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Aligning users' and stakeholders' needs: How incentives can reshape the carsharing market

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ABSTRACT

Carsharing services provide users with a new way of approaching mobility and accessing shared vehicles. Since the initial pilot studies in the early 90s, technological innovations (e.g., advances in mobile technology, increased range of electric cars) and the establishment of new business models (e.g. station-based, free-floating, peer-to-peer, packages by time and/or kilometres) helped branding carsharing as a sustainable yet flexible and personalized mobility alternative. On the other hand, the carsharing market today is extremely scattered, as it can include multiple operators, which are often in competition among each other. While this variety of operators provides the user with a variety of travel options, without proper coordination, this competition can reduce the efficiency of the carsharing market and, in extreme cases, of the entire transportation system.

In this context, this paper studies the needs of travellers, local authorities, and carsharing service providers, and analyses how incentives can be used to align their goals. Taking Munich, Copenhagen, and Tel Aviv-Yafo as case studies, focus groups were used to identify thirteen different travellers' needs, which are grouped into five main categories: ownership issues, coverage area, financial aspects, vehicle settings, and integration of carsharing with other modes. Moreover, to understand the needs of service providers and public authorities, in-depth interviews were conducted. The results indicate that regulatory barriers, integration with other transport modes, and social equity issues are the most critical elements for the thriving of carsharing services. Our results also suggest that incentives can be divided into two main categories, namely direct and indirect incentives. With regards to direct incentives, parking stood out as the most important incentive. Among indirect incentives, those associated with the integration of carsharing with other transport services, were prominent. As part of the methodology, the results of the qualitative study are validated through a quantitative analysis. A bigger sample of the population answered an online survey, which was used to validate the list of potential incentives that can help aligning the goals of stakeholders and users.

1. Introduction

Carsharing systems gained popularity during the early 90 s and are arguably the pioneer mode of the shared mobility concept (Shaheen et al., 2018; Firnkorn and Müller, 2011). The idea behind carsharing is to provide individuals access to a fleet of shared vehicles, creating an alternative for private vehicle ownership (Shaheen et al., 2009) and a complement to alternative transport modes, such as public transportation, cycling, and walking (Millard-Ball, 2005). While there is no official definition of carsharing (Ampudia-Renuncio et al., 2018,

2020), researchers agree that car sharing can be described as “the practice where multiple people in a for-profit or non-profit organization share the use of multiple vehicles in exchange for a fee” (Millard-Ball, 2005)[Pag. 2–3]. Traditional carsharing systems are based on fixed stations, meaning the shared vehicles can only be accessed at certain locations. Additionally, their use is limited to round trips. More recently, new types of carsharing systems – such as free-floating carsharing and peer-to-peer carsharing – have emerged. These new models allow users to start and end their trip at different locations within a certain area (free-floating) or to share privately owned vehicles

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in an organized way (peer-to-peer). However, the coexistence of these different services creates new scenarios for policymakers and planners, who must deal with both the positive and negative impacts of these services. If properly integrated within the mobility landscape, carsharing may reduce car-ownership (Martin et al., 2010; Jochem et al., 2020), Vehicle Miles Travelled (VMT) (Clewlow, 2016), and lower greenhouse gas emissions (Jung and Koo, 2018; Martin and Shaheen, 2011). At the same time, political, societal, and economical issues can pose serious threats to the success of a carsharing system (Garrett et al., 2021).

Carsharing is a very complex ecosystem that can only be optimized by understanding the needs of three main stakeholders: users, local authorities, and service providers. Several barriers are at the heart of its complexity, and four prominent ones are of particular interest for this research:

- 1. Auto-oriented policies or context-specific barriers:** Carsharing alone cannot compensate for these barriers. From an urban perspective, high population density, good pedestrian environment, and public transport-oriented policies are all elements that help carsharing to succeed (Millard-Ball, 2005). However, the introduction of carsharing services in areas/cities where car-friendly policies are promoted, can make carsharing service another contributor for increasing road congestion (Wu et al., 2020).
- 2. Flexibility and accessibility:** Different users have different habits. The main benefit of private cars is the freedom that comes with the concept of ownership (Giesel and Nobis, 2016; Haustein, 2021a; Moody et al., 2021). Privately owned vehicles are easily accessible at all times and can be used for different purposes. For some users, this means the possibility to carry tools and equipment while for others the opportunity to perform spontaneous trips. To become a suitable alternative, carsharing services need to offer a similar level of flexibility at a more affordable price.
- 3. Competition among carsharing operators:** A growing number of cities have more than one carsharing system operating within its administrative borders. Some of these operators have conflicting goals (e.g. compete for the same users) while others have entirely different business models and therefore complement each-other (Wu et al., 2020). While this variety of operators provides the user with a variety of travel options, depending on local contexts and regulations, from a system prospective, this competition can either boost or reduce the overall efficiency of a carsharing system.
- 4. Challenges in the integration of different shared mobility services:** While there is a general tendency towards integration (Georgakis et al., 2020), designing instruments (such as mobile phone apps) that are able to integrate so many actors within a single framework is a time-consuming process, which might face resistance from the service providers.

Different cities have different regulations, different barriers, and different mobility targets. Similarly, cultural differences can also lead to complete different usage patterns (Klinger et al., 2013; Haustein and Nielsen, 2016). Additionally, the objectives of the three actors, i.e., travellers, local authorities, and service providers, are not always aligned. For example, service providers might prioritize profit and market share over sustainability, while users may focus mainly on travel times and comfort. Introducing mobility incentives is one way of aligning these different goals and achieving higher benefits for all actors involved into this system (Matyas, 2020).

Incentives in carsharing markets have not been extensively researched in the literature. The reason is that modelling incentives for a carsharing system is a complex task, with a few exceptions such as pricing (Ciari et al., 2015; Giorgione et al., 2020) and fleet management (i.e., relocation of cars in the network to improve service quality) (Hermann et al., 2014; Ampudia-Renuncio et al., 2018), whose effect

can be relate with the overall costs and performance-related costs of the system. In the first place, distinguishing between incentives for users and for service-providers is not always straightforward. For instance, parking-related incentives are typically considered as a benefit to the service provider. Usually, providers make contracts with the municipality and pay for the possibility to use public parking spots. The rental price of the vehicle is then influenced by this cost. If the municipality sets a relatively low price, this incentive is very beneficial for the operator. However, at the same time, as parking spots' price influences the final rental cost, it can also benefit users. Similarly, creating carsharing hubs (mobility stations) can be considered as a form of incentive for both users and operators. For the user, mobility stations increase accessibility and make carsharing more integrated with other transport modes, such as public transport. For operators, it increases visibility and, potentially, market share.

Another important aspect is to understand what motivates people to join a carsharing system and how these motivations change across different regions and systems (free-floating, peer-to-peer, station-based). A research done in North American identified four different motivational patterns that can drive users toward registering to a carsharing system (Schaefer, 2013): (1) value-seeking (i.e. economically more convenient than owning a car); (2) convenience (compared to not having a car), (3) lifestyle (community orientation of certain customers), (4) and environmental motives (sustainability of sharing a car). Other studies done in Denmark (Garrett et al., 2021; Nielsen et al., 2015) found strong evidence that the main motivational basis for joining carsharing is the reduced costs compared to owning a car combined with the increased flexibility that provides with respect to not having a car. Environmental aspects and lifestyle are mentioned as an advantage but they rarely constitute the main motive.

Based on these considerations, this paper analyses the main barriers and opportunities for carsharing systems, provides an in-depth analysis of users' and stakeholders' needs, and analyses how incentives can align them. As carsharing only makes sense as a part of a wider network of mobility services, this research takes three cities as a case study: Munich (Germany), Tel Aviv-Yafo (Israel), and Copenhagen (Denmark). The three cities differ among each other in terms of sizes, cultural aspects, and number of active carsharing operators within their administrative borders. Our main data sources consist of a series of focus groups and interviews with existing and potential carsharing users, service providers, and local authorities. Travellers (i.e., users and non-users) were asked to (1) evaluate their current mobility choices, (2) explain their expectations when using a carsharing service, and (3) discuss about existing barriers that hinder their usage of this service. Additionally, a travel survey was explicitly designed to analyse the main points raised during the interviews with carsharing users and potential users, and validate the results presented in this paper on a larger sample of the population. Our results suggest that users' needs can be grouped into five main categories: car-ownership issues, service coverage, financial aspects, vehicle settings, and the lack of integration with other modes. Starting from these five themes, thirteen users' needs are identified, which can be addressed with incentives. For the stakeholders (local authorities and service providers), the main problems that emerged are the profitability of the system, the regulatory aspects, and social equity issues.

The remainder of this paper is organized into six sections. The next section provides background information, including existing research and relevant terminology. In Section 3, the methodology used to design the focus groups and interviews, as well as the approach used to handle and analyse the data, are described in detail. Section 4 presents the users' and stakeholders' needs. Section 5 discusses some policy implications and provides a list of potential incentives to align the different user needs. In Section 6, a descriptive analysis based on a representative sample of the population is used to generalize these findings. Finally, Section 7 presents the conclusions.

2. Background

2.1. Carsharing

Carsharing is a model of car rental that involves a fleet of vehicles scattered around a city for the use of a registered group of members (Shaheen et al., 1999). Differently from a traditional car rental, this system is accessible at any time and has a specific price structure, which positions it somewhere between private and public transport (Jorge and Correia, 2013). In a carsharing system, fixed private car ownership costs such as insurance and maintenance are incorporated into rental costs. Steininger et al. (1996), Ciari et al. (2015). Depending on the business model of the carsharing service, the usage of shared cars is then charged by km, minute, hour, or by the day. In certain cases, members also have to pay a registration cost and/or a monthly or annual membership fee.

Today, carsharing appears mainly in three forms: station-based, free-floating, and Peer-to-Peer (P2P). Station-based is the oldest carsharing scheme, with some services such as the German *StattAuto* (Berlin, 1988) that not only survived until today but have proven that carsharing can reduce car-ownership and promote a more sustainable urban mobility (Giesel and Nobis, 2016). In station-based systems, vehicles are available at certain locations and their use is usually limited to complete round trips. While users located nearby a station have quick access to a vehicle that can, in many cases, substitute a private vehicle, station-based schemes have a rigid structure. They provide limited flexibility to the user and, most notably, they are not suited for one-way trips such as commuting to work (without renting the vehicle for the whole day) (Le Vine et al., 2014b). Free-floating carsharing schemes provide a more convenient service for one-way trips by making use of public parking spaces for easier vehicle pick-up and drop-off (Becker et al., 2018). However, the need to access public parking spaces causes free-floating services to be dependent on local conditions of parking availability and congestion. While free-floating schemes are more dynamic and offer opportunities for a more “spontaneous” travel behaviour, this flexibility comes with a significantly higher maintenance cost for the service operator compared to the station-based system, as the operator often needs to transfer vehicles from low demand to high demand areas along the day. Today, mixed free-floating/station-based systems also exist. These systems are similar to free-floating services, meaning that a physical station does not exist. However, these services are more limited than fully fledged free-floating services, as usually the car can only be dropped in certain areas. At the same time, the rental price is comparable to a traditional station-based service. Finally, P2P is a more recent form of carsharing where private owners share temporarily their own private vehicle with other citizens in exchange for economic compensations. While this form of mobility always existed between private individuals (e.g. borrowing/lending the car to another person), P2P services provide the infrastructure to extend this scheme to a larger number of users.

While current predictions concerning the carsharing demand forecast an exponential growth of the carsharing market (Deloitte, 2017), similar studies in the past proved to be overoptimistic (Muheim and Reinhardt, 1999), significantly overestimating the diffusion levels of these systems. Most of the research on carsharing has been performed during the last two decades (Millard-Ball, 2005), and has mostly focused on station-based systems (Becker et al., 2018). Only in recent years, studies have focused on free-floating and P2P schemes (Becker et al., 2018; Ampudia-Renuncio et al., 2018, 2020). Additionally, while most of the current research focuses on one specific type of carsharing, station-based and free-floating carsharing schemes are more likely to complement each other rather than to compete. More recent studies showed in fact that the two systems have two entirely different usage patterns (Le Vine et al., 2014b; Becker et al., 2017; Namazu and Dowlatabadi, 2018). Station-based frameworks are more likely to be used next to public transport, offering an alternative to the

private car when public transport is not competitive, while free-floating is more likely to compete with public transport for short distance trips (Ampudia-Renuncio et al., 2020). However, if properly integrated with other mobility services, free-floating services can also facilitate first- and last-mile public transit connections (Shaheen and Chan, 2016; Le Vine et al., 2014a). According to the literature, the break-even point for a carsharing system – i.e., the point below which carsharing turns out to be cheaper than private car ownership – is roughly less than 18,000 kilometres travelled per year (15,000 if insurance costs are also considered) (Steininger et al., 1996; Petersen, 2013). However, this number decreases to a range between 5000 km and 10000 km when considering maintenance costs and different types of subscriptions (Pretenthaler and Steininger, 1999). This break-even point is also likely to be different in the case of free-floating services. Station-based sharers are characterized by a functional, or even negative, attitude towards private cars. By contrast, recent studies (Becker et al., 2017; Hausteine, 2021b) suggest that free-floating users often perceive the car as a status symbol and have limited environmental concern. The main reason to use this system is to save money and to try new vehicles. A qualitative study performed in Italy (Mattia et al., 2019) also indicated that free-floating carsharers value flexibility and show excitement for specific car models, while the environmental aspect was not perceived as relevant for the respondents.

As carsharing service performance is heavily affected by land-use and local barriers, to unleash its full potential it is necessary to incorporate the carsharing framework into regional strategies aimed at supporting local mobility policies (Shaheen and Cohen, 2018). To this end, stakeholder-directed (Shaheen and Cohen, 2018) and user-directed (Xie et al., 2019) incentives should be used to align public and private objectives. In Xie et al. (2019), the authors present a framework to analyse the effect of personalized incentives on travel behaviour, identifying how the perception of delay changes between different population segments and how incentives can be used to promote more equitable and efficient travel choices. In Firnkorn and Müller (2011), the authors focus instead on the environmental aspects of carsharing. In their model, the authors consider environmental aspects (such as emissions and land consumption) together with social and economic features to evaluate the possible effects of free-floating carsharing systems on the environment. The authors find that free-floating services are likely to reduce the environmental footprint of a transport system, as long as they are developed complementary to public transportation. While several studies identified positive effects of carsharing on car ownership and use (e.g. Nijland and van Meerkerk (2017), Firnkorn and Müller (2011)), most of these assessments are based on retrospective data and/or hypothetical purchase decisions and miss a control group, which limit the reliability of the estimation. Effects found in longitudinal data using a control group design are much smaller, in particular for free-floating carsharing (Becker et al., 2018; Hausteine, 2021b), which seem more often used to complement existing mobility options rather than to replace a car (Namazu and Dowlatabadi, 2018). Finally, Shaheen and Cohen (2018), Millard-Ball (2005) propose a comprehensive analysis of carsharing systems in North America. In Millard-Ball (2005), a thorough study on the roles of carsharing in enhancing mobility as part of the transportation system is proposed. The authors analyse potential incentives and barriers, and ways to mitigate the latter. As these recommendations mostly focus on early carsharing systems, Shaheen and Cohen (2018) introduces a broader study, covering all shared-mobility services, including car-hailing and bike-sharing. The authors identify the four barriers outlined in Section 1 as the main ones for a carsharing system to succeed, stressing how incentives and local policies can promote a more sustainable and equitable implementation of this service. Their recommendations, however, are limited to the North American market. The current state-of-the-art, as reflected in the description of previous studies, serves as the starting point for the current research, which aims at providing recommendations for the successful implementation of carsharing schemes in general and for incentives considering different urban contexts.

2.2. Qualitative travel-behaviour analysis

Most of the research discussed in the previous sections uses quantitative methodologies to examine carsharing. While many of these methodologies leverage traditional survey data, carsharing systems are based on ICT (Information and Communication Technology) solutions. Therefore, a large amount of data (such as origin–destination flows) is generated, although not always made available for research. This type of data can be harvested from web-based platforms (Ciociola et al., 2017) and used to study the spatial and temporal distribution of carsharing trips within a certain study area with a high level of accuracy. Müller et al. (2017), Ampudia-Renuncio et al. (2020).

While useful in identifying patterns and distributions, these methodologies cannot completely explain the reason behind human decisions (Hesse-Biber, 2010). Hence, the last decade has witnessed an increasing number of papers based on qualitative analysis (e.g., interviews, focus groups, open ended questions) to understand these reasons and to investigate new and unforeseen travel dynamics (Beirão and Cabral, 2007; Nielsen et al., 2015; Mars et al., 2016; Shaheen and Cohen, 2018; Matyas, 2020; Villeneuve and Kaufmann, 2020; Jain et al., 2020). Qualitative studies are in fact useful to examine new topics, as the respondent is not restricted to a limited number of pre-defined alternatives. However, qualitative analysis is influenced by subjectivity, which makes this approach, as a sole source of information, widely criticized in practice (Madill and Gough, 2008). Qualitative analysis is especially appropriate to understand the relationships that quantitative methods find while quantitative methods can be used to generalize the findings from a qualitative study (Mars et al., 2016). Therefore, both elements are required to fully capture the complexity of a carsharing system (Shaheen and Cohen, 2018).

When it comes to qualitative studies in transportation, *in-depth interviews* and *focus groups* represent the most common forms of data-collection (Mars et al., 2016). The difference between them is that, in the former case, each respondent is interviewed individually, while in the latter participants present and discuss their own points of view in a group (Krueger, 2014). On the one hand, focus groups are commonly used when the discussion between respondents is expected to provide additional value to the study (Grudens-Schuck et al., 2004). Interviews, on the other hand, mitigate social pressure and create a better environment to understand the reasons behind the behaviour of the respondent as well as to explore sensitive themes that one would not like to discuss in a group (Braun and Clarke, 2006).

When it comes to analysing the data, *content-analysis*, *thematic-analysis*, and *grounded-theory* are three of the most commonly adopted approaches (Mars et al., 2016). *Content analysis* consists in defining units of analysis, creating codes, and establishing themes (Cho and Lee, 2014). *Thematic analysis* explores the data, organizes and analyses themes and ideas, and identifies patterns from the data (Braun and Clarke, 2006). The two approaches present similarities, as both approaches involve labelling and grouping the data to identify themes. The difference is that *Content analysis* is a technique that can be used for qualitative as well as quantitative studies. This model puts emphasis on the frequency of words/themes to identify important topics, which makes it more robust with respect to other techniques in qualitative analysis. However, it might suggest discarding important themes just because they are not frequently discussed. As for *Thematic analysis*, it focuses on identifying themes. However, the process is based on the experience of the analyst and therefore subject to interpretation (Mars et al., 2016). Finally, *Grounded-Theory* is a technique that clusters data into codes, themes, and finally into a theory (Glaser et al., 1968). Similarly to *content analysis*, this technique can be used also for quantitative analysis (Cho and Lee, 2014). However, it is particularly suited to identify themes emerging from focus groups (Krueger, 2014).

Existing research suggests a clear procedure that can help in obtaining robust analysis from qualitative studies in travel behaviour (Mars

et al., 2016). First, both focus groups and interviews should be conducted, as these tools provide different insights about user behaviour. Second, traditional quantitative analysis is necessary to generalize findings from qualitative studies. Looking at the existing literature on carsharing, only a few works combine both quantitative and qualitative analysis. The works presented in Millard-Ball (2005), Shaheen and Cohen (2018) are rare examples of research developed making use of both quantitative and qualitative approaches at once. However, their results only apply to the North American market, and cannot be directly applied to the other contexts. In Matyas (2020), thematic analysis and survey data are used to investigate barriers and opportunities for implementing the Mobility as a Service (MaaS) concept in London. However, the results propose in Matyas (2020) only considers travellers' needs, while ignoring the needs of service providers and local authorities.

3. Methodology

In this section, we present the methodology used in this study. The data collection and data analysis methods are briefly described in Section 3.3. This research makes use of different instruments (stated preferences experiment, focus groups, interviews) and targets different stakeholders (operators, users, authorities). In this section, we first, introduce how and why we selected the study area, then we introduce the data used in this research and the method adopted to process and analyse them.

The purpose of this study is not simply to understand the current usage and limitations of carsharing systems but to understand which role incentives play into the carsharing market and how they can change the current situation. Focus-groups are used in this study to identify travellers' needs and the incentives that can help in satisfying them. Similarly, In-depth interviews are used to investigate the needs of the other stakeholders (e.g. service providers, local authorities, but also public transport operators). Finally, survey data are deployed to generalize the findings from the qualitative analysis.

3.1. Study area

As discussed in the previous section, differences in the urban environment influence the success of a carsharing system. In this research, we chose three different, yet comparable cities as a case study: Munich (Germany), Tel Aviv-Yafo (Israel), and Copenhagen (Denmark). The three cities have been selected as they share very different transportation systems and policies, which allow for studying the needs of travellers and stakeholders in different contexts. At the same time, the three cities share some similarities. Copenhagen is the cultural and economic centre of Denmark. Munich is the capital of the state of Bavaria and Germany's third largest city. Tel-Aviv Yafo is the second largest city in Israel and the economic centre of the country. All these cities are characterized by a densely populated urban core, a good public transport network, and the availability of several carsharing systems, all these being elements that make them suited for the study at hand. More information about the cities are available in Table 1.

With regards to the transit network, in all cities suburban trains connect the city centre with the metropolitan area. However, the three cities also differ in many aspects. Munich has a metro-oriented transit system, which connects an extended network of trams (72 km) and bus routes (94 lines). The transit network in Copenhagen makes intense use of high frequency buses. A metro-line also exists, and it connects the central areas of the city with the suburbs. In Tel Aviv-Yafo, a dense bus network serves passengers within the city and is connected to four major suburban train stations. Currently three lines of light rail are being developed in Tel Aviv metropolitan area and a plan for a Metro system is being discussed.

Concerning car-ownership, the cost of owning a car in Munich is much lower than in Copenhagen and Tel Aviv-Yafo. This is reflected on the higher number of cars per 1000 inhabitants (see Table 1). However,

Table 1
Information about Munich, Copenhagen, and Tel Aviv-Yafo (12/2019)^a.

Category	Variable	Munich	Copenhagen	Tel Aviv-Yafo
Population	City	1,484,226	736,645	451,500
	Metropolitan area	2,606,021	1,846,023	3,984,900
	City-Metr. area ratio	56%	39%	11%
Area (sq.km)	City	310	98	52
	Metropolitan area	5,500	2,562	1,516
	City-Metr. area ratio	6%	4%	3%
Population density (per sq.km)	City	4,800	7,455	8,718
	Metropolitan area	460	720	2,361
Mode Share	Public Transport	24%	19%	17%
	Private motorized	34%	32%	56%
	Active modes	42%	49%	27%
Carsharing (N. operators)	Station-Based	4	5	1
	Free-Floating	3	2	1
	P2P	NA	1	NA
Public Transport	Tram	Yes	No	No
	Metro	Yes	Yes	No
	Suburban train	Yes	Yes	Yes
Active modes	Cycling network (Km)	1,200	382	160
	Bike sharing	Yes	Yes	Yes
	E-scooter sharing	Yes	Yes	Yes
Motorized private modes	Car ownership per 1000 inhabitants	550	438	394

^aAuthor's own sources.

Tel Aviv-Yafo has also a high car-ownership rate when compared to other cities in Israel, which is reflected in the high mode share in Table 1.

When it comes to active modes, both in Copenhagen and Munich cycling represents the main transport mode. This is the result of many years of political and administrative focus on improving the conditions for cycling in both cities. A crucial element which however makes Copenhagen one of the most bicycle-friendly city in the world (Haustein et al., 2020) is the network of dedicated bicycle infrastructure and the integration with the transit system, which allows travellers to board the metro, train, and harbour bus with bikes (Goletz et al., 2020). In Tel Aviv-Yafo, cycling is very popular, as well as the use of e-scooters, and the city is now redeveloping a robust infrastructure for cycling. However, the high use of these modes is concentrated mostly at the urban core of the city.

In terms of carsharing and shared mobility in general, the three cities also differ. While shared-services are present in all the cities, Tel Aviv-Yafo presents a more limited offer when compared to Munich and Copenhagen. The city has only two carsharing operators, *AutoTel* and *Car2Go*. *AutoTel* (free-floating with over 300 free dedicated parking spots) is a joint venture initiated by the Tel Aviv-Yafo Municipality and the Tel Aviv-Yafo Economic Development Authority. For the establishment and operation of the service, the Tel Aviv-Yafo Economic Development Authority is collaborating with the other system present in the city, *Car2Go*. Copenhagen and Munich, on the other hand, present a richer offer of services, with several station-based and free-floating services. Additionally, in these cities, both multinational commercial service providers, such as *Car2Go*, and local service providers, such as *LetsGo*, coexist. This adds an additional level of complexity to the mobility landscape as these operators have usually different goals, with multinational operators having a stronger focus on profitability and local service providers on improving mobility at a local level. Further details on the different operators, their characteristics, the number of shared vehicles, and their pricing schemes can be observed in Appendix A.

Finally, we briefly discuss how different mobility services interact in the three cities. The mobility offer in Munich is not only comprehensive but – to a certain extent – also well integrated. Beyond its public transport offer, the Munich Transport Company (MVG) also provides e-scooters, bike-sharing and carpooling. These services are integrated within one online application (APP) (MVG More) that coordinates

regional railway, metro, tram, bus, e-scooters, bikesharing, some car-sharing operators, and taxi. Yet, the quite advanced APP comes with some limitations. First, the app mostly includes MVG services. Second, due to the complexity of the APP, the integration of additional services requires significant amount of time. As a consequence, other private operators created similar APPs on their own. The application developed by the car-rental (and carsharing) operator *Sixt*, for example, includes carsharing, car-rental, e-scooters, and taxi within one single app. Beyond the diversity of journey planners and mobility applications, it is also important to note that most of the services integrated within MVG More still require the user to install and register to other platforms. For instance, in order to use *ShareNow* (carsharing), users still need to install the proprietary application from ShareNow and to register to the service. In Copenhagen, the Danish multimodal journey planner app *Rejseplanen* (Travel planner) started to include information about combining all modes of public transport, with private (e.g., carsharing, bike sharing) transport services for the residents of the North Denmark Region. Finally, in Tel Aviv-Yafo the integration is more limited. The Rav-Kav smart card is the main form of payment for public transportation and can be used to board trains or buses. However, limited integration with other mobility services exists.

3.2. Data collection

The data used in this paper comes from both focus groups and interviews. The analysis is based on four focus groups (± 30 total respondents) and 18 in-depth interviews. General statistics about the composition of both are detailed in Tables 2a–2b. The scheduled duration of both interviews and focus group was 100 min. In both cases, convenience sampling techniques were used to select participants, as traditional techniques like random sampling have been proved not to be suitable for qualitative data collection (Nagle B., 2013; Krueger, 2014).

For the focus groups, actual (i.e. already carsharing users) and potential users (i.e. currently not a carsharing user) were the target groups of this study. Therefore, some criteria, such as being over 18, holding a driving license, and living in the operational area of the carsharing service, were defined. Before the beginning of the discussion in each focus group, basic concepts related to carsharing services, such as “station-based carsharing”, “free-floating carsharing” and “flexible pricing” were illustrated. The recruitment strategy was slightly different in the three cities. In Munich, the municipality provided a list of

Table 2a
Focus Group — List of characteristics.

Category	Variable	Munich	Copenhagen	Tel Aviv-Yafo
Gender	Male	4	11	5
	Female	3	4	3
Education	Under bachelor	0	2	0
	Bachelor degree	3	1	5
	Master degree	1	9	3
	Above master	2	3	0
	Other	1	0	0
Age	18–29	1	5	2
	30–39	1	6	3
	40–49	1	3	0
	50–49	4	1	2
	60+	0	0	1
Family status	With children	3	5	4
	Without children	4	10	4
Home Location	City	7	4	4
	Metropolitan area	0	11	4
Employment status	Full-time	5	11	7
	Part-time	2	1	1
	Unemployed	0	1	0
	Student	0	2	2

Table 2b
Interviews — Type and number of stakeholders interviewed in each city.

Stakeholder Type	Munich	Copenhagen	Tel Aviv-Yafo
Public Transport Operator	1	1	0
Carsharing Operator (free-floating)	3	1	0
Carsharing Operator (station-based)	1	1	0
Carsharing Operator (P2P)	NA	1	NA
Non-profit environmental organization	1	1	0
Consumer council	0	1	0
Public authority	2	1	1
Real-estate developer	0	0	2

150 possible candidates that matched the above-mentioned requirements. These individuals were selected among the respondents of the household survey on mobility-related that the municipality of Munich conducted in 2019. A total of 17 participants were contacted, 7 of which agreed to join the Focus Group. In Copenhagen, two focus groups were organized. For the first focus group, 5 participants were internally recruited within the DTU's Department of Technology, Management and Economics. To recruit participants for the second focus group, the research team conducted an online recruitment campaign that was supported by local companies and associations. To recruit participants in Tel Aviv-Yafo, the team collaborated with the carsharing service provider *AutoTel*. *AutoTel*'s marketing department reached out potential participants among current and potential users. In all cities, the participants of the focus group were also asked to complete a questionnaire about their socioeconomic information, such as age, gender, education, income level, and experience with carsharing services. The results of this questionnaire for each city are presented in [Table 2a](#).

Then, after answering and discussing the semi-structured questions/topics defined for the focus group, users were asked to rank different incentives on a scale from 1 to 5, with one being the lowest score. This procedure has been conducted after the discussion in order to avoid influencing the respondent's opinion. The results are presented in the [Appendix B](#). It is important, however, to stress that the sample of respondents does not aim to be representative of the entire population. Therefore, the rank of incentives cannot be assumed to be representative of the population. Focus groups focused on identifying travellers' needs, and the incentives that can help in satisfying these needs. Therefore, the list of incentives was used uniquely to link the needs of different users to their preferences in terms of incentives.

In the case of interviews, relevant stakeholders have been contacted in each city, including city officials, service providers, environmental

associations, and real-estate companies. Particular attention was made to contact different types of operators, from commercial free-floating to local P2P operators. A list of the different types of interviews is presented in [Table 2b](#).

3.3. Data analysis

The qualitative analysis was performed manually using the framework of data analysis presented in [Krueger \(2014\)](#), which is based on the *grounded theory* method proposed in [Glaser et al. \(1968\)](#). The method is briefly summarized in this section. In this research, abbreviated transcripts are used to organize the data. These only includes the relevant parts of the conversation. As interviews were conducted in different languages (English, German, and Hebrew) and some needed to be translated to English, full transcripts would entail a level of detail that is not necessary for the scope of this study and make the translations more cumbersome. Most of the analysis presented in this research is based on translated versions of the original discussions, for which abbreviated transcripts provide a similar level of detail as compared to full transcripts (i.e. word-for-word record of the full interview).

Concerning the coding phase, each city had a local team in charge of collecting and processing the data. A central team was in charge of coordinating the research effort. For each focus group or interview, abbreviated transcripts were divided into quotes. Each quote represented an answer or comment from one participant in regards to one specific topic/question. Each quote received a code/label. The same code was assigned to different quotes that expressed similar concepts. It is important to highlight that codes were not simply associated with words - i.e., a similar word would be classified in the same code. In fact, as the same word can be used to express opposite feelings, codes must rather represent similar comments/ideas rather than similar words. The local teams in each city provided the first codes. These codes were then modified by the leading team, which took care of consistency by assigning the same codes to all focus groups and interviews. The leading team then sent the modified codes to the local team for validation. These procedures continued until central and local teams agreed on the coding.

Once that the initial coding phase was terminated, quotes were grouped and assigned to their original topics/question. Then, quotes were classified as follows:

- The quote does answer the question/is relevant for the topic: Keep the quote;
- The quote is relevant for the topic as well as to another or new topic: Keep quote and copy the quote to all relevant topics;
- The quote does not answer the question but answers another question: Move to the correct topic;
- The quote does not fit in any question or topic: If relevant, create new topic.

By systematically comparing data, links were identified between topics, allowing them to be developed into a larger theme. When all data has been properly classified and new themes could not be created, the process stopped. The entire methodological framework is summarized in [Fig. 1](#).

3.4. Notes about COVID-19

This study has been conducted between February 2020 and April 2020, therefore at the beginning of the Covid-19 pandemic. In this section, we shortly describe how this influenced the current study. First, as a consequence of the Covid-19, the team decided to switch to an online environment. For the focus groups, the video-conferencing platforms Zoom and Web-ex were selected, depending on what was more convenient for both the local team and respondents.

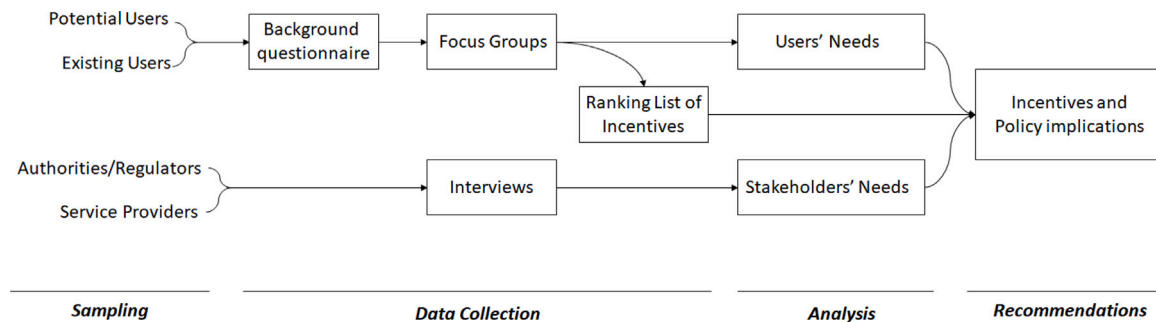


Fig. 1. The methodology adopted in this study.

The focus group in Munich was supposed to take place on March 16th in the facilities predisposed by the City of Munich, Department of Urban Planning and Building Regulations. Due to the COVID-19 outbreak, the free state of Bavaria initiated a full-lockdown on March 13th, so all activities and public events, including the focus group, have been cancelled and put on hold. With the new settings, described above, the focus group was organized and successfully held on March 26th. Only 7 out of the 17 initial candidates agreed to perform the Focus Group online.

In Copenhagen, two focus groups and seven interviews were conducted between the 27th of February and the 26th of March of 2020. While the first focus group and the first two interviews were conducted face-to-face, the second focus group and the last five interviews were performed online because of the lockdown imposed in Copenhagen from the 12th of March due to the COVID-19 pandemic.

In Tel Aviv-Yafo, the focus group was conducted face-to-face on March 1st, two weeks before the first restrictions were imposed in Israel. The interviews which were conducted around two weeks later were performed online. In Munich and Copenhagen, focus groups and interviews were conducted within the first few weeks of the first lockdown, so the answers provided are expected not to be influenced by the long-term effects of the Covid-19 pandemic.

4. Results: qualitative analysis

This section focuses on identifying the main barriers in carsharing systems implementation, and the incentives which can create a more sustainable service. The remaining of this section is thus divided into two. First, we present the main findings from the focus groups, then the major challenges that emerged from the interviews are presented. The categories mentioned in this section explains “why” users decide whether or not to use carsharing. These categories indicate the main barriers that carsharing operators need to overcome and the main requirements that they need to fulfil. The terms *FGT*, *FGM*, and *FGC*, refer to quotes from the focus groups in Tel Aviv-Yafo, Munich, and Copenhagen, respectively. As two focus groups were held in Copenhagen, *FGC1* and *FGC2* are used to differentiate them.

4.1. Users' needs and potential incentives

The analysis of the transcripts revealed that respondents identified thirteen potential areas of improvements where incentives can support the success of carsharing services. These are summarized into five main themes, each of which is discussed in the next subsections. The structure of our results is presented in Fig. 2. The frequency of the labels shows why *frequency* is not always sufficient to detect important topics. The sub-topics *Liability and safety* and *Vehicle settings*, for instance, where discussed less frequently than other topics. However, based on the discussion in the Focus groups, it became clear that safety is perceived as more important than more frequent topics, such as *Electric vehicles*. This is why the *grounded theory* method is a very popular one in the context of Focus groups (Glaser et al., 1968; Krueger, 2014).

4.1.1. Carsharing and car ownership

Overall, the perception and the general feeling towards carsharing services were very good among participants.

- “It solves everything”[FGT].
- “The service gives an answer in weekends and evenings. It is a good solution, quick and available”[FGT].

According to all respondents, carsharing reduces the cost and the stress of owning a car if you do not use it frequently. This is line with other works on carsharing (Jain et al., 2021). Respondents in Copenhagen and Tel Aviv-Yafo, however, showed to be more sensitive to the issue of car ownership than users in Munich. In Tel Aviv-Yafo, reducing car ownership was reported as the overarching objective of carsharing. Focus group participants understand carsharing in the context of promoting a sustainable transportation system: mainly reducing car ownership per household — from two cars to one, and then to none.

- “The goal is [having] no more private cars. Our household has gone from two cars, five years ago, to one car today”[FGT].
- “In general, the idea is to encourage people to use less cars”[FGT].

In Copenhagen, users frequently mentioned in the discussion the dynamics between car ownership and carsharing usage. Users reported that, for carsharing to be perceived as a real alternative, it should be more convenient than owning a car. However, this often happens only on specific destinations or in a densely populated area.

- “I think that for a lot of people, who live in cities, it isn't so cost-effective to own a car [...] to go and pick someone at the station or in the airport. . . is always when I think I would use carsharing, because of the convenience of having a car available when needed” [FGC2].
- “For me to adopt that model, it would need to offer [a level of] convenience that is bigger than what I have at the moment as a car owner. Of course, the price is also very important, but I think that for me the convenience is definitely a key point for the carsharing”[FGC2].

However, respondents reported that unfamiliarity with the different cars available in the fleet of carsharing services is a source of stress and one reason for not considering using carsharing. While this issue is discussed more into details under the theme “*Fleet diversity and setting*”, this lack of trust in the shared vehicle is one more reason to own a private car rather than use car-sharing vehicles:

- “One thing for me is the convenience of owning a car instead of [using] carsharing, because it is my car, I know where it is parked [...]. There is a lot of unknowns for me [when using a carsharing service]. The same thing for the driving itself, I mean, I have driven my car for many years, I know how it behaves, I know exactly how it drives. . . jumping around from car to car [different types of shared cars], I think that it would put me off a little bit. . . I know where my car fits, I know where it doesn't, I know how it behaves”[FGC2].

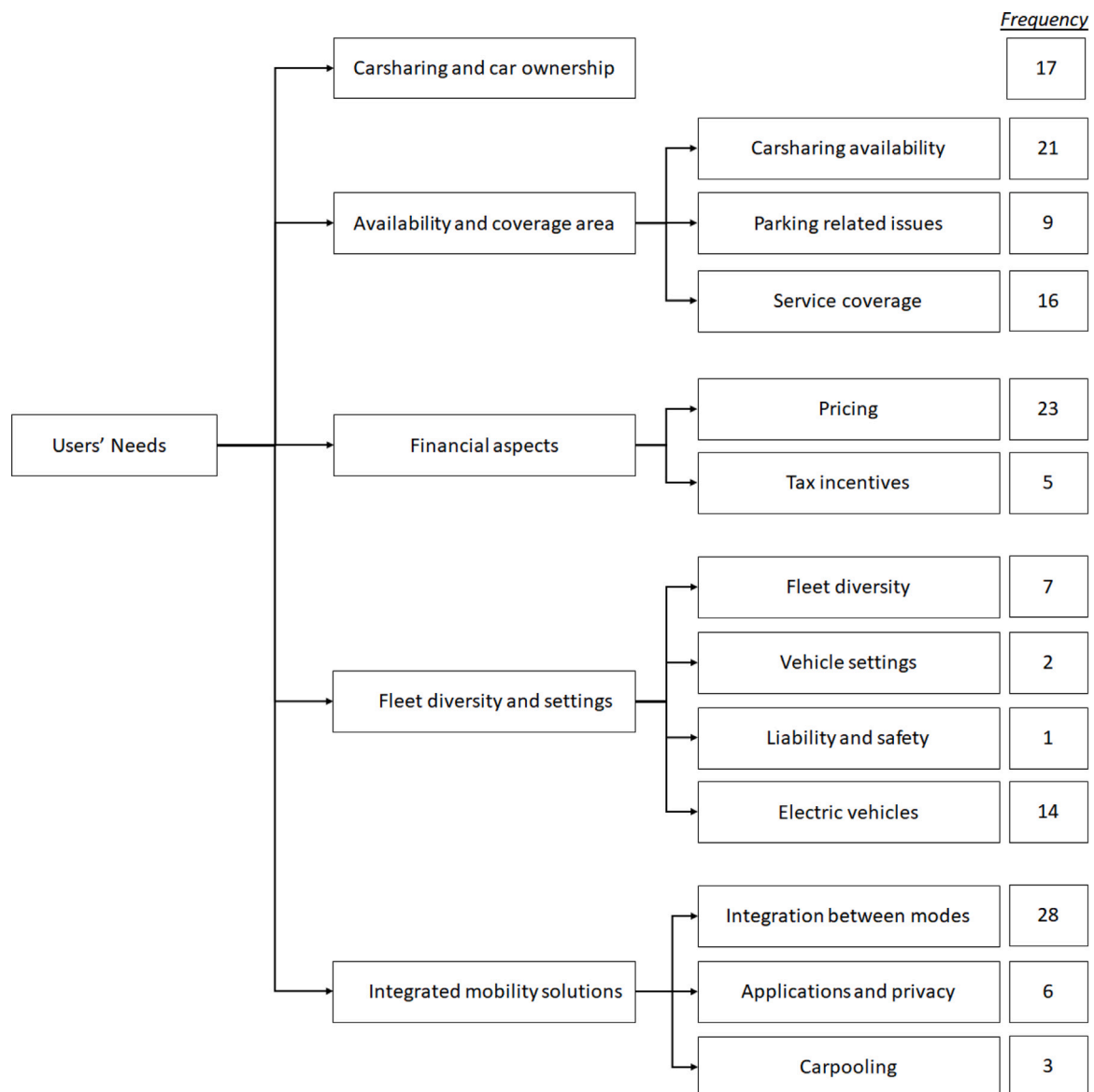


Fig. 2. Main themes and sub-topics that emerged from the analysis of the focus group discussion and their frequencies.

- “I don’t trust that much sensors. Sometimes I can feel that the car is safe... But there is always a little bit of uncertainty about whether the basic things, like pressure [of tires], brakes, level of oil and circuits are taken care of... That is the part where I do not feel safe sometimes”[FGC2].

In Munich, the car-ownership cost was not reported as a major threat to carsharing. This might reflect a major cultural difference between the three countries. Serving as world headquarters for the automaker BMW since 1973, Munich has a high car-ownership rate. At the same time, carsharing vehicles are well integrated into the urban mobility landscape and represent a widely accepted alternative to taxi and car-hailing services. In Munich, for example, the Uber car-hailing company operates but it only uses professional drivers and it is not a popular choice. This is also confirmed from some of the carsharing operators participating in the study, who mentioned how carsharing and car-hailing are often competing in the same market: “Where ride-hailing is strong, carsharing suffers”. Munich hosts several carsharing operators and offers a wide range of alternatives to the user. Despite this diversity, and despite demonstrations that carsharing is reducing car-ownership in Germany (Giesel and Nobis, 2016), our

analysis shows how carsharing in Munich is not necessarily perceived as an instrument to reduce car ownership. If carsharing is not accessible or it is expensive, then users might consider replacing it with a private car: “We actually need a car more in our free time, for weekends, also for holidays and it is getting more and more difficult to get a car (with a carsharing operator)”[FGM].

4.1.2. Availability and coverage area

When it comes to vehicle availability, three main aspects have been identified where incentives can improve the existing services. In all cities, the greatest form of incentive emerged is definitely *car availability*, in terms of availability in the neighbourhood (e.g., vehicles is not available when needed, neighbourhood outside coverage area). Often booking systems are unavailable, meaning that the user cannot plan in advance and might not have a car when he needs it or – worse – the only car available might have a problem:

- “The [shared] cars are unavailable [for me me/my needs]. They are everywhere. Just not in my area”[FGT].
- “[The shared vehicles is not at the designated spot] And then I get 20 min credit. I’m really happy about that, but then I’m on the train for about an hour” [FGM].

- “Any kind of discounts that you can get...if somehow you get a discount if you take a car from a less popular area to a more popular area...”[FGC2].
- “I have a hotspot on the station, so I need to walk [to access some transport], and either to the station or to the hotspot is more or less the same. There is a lot of times where there is no availability of [shared] cars there... I would also access a train [and] I can perfectly know when the train is coming and I can plan towards it, then, [carsharing] is not beneficial for me”[FGC2].

In Tel Aviv-Yafo, participants identified the *carsharing coverage area* as one of the most important issues to be considered. When asked about places that the service should cover, participants referred mostly to cities in the metropolitan area inner and middle belts. As discussed in [Appendix A](#), one of the service providers (AutoTel) operates only within the city of Tel Aviv-Yafo, while the other (Car2Go) also operates in the metropolitan area inner belt.

- “Today’s coverage area is quite limited”[FGT]

High population density helps carsharing services – in principle – to succeed (Millard-Ball, 2005). However, it can also become a major problem in an unregulated market. In all those situations in which dedicated parking spots were not available, *parking* has been described as a major source of stress from nearly all respondents in all cities. Users seem not to perceive a real benefit when using carsharing compared to private car. Several respondents reported this as a major deterrent in some neighbourhoods where scarce parking availability translates into a higher rental cost (considering that users need to pay the vehicle for the entire rental period as well as to worry about the parking ticket).

- “I use carsharing a lot, when I have meetings in Copenhagen (city centre). The main reason for that is because public transport is 3 times slower... However, it is extremely difficult to park in Copenhagen, [which is] another source of stress. If I have a meeting in Copenhagen, I have to always have 15 min just to find the parking [space] and also to make sure that the place where I left the car has no risk of getting a parking ticket”[FGC1].
- “[Parking] was always a big problem for us. We are with [carsharing operator’s name] for about 10 years now. There it was always so that one had to get the car first and then you couldn’t leave it anywhere in front of the door or you had to find a parking space to fix the child seat”[FGM].

Dedicated parking spots are an important incentive to avoid parking-related stress. However, these parking spots can only help if their number is adequate to the fleet size and if local authorities help preventing illegal parking.

- “There are some [dedicated parking spots], but not many... in Copenhagen, if we are competing for parking with the normal cars, then certain times is very complicated”[FGC1]
- “Private cars are parking in [operator’s name] dedicated parking spots” [FGT]

4.1.3. Financial incentives

When it comes to the monetary aspects of carsharing, two main aspects emerged from the focus groups: *pricing schemes* and *tax incentives*. Pricing schemes can encourage both long and short-term rentals, and provide a powerful weapon to fight car-ownership. Respondents pointed out that pricing is in fact the first criteria they ponder in order to decide whether to use carsharing or not, as each user faces the economical decision based on how many kilometres they plan to travel. Another important aspect reported during the focus groups is transparency. The possibility to calculate the cost of usage in advance plays an important role in deciding whether to use the carsharing service or not.

Users reported that they use carsharing mostly because it is cheaper and, in some cases, more convenient than driving a private car. Even car owners described carsharing as more convenient for specific situations than private car, such as the case of one-way trips.

- “We have looked at [the total cost] [...] in the year with everything [included] we have had about 3000 euros of pure rental costs”[FGM].
- “the combination of time price and kilometre price was always the case [with this operator] and that was relatively transparent”[FGM].
- “Although we have our car, usually, I take carsharing with my husband when we travel together and we have a lot of luggage and we want to go to the airport. It is very convenient and I think that is the fastest and cheapest way to do that [FGC1].

However, for some respondents, the pricing packages can be still currently too high. One user highlighted how price can change dramatically due to unpredictable issues, which can change the trip cost and create a significant amount of stress. Some users reported that, when the price of the trip depends on the usage period, they try to drive as fast as they can, sometimes triggering dangerous situations. In general, users stressed that a guaranteed price combined with mobility packages can attract more people to the carsharing platform. One participant pointed out that carsharing should provide better packages so that users can be always certain that they will pay the least amount and can better organize their mobility needs.

- “[An incentive for me to use more carsharing would be] having certainty of price. Because... sometimes you just jump into an event or something that you didn’t forecast... an accident on the highway, and suddenly what you planned is no longer valid”[FGC1].
- “[...] you don’t pay per kilometre, but per minute, so sometimes to save money I just drive as fast as I can to save money [...] but I know a lot of young people actually do it, which is dangerous and something that should change”[FGC].
- “I think that the price is too high per minute for the trips that I am doing and I am not even considering the hourly packages because I have my own car. [The price] has to be really low... to beat my own car, because it is low maintenance and I own it anyway”[FGC2].

During one of the focus groups, there was a heated discussion about tax incentives. Two users reported that, while tax-incentives sound very promising from the perspective of the user, these incentives probably should not be deployed as they would penalize public transportation and not be a good use of tax payers’ money.

- “I would find odd if there was government money spent on subsidizing private companies in the transport sector, while it is fairly expensive to use public transport. We as citizens do not own (carsharing companies names), so if our tax money is going to be spent helping these companies to flourish, I don’t think that is a good idea”. [FGC2].

Only in Tel Aviv-Yafo, participants referred to tax-incentives as a potential indirect incentive to reduce private car-ownership

- “[Taxation should be a] Punishment or taxation for people who hold private cars”. [FCT].
- “Reduction of city property tax if you do not issue a parking permit” / “A parking permit is an asset with a value – the value of a parking space divided by the number of residents. If you do not use this asset you are entitled to compensation” [FCT].

4.1.4. Fleet diversity and setting

When it comes to fleet composition and vehicle settings, four main needs have been identified that can be addressed using incentives: *fleet diversity*, *vehicle settings*, *liability and safety*, and *electrification of the fleet*.

The first element discussed was *fleet diversity*. Users reported that fleet diversity is an important characteristic of the service and that

having access to different vehicles is associated with several positive factors. All users that enjoy driving, including car owners, reported that they do enjoy driving different vehicles and this is a possible incentive for using carsharing instead of their own vehicle. Another advantage of fleet diversity is the possibility to accommodate different user needs. For instance, one user reported that it is useful to have access to a vehicle that is more appropriate for performing specific activities while another reported that he/she can only drive automatic cars and that having automatic vehicles in the fleet is a major element for choosing carsharing. However, some users also reported that car diversity is a secondary aspect, that standard 5 seats vehicles are sufficient in most of case, and that they were happy with a limited types of vehicles.

- “So I’ve basically already driven everything possible with them from the Audi A3 to a Tiguan to a Renault Zoe, so these electric vehicles”[FGM].
- “I like driving. Of course, people who like driving tend to want car ownership. . . but there is a cool thing about CS, which is you get to try different cars”[FGC].
- “There is always a booster in the cars. The accessories are satisfactory and good”[FGT].
- “We are here in [location’s name] and we are very lucky that [operator name] has a wide range of vehicles and I think it is really good that you can get a van [small truck] when you need one” [FGM].
- “Type of car, for me, does actually matter, because growing up in Canada, I only learnt how to drive automatic [cars]”[FGC].
- [Hyundai i10 is in a] “surprisingly good size. We are using it for the entire family. We even used the car to deliver a closet”[FGT].

Vehicle settings have been described as the fleet diversity evil twin. Even drivers who enjoy driving different vehicles agree that changing the settings of the shared car at each time they use it is quite unpleasant. One participant commented that some accessories, such as heated seats, can even create discomfort and dangerous situations.

- “The other day, I was driving a [operator’s name] car and I was going to the airport. [. . .] I was getting late, I just got the closest car. . . the problem was that I was with a very hot jacket, I did not have the time to sit down and take it off. . . I was driving and the heating of the seat was in maximum and it was a nightmare for me. I was starting to burn. . . and with frustration also, because I was trying to get where it was the button. Of course, I finally found the button after had parked and it was next to my foot or something like that”. [FGC2].
- “So far this works quite well. Until 1.5 years ago when I had a child. It is a little more effort to carry the child seat to a carsharing car”[FGM].

During the focus group, users discussed vividly liability and safety issues. While this topic was not discussed frequently, it emerged as a very important one. Some users reported discomfort related to the uncertainty of the conditions of the car as well as liability (i.e. being charge for pre-existing damages). However, it emerged that not taking care of the insurance as well as the maintenance is one of the main advantages of using carsharing.

- “With [operator’s name] you first have to go around the car, see if there is any new damage, compare it with the board book, see if there is new damage, of course, you have to report if the car is dirty”[FGM].
- “I am at the point today where I just don’t feel like dealing with these things [insurance] in detail” [FGM].
- “[by using carsharing you have a car] without the problems. . . that was the nightmare that I have with my previous car [owned]. . . maintenance, insurance. . . I feel like it [shared car] as my own car right now” [FGC].

When it comes to the electrification of the fleet, the overall feeling was positive. However, a main concern comes from the perception that there is not enough infrastructure currently to rely exclusively on

electric vehicles. Electrification is a secondary aspect when compared to vehicle availability and, as we will discuss in the next section, integration with other modes is a crucial aspect.

- “So I use it [carsharing] regularly but not weekly. And I’m a fan of it, too. I think it’s just great. I use electric vehicles and also small [vehicles], what for me, not exactly a talented parker, is quite good”[FGM].
- “The number of charging stations is a barrier in order to the complete transition to electric vehicles”[FGT].
- “[concerning electric vehicles] I want to have a provider and use the possibilities that are given. Whether it is an e-scooter or a car or something else, I don’t care”. [FGM].

4.1.5. Integrated mobility solutions

Concerning the possibility of integrating multiple services, three main observations have emerged.

Integration between modes is perceived as a main limitation of the current systems. On the one hand, digital integration is still perceived as extremely futuristic by most users. On the other hand, almost all respondents – members and not – pointed out that this would be an important incentive to reduce car-ownership in the city. Users eagerly asked for integrated services and showed a strong willingness to adapt to it.

- “I think a big thing is always this organization history [setting up the service]. I need an app, I need an account, I need this, I need that. I think if you have it once, once you are inside, once you have wised yourself up, it will work”[FGC].
- “So I imagine it would be like Google maps and I see the different providers and I click on them and have an account in this system and they charge each other. That would then perhaps take up the problem”[FGM].
- “If I get a day ticket in Munich today I can go by bus, subway and tram. If one would increase the offer and include other mobility services. If I take a car or one of these e-scooters, if I have the possibility to use all of these [new services], it would give an enormous range of options”. [FGM].

Another topic that emerged during the discussion was applications and privacy. The respondents reported how the existing (smartphone) applications offer very limited support when it comes to integration. Related to carsharing services, the application should provide information about overnight parking and booking systems and suggest different routes/transport modes. Another issue reported was privacy, as respondents reported concern about the current data protection settings. Other users reported that providing more information on data privacy is probably not a good strategy, as the general tendency is not to read all the information in detail. One user pointed out that having a third-party validation would be a good incentive to make users feel safer with regards to how their data is being handled.

- “It is a matter of principle. . . I worry about the ownership of my data” [FGC].
- “From the moment I am using, I am agreeing to share this with that company. But I want to make sure that only the company [I agreed with] uses it [the data] for wherever I have consent” [FGC].
- “The app should let us know an estimated time when a car will be available”[FGT].
- “We should be able to report when an unauthorized car is parking in a designated parking. When the tow truck arrives, it can remove the report”[FGT].

Another aspect discussed by the respondents was the combination of carpooling and carsharing services. However the perception of respondents in regards to this matter was different in the three cities. In Munich and Copenhagen, such an integration was not positively

perceived by all participants, as some argued that this would jeopardize the flexibility of the carsharing system or make people uncomfortable by sharing the car with strangers.

- “I don’t think that I would be so happy if I was planning to take a carsharing to go from one place to another, just one time on a Sunday evening and some guy also want to go in the same direction. I doubt that I probably picked that guy up, I just think that it would seem a bit odd. But if I was going to work or up to [place of study], then I would definitely do it”[FGC].
- “I think it is a good idea [combining car-pooling and CS], it could be an incentive for a lot of people. It could be nice to have more people in the car, it could be quite good for a lot of people that are very environmentally conscious”[FGC].

In Tel Aviv-Yafo, however, integrating carsharing services with other mobility services such as carpooling was highly prioritized by the participants. When asking about combined ticketing or transit passes there was a unison call for promoting such solution (see also in the ‘perception and general feeling towards CS’ in the section above). When asking specifically regarding the integration of carsharing and carpooling, participants replied the following in Tel Aviv-Yafo:

- “The service should be extended beyond the service subscribers – carsharing for Carpooling. . . it should be integrated in the app”[FGT].
- “Everyone who lives in the city will be able to use it. This can shorten the registration process. If the additional user pays the relative travel price, there is no problem to deviate from my route for picking him/her up”[FGT].
- “I’ll agree to leave 15 min early to save costs”[FGT].

4.2. Stakeholders’ needs and potential incentives

In this subsection, we present verbatim quotes (or our translation of them, if they were not in English) from the interviews with the stakeholders (list of stakeholders provided in Table 2b). With their experience with the carsharing business, the interviewees provided various insights into the current main existing barriers for carsharing and how incentives can help to mitigate these barriers. During the interviews with the stakeholders, four main themes received significant attention in all cities, and appear to be the most relevant topics when studying new incentives. These themes are “Incentives related to regulation”, “Incentives to integrate carsharing with other modes”, “Direct and indirect incentives”, and “Incentives to promote social equity”. The alphanumeric codes associated to each sentence are only used to identify quotes in the transcripts and carry no information, as this would violate privacy agreements with the respondents.

4.2.1. Incentives related to regulation

As reported by the interviewees, the effectiveness of carsharing incentives depends entirely on the regulatory framework, the vision of the authorities, and the vision of the operator. In this sense, incentives can appear in the form of regulations, providing the proper tools to reduce the attractiveness of private cars. Some stakeholders also stressed that incentives are an important tool that authorities can use to fulfilling their mobility agenda. The most important aspect is that, despite not always sharing the same objectives, operators and authorities agree that a highly regulated market can better support carsharing services. In the quote below, one operator (free-floating service) describes how important it is to have a regulated, and even a closed market:

- “It does not matter if you are a car renting operator or a carsharing service itself or even a hotel that offers car to rent, legal barriers are the point. There are very different and very specific conditions and there is no overall legal system, and that makes it very complicated from their side” [JB-4].

- “Milan for example had a closed market, you had to apply for it and nobody else could join the market. [...] Milan is a very progressive example, as they learned a lot over time, and it is one of the few cities that was dictating business area, driver age, and policies” [N-10].
- “[carsharing] is not sustainable commercially unless it is considered in a larger scheme”[N-22].

Four sub-topics emerged when discussing the role of the regulators. Each of these topics is briefly discussed hereafter.

Regulation of carsharing and car ownership: According to the public authorities interviewed, carsharing should be regulated as a complementary service, addressing challenges that the current public transportation system fails to solve, for which carsharing – and more specifically station-based carsharing – is a powerful instrument to fight car ownership.

- “The challenge for the station-based carsharing is that you have offers for people that are really substituting the car” [CH-3].
- “The easiest [way to deploy carsharing] is a bilateral agreement without incentives. But if there is a specific goal, such as equity, then you can put incentives but they need to be used moderately to get as much demand as possible”[CH-24].
- “[the question for the authority is] What would be more effective – to invest in [name of a provider] or to invest in public transport lanes?”[TAY-3-12]

Collaborative carsharing and real estate: From the point of view of the operator, companies say that the easiest way to organize a good service is to directly collaborate with big corporations and provide carsharing for business. For instance, incentives should be used to prevent people moving to new areas from purchasing a vehicle:

- “[carsharing] should be integrated in large scale development projects as a way to decrease private cars ownership and space allocated to parking”. [TAY-1-4].

Carsharing parking: Parking was a recurrent topic during both interviews and focus groups. Operators reported how limited support from the local authorities/municipalities in this direction is one of the main reasons to create a service that is more expensive and less efficient (or equitable).

- “For example, we also find it very hard to make agreements about parking. [...] Until now it’s not been possible for us to find any agreement that would actually make room for our vehicles because we are seen as just more cars ”[E-11].

The issue with providing dedicated parking spaces in cities for carsharing services involves also a discussion on the allocation/reservation of public spaces to help private companies.

Carsharing electric cars: All stakeholders discussed how the electrification of the fleet is an important aspect for modern carsharing systems. When asked what are the main limitations, interviewees explained that there is not enough infrastructure available to use only electric vehicles at the moment and that this prevents them to seriously commit to electrification.

- “Number of charging stations is a barrier in order to the complete transition to electric vehicles as well”[E-12].

Copenhagen is a living example of this challenge. The city has made significant investment in charging infrastructure. This is due to the fact that the country has the ambitious target to make most of its fleet electric by 2030. This target includes all vehicles — from private cars to carsharing and even taxi. Together with the increased number of charging stations, the state also deployed tax incentives to purchase electric cars, while at the same time is increasing ownership cost for traditional combustion engine cars. Following this trend, many

carsharing companies have significantly increased the number of EVs in their fleet and one company – Green Mobility – has only electric vehicles.

4.2.2 Incentives to integrate carsharing with other modes

The second theme that emerged from our analysis is *integration*. Integration between different transport modes is often described as the panacea for urban mobility. However, integration is only possible if service providers agree to collaborate. The analysis of the transcripts suggests that barriers still exist and that more incentives are needed to promote integration. In general, both public stakeholders and private operators agreed that there is a need to incentivize integration between carsharing services and other mobility solutions:

- “As a city, we try to integrate it [carsharing][...]. We implemented mobility hubs, where different mobility options are integrated” [CH-5].
- “What would be more effective is to invest in [name of a public transport operator]. But often [the integration process] is a bit slow” [N-17].

Selling integrated tickets (public transport and carsharing), introducing new pricing strategies, creating mobility hubs and using digital marketing are few examples on how to promote integration. One important aspect for private operators is the time frame for that. Some interviewees reported that it can take several years to integrate a single carsharing operator within a larger transport system and that delays are mostly related to public authorities and public transport operators, which are less motivated to speed up this process. To overcome this issue, many operators discussed the possibility to create a separate platform that integrates private services while excluding public operators. Larger companies like *Share Now* and *Sixt share* have already developed such a system in several cities, including Munich. These platforms allow the user to see multiple travel options at the same time and choose what is more convenient.

- “It would make sense to build a subscription which is on top of this aggregation platform from public transport” [MI-17].
- “We implemented mobility hubs, where different mobility options are integrated. And this is not only [for] carsharing, but bike-sharing, electric vehicles, and they can be combined with public transport by creating a very rich transport node. But this integration should be also digital, which is even harder” [CH-5]. =

The digital integration of fares is difficult because operators need to have an agreement on how to collect the fare and how to fairly divide it among transport operators of the modes used (as different transport solutions require, for example, different levels of investments on infrastructure, different operational and maintenance costs). About the *integration between car-pooling and carsharing services*, the perception of operators varies. For station-based carsharing operators and for public transport operators this would make sense, while for free-floating this is a less appealing option as it requires the users to drive extra kilometres and have longer travel times.

- “We thought about it [combining carsharing and car-pooling] but it’s not something that we do. It’s not a really big thing we think. Often when you do this carpooling then you have to drive extra kms to pick up a person and each km costs. So I don’t know how a big incentive it is really but people are free to use it” [G41-42].

Another type of incentive that has been positively evaluated is the possibility to introduce *mobility credits*, but it does require more integrated services.

- “(Mobility credits) This is the entire MaaS [Mobility as a Service] idea. I believe in this idea. I do not think we can use mobility credits in the supermarket, probably, or outside the transport system. But because I think we are not there yet” [CH-32].

Finally, when it comes to software development, some private business already started creating *integrated platforms*, developing applications where carsharing, micromobility solutions, and even public transport are integrated. The integration is usually – but not always – limited to choosing between multiple alternatives and does not offer integrated fares. Even in this simple case, the integration between carsharing and public transport can be complicated due to differences in the level of digitalization of services and, in this sense, companies should help in the solution for compatibilization:

- “We also see of course that many who use public transportation use our service combined and then of course, we also see bicycles. For the future development our biggest competitor is the private car. [...] when you go in this map function, you can actually choose the [carsharing operator name] vehicle and then you’ll be pushed to our app. So that’s one incentive” [E-16, E-21].
- “Carsharing companies are very advanced with their apps and the digitization of their services. So I think [they could] use their abilities in that area in order to make... something that really works for customers” [D-17].

4.2.3 Direct and indirect incentives

Whether we are talking about existing services or new ones, carsharing has enormous initial costs, including fleet acquisition, management, and insurance costs. These difficulties can be harnessed by planning authorities to incentivize providers, helping business success in exchange for imposing conditions. During the interviews, respondents highlighted the existence of two main forms of incentives that can be used to promote carsharing. *Direct incentives* represent incentives that directly reduce the cost and/or improve the service. These include, for example, the parking cost. *Indirect incentives* are instead related to external factors, such as the availability of charging stations or integration between services.

Electric vehicles: A first indirect incentive mentioned by the respondents is the development of the proper infrastructure for electric vehicles, as this would provide the operators with the possibility to upgrade their fleets. First, there is a need to promote emission-free vehicles. Second, station-based carsharing business model is operationally more suited for environmentally friendly solutions, as it can more easily adapt to the infrastructure.

- “[The use of] Electric cars have restrictions due to the charging infrastructure” [SB-1].

Marketing strategies: Several interviewees highlighted that indirect incentives such as marketing and communication strategies could be an important asset, as the public at a large is often not aware of the available services, and a large pool of unaware potential users exist. Other respondents explained how different companies can cooperate in order to help each other having more visibility.

- “We have some cooperation like marketing cooperation, for example with Ikea, if you come with [operator name] you get a free hotdog” [MI-32].
- “I think that some people don’t know about the [CS] system. You have to invite new users into the system to get it more used” [F-8].
- “What I want to emphasize is that a lot of people don’t know [about carsharing services]. Awareness is in general low” [A-62].
- “We have made a lot of agreements with other associations. They promote us towards their members, and then they get a discount” [G-40].

Examples of *direct incentives* include pricing, parking, and fleet diversity. These incentives are in line with what was already discussed when analysing users’ needs in the previous section. Specific importance was however given to pricing. Carsharing operators find

themselves in a very difficult position, as low prices translate in cannibalization of public transport while high fees lead to losing customers. Carsharing operators should define appropriate prices, so that carsharing becomes an alternative next to public transport, instead of a competitor.

- *“I think there it should be a stronger public transport and then it [carsharing] should be a second choice. [...] So, we should have some incentives that shows when we want people to use the carsharing cars and when to not use them” [F-22].*

4.2.4 Incentives to promote social equity

According to both private and public stakeholders, carsharing in its current form is not equitable in the cities studied. The service is still very expensive for many people (in comparison with public transport) and operators are not necessarily interested in covering all areas of the city and its metropolitan area. Incentives can help to mitigate this inequity. According to our analysis, incentives should be mostly used to address social issues and allow low-income households, who do not own a private car, to use it when there is a need. Additionally, as pointed out from one of the interviewees, carsharing is not always profitable without public incentives. This means that carsharing services without the support from the authorities will hardly promote social equity. According to our interviewees, outside the cities is where the carsharing system suffers the most to profit.

- *“It [carsharing business model] is just based on cities, there are very rare offers in the countryside or rural areas, so you always need this critical mass to bring this system, like in the city” Environmental organization.*
- *“Subsidies are needed for bringing the vehicles to the area where is not profitable. The problem is not the demand, but the fact that cars stay there after” Free-floating carsharing operator.*
- *“We see not all areas obviously are good areas even in Copenhagen, so a price differentiation to hit better between demand and supply in certain areas is also a strong incentive [for users]” Free-floating carsharing operator.*
- *“So why we implemented our own [carsharing system] system here [in this location] is because these companies [conventional carsharing operators] can't earn money outside Copenhagen” Local authority.*

Direct incentives are thus needed to compensate for this imbalance, but pricing policies alone might not be sufficient, as one respondent explained to us. Next to pricing, positive incentives comprise parking policies — including different pricing schemes between different areas of the city, and mobility hubs/stations that integrate public transport.

- *“If it is a price problem, let's bring the price down as it is convenient for us [to stimulate fleet re-balancing]. Still, people do not bring the car back in the morning. This means it is not a price problem, it is something else. Probably public transport works better in the morning” [N-14].*
- *“I believe in privileged parking lots. But you also need to reduce access to private cars” [CH-25].*
- *“We try to come up with concepts that make sense in private or public spaces. Our concern is to implement mobility concepts sensibly within neighborhoods” [MV-5].*

Finally, an important topic was whether carsharing operators should be subsidized from the public authorities or not. While partially related to regulations and role of the authority, interviewees were asked if carsharing is a profitable in the current settings. The answers on this topic were different. Some operators have a nonprofit-business model and consider carsharing as an extension of the public transportation. In this case, subsidies are considered an important tool to promote carsharing as an alternative to private-car ownership. Other operators, however, have a more business-oriented mindset and mentioned that

carsharing should be a self-standing business and subsidies should only be used to increase the coverage area, as discussed in the previous point.

- *“Carsharing as a standalone model would work, no. It is not sustainable commercially unless it is considered in a larger scheme [such as car-rental, car-hailing]. Should it be subsidized? No. I believe in free market”. Free-floating service provider.*
- *“I don't think we will ever reach a point where we will be fully solved to stay in [to be profitable]. We will need to rely on help from the government in order to create a better experience with our service”. Free-floating service provider.*
- *“If new things are promoted, we need support. When it comes to electromobility, we need support, not just directly, but also as communication. Above all, changes in regulations must be economically viable” Station-based service provider.*

5 Discussion and policy recommendations

This study introduces insights into carsharing users' and stakeholders' needs and how incentives can help satisfying these needs and aligning goals. The analysis shows that respondents think that incentives can be used to promote carsharing as a sustainable mobility option, design a more equitable system, and advance emerging mobility concepts such as integrated ticketing or – in the long run – Mobility as a Service (MaaS). The Policy recommendations are presented considering the same categories mentioned during the stakeholders analysis. Additionally, the feedback from the users received in the focus groups about these recommendations is also included in the discussion. When not specified, the term *respondents* refer to all respondents - i.e., both participants of interviews and focus groups. Finally, a list of potential incentives is presented. Some of these incentives appear multiple times, as they can impact different user's and stakeholder needs.

5.1 Regulatory aspects

There is a relationship between incentives and how the regulatory framework is setup. Several forms of setups serve to incentivize carsharing operations. The regulation can be defined according to partnerships between public authorities and private operators, can be set by public authorities or can be based on collaboration — ongoing dialog. Emerging from the analysis of the interviews, it is evident that a partnership can be a convenient arrangement for both carsharing companies and public partners.

However, an excessive public–private partnerships is perceived negatively by some carsharing operators who declared that they have no interest in becoming heavily subsidized. Such free-market-oriented companies often have carsharing as a sub-product within a larger business model (e.g., car manufacturing or car rental), which contributes to the overall success of the company in various forms, such as complementing other mobility offers, visibility, and marketing. These types of operators are typically large free-floating companies that aim to compete mostly with taxis and car-hailing companies. For this type of company, direct incentives, such as parking incentives, can be adopted, for example, to encourage them to provide shared cars in areas of potentially low profitability. Other forms of incentives for them should focus on the integration aspect, as these companies are often quite motivated to get more visibility and a higher market share.

Other carsharing operators, on the contrary, have a nonprofit business model, relying heavily on public provided subsidies. These companies are often – but not only – more traditional carsharing services, such as station-based but also free-floating services characterized by small operational areas. While usually requiring a high registration fee — these services proved to be quite successful in targeting drivers who are willing to get rid of their private car or remain car-less. The success of this business model depends on the rental cost – often a

combination of time and distance – being low and easy to estimate in advance. Differently from free-market-oriented companies addressed in the previous paragraph, these companies require more direct subsidies to keep their business alive, having no alternative business model and directly serving car-ownership reduction goal.

Where available, peer-to-peer service providers have the potential to overcome some of the issues discussed earlier, specifically the upfront cost associated with other carsharing business models, as they have lower initial costs. However, peer-to-peer carsharing solutions have other major limitations that cannot be solved without proper support, such as regulatory barriers, which make this business model challenging if not impossible in some countries (e.g., car insurance, taxation). This means that regulations and integration related incentives are the main tools to promote this type of service. Without proper integration, these services stand the risk to become an Uber-like mobility service and, eventually, even increase congestion. This risk of course can occur with all carsharing services. The difference, however, is that in traditional carsharing services the operator is directly responsible for the fleet, and regulators can easily communicate with each provider. In P2P, the decentralized scheme creates an additional level of complexity that might be impossible to control without a proper regulatory framework.

These issues presented themselves differently in the three cities. In Tel Aviv-Yafo, where only two operators coexist and one of them is highly subsidized, respondents from both focus groups and interviews are concerned with carsharing's environmental contribution. They argue that incentives are required towards car ownership reduction, and that incentives for carsharing should only be used in this context. For such cities where carsharing is still developing, one of the main challenges to promote carsharing is to demonstrate its effectiveness in the fight against car-ownership and draw a viable deployment road-map. Integration of carsharing with carpooling and with public transport platforms can also serve a similar purpose of substantiating the potential environmental benefits of carsharing.

Carsharing in Munich is mature, being part of everyday life for many citizens that live in the metropolitan area, resulting for many individuals in car ownership replacement (as reported in the focus group). The carsharing market offers a large variety of services, with peer-to-peer carsharing services one of the few missing options. Operators reported overall a positive experience when dealing with the local authorities, which have dedicated teams working on carsharing related issues and promoting its integration with the other existing mobility services. The main challenge related to the support of carsharing solutions is related to the design of incentives that can help authorities in achieving their mobility goals, specifically in regards to providing carsharing as a solution even in less financially attractive neighbourhoods, reducing parking demand and shifting demand from private car to public transport.

Finally, carsharing in Copenhagen is extremely advanced, with multiple existing operators ranging from free-floating to peer-to-peer carsharing services. However, from a regulatory point of view, the city still does not offer an ideal environment for carsharing services. Some service providers reported difficulties in initiating a discussion with the authorities, mostly because many different offices are responsible for carsharing regulations and finding the right one is challenging. The situation is more complex when considering that innovative mobility solutions at a regional level often crossover Danish and Swedish authorities, adding other barriers on top of the existing ones. On the other hand, local authorities in Copenhagen have already started several initiatives to support carsharing, including the deployment of charging stations and the introduction of incentives for electric vehicles and parking (in the case of station-based systems). One of the main challenges is that free-floating services in Copenhagen seem not to have a significant effect on car-ownership (Garrett et al., 2021), which is one reason for the authorities to offer less incentives to this type of service compared to other alternatives (such as promoting electric

vehicles). Integration incentives here should include the definition of an integrative public body to address sharing mobility and clear conditions on what are the requirements for receiving support from the local authorities.

Essentially, carsharing clearly cannot tackle car-ownership on its own as a standalone free-market solution. Integrating carsharing services with other mobility solutions can help it to become a sustainable solution. Authorities can incentivize this integration by triggering this process and supporting it. From the regulatory point of view, stronger policies to fight car ownership are needed. If the authorities have not a clear plan, or if carsharing is not included as a part of it, incentives are likely to have marginal or no effect. Defined long-term strategies to promote sustainable mobility, and dedicated offices/responsibilities within the administration to deal with carsharing operators can play a relevant role in developing effective carsharing incentives.

5.2 Integrated Mobility services

As the previous sub-section highlighted, integration with other transport modes is an important aspect for carsharing. Without integration, both authorities and users will consider carsharing as a simple alternative to private car. While this is not necessarily a negative attribute, authorities may be reluctant in promoting such a service and would more likely consider it similarly to private automobiles when developing new policies such as closing the city centre to cars. Thus, exploring better ways to integrate carsharing services and make urban mobility more sustainable serves both operators and authorities. On this topic, the answers were extremely consistent in all cities. Integration is a priority for most of the respondents, from public authorities to service operators and citizens associations. However, it also emerges that, currently, the services are not sufficiently integrated and the integration level is inconsistent between the cities.

In Munich, where carsharing is going strong, one incentive that has been deployed is to develop mobility stations close to public transport stops. However, some respondents (interviews) reported resistance from the public transport operators to allow carsharing providers using these stations. This is mostly because – based on our interviews – many carsharing trips are replacing public transport trips. This is particularly true for free-floating services, as observed in previous studies (Garrett et al., 2021). This potential competition with public transport makes physical integration more challenging. Carsharing needs therefore to be implemented in a way that does not compete with public transport and promotes integration. This can be achieved, for instance, by deploying pricing policies (parking fees, discounted rates on certain routes) that can reduce the competition between the two modes. Another limitation is that digital integration is often too slow, as it takes years to integrate all mobility services into one single application. Similar problems have been reported in Copenhagen, where the digital integration process took almost 8 years for one operator. In both Copenhagen and Munich, private operators reported that they are already integrating other services within their own platform in order to speed up the process. Finally, for Tel Aviv-Yafo, integration also emerged as a barrier that needs to be addressed, having no current integrated digital platform. Respondents from the interviews suggested using the development of the new light rail network in Tel Aviv-Yafo as a catalyst for a holistic approach to transportation, where other mobility services – such as carsharing – are not anymore considered as isolated services but as part of a larger ecosystem.

In all cities, the major solutions pointed out by the participants (interviews and focus groups) are the creation of mobility stations, provision of integrated ticket services, mobility packages that combine carsharing with public transport (MaaS like packages), and mobility credits (to use in exchange of goods but mainly for mobility services).

Table 3
Most mentioned Incentives to meet users' and stakeholders' needs.

Incentive/Action	Thematic area	Indirect	Example from transcripts
Clearly regulated market	Regulatory aspects	X	"At the very beginning it was a barrier to start it out in terms of insurance and in terms of getting the permission to do it. Nobody knew who really to contact so we were contacting different authorities" [C-22]
Private car-free areas	Regulatory aspects	X	"I believe in privileged parking lots. But you also need to reduce access to private cars" [CH-25]
Dedicated parking facilities	Regulatory aspects Integration	X	"Normally they [carsharing vehicles] don't have a designated area, so I have to find a parking space with my [private] car as well" [FGM]
Reduced parking fees	Integration		"Depending on the city, the cost [of parking fees] is between 5 to 15% of our cost" [N-10]
Mobility solutions integrated APP	Integration	X	"I started a dialogue with them [the local authority] and it took 8 years before they integrated [the service within the digital system]. These processes take too long. Now we have to import the software from Germany" [C-38].
Mobility hub	Integration Sustainability	X	"We are interested in joining a common platform as we already collaborate quite closely with public authorities and public transport operators" [N-16]
Coverage outside the cities for longer trips/connectivity between big cities	Integration Equity	X	"If I travel to Kfar Shalem or the Yarkon Park [areas outside city center], I don't know if there will be an available car to come back" [FGT]
Integrated ticketing/mobility packages	Integration Equity Sustainability	X	"It would be great if you can agree to MaaS [Mobility as a Service package] and pay one ticket for all" [FGC2-27]
New infrastructure for electric vehicles	Sustainability	X	"Number of charging stations is a barrier in order to the complete transition to electric vehicles as well" [E-12]
Dynamic pricing/incentives for fleet re-balancing	Equity Sustainability Promoting carsharing	X	"Any kind of discounts that you can get... if somehow you get a discount if you take a car from a less popular area to a more popular area... if there is a problem that many cars are there [less popular areas] for too long" [FGC]
Clear and consistent pricing	Promoting carsharing		"The combination of time price and kilometre price was always the case with [operator name] and that was relatively transparent" [FGM]
Guaranteed vehicle availability	Promoting carsharing		"[I would like to use it [the carsharing service], but the [shared] car is not there" [FGM]
Private car taxation	Promoting carsharing		"[I believe that we should have Higher] taxation for people who hold private cars" [FGT]
Marketing and communication strategies*	Promoting carsharing	X	"What I want to emphasize is that a lot of people don't know [about CS]. Awareness is in general low" [A-62]

5.3 Promoting equity and sustainability

Public authorities in general try to promote sustainable solutions and social equity while addressing mobility improvements. When referring to equity, we mostly refer to how accessible the carsharing is for all users in the transport system — in terms of costs, technology access, and space. In a completely unregulated market, without any form of incentive, equity is likely to be neglected. Carsharing works best in highly populated areas, making different areas of the city not equally profitable. It is almost impossible to expect similar level of services in the city centre and the suburbs – not to mention rural areas – with an unregulated market. While equal access to carsharing is not necessarily a goal that should be pursued, carsharing can support equity while serving areas where mass-transit is inefficient. Stakeholders' opinion on this subject differ in the cities. In Tel Aviv-Yafo, for example, policymakers showed doubts about promoting carsharing instead of public transport and stressed that carsharing should be accessible to low-income people, which however is not likely if the service is not properly subsidized. Operators in Munich reported their willingness to provide a good service in all areas of the network but also stressed that incentives should help to make such business model more profitable. In Copenhagen, which offer an impressive range of carsharing services, operators reported that the main problem with equity is the lack of support from the authorities, which in turn said that rethinking/creating a business model that work in low density areas is essential. Based on the results of our analysis, incentives, and in particular, financial incentives, should mostly be used to support equity, resulting in alignment of public and private objectives. This vision can happen through a series of incentives discussed in the previous sections, including integration, pricing, parking policies (e.g. reduced parking fees for those operators that cover certain areas), electrification, and increased service accessibility.

5.4 Promoting carsharing: direct and indirect incentives

When it comes to incentives, responses from both interviews and focus groups could be separated into two main categories — *direct* and *indirect* incentives. Direct incentives directly reduce costs (reducing the parking cost is one example of a direct incentive), while indirect incentives, as the name suggests, consist of introducing elements, such as mobility stations, that modify the existing transport offer in favour of carsharing.

Direct incentives: Most respondents focused on three main direct incentives that can make carsharing more profitable for the operator and more attractive for the users: parking, pricing, and tax incentives.

- *Parking:* Parking is by far the most important direct incentives, ranked highest for users as well. In Tel Aviv-Yafo, interviewees claimed that carsharing should always have a sufficient number of parking facilities in the most attractive areas (such as transportation hub, commercial centres and High Tech zones) to enlarge the customer base and reduce the cost associated to carsharing (e.g., users driving further while searching for a parking spot). In Munich, respondents from the interviews reported that as parking is a significant cost for operators, local authorities could use it as a leverage when negotiating with carsharing operators. In Copenhagen, operators reported limited support from the authorities, and that parking-related incentives would support both cost reduction and a higher level of service of the system. This should include dedicated parking spots to reduce the rental period and thus the overall cost of the service for the users but also decrease the fleet management costs for the operator.
- *Pricing:* A good implementation of carsharing services is about balance. Low prices lead to the cannibalization of public transport while high fares reduce carsharing competitiveness with taxis and

private cars. Some respondents stressed that carsharing should be an alternative to private cars, car-hailing, and taxi. In this context, pricing is the main controller. As the price for other mobility services (e.g., public transport, taxi) change from country to country, authorities should make sure that the price of the carsharing is low enough to make it a strong competitor for private transportation, taxi, and car-hailing, but high enough to keep public transport overall more economically advantageous. Subsidies incentives may be needed to help carsharing operators maintaining a balanced price.

- **Tax-incentives:** Nearly all respondents agreed that tax-incentives for operators should be only used to promote sustainable mobility options. Carsharing services should be eligible to them only when: (1) promoting electrification of the carsharing fleet (or emission-free vehicles in general); (2) having the same taxation as the highly regulated taxi operators when complying to similar regulations.

Indirect incentives: The three most popular forms of indirect incentives are incentives related to integration, marketing and communication strategies, and promoting fleet electrification.

- **Integration:** As highlighted before, integration is a major player in the transport market. Integration can help service providers enlarging their consumer base, complement other mobility services, develop mobility packages in collaboration with public operators and, thus, develop a wider range of personalized incentives and mobility packages. A well-integrated mobility system is also a fundamental incentive to avoid cannibalization of public transport.
- **Marketing and communication strategies:** Emerging from Munich and Copenhagen discussions, marketing and communication campaigns can help service providers to make customers aware of alternatives to private automobiles, including carsharing. By showing carsharing as a more convenient option and organizing free trials, the operator can not only showcase its mobility offer but also propose a personalized package to the users engaged in the activity.
- **Promote electrification:** As emerging in all the cities studied, transition to electrification can only occur with strong support from the public authorities. Some service providers are willing to switch to electric vehicles as soon as the conditions mature. This means that (i) the vehicles should meet all different users' needs and (ii) the city needs to have the infrastructure to support EV vehicles — e.g., sufficient number of accessible charging stations, and reasonable charging prices. Carsharing operators will naturally shift to electric vehicles once that the market is ready but will hardly push for electrification without proper support. As mentioned, Copenhagen is a good example in this sense. The local authorities have been using different policies that promote electrification, including tax reductions and wide deployment of charging stations not only in the city but also in the suburbs. While these policies do not target carsharing explicitly, carsharing operators took advantage of it, increasing the number of EVs to the point that one operator (Green Mobility — free-floating) uses only EVs.

Finally, [Table 3](#) provides a list of incentives that can be used to address each of the challenges discussed in this section. The incentives are divided into the thematic areas discussed in this section.

6 Validation using quantitative data

The characterization of the cities and findings described in the previous sections were used as input to develop a survey made available in Copenhagen, Munich, and Tel Aviv-Yafo between July and September of 2020. A sample of 1277 respondents is used in our analysis (543 from Copenhagen, 490 from Munich, and 244 from Tel Aviv-Yafo).

For a detailed analysis of the survey, please refer to [Monteiro et al. \(2022\)](#). This section provides a short overview of the answers related to carsharing incentives and aims to validate the observations made in the previous section.

The survey was designed to collect comparable data across the different cities being studied and different typologies of carsharing services. A specific section of the survey focused on carsharing incentives. Based on the discussion presented in [Section 5](#), incentives were presented into five categories: *Pricing/cost*, *Vehicle characteristics*, *Parking of shared cars*, *Flexibility of the service*, and *Service characteristics*. Each respondent was asked to choose what they believed to be the three most important factors of each category.

The results, which are shown in [Fig. 3](#), support what already emerged in [Sections 4 and 5](#). Not surprisingly, dedicated parking lots, pricing/cost related incentives, and combining carsharing plans (e.g. daily/weekly packages) are the most important type of incentive for the respondents in all cities. In line with the discussion in [Section 5.4](#), parking related incentives are also perceived as fundamental in all cities. This is not surprising, since most of Tel Aviv-Yafo respondents agreed that it is difficult to find parking. In both Tel Aviv-Yafo and Copenhagen, respondents think that the most important incentives related to parking are dedicated parking lots. Another important incentive is the possibility to book the vehicle in advance (according to more than 40% of the survey respondents). On the opposite extreme, it seems that family packages, the option to combine car pooling and carsharing, and operator support in case of accident are perceived as less relevant. Other important incentives are *combined carsharing plans*. Combining plans means in this case special rates (e.g., packages for longer trips, for the weekend, off-peak travels) and integration with other transport modes (both public transport and other mobility solutions available in the city). In all cities, plans in line with the concept of Mobility as a Service (MaaS) were preferred. Instead of simply combining carsharing and public transport, respondents prefer plans that consist of the association of different mobility services from public and private operators and allow them to access and combine different transport modes providing seamless door to door trips.

It should be noted that some major differences between the three cities do occur. In Copenhagen, an incentive like not having to pay for one-time subscription is significantly better perceived than in the other cities, while the integration between carsharing and other transport modes, although important, is perceived as less important in Copenhagen when compared to the answers from Munich and Tel Aviv-Yafo. At the same time, daily fees/packages are pointed as very important in both Munich and Tel Aviv-Yafo, while this is not the case in Copenhagen. Differently from the other cities, respondents in Tel Aviv-Yafo positively perceived tax incentives, which indicates that the society in Tel Aviv-Yafo is more open to this type of incentive, which can be seen as controversial for Copenhagen's and Munich's contexts.

Finally, [Fig. 4](#) compares the incentives chosen as important in the travel survey with those most relevant for the participants of the focus groups in each city (see [Appendix B](#)). Only a partial list from the survey was considered, as the survey included a much larger number of potential incentives and the wording often varied between the survey and the focus group questionnaire. This comparison aims to assess the importance/attractiveness that users assigned to the various incentives. While the results do not suggest any statistical correlation between the data, which is not surprising given that the information in the focus groups is not statistically significant and the different data collection methods adopted, one phenomena is rather clear. All the incentives that were indicated as attractive by a substantial amount of the survey participants (40% and up) were ranked relatively high (3+) by the focus groups participants. As [Fig. 4](#) reveals, this is true for all 3 cities and confirms our previous findings.

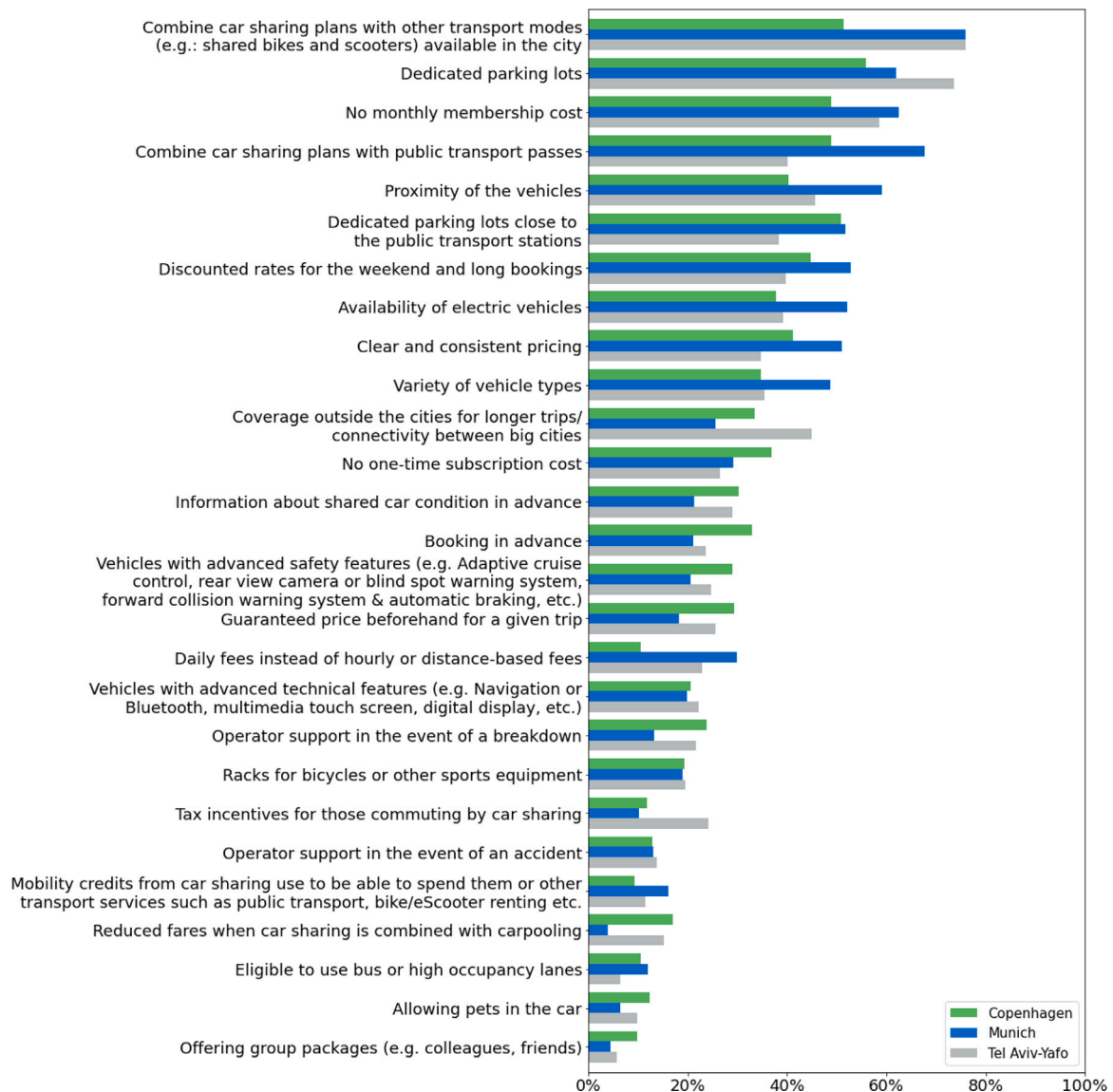


Fig. 3. Most important incentives for respondents in each city.

7 Conclusions

This study provides in-depth elicitation of carsharing users' needs and provides a list of potential user-directed and stakeholder-directed incentives that can be used to understand the perceived barriers for using this service. This is achieved through focus groups with existing and future/prospect carsharing users, and in-depth interviews with service providers, real estate developers, consumer associations, and city officials. In this paper, three different yet comparable cities are analysed: Tel Aviv-Yafo, Munich, and Copenhagen. Our results suggest that, when it comes to carsharing, the public at large has a wide range of options that they often do not fully understand or are aware of. Car-sharing service providers also have to deal with regulatory barriers that change from country to country, a significant upfront costs (fleets, insurance), and limited or even negative profits. Additionally, carsharing, if not well implemented, can compete with more sustainable mobility solutions, creating negative system-wide impacts. This research studies which incentives can be adopted to help carsharing business viability while at the same time promoting sustainable mobility.

Overall, the study shows that, in general, there is a positive attitude towards carsharing. Existing incentives are classified into two main categories, named *direct* and *indirect* incentives. *Direct incentives*, such

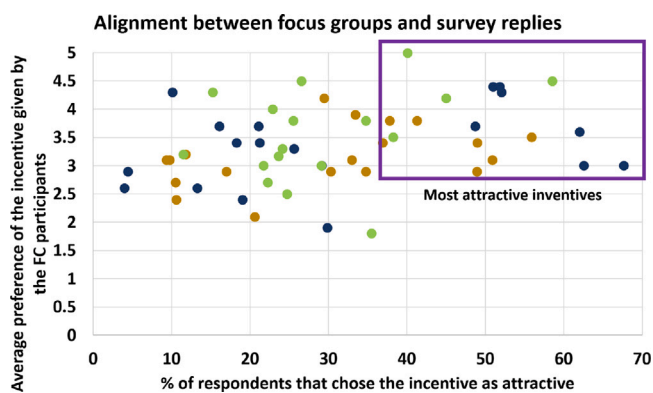


Fig. 4. Comparison between incentives according to the travel survey and to the focus groups.

as pricing, reduce the cost and/or improve the service. *Indirect incentives* relate to external factors, such as marketing strategies or the creation of mobility hubs. The effectiveness of these incentives depends on the aim/goal of the authority that deploys them and the way they are implemented. From the operator side, regulatory aspects, social equity, and integration with other mobility services were indicated as the main problems that can and should be addressed with incentives. From a user perspective, one of the main conclusions that can be drawn from the qualitative analysis is that carsharing services alone are currently not able to address all car-related needs. This conclusion is shared with a study focusing on the first free-floating carsharing users in Copenhagen (Garrett et al., 2021). Our analysis shows that the decision to choose carsharing over a private car is mostly – but not entirely – an economic decision. In line with previous studies, reducing hassles related to car ownership (e.g. maintenance) can be a motivator for carsharing adoption, while the perceived convenience and freedom related to owning one's own car is a key barrier (Jain et al., 2021). A great variety in the carsharing fleet is attractive for users with high affective car motives and different car user needs, while getting used to different types of cars is a barrier for others. For some users, giving up on the private car means giving up on performing certain activities, as carsharing is simply not perceived as a valid alternative. Another observation is that these needs differ significantly from individual to individual. For some users, the possibility to have a shared-car over the weekend is the most important aspect, while for others instant availability at any moment is more critical.

The carsharing ecosystem presents another level of inherent complexity. Free-floating and station-based systems operate differently, attracting different users, and needing different types of incentives (Becker et al., 2017; Hausteine, 2021b; Namazu and Dowlatabadi, 2018). Thus, users who are better at planning often rely almost uniquely on station-based systems, while flexible users mostly adopt free-floating services. Of course, other elements such as the purpose of the trip, the specific business model and the coverage area also play an important role when choosing a specific carsharing service. Yet, there is a large pool of users with a mixed rigid/flexible behaviour that need to be addressed. Personalized incentives present the only viable solution to attract all users types. As personalization may increase the level of complexity of an already complex system, care should be taken to select solutions that will not confuse the user further and deter carsharing use. To increase the potential effect on car ownership reduction, it is also advisable to specifically address people in times of transitions, where car ownership may be reconsidered, e.g. residential relocation, job shifts or retirement (Jain et al., 2020; Hausteine, 2021a).

Furthermore, carsharing is not sufficiently integrated with other mobility services. Integration brings the added value of other mobility services, such as public transport, e-scooters, taxis, and bike-sharing, into the carsharing model, making all services more attractive. Together with the concept of *tailor-made mobility offers* already introduced, this opportunity is perceived as the main way to promote carsharing and fight car ownership. Without integration incentives, carsharing initiatives will remain a standalone system, with limited integration to other mobility services, missing the opportunity of MaaS provision. They also stand the risk of local failure. The window of opportunity to produce viable and fully integrated solutions (e.g., with public transport) is thus limited. Yet, recent research indicates that even when offering an always available mobility service, people are not willing to give up their private car (Moody et al., 2021). Beyond technological solutions, the symbolic-affective motives related to car ownership need to be addressed as well (Hausteine, 2021a).

It is worthy highlighting that this study focuses on three cities and the results should not be generalized. However, even with this limitations, this study provides valuable information into the role that incentives have in reshaping carsharing markets, aligning users and stakeholders needs, and promoting carsharing as a sustainable mobility solution. Another limitation, typical of qualitative studies, is the

reduced sample size. To mitigate this issue, a travel survey was used to validate our findings on a larger sample of the population. While the results are encouraging, future work should focus on providing a deeper analysis of this data set and specifically on understanding the differences between existing users, past users, and potential users. Another important aspect to understand is how the coverage area of each operator impacted the attitude towards carsharing. The current extension of the operational area of carsharing services is likely to condition the responses of the focus group. This is reflected in the different results observed. For example, in Munich, the service is mostly developed within the city borders. As a consequence, our results highlighted the need for developing carsharing systems outside the urban core. In Copenhagen, where carsharing operates outside the city borders, this issue was less relevant when compared to other aspects, such as the lack of dedicated parking facilities. Nevertheless, the results from the quantitative analysis show that both topics are relevant in both cities. While overall we observed consistency between the qualitative and quantitative analysis, this relationship between coverage area and attitude toward carsharing should be considered in future research, and most definitely when selecting candidates for focus groups in qualitative analysis.

CRediT authorship contribution statement

Guido Cantelmo: Conceptualization, Methodology, Software, Data curation, Writing – original draft, Visualization, Investigation, Software, Validation, Writing – review & editing. **Roja Ezzati Amini:** Conceptualization, Methodology, Software, Software, Validation, Writing – review & editing. **Mayara Moraes Monteiro:** Conceptualization, Methodology, Software, Data curation, Visualization, Investigation, Software, Validation, Writing – review & editing. **Amnon Frenkel:** Conceptualization, Methodology, Software, Software, Validation, Writing – review & editing. **Ofer Lerner:** Conceptualization, Methodology, Software, Data curation, Visualization, Investigation, Software, Validation, Writing – review & editing. **Sharon Shoshany Tavory:** Conceptualization, Methodology, Software, Visualization, Investigation, Software, Validation, Writing – review & editing. **Ayelet Galtzur:** Conceptualization, Methodology, Software, Visualization, Investigation, Software, Validation, Writing – review & editing. **Maria Kamargianni:** Conceptualization, Methodology, Software, Software, Validation, Writing – review & editing. **Yoram Shiftan:** Conceptualization, Methodology, Software, Software, Validation, Writing – review & editing. **Christiane Behrischi:** Conceptualization, Methodology, Software, Software, Validation, Writing – review & editing. **Carlos M. Lima Azevedo:** Conceptualization, Methodology, Software, Software, Validation, Writing – review & editing. **Sonja Hausteine:** Writing – review & editing. **Constantinos Antoniou:** Conceptualization, Methodology, Software, Software, Validation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Carsharing systems

In this Appendix, we provide more details about the available carsharing services in each city, as well as the products being offered to the respondent. All tables are presented at the end of the section.

Table 4
Carsharing characteristics in Munich at the time of the study.

Operator	Fleet type	Operational area		Pricing				
		MUN	Metr.	Membership	Minute	Hour	Day	Km
Car2Go (Free-Floating now Share now)	Petrol	X	X	–	0.19–0.31 €/min.	13–18 €/2 h	49–79 €	0.19 €/after 200 km
DriveNow (Free-Floating now Share now)	Petrol, electric	X	X	–	0.31 €/min.	16–18 €/2 h	59–69 €	0.19 €/after 200 km
SixtShare (Free-Floating)	Petrol, electric	X	X	–	0.21–0.23 €/min.	–	76–98 €	–
Miles (Free-Floating)	Petrol	X	X	–	–	35 €/6h	59 €	0.89 €/km
Oply ^c (Station-based ^b)	Petrol	X	X	–	–	6–9 €/h	35–45 €	0.25 €/after 200 km
Flinkster (Station-based ^b)	Petrol	X	X	9€ ^a	–	1.5–1.9 €/h	33–48 €	0.25 €/km
Stattauto (Station-based ^b)	Petrol	X	X	40€ ^a	–	2.3–4 €/h	23–40 €	0.18–0.39 €/km

^aPlus deposit for insurance costs.

^bArea based (Free-floating within an area).

^cThe service is terminated.

Table 5
Carsharing characteristics in Copenhagen at the time of the study.

Operator	Fleet type	Operational area		Pricing				
		CPH	Metr.	Membership	Minute	Hour	Day	Km
DriveNow (Free-Floating)	Electric and Petrol	X	X	90 dkk (~12€)	2–4 dkk/min (~0.26–0.53€)	300 dkk/3h (~40€)	500 dkk/day (~67€)	–
GoMore (P2P)	Petrol, hybrid, diesel, electric	X	X	–	–	–	195–3500 dkk/day (~26–470€)	–
GreenMobility (Free-Floating)	Electric (~400 cars)	X	X	–	2–4 dkk/min (~0.26–0.53€)	–	595 dkk/day (~80€)	–
LetsGo (Station-Based)	Electric and Petrol (~250 cars)	X	–	950 dkk ^a (~127€)	–	0–29 dkk (~0–4€)	–	1.4–2.9 dkk (~40€)
Albertslund Delebil (Station-Based)	Electric and Petrol	–	X	1000 dkk ^a (~135€)	–	15 dkk (~2€)	–	1.9–2.9 dkk (~0.2–0.4€)
Islandsbrygge Delebil (~30 members, Station-Based)	4 vehicles	X	–	2500 dkk ^a (~323€)	–	18 dkk (~2.4€)	–	3.3–4 dkk (~0.4–0.5€)
Lynby Delebiler (Station-Based)	Diesel and Petrol (~17 cars)	–	X	2000 dkk ^a (~268€)	–	12 dkk (~1.6€)	228 dkk (~30€)	1.2–2.5 dkk (~0.15–0.3€)
Køge Delebiler (Partnership with LetsGo, Station-Based)	Hybrid and Petrol (~5 cars)	–	X	1000 dkk ^a (~135€)	–	20 dkk (~2.7€)	250 dkk (~33€)	2 dkk (~0.26€)

^aPlus monthly subscription, EUR 1 = DKK 7.436 (European Central Bank — 27/12/2021).

A.1. Munich

Carsharing is extremely popular in Munich and several operators exist. In this Appendix, we report the seven most popular options. Car2Go, DriveNow, and SixtShare are free-floating carsharing systems. Their characteristics are quite similar. The rental is based on the number of minutes and there is no registration fee. For longer duration – more than one hour – operators offer some discount. More information on the pricing policies is provided in Table 4. It should also be stressed that Car2Go and DriveNow merged and use a common platform called ShareNow. However, vehicles and prices are still different, as one is operated by Mercedes and the other one by BMW. Flinkster and Stattauto represent station-based services. Finally, Miles and Oply are also station-based, but they provide more flexibility to the user, as registration is free and are slightly more expensive to use than other station-based carsharing services. Also, it should be noted that in February 2020 Oply went out of business. The reason the car-operator is still included within the list is that it was quite popular in Munich and users were very familiar with their business model. The service was offering the following types of cars: Ford Fiesta, Ford Focus, Maxda MX5 (sport car) and Renault Traffic (transporter). More details about the area covered by each service provider as well as pricing are provided in Table 4.

A.2. Copenhagen

The first organized carsharing scheme in Denmark was established in 1997 in Odense. The year after, Hertz car rental offered a carsharing scheme in Copenhagen at the request of the City of Copenhagen (Kommune, 2017). Subsequently, many carsharing schemes have been established, typically in association form. Free-floating carsharing was introduced in Copenhagen in September of 2014 (Car2go), followed by DriveNow (currently ShareNow) in September of 2015 and by Green Mobility in January of 2016. Car2go has withdrawn from Denmark in 2016 (Kommune, 2017). Selected carsharing services available in Copenhagen metropolitan region are presented in Table 5 to give an overview of the current carsharing system. Currently, the city of Copenhagen has reserved some dedicated parking spaces for station-based carsharing services (Municipality, 2021).

A.3. Tel Aviv-Yafo

Two carsharing systems exist in Tel Aviv-Yafo. AutoTel is a joint carsharing venture initiated by the Tel Aviv-Yafo Municipality and the Tel Aviv-Yafo Economic Development Authority Ltd. For the establishment, operation and service delivery, the Tel Aviv-Yafo Economic Development Authority Ltd. is collaborating with Car2Go, a Carsharing provider (see below). Launched in October 2017, AutoTel operates 260

Table 6
Carsharing characteristics in Tel Aviv-Yafo at the time of the study.

Operator	Fleet type	Operational area		Pricing				
		TAY	Met.	Membership	Minute	Hour	Day	Km
AutoTel	Petrol cars (~260 cars)	X	–	10–40 NIS (~2.8–11€)	1.2–1.7 NIS (~0.33–0.47€)	–	–	–
Car2Go (P2P)	Petrol cars (~300 cars)	X	X	20–190 NIS (~5.6–53€)	–	13–46 NIS (~3.4–13€)	160–500 NIS/day (~45–140€)	1–2 NIS (~0.3–0.6€)

*Plus monthly subscription, EUR 1 = NIS 3.573 (European Central Bank — 27/12/2021).

Table 7
Comparison of the different users' incentives across the three cities — Average Score.

Incentives compared across cities	Tel Aviv-Yafo	Munich	Copenhagen
Clear and consistent price regulation/Fixed prices	3.8	4.4	3.8
Dedicated parking lots	4.7	4.4	3.5
Electric vehicles/environmentally friendly vehicles	2.7	4.3	3.8
Tax-Incentives: Tax incentives for those commuting with sustainable transport alternatives, including carsharing and carpooling	3.3	4.3	3.2
Monetary incentives from the city: Keep cost of the carsharing low	4.0	4.1	3.8
Information for parking availability at the destination area beforehand	4.5	4.0	3.5
Option to switch drivers	–	3.9	3.4
Coverage outside the cities for longer trips/connectivity between big cities	4.2	3.7	3.9
Third party validation about location data storage and usage to make sure that it is anonymized and stay private	–	3.7	3.4
Mobility credits from carsharing use: to be able to spend them for public transport modes	3.2	3.7	3.1
Offer a variety of vehicles types (different brands and sizes)/choose vehicle depending on your personal needs	1.8	3.7	2.9
Clear explanation about how location data is stored and handled	–	3.7	2.8
Flexible/dynamic pricing (e.g. reduced prices outside rush hours or in low demand areas)	3.5	3.7	2.6
Guaranteed availability	5.0	3.6	4.3
Off-street parking close to Public Transport	3.5	3.6	3.1
Guaranteed price beforehand for a given trip	3.8	3.4	4.2
Information about vehicle condition/cleanliness beforehand	3.0	3.4	2.9
Booking in advance (e.g. previous day)	3.2	3.3	3.1
Parking-related credits	2.5	3.3	2.8
Promotional incentives: no registration/renewal fees/first rides for free	4.5	3.0	3.4
Transit passes and membership; family packages	5.0	3.0	2.9
Group packages/accounts (e.g. business packages, colleagues' packages, friend packages)	–	2.9	3.1
Work-related carsharing: Free carsharing for business trips	3.6	2.6	3.4
Reduced fares when carsharing combined with carpooling	4.3	2.6	2.9
High occupancy lanes/dedicated lanes	3.0	2.6	2.4
Additional in-car features included e.g. sound system	2.5	2.4	2.1
Daily fees instead of hourly or distance-based fees	4.0	1.9	2.7
Option of choosing the same vehicle type/brand (consistency, security)	1.0	1.6	2.4
Credits that can be exchanged for goods: supermarkets discounts etc	2.2	1.6	1.9

Hyundai i10 vehicles and has 520 dedicated parking spaces across the city, allowing subscribers to pick up a vehicle from one point in the city and return it at another point. The AutoTel vehicles can be parked in one of the 520 designated parking spaces or in any regulated, “blue and white”, parking space in the city. For such, the operational model is a combination of the A2B and the free-floating model. The service is provided only within the municipal area of Tel Aviv-Yafo, while users can make trips beyond this area. The main components of the service cost consist of monthly subscription fees (10 or 40 NIS) and travel costs per minute (1.7 or 1.2 NIS). Higher rates are charged outside the municipal area. Business plans are also available. *Car2Go* (“Car to Go”) is a carsharing company founded in Israel in 2008. Car2Go offers carsharing services for both private and business use. Within the Tel Aviv metro area, the service is currently provided in 5 cities of the inner ring — Tel Aviv-Yafo, Ramat Gan, Givatayim, Herzeliya, and Raanana; and is planned to expand to additional cities. In the Tel Aviv metro area Car2Go operates a fleet of around 300 vehicles under the A2 A (Area-to-Area) operational model. The main components of the service cost (for private subscribers) consist of monthly subscription fees (20–50 NIS in 2 plans), an hourly fee (17–50 NIS) up to the sum of a daily rate (160–500 NIS), and travel costs per KM (1–2 NIS). Several types of cars are offered, including small, family, small trucks and “prestige” vehicles. Weekend supplement fees apply.

Details about costs and operational area are provided in [Table 6](#)

Appendix B. Ranking of the incentives

At the end of each focus group, participants were asked to rank a series of incentives on a scale from 1 to 5, with one being the lowest score. The full list with average scores per city is presented in [Table 7](#).

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