2 (2.15%)	-	3 (5.56%)
	2	-	-	-	7 (7.53%)	-	4 (7.41%)
	3	-	11 (12.22%)	-	7 (7.53%)	-	10 (18.52%)
	4	-	24 (26.67%)	-	24 (25.81%)	-	18 (33.33%)
	5	-	32 (35.56%)	-	26 (27.96%)	-	11 (20.37%)
	6	-	10 (11.11%)	-	16 (17.20%)	-	8 (14.81%)
	7 (Strongly agree)	-	7 (7.78%)	-	11 (11.83%)	-	-
The urgent need to reduce ecological destruction caused by using the car has been overestimated	**1 (Strongly disagree)**	21 (34.43%)	27 (24.32%)	16 (26.67%)	22 (19.64%)	14 (22.58%)	23 (20.72%)
	2	4 (6.56%)	9 (8.11%)	5 (8.33%)	10 (8.93%)	4 (6.45%)	9 (8.11%)
	3	4 (6.56%)	19 (17.12%)	4 (6.67%)	13 (11.61%)	4 (6.45%)	7 (6.31%)
	4	5 (8.20%)	17 (15.32%)	11 (18.33%)	20 (17.86%)	15 (24.19%)	25 (22.52%)
	5	12 (19.67%)	15 (13.51%)	7 (11.67%)	18 (16.07%)	9 (14.52%)	21 (18.92%)
	6	3 (4.92%)	10 (9.01%)	8 (13.33%)	33 (11.61%)	9 (14.52%)	15 (13.51%)
	7 (Strongly agree)	12 (19.67%)	14 (12.61%)	9 (15.00%)	16 (14.29%)	7 (11.29%)	11 (9.91%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Non-users (n=126)	Bike-sharing Users (n=75)	Non-users (n=127)	Scooter-sharing Users (n=77)	Non-users (n=126)
I believe that using a car causes many environmental problems	1 (Strongly disagree)	8 (13.11%)	5 (4.50%)	-	1 (0.89%)	4 (6.45%)	5 (4.50%)
	2	1 (1.64%)	10 (9.01%)	2 (3.33%)	5 (4.46%)	6 (9.68%)	3 (2.70%)
	3	2 (3.28%)	10 (9.01%)	2 (3.33%)	15 (13.39%)	3 (4.84%)	9 (8.11%)
	4	6 (9.84%)	25 (22.52%)	10 (16.67%)	16 (14.29%)	14 (22.58%)	23 (20.72%)
	5	13 (21.31%)	18 (16.22%)	9 (15.00%)	23 (20.54%)	11 (17.74%)	27 (24.32%)
	6	11 (18.03%)	21 (18.92%)	14 (23.33%)	24 (21.43%)	13 (20.97%)	17 (15.32%)
	7 (Strongly agree)	20 (32.79%)	22 (19.82%)	23 (38.33%)	28 (25.00%)	11 (17.74%)	27 (24.32%)
I feel morally obliged to reduce the environmental impact due to my travel patterns	1 (Strongly disagree)	7 (11.48%)	13 (11.71%)	3 (5.00%)	12 (10.71%)	2 (3.23%)	7 (6.31%)
	2	3 (4.92%)	9 (8,11%)	3 (5.00%)	13 (11.61%)	5 (8.06%)	9 (8.11%)
	3	5 (8.20%)	10 (9.01%)	6 (10.00%)	12 (10.71%)	5 (8.06%)	13 (11.71%)
	4	9 (14.75%)	20 (18.02%)	10 (16.67%)	30 (26.79%)	14 (22.58%)	17 (15.32%)
	5	7 (11.48%)	23 (20.72%)	15 (25.00%)	16 (14.29%)	12 (19.35%)	30 (27.03%)
	6	17 (27.87%)	18 (16.22%)	11 (18.33%)	16 (14.29%)	14 (22.58%)	21 (18.92%)
	7 (Strongly agree)	13 (21.31%)	18 (16.22%)	12 (20.00%)	13 (11.61%)	10 (16.13%)	14 (12.61%)
I would feel guilty if I did not reduce the environmental impact of my travel patterns	1 (Strongly disagree)	9 (14.75%)	14 (12.61%)	5 (8.33%)	14 (12.50%)	5 (8.06%)	6 (5.41%)
	2	2 (3.28%)	12 (10.81%)	3 (5.00%)	9 (8.04%)	2 (3.23%)	14 (12.61%)
	3	5 (8.20%)	12 (10.81%)	3 (5.00%)	15 (13.39%)	6 (9.68%)	10 (9.01%)
	4	8 (13.11%)	21 (18.92%)	14 (23.33%)	26 (23.21%)	15 (24.19%)	18 (16.22%)
	5	11 (18.03%)	21 (18.92%)	16 (26.67%)	26 (23.21%)	13 (20.97%)	27 (24.32%)
	6	14 (22.95%)	15 (13.51%)	9 (15.00%)	12 (10.71%)	12 (19.35%)	24 (21.62%)
	7 (Strongly agree)	12 (19.67%)	16 (14.41%)	10 (16.67%)	10 (8.93%)	9 (14.52%)	12 (10.81%)
I would feel good if I traveled more sustainably	1 (Strongly disagree)	5 (8.20%)	11 (9.91%)	1 (1.67%)	6 (5.36%)	1 (1.61%)	3 (2.70%)
	2	-	7 (6.31%)	2 (3.33%)	1 (0.89%)	3 (4.84%)	4 (3.60%)
	3	2 (3.28%)	7 (6.31%)	3 (5.00%)	8 (7.14%)	3 (4.84%)	8 (7.21%)
	4	12 (19.67%)	21 (18.92%)	10 (16.67%)	24 (21.43%)	14 (22.58%)	18 (16.22%)
	5	10 (16.39%)	21 (18.92%)	12 (20.00%)	27 (24.11%)	14 (22.58%)	25 (22.52%)
	6	12 (19.67%)	15 (13.51%)	15 (25.00%)	27 (24.11%)	11 (17.74%)	33 (29.73%)
	7 (Strongly agree)	20 (32.79%)	29 (26.13%)	17 (28.33%)	19 (16.96%)	16 (25.81%)	20 (18.02%)
Political issues (green environmental scale)	1 (Not green)	1 (1.64%)	5 (4.50%)	-	3 (2.68%)	-	2 (1.80%)
	2	1 (1.64%)	5 (4.50%)	2 (3.33%)	1 (0.89%)	1 (1.61%)	2 (1.80%)
	3	-	6 (5.41%)	1 (1.67%)	6 (5.36%)	4 (6.45%)	6 (5.41%)
	4	13 (21.31%)	28 (25.23%)	10 (16.67%)	39 (34.82%)	16 (25.81%)	29 (26.13%)
	5	21 (34.43%)	29 (26.13%)	21 (35.00%)	39 (34.82%)	23 (37.10%)	28 (25.23%)
	6	13 (21.31%)	24 (21.62%)	18 (30.00%)	13 (11.61%)	10 (16.13%)	32 (28.83%)

People's routines and experiences of using shared mobility service		Shared mobility services Car-sharing Users (n=76)	Non-users (n=126)	Bike-sharing Users (n=75)	Non-users (n=127)	Scooter-sharing Users (n=77)	Non-users (n=126)
	7 (Very green)	12 (19.67%)	14 (12.61%)	8 (13.33%)	11 (9.82%)	8 (12.90%)	12 (10.81%)
Political issues ("left" or "right")	Far to the left	9 (14.75%)	3 (2.70%)	9 (15.00%)	4 (3.57%)	4 (6.45%)	7 (6.31%)
	Left	8 (13.11%)	15 (13.51%)	12 (20.00%)	16 (14.29%)	6 (9.68%)	18 (16.22%)
	Quite left	10 (16.39%)	26 (23.42%)	10 (16.67%)	23 (20.54%)	17 (27.42%)	25 (22.52%)
	Neither to the left nor the right	23 (37.70%)	44 (39.64%)	20 (33.33%)	37 (33.04%)	27 (43.55%)	42 (37.84%)
	Quite right	4 (6.56%)	10 (9.01%)	3 (5.00%)	14 (12.50%)	4 (6.45%)	11 (9.91%)
	Right	4 (6.56%)	9 (8.11%)	2 (3.33%)	12 (10.71%)	2 (3.23%)	4 (3.60%)
	Far to the right	3 (4.92%)	4 (3.60%)	4 (6.67%)	6 (5.36%)	2 (3.23%)	4 (3.60%)

Furthermore, some differences in the routines and daily travel patterns of male and female users (survey respondents) of each shared transportation service can be seen as listed in Table A12.

Table A12: Differences in the routines and daily travel patterns of male and female users of each shared transportation service.

User's routines and experiences of using shared mobility service		Users of shared Mobility Services Car-sharing (n=76) Males (n=37)	Females (n=39)	Bike-sharing (n=75) Males (n=49)	Females (n=26)	Scooter-sharing (n=77) Males (n=44)	Females (n=33)
The incentive to use car-sharing (or more use)	Availability near my home/work	18[22]	19*	-	-	-	-
	Reduction in costs	22*	16*	-	-	-	-
	More sustainable travel	12*	11*	-	-	-	-
	Increased comfort during travel	2*	10*	-	-	-	-
	The convenience of having it only when needed	11*	11*	-	-	-	-
	Avoiding responsibilities related to maintenance and repairs	8*	8*	-	-	-	-
The incentive to use bike-sharing/scooter-sharing (or more use)	Availability near my home/work	-	-	24*	16*	20*	16*
	Reduction in costs	-	-	17*	8*	13*	12*
	More sustainable travel	-	-	17*	9*	15*	6*
	Increased comfort during travel	-	-	14*	2*	9*	4*
	The convenience of having it only when needed	-	-	16[23]	10*	16*	12*
	Avoiding responsibilities related to maintenance and repairs	-	-	8*	6*	9*	9*
	Smooth track without slope	-	-	0 (0.00%)	1*	5*	4*
Departure time (day) that may cause the use of the service	Travel on a weekday morning	6*	17*	27*	16*	25*	19*
	Travel on a weekend morning	15*	10*	20*	11*	22*	17*

[22] Respondents could select more than one option, up to three options.
[23] Respondents could select more than one option, up to three options.

	Travel on a weekday evening	18*	12*	11*	6*	10*	5*
	Travel on a weekend evening	12*	18*	8*	4*	6*	6*
The trip purpose that may cause the use of the service	**Travel for leisure (e.g., vising friends or shopping)**	9 (24.32%)	10 (25.64%)	18 (36.73%)	6 (23.08%)	15 (34.09%)	16 (48.48%)
	Travel for non-leisure (going to work/school)	15 (40.54%)	12 (30.77%)	14 (28.57%)	9 (34.62%)	11 (25.00%)	9 (27.27%)
	Both	13 (35.14%)	17 (43.59%)	17 (34.69%)	11 (42.31%)	44 (40.91%)	8 (24.24%)

A4.3 Socio-demographic characteristics of selected users and non-users of each of the shared mobility services

The socio-demographic characteristics of survey respondents who are users and non-users of car-sharing, bike-sharing and scooter-sharing services, and their responses to the BWM questions are selected, listed in Tables A13 to A18 (question set C in surveys 1 to 3). As mentioned in section 5.4.3 (Chapter 5), after removing pairwise comparisons with unacceptable consistency ratios, different sample sizes can be obtained and utilized for different levels of the model.

Table A13: Socio-demographic characteristics of different sets of survey respondents (selected car-sharing users) (question set C in survey 1), shown in the second row of Table 38.

Socio-demographic factors		**Main criteria set (n=15)**		**Trip-related characteristics (n= 39)**		**Car-sharing characteristics (n=36)**		**Availability and accessibility (n=39)**	
		n	(%)	n	(%)	n	(%)	n	(%)
Gender	**Male**	8	53.33	18	46.15	20	55.56	18	46.15
	Female	7	46.67	21	53.85	16	44.44	21	53.85
Age	**18-24**	0	0.00	1	2.56	2	5.56	1	2.56
	25-34	4	26.67	8	20.51	11	30.56	8	20.51
	35-44	6	40.00	15	38.46	11	30.56	15	38.46
	45-54	1	6.67	11	28.21	10	27.78	11	28.21
	55-64	4	26.67	3	7.69	2	5.56	3	7.69
	> 64	0	0.00	1	2.56	0	0.00	1	2.56
Education level	**Not completed primary school**	0	0.00	0	0.00	0	0.00	0	0.00
	Elementary school	0	0.00	0	0.00	0	0.00	0	0.00
	Upper secondary school or equivalent shorter than three years	0	0.00	0	0.00	0	0.00	0	0.00
	Upper secondary school or equivalent three years or more	4	26.67	14	35.90	13	36.11	14	35.90
	Post-secondary education, not college, less than three years	0	0.00	2	5.13	3	8.33	2	5.13
	Post-secondary education, not college, three years or more	1	6.67	1	2.56	2	5.56	1	2.56
	University less than three years	0	0.00	1	2.56	3	8.33	1	2.56
	University 3 years or more	7	46.67	17	43.59	12	33.33	17	43.59
	Degree from postgraduate studies	3	20.00	4	10.26	3	8.33	4	10.26
Marital status	**Single**	8	53.33	14	35.90	16	44.44	14	35.90
	Married or domestic partnership	7	46.67	25	64.10	20	55.56	25	64.10
	Entrepreneur/freelancer	0	0	1	2.56	3	8.33	1	2.56

Business or professional status	**Officer/manager**	2	13.33	3	7.69	3	8.33	3	7.69
	Clerk/trade employee	7	46.67	21	53.85	19	52.78	21	53.85
	Worker	0	0.00	1	2.56	2	5.56	1	2.56
	Teacher	1	6.67	2	5.13	0	0.00	2	5.13
	Representative	1	6.67	0	0.00	0	0.00	0	0.00
	Craftsman / trader / operator	0	0.00	1	2.56	2	5.56	1	2.56
	Student	0	0.00	2	5.13	2	5.56	2	5.13
	Housewife	0	0.00	3	7.69	1	2.78	3	7.69
	Retired	0	0.00	1	2.56	0	0.00	1	2.56
	Waiting for first job / never worked	1	6.67	0	0.00	1	2.78	0	0.00
	Unemployed / lost his/her job	0	0.00	1	2.56	1	2.78	1	2.56
	Other	3	20.00	3	7.69	2	5.56	3	7.69
Number of people, including respondents, living in the home	**One person**	4	26.67	4	10.26	3	8.33	4	10.26
	Two people	5	33.33	14	35.90	10	27.78	14	35.90
	Three people	4	26.67	11	28.21	13	36.11	11	28.21
	Four people	1	6.67	7	17.95	6	16.67	7	17.95
	Five or more people	1	6.67	3	7.69	4	11.11	3	7.69
Number of drivers, including respondents, living in the home	**0**	0	0	0	0.00	0	0.00	0	0.00
	1	8	53.33	11	28.21	9	25.00	11	28.21
	2	5	33.33	19	48.72	16	44.44	19	48.72
	More than 2	2	13.33	9	23.08	11	30.56	9	23.08
Presence of children at home	**Yes**	7	46.67	19	48.72	18	50.00	19	48.72
	No	8	53.33	20	51.28	18	50.00	20	51.28
The age of the respondent's child/children	**0-3 years old**	3[24]	-	7*	-	5*	-	7*	-
	4-6 years old	2*	-	3*	-	3*	-	3*	-
	7-15 years old	0	0.00	6*	-	5*	-	6*	-
	16 years or more	2*	-	7*	-	7*	-	7*	-
Number of cars available for use in the respondent's home	**No car**	3	20.00	2	5.13	3	8.33	2	5.13
	One car	4	26.67	15	38.46	12	33.33	15	38.46
	Two cars	7	46.67	19	48.72	18	50.00	19	48.72
	Three cars or more	1	6.67	3	7.69	3	8.33	3	7.69
Monthly income of the respondent after tax	**Up to 500 Euros**	0	0.00	2	5.13	2	5.56	2	5.13
	501 Euros - 1000 Euros	1	6.67	1	2.56	3	8.33	1	2.56
	1001 Euros - 1500 Euros	6	40.00	17	43.59	15	41.67	17	43.59
	1501 Euros - 2000 Euros	4	26.67	8	20.51	6	16.67	8	20.51
	2001 Euros - 2500 Euros	0	0.00	5	12.82	3	8.33	5	12.82
	2501 Euros - 3000 Euros	2	13.33	1	2.56	3	8.33	1	2.56
	3001 Euros - 4000 Euros	0	0.00	2	5.13	1	2.78	2	5.13
	4001 Euros - 5000 Euros	1	6.67	1	2.56	1	2.78	1	2.56
	5001 Euros - 6000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	6001 Euros - 10000 Euros	0	0.00	1	2.56	1	2.78	1	2.56
	More than 10,001 Euros	1	6.67	1	2.56	1	2.78	1	2.56
Respondent's household monthly income after tax	**Up to 500 Euros**	0	0.00	0	0.00	0	0	0	0.00
	501 Euros - 1000 Euros	1	6.67	0	0.00	1	2.78	0	0.00
	1001 Euros - 1500 Euros	2	13.33	5	12.82	3	8.33	5	12.82
	1501 Euros - 2000 Euros	4	26.67	8	20.51	8	22.22	8	20.51
	2001 Euros - 2500 Euros	1	6.67	9	23.08	7	19.44	9	23.08
	2501 Euros - 3000 Euros	2	13.33	6	15.38	6	16.67	6	15.38
	3001 Euros - 4000 Euros	2	13.33	5	12.82	4	11.11	5	12.82
	4001 Euros - 5000 Euros	1	6.67	2	5.13	3	8.33	2	5.13
	5001 Euros - 6000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	6001 Euros - 10000 Euros	0	0.00	3	7.69	3	8.33	3	7.69
	More than 10,001 Euros	2	13.33	1	2.56	1	2.78	1	2.56
How respondents manage their expenses with their current income	**Very good**	0	0.00	7	17.95	8	22.22	7	17.95
	Fairly good	10	66.67	15	38.46	13	36.11	15	38.46
	Neither good nor bad	5	33.33	12	30.77	12	33.33	12	30.77
	Pretty bad	0	0.00	5	12.82	3	8.33	5	12.82
	Very bad	0	0.00	0	0.00	0	0.00	0	0.00

[24] Respondents could select more than one option, up to three options.

Table A14: Socio-demographic characteristics of different sets of survey respondents (car-sharing non-users), shown in the third row of Table 38 (question set C in survey 1).

Socio-demographic factors		Main criteria set (n=24)		Trip-related characteristics (n= 59)		Car-sharing characteristics (n=56)		Availability and accessibility (n=59)	
		n	(%)	n	(%)	n	(%)	n	(%)
Gender	Male	14	58.33	32	54.24	29	51.79	32	54.24
	Female	10	41.67	27	45.76	27	48.21	27	45.76
Age	18-24	4	16.67	6	10.17	6	10.71	6	10.17
	25-34	4	16.67	9	15.25	9	16.07	9	15.25
	35-44	1	4.17	6	10.17	6	10.71	6	10.17
	45-54	6	25	11	18.64	15	26.79	11	18.64
	55-64	4	16.67	14	23.73	12	21.43	14	23.73
	> 64	5	20.83	13	22.03	8	14.29	13	22.03
Education level	Not completed primary school	0	0.00	0	0.00	0	0.00	0	0.00
	Elementary school	0	0.00	0	0.00	0	0.00	0	0.00
	Upper secondary school or equivalent shorter than three years	0	0.00	6	10.17	5	8.93	6	10.17
	Upper secondary school or equivalent three years or more	8	33.33	20	33.90	17	30.36	20	33.90
	Post-secondary education, not college, less than three years	0	0.00	0	0.00	0	0.00	0	0.00
	Post-secondary education, not college, three years or more	1	4.17	4	6.78	4	7.14	4	6.78
	University less than three years	1	4.17	1	1.69	2	3.57	1	1.69
	University 3 years or more	13	54.17	25	42.37	25	44.64	25	42.37
	Degree from postgraduate studies	1	4.17	3	5.08	3	5.36	3	5.08
Marital status	Single	12	50	26	44.07	21	37.50	26	44.07
	Married or domestic partnership	12	50	33	55.93	35	62.50	33	55.93
Business or professional status	Entrepreneur/freelancer	0	0.00	1	1.69	2	3.57	1	1.69
	Officer/manager	2	8.33	4	6.78	4	7.14	4	6.78
	Clerk/trade employee	7	29.17	18	30.51	22	39.29	18	30.51
	Worker	1	4.17	1	1.69	2	3.57	1	1.69
	Teacher	2	8.33	2	3.39	2	3.57	2	3.39
	Representative	0	0.00	2	3.39	0	0.00	2	3.39
	Craftsman / trader / operator	0	0.00	1	1.69	0	0.00	1	1.69
	Student	4	16.67	8	13.56	6	10.71	8	13.56
	Housewife	1	4.17	3	5.08	2	3.57	3	5.08
	Retired	6	25.00	14	23.73	10	17.86	14	23.73
	Waiting for first job / never worked	0	0.00	2	3.39	2	3.57	2	3.39
	Unemployed / lost his/her job	1	4.17	2	3.39	1	1.79	2	3.39
	Other	0	0.00	1	1.69	3	5.36	1	1.69
Number of people, including respondents, living in the home	One person	4	16.67	13	22.03	8	14.29	13	22.03
	Two people	9	37.50	21	35.59	16	28.57	21	35.59
	Three people	7	29.17	9	15.25	15	26.79	9	15.25
	Four people	4	16.67	14	23.73	15	26.79	14	23.73
	Five or more people	0	0.00	2	3.39	2	3.57	2	3.39
Number of drivers, including respondents, living in the home	0	0	0.00	0	0.00	0	0.00	0	0.00
	1	7	29.17	23	38.98	15	26.79	23	38.98
	2	13	54.17	24	40.68	27	48.21	24	40.68
	More than 2	4	16.67	12	20.34	14	25.00	12	20.34
Presence of children at home	Yes	5	20.83	19	32.20	25	44.64	19	32.20
	No	19	79.17	40	67.80	31	55.36	40	67.80
	0-3 years old	0	0.00	6[25]	-	4*	-	6*	-
	4-6 years old	0	0.00	6*	-	3*	-	6*	-

[25] Respondents could select more than one option, up to three options.

Socio-demographic factors		Main criteria set (n=24)		Trip-related characteristics (n= 59)		Car-sharing characteristics (n=56)		Availability and accessibility (n=59)	
		n	(%)	n	(%)	n	(%)	n	(%)
The age of the respondent's child/children	**7-15 years old**	4*	-	7*	-	12*	-	7*	-
	16 years or more	2*	-	11*	-	6*	-	11*	-
Number of cars available for use in respondent's home	**No car**	1	4.17	4	6.78	3	5.36	4	6.78
	One car	10	41.67	30	50.85	24	42.86	30	50.85
	Two cars	11	45.83	21	35.59	24	42.86	21	35.59
	Three cars or more	2	8.33	4	6.78	5	8.93	4	6.78
Monthly income of the respondent after tax	**Up to 500 Euros**	4	16.67	9	15.25	8	14.29	9	15.25
	501 Euros - 1000 Euros	3	12.50	5	8.47	4	7.14	5	8.47
	1001 Euros - 1500 Euros	4	16.67	9	15.25	12	21.43	9	15.25
	1501 Euros - 2000 Euros	3	12.50	15	25.42	8	14.29	15	25.42
	2001 Euros - 2500 Euros	7	29.17	10	16.95	11	19.64	10	16.95
	2501 Euros - 3000 Euros	0	0.00	5	8.47	8	14.29	5	8.47
	3001 Euros - 4000 Euros	2	8.33	2	3.39	2	3.57	2	3.39
	4001 Euros - 5000 Euros	1	4.17	2	3.39	2	3.57	2	3.39
	5001 Euros - 6000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	6001 Euros - 10000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	More than 10,001 Euros	0	0.00	2	3.39	1	1.79	2	3.39
Respondent's household monthly income after tax	**Up to 500 Euros**	0	0.00	1	1.69	1	1.79	1	1.69
	501 Euros - 1000 Euros	1	4.17	4	6.78	4	7.14	4	6.78
	1001 Euros - 1500 Euros	2	8.33	8	13.56	4	7.14	8	13.56
	1501 Euros - 2000 Euros	2	8.33	13	22.03	10	17.86	13	22.03
	2001 Euros - 2500 Euros	8	33.33	8	13.56	12	21.43	8	13.56
	2501 Euros - 3000 Euros	2	8.33	5	8.47	9	16.07	5	8.47
	3001 Euros - 4000 Euros	5	20.83	12	20.34	9	16.07	12	20.34
	4001 Euros - 5000 Euros	2	8.33	3	5.08	3	5.36	3	5.08
	5001 Euros - 6000 Euros	2	8.33	3	5.08	3	5.36	3	5.08
	6001 Euros - 10000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	More than 10,001 Euros	0	0.00	2	3.39	1	1.79	2	3.39
How respondents manage their expenses with their current income	**Very good**	2	8.33	3	5.08	3	5.36	3	5.08
	Fairly good	9	37.50	27	45.76	20	35.71	27	45.76
	Neither good nor bad	11	45.83	21	35.59	24	42.86	21	35.59
	Pretty bad	1	4.17	5	8.47	6	10.71	5	8.47
	Very bad	1	4.17	3	5.08	3	5.36	3	5.08

Table A15: Socio-demographic characteristics of different sets of survey respondents (bike-sharing users), shown in the second row of Table 39 (question set C in survey 2).

Socio-demographic factors		Main criteria set (n=15)		Trip-related characteristics (n= 38)		Bike-sharing characteristics (n=37)		Availability and accessibility (n=38)	
		n	(%)	n	(%)	n	(%)	n	(%)
Gender	**Male**	7	46.67	26	68.42	23	62.16	26	68.42
	Female	8	53.33	12	31.58	14	37.84	12	31.58
Age	**< 18**	0	0.00	0	0.00	0	0.00	0	0.00
	18-24	0	0.00	0	0.00	0	0.00	0	0.00
	25-34	0	0.00	11	28.95	10	27.03	11	28.95
	35-44	2	13.33	8	21.05	12	32.43	8	21.05
	45-54	6	40.00	8	21.05	9	24.32	8	21.05
	55-64	3	20.00	7	18.42	4	10.81	7	18.42
	> 64	4	26.67	4	10.53	2	5.41	4	10.53
Education level	**Not completed primary school**	0	0.00	0	0.00	0	0.00	0	0.00
	Elementary school	0	0.00	0	0.00	0	0.00	0	0.00
	Upper secondary school or equivalent shorter than three years	0	0.00	1	2.63	0	0.00	1	2.63
	Upper secondary school or equivalent three years or more	3	20.00	9	23.68	10	27.03	9	23.68
	Post-secondary education, not college, less than three years	1	6.67	0	0.00	1	2.70	0	0.00

Socio-demographic factors		Main criteria set (n=15)		Trip-related characteristics (n= 38)		Bike-sharing characteristics (n=37)		Availability and accessibility (n=38)	
		n	(%)	n	(%)	n	(%)	n	(%)
	Post-secondary education, not college, three years or more	3	20.00	2	5.26	3	8.11	2	5.26
	University less than three years	0	0.00	0	0.00	0	0.00	0	0.00
	University 3 years or more	4	26.67	15	39.47	14	37.84	15	39.47
	Degree from postgraduate studies	4	26.67	11	28.95	9	24.32	11	28.95
Marital status	Single	3	20	12	31.58	10	27.03	12	31.58
	Married or domestic partnership	12	80	26	68.42	27	72.97	26	68.42
Business or professional status	Entrepreneur/freelancer	3	20.00	7	18.42	7	18.92	7	18.42
	Officer/manager	0	0.00	4	10.53	5	13.51	4	10.53
	Clerk/trade employee	5	33.33	11	28.95	9	24.32	11	28.95
	Worker	0	0.00	3	7.89	1	2.70	3	7.89
	Teacher	1	6.67	2	5.26	1	2.70	2	5.26
	Representative	1	6.67	2	5.26	2	5.41	2	5.26
	Craftsman / trader / operator	0	0.00	0	0.00	1	2.70	0	0.00
	Student	0	0.00	0	0.00	1	2.70	0	0.00
	Housewife	1	6.67	2	5.26	4	10.81	2	5.26
	Retired	3	20.00	2	5.26	2	5.41	2	5.26
	Waiting for first job / never worked	0	0.00	0	0.00	0	0.00	0	0.00
	Unemployed / lost his/her job	1	6.67	3	7.89	3	8.11	3	7.89
	Other	0	0.00	2	5.26	1	2.70	2	5.26
Number of people, including respondents, living in the home	One person	1	6.67	8	21.05	7	18.92	8	21.05
	Two people	8	53.33	11	28.95	9	24.32	11	28.95
	Three people	4	26.67	8	21.05	8	21.62	8	21.05
	Four people	2	13.33	7	18.42	10	27.03	7	18.42
	Five or more people	0	0.00	4	10.53	3	8.11	4	10.53
Number of drivers, including respondents, living in the home	0	0	0.00	0	0.00	0	0.00	0	0.00
	1	4	26.67	18	47.37	15	40.54	18	47.37
	2	10	66.67	12	31.58	15	40.54	12	31.58
	More than 2	1	6.67	8	21.05	7	18.92	8	21.05
Presence of children at home	Yes	6	40	15	39.47	16	43.24	15	39.47
	No	9	60	23	60.53	21	56.76	23	60.53
The age of the respondent's child/children	0-3 years old	1[26]	-	5*	-	5*	-	5*	-
	4-6 years old	0	0.00	2*	-	4*	-	2*	-
	7-15 years old	3*	-	7*	-	7*	-	7*	-
	16 years or more	2*	-	10*	-	9*	-	10*	-
Number of cars available for use in respondent's home	No car	2	13.33	3	7.89	4	10.81	3	7.89
	One car	7	46.67	22	57.89	18	48.65	22	57.89
	Two cars	6	40.00	11	28.95	13	35.14	11	28.95
	Three cars or more	0	0.00	2	5.26	2	5.41	2	5.26
Monthly income of the respondent after tax	Up to 500 Euros	3	20.00	2	5.26	4	10.81	2	5.26
	501 Euros - 1000 Euros	1	6.67	6	15.79	4	10.81	6	15.79
	1001 Euros - 1500 Euros	4	26.67	7	18.42	9	24.32	7	18.42
	1501 Euros - 2000 Euros	1	6.67	9	23.68	5	13.51	9	23.68
	2001 Euros - 2500 Euros	2	13.33	3	7.89	3	8.11	3	7.89
	2501 Euros - 3000 Euros	1	6.67	4	10.53	6	16.22	4	10.53
	3001 Euros - 4000 Euros	1	6.67	3	7.89	4	10.81	3	7.89
	4001 Euros - 5000 Euros	2	13.33	1	2.63	1	2.70	1	2.63
	5001 Euros - 6000 Euros	0	0.00	1	2.63	0	0.00	1	2.63
	6001 Euros - 10000 Euros	0	0.00	1	2.63	0	0.00	1	2.63
	More than 10,001 Euros	0	0.00	1	2.63	1	2.70	1	2.63
Respondent's household monthly income after tax	Up to 500 Euros	2	13.33	2	5.26	2	5.41	2	5.26
	501 Euros - 1000 Euros	0	0.00	4	10.53	3	8.11	4	10.53
	1001 Euros - 1500 Euros	2	13.33	5	13.16	7	18.92	5	13.16
	1501 Euros - 2000 Euros	1	6.67	6	15.79	1	2.70	6	15.79
	2001 Euros - 2500 Euros	2	13.33	6	15.79	6	16.22	6	15.79
	2501 Euros - 3000 Euros	3	20.00	1	2.63	2	5.41	1	2.63
	3001 Euros - 4000 Euros	3	20.00	5	13.16	8	21.62	5	13.16
	4001 Euros - 5000 Euros	1	6.67	5	13.16	6	16.22	5	13.16
	5001 Euros - 6000 Euros	1	6.67	1	2.63	0	0.00	1	2.63

[26] Respondents could select more than one option, up to three options.

Socio-demographic factors		Main criteria set (n=15)		Trip-related characteristics (n= 38)		Bike-sharing characteristics (n=37)		Availability and accessibility (n=38)	
		n	(%)	n	(%)	n	(%)	n	(%)
	6001 Euros - 10000 Euros	0	0.00	2	5.26	1	2.70	2	5.26
	More than 10,001 Euros	0	0.00	1	2.63	1	2.70	1	2.63
How respondents manage their expenses with their current income	**Very good**	1	6.67	2	5.26	2	5.41	2	5.26
	Fairly good	7	46.67	14	36.84	17	45.95	14	36.84
	Neither good nor bad	4	26.67	13	34.21	9	24.32	13	34.21
	Pretty bad	2	13.33	8	21.05	8	21.62	8	21.05
	Very bad	1	6.67	1	2.63	1	2.70	1	2.63

Table A16: Socio-demographic characteristics of different sets of survey respondents (bike-sharing non-users) shown in the third row of Table 39 (question set C in survey 2).

Socio-demographic factors		Main criteria set (n=32)		Trip-related characteristics (n= 69)		Bike-sharing characteristics (n=63)		Availability and accessibility (n=69)	
		n	(%)	n	(%)	n	(%)	n	(%)
Gender	**Male**	21	65.63	33	47.83	33	52.38	33	47.83
	Female	11	34.38	36	52.17	30	47.62	36	52.17
Age	**< 18**	0	0.00	0	0.00	0	0.00	0	0.00
	18-24	1	3.13	2	2.90	2	3.17	2	2.90
	25-34	6	18.75	8	11.59	8	12.70	8	11.59
	35-44	8	25.00	14	20.29	15	23.81	14	20.29
	45-54	7	21.88	21	30.43	15	23.81	21	30.43
	55-64	5	15.63	10	14.49	10	15..87	10	14.49
	> 64	5	15.63	14	20.29	13	20.63	14	20.29
Education level	**Not completed primary school**	0	0.00	0	0.00	0	0.00	0	0.00
	Elementary school	0	0.00	1	1.45	2	3.17	1	1.45
	Upper secondary school or equivalent shorter than three years	3	9.38	5	7.25	4	6.35	5	7.25
	Upper secondary school or equivalent three years or more	10	31.25	29	42.03	22	34.92	29	42.03
	Post-secondary education, not college, less than three years	4	12.50	3	4.35	4	6.35	3	4.35
	Post-secondary education, not college, three years or more	1	3.13	4	5.80	3	4.76	4	5.80
	University less than three years	0	0.00	6	8.70	4	6.35	6	8.70
	University 3 years or more	11	34.38	15	21.74	17	26.98	15	21.74
	Degree from postgraduate studies	3	9.38	6	8.70	7	11.11	6	8.70
Marital status	**Single**	10	31.25	22	31.88	21	33.33	22	31.88
	Married or domestic partnership	22	68.75	47	68.12	42	66.67	47	68.12
Business or professional status	**Entrepreneur/freelancer**	3	9.38	7	10.14	7	11.11	7	10.14
	Officer/manager	1	3.13	4	5.80	3	4.76	4	5.80
	Clerk/trade employee	13	40.63	23	33.33	20	31.75	23	33.33
	Worker	0	0.00	4	5.80	3	4.76	4	5.80
	Teacher	2	6.25	3	4.35	2	3.17	3	4.35
	Representative	0	0.00	1	1.45	1	1.59	1	1.45
	Craftsman / trader / operator	1	3.13	0	0.00	0	0.00	0	0.00
	Student	3	9.38	2	2.90	3	4.76	2	2.90
	Housewife	1	3.13	5	7.25	3	4.76	5	7.25
	Retired	2	6.25	10	14.49	10	15.87	10	14.49
	Waiting for first job / never worked	0	0.00	1	1.45	1	1.59	1	1.45
	Unemployed / lost his/her job	5	15.63	8	11.59	9	14.29	8	11.59
	Other	1	3.13	1	1.45	1	1.59	1	1.45
Number of people, including	**One person**	3	9.38	11	15.94	10	15.87	11	15.94
	Two people	13	40.63	27	39.13	27	42.86	27	39.13
	Three people	9	28.13	17	24.64	16	25.40	17	24.64

Socio-demographic factors		Main criteria set (n=32)		Trip-related characteristics (n= 69)		Bike-sharing characteristics (n=63)		Availability and accessibility (n=69)	
		n	(%)	n	(%)	n	(%)	n	(%)
respondents, living in the home	Four people	6	18.75	14	20.29	9	14.29	14	20.29
	Five or more people	1	3.13	0	0.00	1	1.59	0	0.00
Number of drivers, including respondents, living in the home	0	0	0.00	0	0.00	1	1.59	0	0.00
	1	6	18.75	21	30.43	20	31.75	21	30.43
	2	21	65.63	40	57.97	34	53.97	40	57.97
	More than 2	5	15.63	8	11.59	8	12.70	8	11.59
Presence of children at home	Yes	12	37.50	27	39.13	19	30.16	27	39.13
	No	20	62.50	42	60.87	44	69.84	42	60.87
The age of the respondent's child/children	0-3 years old	3[27]	-	4*	-	2*	-	4*	-
	4-6 years old	3*	-	5*	-	5*	-	5*	-
	7-15 years old	3*	-	9*	-	5*	-	9*	-
	16 years or more	5*	-	13*	-	10*	-	13*	-
Number of cars available for use in respondent's home	No car	0	0.00	6	8.70	8	12.70	6	8.70
	One car	16	50.00	28	40.58	31	49.21	28	40.58
	Two cars	15	46.88	31	44.93	23	36.51	31	44.93
	Three cars or more	1	3.13	4	5.80	1	1.59	4	5.80
Monthly income of the respondent after tax	Up to 500 Euros	5	15.63	13	18.4	12	19.05	13	18.84
	501 Euros - 1000 Euros	4	12.50	7	10.14	6	9.52	7	10.14
	1001 Euros - 1500 Euros	4	12.50	10	14.49	10	15.87	10	14.49
	1501 Euros - 2000 Euros	10	31.25	18	26.09	15	23.81	18	26.09
	2001 Euros - 2500 Euros	3	9.38	10	14.49	8	12.70	10	14.49
	2501 Euros - 3000 Euros	2	6.25	3	4.35	5	7.94	3	4.35
	3001 Euros - 4000 Euros	4	12.50	5	7.25	6	9.52	5	7.25
	4001 Euros - 5000 Euros	0	0.00	1	1.45	1	1.59	1	1.45
	5001 Euros - 6000 Euros	0	0.00	1	1.45	0	0.00	1	1.45
	6001 Euros - 10000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	More than 10,001 Euros	0	0.00	1	1.45	0	0.00	1	1.45
Respondent's household monthly income after tax	Up to 500 Euros	4	12.50	6	8.70	7	11.11	6	8.70
	501 Euros - 1000 Euros	1	3.13	3	4.35	3	4.76	3	4.35
	1001 Euros - 1500 Euros	4	12.50	12	17.39	10	15.87	12	17.39
	1501 Euros - 2000 Euros	4	12.50	8	11.59	7	11.11	8	11.59
	2001 Euros - 2500 Euros	5	15.63	12	17.39	7	11.11	12	17.39
	2501 Euros - 3000 Euros	5	15.63	10	14.49	14	22.22	10	14.49
	3001 Euros - 4000 Euros	7	21.88	12	17.39	12	19.05	12	17.39
	4001 Euros - 5000 Euros	1	3.13	2	2.90	2	3.17	2	2.90
	5001 Euros - 6000 Euros	1	3.13	3	4.35	1	1.59	3	4.35
	6001 Euros - 10000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	More than 10,001 Euros	0	0.00	1	1.45	0	0.00	1	1.45
How respondents manage their expenses with their current income	Very good	1	3.13	7	10.14	3	4.76	7	10.14
	Fairly good	16	50.00	31	44.93	31	49.21	31	44.93
	Neither good nor bad	9	28.13	21	30.43	17	26.98	21	30.43
	Pretty bad	3	9.38	7	10.14	7	11.11	7	10.14
	Very bad	3	9.38	3	4.35	5	7.94	3	4.35

Table A17: Socio-demographic characteristics of different sets of survey respondents (scooter-sharing users), shown in the second row of Table 40 (question set C in survey 3).

Socio-demographic factors		Main criteria set (n=13)		Trip-related characteristics (n= 42)		Scooter-sharing characteristics (n=37)		Availability and accessibility (n=42)	
		n	(%)	n	(%)	n	(%)	n	(%)
Gender	Male	8	61.54	24	57.14	22	59.46	24	57.14
	Female	5	38.46	18	42.86	15	40.54	18	42.86
Age	< 18	0	0.00	0	0.00	0	0.00	0	0.00
	18-24	1	7.69	2	4.76	2	5.41	2	4.76
	25-34	5	38.46	11	26.19	6	16.22	11	26.19
	35-44	2	15.38	4	9.52	9	24.32	4	9.52
	45-54	2	15.38	4	9.52	2	5.41	4	9.52
	55-64	3	23.08	11	26.19	14	37.84	11	26.19
	> 64	0	0.00	10	23.81	4	10.81	10	23.81

[27] Respondents could select more than one option, up to three options.

Socio-demographic factors		Main criteria set (n=13)		Trip-related characteristics (n= 42)		Scooter-sharing characteristics (n=37)		Availability and accessibility (n=42)	
		n	(%)	n	(%)	n	(%)	n	(%)
Education level	**Not completed primary school**	0	0.00	0	0.00	0	0.00	0	0.00
	Elementary school	0	0.00	1	2.38	0	0.00	1	2.38
	Upper secondary school or equivalent shorter than three years	1	7.69	3	7.14	4	10.81	3	7.14
	Upper secondary school or equivalent three years or more	2	15.38	13	30.95	12	32.43	13	30.95
	Post-secondary education, not college, less than three years	0	0.00	3	7.14	1	2.70	3	7.14
	Post-secondary education, not college, three years or more	1	7.69	2	4.76	1	2.70	2	4.76
	University less than three years	1	7.69	3	7.14	2	5.41	3	7.14
	University 3 years or more	6	46.15	14	33.33	13	35.14	14	33.33
	Degree from postgraduate studies	2	15.38	3	7.14	4	10.81	3	7.14
Marital status	**Single**	7	53.85	14	33.33	12	32.43	14	33.33
	Married or domestic partnership	6	46.15	28	66.67	25	67.57	28	66.67
Business or professional status	**Entrepreneur/freelancer**	0	0.00	2	4.76	1	2.70	2	4.76
	Officer/manager	1	7.69	6	14.29	6	16.22	6	14.29
	Clerk/trade employee	5	38.46	10	23.81	13	35.14	10	23.81
	Worker	1	7.69	1	2.38	2	5.41	1	2.38
	Teacher	0	0.00	0	0.00	0	0.00	0	0.00
	Representative	0	0.00	1	2.38	0	0.00	1	2.38
	Craftsman / trader / operator	1	7.69	3	7.14	2	5.41	3	7.14
	Student	3	23.08	5	11.90	4	10.81	5	11.90
	Housewife	1	7.69	1	2.38	2	5.41	1	2.38
	Retired	0	0.00	11	26.19	6	16.22	11	26.19
	Waiting for first job / never worked	0	0.00	0	0.00	0	0.00	0	0.00
	Unemployed / lost his/her job	0	0.00	0	0.00	0	0.00	0	0.00
	Other	1	7.69	2	4.76	1	2.70	2	4.76
Number of people, including respondents, living in the home	**One person**	4	30.77	11	26.19	7	18.92	11	26.19
	Two people	4	30.77	15	35.71	11	29.73	15	35.71
	Three people	2	15.38	9	21.43	13	35.14	9	21.43
	Four people	2	15.38	6	14.29	5	13.51	6	14.29
	Five or more people	1	7.69	1	2.38	1	2.70	1	2.38
Number of drivers, including respondents, living in the home	**0**	1	7.69	5	11.90	2	5.41	5	11.90
	1	5	38.46	15	35.71	11	29.73	15	35.71
	2	4	30.77	11	26.19	12	32.43	11	26.19
	More than 2	3	23.08	11	26.19	12	32.43	11	26.19
Presence of children at home	**Yes**	2	15.38	11	26.19	12	32.43	11	26.19
	No	11	84.62	31	73.81	25	67.57	31	73.81
The age of the respondent's child/children	**0-3 years old**	0	0.00	0	0.00	0	0.00	0	0.00
	4-6 years old	0	0.00	0	0.00	1[28]	-	0	0.00
	7-15 years old	0	0.00	2*	-	1*	-	2*	-
	16 years or more	2*	-	10*	-	6*	-	10*	-
Number of cars available for use in respondent's home	**No car**	0	0.00	3	7.14	1	2.70	3	7.14
	One car	10	76.92	21	50.00	17	45.95	21	50.00
	Two cars	2	15.38	14	33.33	16	43.24	14	33.33
	Three cars or more	1	7.69	4	9.52	3	8.11	4	9.52
Monthly income of the respondent after tax	**Up to 500 Euros**	2	15.38	5	11.90	4	10.81	5	11.90
	501 Euros - 1000 Euros	1	7.69	3	7.14	1	2.70	3	7.14
	1001 Euros - 1500 Euros	1	7.69	10	23.81	5	13.51	10	23.81
	1501 Euros - 2000 Euros	7	53.85	9	21.43	12	32.43	9	21.43
	2001 Euros - 2500 Euros	1	7.69	6	14.29	3	8.11	6	14.29
	2501 Euros - 3000 Euros	0	0.00	5	11.90	6	16.22	5	11.90
	3001 Euros - 4000 Euros	0	0.00	3	7.14	3	8.11	3	7.14
	4001 Euros - 5000 Euros	1	7.69	1	2.38	3	8.11	1	2.38
	5001 Euros - 6000 Euros	0	0.00	0	0.00	0	0.00	0	0.00

[28] Respondents could select more than one option, up to three options.

Socio-demographic factors		Main criteria set (n=13)		Trip-related characteristics (n= 42)		Scooter-sharing characteristics (n=37)		Availability and accessibility (n=42)	
		n	(%)	n	(%)	n	(%)	n	(%)
	6001 Euros - 10000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	More than 10,001 Euros	0	0.00	0	0.00	0	0.00	0	0.00
Respondent's household monthly income after tax	**Up to 500 Euros**	1	7.69	1	2.38	1	2.70	1	2.38
	501 Euros - 1000 Euros	0	0.00	1	2.38	0	0.00	1	2.38
	1001 Euros - 1500 Euros	1	7.69	8	19.05	3	8.11	8	19.05
	1501 Euros - 2000 Euros	5	38.46	8	19.05	7	18.92	8	19.05
	2001 Euros - 2500 Euros	0	0.00	8	19.05	6	16.22	8	19.05
	2501 Euros - 3000 Euros	1	7.69	7	16.67	5	13.51	7	16.67
	3001 Euros - 4000 Euros	1	7.69	3	7.14	6	16.22	3	7.14
	4001 Euros - 5000 Euros	2	15.38	3	7.14	4	10.81	3	7.14
	5001 Euros - 6000 Euros	0	0.00	1	2.38	2	5.41	1	2.38
	6001 Euros - 10000 Euros	2	15.38	2	4.76	3	8.11	2	4.76
	More than 10,001 Euros	0	0.00	0	0.00	0	0.00	0	0.00
How respondents manage their expenses with their current income	**Very good**	2	15.38	5	11.90	8	21.62	5	11.90
	Fairly good	4	30.77	13	30.95	16	43.24	13	30.95
	Neither good nor bad	4	30.77	17	40.48	9	24.32	17	40.48
	Pretty bad	2	15.38	5	11.90	3	8.11	5	11.90
	Very bad	1	7.69	2	4.76	1	2.70	2	4.76

Table A18: Socio-demographic characteristics of different sets of survey respondents (scooter-sharing non-users) shown in the third row of Table 40 (question set C in survey 3).

Socio-demographic factors		Main criteria set (n=24)		Trip-related characteristics (n= 66)		Scooter-sharing characteristics (n=48)		Availability and accessibility (n=66)	
		N	(%)	n	(%)	n	(%)	n	(%)
Gender	**Male**	11	45.83	30	45.45	24	50.00	30	45.45
	Female	13	54.17	36	54.55	24	50.00	36	54.55
Age	**< 18**	0	0.00	0	0.00	0	0.00	0	0.00
	18-24	1	4.17	1	1.52	1	2.08	1	1.52
	25-34	2	8.33	11	16.67	6	12.50	11	16.67
	35-44	6	25.00	18	27.77	12	25.00	18	27.77
	45-54	11	45.83	22	33.33	18	37.50	22	33.33
	55-64	3	12.50	10	15.15	10	20.83	10	15.15
	> 64	1	4.17	4	6.06	1	2.08	4	6.06
Education level	**Not completed primary school**	0	0.00	0	0.00	0	0.00	0	0.00
	Elementary school	0	0.00	0	0.00	0	0.00	0	0.00
	Upper secondary school or equivalent shorter than three years	0	0.00	5	7.58	2	4..17	5	7.58
	Upper secondary school or equivalent three years or more	7	29.17	18	27.27	17	35.42	18	27.27
	Post-secondary education, not college, less than three years	0	0.00	2	3.03	2	4.17	2	3.03
	Post-secondary education, not college, three years or more	3	12.50	6	9.09	4	8.33	6	9.09
	University less than three years	3	12.50	1	1.52	3	6.25	1	1.52
	University 3 years or more	11	45.83	30	45.45	17	35.42	30	45.45
	Degree from postgraduate studies	0	0.00	4	6.06	3	6.25	4	6.06
Marital status	**Single**	9	37.50	26	39.39	19	39.58	26	39.39
	Married or domestic partnership	15	62.50	40	60.61	29	60.42	40	60.61
Business or professional status	**Entrepreneur/freelancer**	1	4.17	4	6.06	5	10.42	4	6.06
	Officer/manager	0	0.00	7	10.61	6	12.50	7	10.61
	Clerk/trade employee	12	50.00	29	43.94	22	45.83	29	43.94
	Worker	1	4.17	7	10.61	3	6.25	7	10.61
	Teacher	1	4.17	3	4.55	0	0.00	3	4.55
	Representative	0	0.00	0	0.00	0	0.00	0	0.00
	Craftsman / trader / operator	0	0.00	0	0.00	0	0.00	0	0.00

Socio-demographic factors		Main criteria set (n=24)		Trip-related characteristics (n= 66)		Scooter-sharing characteristics (n=48)		Availability and accessibility (n=66)	
		N	(%)	n	(%)	n	(%)	n	(%)
	Student	2	8.33	3	4.55	4	8.33	3	4.55
	Housewife	4	16.67	3	4.55	3	6.25	3	4.55
	Retired	1	4.17	4	6.06	1	2.08	4	6.06
	Waiting for first job / never worked	0	0.00	1	1.52	0	0.00	1	1.52
	Unemployed / lost his/her job	1	4.17	2	3.03	2	4.17	2	3.03
	Other	1	4.17	3	4.55	2	4.17	3	4.55
Number of people, including respondents, living in the home	One person	8	33.33	13	19.70	10	20.83	13	19.70
	Two people	4	16.67	25	37.88	16	33.33	25	37.88
	Three people	6	25.00	12	18.18	9	18.75	12	18.18
	Four people	6	25.00	15	22.73	12	25.00	15	22.73
	Five or more people	0	0.00	1	1.52	1	2.08	1	1.52
Number of drivers, including respondents, living in the home	0	3	12.50	5	7.58	4	8.33	5	7.58
	1	6	25.00	16	24.24	12	25.00	16	24.24
	2	9	37.50	38	57.58	24	50.00	38	57.58
	More than 2	6	25.00	7	10.61	8	16.67	7	10.61
Presence of children at home	Yes	9	37.50	23	34.85	19	39.58	23	34.85
	No	15	62.50	43	65.15	29	60.42	43	65.15
The age of the respondent's child/children	0-3 years old	12	-	2[29]	-	2*	-	2*	-
	4-6 years old	1*	-	3*	-	1*	-	3*	-
	7-15 years old	4*	-	11*	-	11*	-	11*	-
	16 years or more	5*	-	10*	-	9*	-	10*	-
Number of cars available for use in respondent's home	No car	2	8.33	8	12.12	6	12.50	8	12.12
	One car	11	45.83	30	45.45	20	41.67	30	45.45
	Two cars	8	33.33	25	37.88	20	41.67	25	37.88
	Three cars or more	3	12.50	3	4.55	2	4.17	3	4.55
Monthly income of the respondent after tax	Up to 500 Euros	6	25.00	8	12.12	6	12.50	8	12.12
	501 Euros - 1000 Euros	2	8.33	5	7.58	4	8.33	5	7.58
	1001 Euros - 1500 Euros	3	12.50	13	19.70	8	16.67	13	19.70
	1501 Euros - 2000 Euros	8	33.33	22	33.33	17	35.42	22	33.33
	2001 Euros - 2500 Euros	2	8.33	7	10.61	3	6.25	7	10.61
	2501 Euros - 3000 Euros	2	8.33	8	12.12	5	10.42	8	12.12
	3001 Euros - 4000 Euros	0	0.00	2	3.03	4	8.33	2	3.03
	4001 Euros - 5000 Euros	1	4.17	1	1.52	1	2.08	1	1.52
	5001 Euros - 6000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	6001 Euros - 10000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	More than 10,001 Euros	0	0.00	0	0.00	0	0.00	0	0.00
Respondent's household monthly income after tax	Up to 500 Euros	3	12.50	4	6.06	2	4.17	4	6.06
	501 Euros - 1000 Euros	0	0.00	2	3.03	1	2.08	2	3.03
	1001 Euros - 1500 Euros	1	4.17	9	13.64	4	8.33	9	13.64
	1501 Euros - 2000 Euros	6	25.00	14	21.21	13	27.08	14	21.21
	2001 Euros - 2500 Euros	3	12.50	6	9.09	3	6.25	6	9.09
	2501 Euros - 3000 Euros	6	25.00	12	18.18	9	18.75	12	18.18
	3001 Euros - 4000 Euros	3	12.50	11	16.67	10	20.83	11	16.67
	4001 Euros - 5000 Euros	2	8.33	6	9.09	5	10.42	6	9.09
	5001 Euros - 6000 Euros	0	0.00	0	0.00	0	0.00	0	0.00
	6001 Euros - 10000 Euros	0	0.00	2	3.03	1	2.08	2	3.03
	More than 10,001 Euros	0	0.00	0	0.00	0	0.00	0	0.00
How respondents manage their expenses with their current income	Very good	0	0.00	2	3.03	2	4.17	2	3.03
	Fairly good	8	33.33	24	36.36	18	37.50	24	36.36
	Neither good nor bad	11	45.83	25	37.88	23	47.92	25	37.88
	Pretty bad	3	12.50	13	19.70	3	6.25	13	19.70
	Very bad	2	8.33	2	3.03	2	4.17	2	3.03

A4.4 Perspectives of whole operators and members of the government regarding some of the travel routines of users of each of the shared transportation services

It is important to figure out the opinions of operators (related to each shared mobility service) and government members about some of the travel routines of users of each shared mobility

[29] Respondents could select more than one option, up to three options.

service, shown in Table A19 (question set D in surveys 4 to 6). This helps to determine the gaps between the views of operators and government members about the travel routine of users of each shared mobility and what users stated about it.

Table A19: Operators' (associated with each shared mobility service) and government members' views on some of the travel routines of users of each shared mobility service (question set D in surveys 4 to 6).

People's routines and experiences of using shared mobility service		Shared mobility services					
		Car-sharing		Bike-sharing		Scooter-sharing	
		Operators	Government members	Operators	Government members	Operators	Government members
Travel distance that may cause the use of the service	Short-distance travel (less than 5 km)	-	1 (25.00%)	2 (100.00%)	4 (80.00%)	1 (100.00%)	3 (100.00%)
	Long-distance travel (5 km or more)	1 (33.33%)	2 (50.00%)	-	-	-	-
	Both	2 (66.67%)	1 (25.00%)	-	1 (20.00%)	-	-
Travel time that may cause the use of the service	Travel less than 30 min	-	2 (50.00%)	2 (100.00%)	4 (80.00%)	1 (100.00%)	3 (100.00%)
	Travel 30 min or more	1 (33.33%)	1 (25.00%)	-	-	-	-
	Both	2 (66.67%)	1 (25.00%)	-	1 (20.00%)	-	-
Departure time (hour) that may cause the use of the service	Travel during peak hours	1 (0.33%)	1 (25.00%)	-	1 (20.00%)	-	1 (33.33%)
	Travel during off-peak hours	1 (0.33%)	-	-	-	-	-
	Both	1 (0.33%)	3 (75.00%)	2 (100.00%)	4 (80.00%)	1 (100.00%)	2 (66.67%)
Departure time (day) that may cause the use of the service	Travel on a weekday morning	1[30]	9*	2*	5*	1*	3*
	Travel on a weekend morning	1*	1*	0 (0.00%)	1*	0 (0.00%)	1*
	Travel on a weekday evening	0 (0.00%)	2*	2*	3*	1*	2*
	Travel on a weekend evening	2*	3*	1*	0 (0.00%)	1*	0 (0.00%)
The trip purpose that may cause the use of the service	Travel for leisure (e.g., vising friends or shopping)	1 (0.33%)	2 (50.00%)	-	-	-	-
	Travel for non-leisure (going to work/school)	-	-	-	4 (80.00%)	-	1 (33.33%)
	Both	2 (66.67%)	2 (50.00%)	2 (100.00%)	1 (20.00%)	1 (100.00%)	2 (66.67%)

[30] Respondents could select more than one option, up to three options.