The Pandemic Implications for Carsharing: An Italian Context

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Communication

The Pandemic Implications for Carsharing: An Italian Context

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Abstract: Carsharing, as an innovative mobility option, can potentially support the urban transition towards a more sustainable mobility system and achieving sustainable development goals. This short communication aims at providing the status of carsharing services in Italy, with a focus on Turin, before and after the COVID-19 pandemic. In this regard, an overview of the role of carsharing in urban traffic is provided. Then, carsharing services in Italy before and after the pandemic are mapped. Accordingly, the implications of the pandemic outbreak for carsharing services are discussed. The provided insights confirm that although carsharing services have been affected by the pandemic, even after returning to normal life, the usage of carsharing is still far below its pre-pandemic level in Italy. Finally, to support sustainable mobility and incentivize using shared mobility services, a research agenda for further research is proposed, targeting the research gaps regarding (i) the factors leading to lower usage of carsharing after the pandemic, (ii) potential solutions and policies to support carsharing services return to their pre-pandemic level and exceeding it, and (iii) examining the impact of provided supports by governments during the pandemic, such as bonuses for purchasing bikes and scooters, on the adoption of carsharing services for the post-pandemic era.

Keywords: carsharing; shared mobility; urban transportation; urban mobility; COVID-19; pandemic

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Citation: Shams Esfandabadi, Z.; Ranjbari, M.; Scagnelli, S.D. The Pandemic Implications for Carsharing: An Italian Context. *Future Transp.* **2023**, *3*, 274–285. https://doi.org/10.3390/futuretransp3010016

Received: 5 January 2023
Revised: 31 January 2023
Accepted: 15 February 2023
Published: 1 March 2023

1. Introduction

Global urbanization is experiencing a growing trend [1], leading to an increased urban population density. The growth of the urban population is accompanied by an increasing demand for transportation in urban areas that would result in large volumes of traffic and congestion as well as serious environmental impacts and health issues [2,3].

Carsharing has attracted a growing tendency by academia and practitioners in the sustainable mobility arena due to its potential positive impacts on the main pillars of sustainability, addressing environmental, economic, and social aspects [4,5]. Due to the potential of carsharing in reducing the number of private cars and accordingly decreasing traffic congestion, it sounds like this innovative mobility option can improve the quality of life to some extent [6,7]. In this vein, carsharing, with a temporary access-based business model instead of traditional ownership-based ones, support sustainable consumption at the demand side, and production at the supply side towards achieving sustainable development goal 12 (i.e., SDG 12: sustainable consumption and production) within 2030 Agenda for Sustainable Development launched by the United Nations [8]. An increase in the utilization of carsharing in the urban transportation system can improve the traffic environment and decrease energy consumption [9].

Before the pandemic, within three years, the number of cities providing carsharing services had reached approximately 1000, leading to a 47% increase in the offers [10]. In terms of the number of users and cars, Europe has experienced an increasing trend in using carsharing, which accounts for approximately 50% of the global carsharing market [11].

The number of registered carsharing users worldwide was approximately 47.5 million in the year 2021, and estimations show that this number will reach approximately 48.5 million in 2022 [12]. Singapore, New Zealand, Switzerland, Luxembourg, and South Korea are expected to have the highest carsharing user penetration in 2022 with percentages of 7.3%, 6.2%, 5.6%, 5.2% and 4.5%, respectively [12]. However, carsharing services still have a niche existence compared to other modes of transport, even in major cities [13]. This is due to the fact that perceived compatibility with daily life strongly affects carsharing adoption [13].

The outbreak of the COVID-19 pandemic affected various aspects of human lives in societies [14–16] and significantly affected transportation in urban areas [17,18]. The utilization of carsharing was seriously impacted by the restriction imposed due to the pandemic [19]. For instance, the demand for carsharing in Milan, one of the most affected areas by COVID-19 in Italy, started to drop at the end of February 2020, decreasing by 26% over only a week, and reduced by 90% until the end of April 2020 in comparison with January 2020, before the spread of COVID-19 in Italy [10,20]. The utilization of carsharing services has not returned to its pre-pandemic level in some countries, such as Italy [21], causing challenges to the urban transportation systems In a survey on the changes in commuting travel behavior after the pandemic, Yoshida and Ye [22] highlighted the role of incentives and real-time information presentation in improving shared mobility services in transportation for commuting purposes. However, the contribution of shared mobility options in the post-COVID era in cities significantly depends on the regulations imposed by cities to regulate such shared services with other modes of transport in a fair manner, considering limited fleet size, fees and parking or outright bans [23]. In this regard, some local governments are implementing a series of sustainable measures to rethink mobility in post-pandemic scenarios, outlining the need to strengthen shared mobility services, such as carsharing, bike-sharing, and scooter-sharing to inviting people to scrap their private cars and use sustainable mobility and green bonuses [24]. For instance, in Italy, the government granted EUR 5 million to finance subsidies for sustainable mobility in 2020, including the purchase of electric bicycles [25].

In this communication article, the status of carsharing services in Italy, with a focus on Turin, a city in the north-western part of this country, before and after the COVID-19 pandemic is discussed and the importance of further studies to return carsharing to its pre-pandemic level is highlighted. The selection of Turin is because the air quality of this city is among the worst in Europe [26,27], and the main contributor to this unfavorable air quality is urban transport [18]. Hence, various initiatives have been undertaken by the Municipality of Turin to transform the city into a "Smart City" [28]. In this regard, carsharing has been promoted and supported as a sustainable mode of transport in the past few years in this city; and recently, two electric shuttles as the first self-driving (fully autonomous) public transport pilot vehicles in Italy were presented in Turin for test [29,30], making Turin the first Italian city to enjoy autonomous shuttles for public transport [31]. Nevertheless, despite the potential of carsharing services for growth in the city of Turin and its capacity to contribute to the improvement of the air quality of this polluted city [32], the pandemic restrictions significantly affected the usage of carsharing in this city, leading to a significant decrease in using such services.

In Section 2 of this communication, the role of carsharing in urban traffic, in general, is briefly discussed and in Section 3 key information about the city of Turin is presented. Section 4 provides an overview of carsharing services in Italy and more specifically in Turin (Section 4.1). The COVID-19 pandemic implications for carsharing in Turin are gone through in Section 5, and finally, concluding remarks and key directions for future research are presented in Section 6.

2. An Overview of Carsharing and Its Role in Urban Traffic

Carsharing follows the concept of sharing economy business models [33,34], supported by information technology [35], and is recognized as a new and potentially more sustainable way of transportation with increasing popularity worldwide [36,37]. Carsharing is provided through four main business models, including (i) business-to-consumer (B2C), in which carsharing is offered by a service provider to the public through one-way or round-trip services (allowing users to return the shared vehicle to a location different from its original pickup location) [38–40], or round-trip or two-way services (requiring the users to pick up and drop off the shared vehicles at the same location) [38,41]; (ii) business-to-business (B2B), in which the service is typically offered to employees of an organization to make work-related trips [42], (iii) business-to-government (B2G), in which the service is offered to a public agency [42], and (iv) peer-to-peer (P2P) or personal vehicle sharing [42], in which the car is owned by a private citizen who makes it temporarily available for use by other private citizens through a platform provided by an external operator [40,43]. Although carsharing has some similarities with ride-hailing and ride-sharing services, it is different from them. Ride-hailing consists of pre-arranged, on-demand transportation services for compensation, connecting drivers of personal vehicles with passengers [44] and ride-sharing services provide an opportunity for drivers and passengers with similar origin-destination pairings to share a ride [45]. Nevertheless, in carsharing services, there is no driver to make a suitable trip for the service user, and only the use of a vehicle owned by a citizen or a business is shared. Carsharing services can be provided either through station-based platforms, in which shared cars should be picked up and dropped off only at specific stations, or through free-floating platforms, in which shared cars could be picked up and dropped off at any place within a specific operational area, providing a different value proposition for users [46].

Carsharing has the potential to lower the number of cars in cities, without decreasing individual mobility, as a shared vehicle can provide mobility services to several users per day. Based on the literature, carsharing has been estimated to have the potential for replacing almost 1–15 privately owned vehicles, depending on several factors, inter alia, the business model and one-way or round-trip services. For instance, while Loose [47] reports the replacement of one shared car for an average of 4–8 private cars, Fleury et al. [48] highlight that 1–6.5 private cars can be replaced by one shared car. Ampudia-Renuncio et al. [49] take into account that three one-way or seven round-trip shared cars can replace one privately owned car. Lane [50] reports the potential replacement of 5–10 shared cars for each private car based on the documents, but also states that during the first year of activities of a carsharing organization in the Philadelphia region, each shared vehicle helped remove an average of 23 private vehicles. Through the shared use of cars, these vehicles are used more intensively in comparison with private cars to serve the same number of trips. Hence, the transition towards a circular economy [37] and building more sustainable cities [49] is accelerated. Nevertheless, the potential of carsharing in increasing car dependency [51], which is an unfavorable outcome of urban transportation, should be taken into account by policymakers.

3. Traffic in Turin, Italy

Turin, with a population of approximately 876,000 inhabitants [52] in an area of 130 km^2, is the capital of the Piedmont region. This metropolitan area is highly industrialized and densely populated (6709.94 inhabitants/km^2) [52] with a motorization rate of around 615 per 1000 inhabitants [53].

Road traffic is one of the most important sources of pollutant emissions in Turin, owning a share of 40% of the PM_{10}, 30% of the $PM_{2.5}$, and 75–77% of NO_2 of the total concentration in the city [54,55]. The role of vehicular trips in the low air quality of the city became clearer during the COVID-19 pandemic lockdowns, in which restrictions were imposed on the mobility of the people. The significant reduction in traffic flow in the Turin metropolitan area during the COVID-19 lockdown period resulted in a significant reduction in the emission of pollutants during this period [56]. The reduction of traffic flow observed during the COVID-19 lockdown period in Turin involved mainly a decrease in passenger cars, as almost 81% of the vehicles used in the city are passenger cars [18]. Therefore, the reduction in the number of private cars is of primary importance in reducing air pollution in this city. In this vein, carsharing services require more attention to grow in Turin, as they have the potential to absorb a part of the demand for private car usage [32]. Furthermore, replacing electric vehicles for conventional internal combustion engine vehicles can play a vital role in the improvement of air quality. The acceptance of private EVs can also be promoted through the diffusion of more electric carsharing services in the city [57].

4. Carsharing in Italy

In Italy, among various shared transport modes, carsharing has become more widespread [58]. Carsharing in Italy started in 2001 when the Car Sharing Initiative started promoting and supporting carsharing as a means for sustainable urban mobility [59]. However, free-floating carsharing started in Italy in 2013 in Milan, and since that time the total number of shared vehicles in Italy has significantly increased, reaching 1293 station-based carsharing vehicles supported by 22 platforms and 5989 free-floating carsharing vehicles supported by 19 service providers in 2020 [60]. In 2021, one station-based and two free-floating services were added to the market, leading the number of station-based and free-floating carsharing services to reach 23 and 21, respectively [21]. Tables 1 and 2 provide information on free-floating and station-based carsharing throughout Italy, respectively, for the year 2020.

Table 1. Free-floating carsharing in 2020 in Italy [60].

Provincial Capital	Service Providers	Fleet Size	No. of Rentals	Distance Traveled (km)	Members
Turin	2	557	1,002,327	5,879,041	266,027
Milan	2	2518	3,208,456	25,232,842	934,777
Venice	1	5	n.a.	n.a.	n.a.
Parma	1	15	n.a.	n.a.	n.a.
Bologna	2	414	210,546	1,984,703	57,546
Ferrara	1	25	n.a.	n.a.	n.a.
Florence	3	634	137,010	1,195,799	164,720
Arezzo	1	24	1074	3974	229
Rome	2	1664	1,650,820	17,038,077	824,049
Latina	1	22	n.a.	n.a.	n.a.
Naples	1	40	n.a.	n.a.	n.a.
Palermo	1	112	3794	17,832	n.a.
Cagliari	1	30	n.a.	n.a.	n.a.

n.a. Not available.

In spite of the challenges that operating carsharing platforms comprising electric vehicles have, which makes the management of these platforms more difficult in comparison with the platforms consisting of only conventional vehicles, using electric vehicles in carsharing fleets is growing [42]. In Europe, the share of electric vehicles from the carsharing fleet is estimated to be much higher than the market average [61], which seems to be promising in terms of the reduction of air pollution and greenhouse gas emissions in the transport sector, as well as the acceleration of the adoption of electric vehicles in societies [61]. Since EVs consume no fuel, they are considered zero-emission vehicles. Nevertheless, in reality, the hypothesis that these vehicles are efficient means to reduce greenhouse gas emissions is faced with three uncertainties including their unclear market penetration, the energy mix used to generate the required electricity for their charging process, and the additional electricity demand they impose on the electricity grid causing new bottlenecks that require additional investment and probably additional greenhouse gas emission to deal with [62].

Carsharing fleet seems to have higher environmental sustainability in comparison with private cars in Italy [59]. Ignoring well-to-tank emissions, the average CO_2 exhaust emission of a private ICE vehicle in Turin is estimated to be 146.9 g/km and the average CO_2 exhaust emission of a shared ICE vehicle in this city is 87.9 g/km [32]. This difference in the amount of CO_2 emission between private and shared cars is mainly because of the lower age, engine power, and weight of the shared vehicles. In 2020, approximately 80.8% of the shared fleet in Italy was petrol-based and about 12.2% was electric (while only 0.13% of the private cars in this country are EVs) [60]. However, while the percentage of Euro 6 private vehicles was 23%, the percentage of Euro 6 shared vehicles was 99% [60]. Due to the closure of the Share'ngo carsharing service provider in 2020, which provided free-floating carsharing services through fully electric vehicles, the electrification rate of the shared fleet decreased from 23% in 2019 to 7% in 2020 [60] but experiences growth in 2021. In 2021, the carsharing fleet in Italy was composed of 67% petrol vehicles, 27% electric vehicles, 5% hybrid vehicles, and 1% methane, diesel, and liquefied petroleum gas [21]. Furthermore, the average age of the shared vehicles in 2021 was estimated to be one year, which is much lower than the average age of private vehicles which is 11.5 years [21,60].

Table 2. Station-based carsharing in 2020 in Italy [60].

Provincial Capital	Service Providers	Fleet Size	No. of Rentals	Distance Traveled (km)	Members
Turin	1	324	114,128	844,547	12,779
Genova	1	70	10,152	452,170	2774
Milan	1	165	n.a.	n.a.	n.a.
Brescia	1	6	431	17,240	65
Bolzano	1	36	5534	577,416	1142
Trento	1	8	1803	84,686	700
Venice	1	40	n.a.	n.a.	n.a.
Padua	1	19	3042	110,805	n.a.
Parma	1	12	1598	44,600	695
Arezzo	1	6	13	220	n.a.
Rome	1	190	13,127	367,556	3200
Trapani	1	6	307	21,152	124
Palermo	1	24	26,277	538,679	5133
Messina	1	20	n.a.	n.a.	n.a.
Enna	1	4	107	3028	47
Catania	1	50	3579	159,623	500
Sassari	1	10	62	1112	n.a.
Cagliari	1	78	11,482	234,233	2016

n.a. Not available.

In general, users of carsharing in Italy are highly educated young people, satisfied with their economic resources, and are also ecologists and technological users [63].

4.1. Carsharing in Turin

Although the launch of carsharing in Turin is traced back to 2002, the main activities of these services started in 2015 when Turin became the third Italian city (after Florence and Milan) in the penetration of carsharing [64]. Carsharing in Turin allows free access to the limited traffic zone in the city and free parking on the blue lines [65].

Currently, although there is no P2P, B2B, and B2G carsharing in Turin, three B2C carsharing platforms are operating, including Sharenow, Enjoy, and LeasysGo.

Sharenow, which is a German company providing carsharing services in urban areas in Europe, is a joint venture of Daimler AG and BMW that in 2018 merged their carsharing companies, car2go and DriveNow [59]. Before this merger, car2go was active in Turin, starting its operation in 2015 with gasoline cars to provide free-floating carsharing services.

Enjoy, which is an Italian company founded by ENI, is the second-largest carsharing company in Italy, offering only Fiat 500 cars for sharing provided by two long-term car rental companies, Leasys and Ald Automotive [59]. Enjoy provides free-floating carsharing services with gasoline vehicles in Turin and started its operation in 2015. The Subscription to the service is free of charge for those with an Italian driving license, and the users only pay for the actual use of the shared car [65].

LeasysGo, belonging to Leasys, started its operation after BlueTorino exited the car-sharing market of Turin. BlueTorino was the only station-based electric carsharing service provider in Turin that started its operation in 2016 and exited the market at the end of December 2020 due to the high losses accumulated over time (EUR 15 million in 2019) [59]. Leasys obtained BlueTorino's license and electric charging network to provide the service with a fleet of electric FIAT 500s [66] instead of the 324 EVs previously used by BlueTorino [60]. This carsharing service provider is the first to make a fleet of only new FIAT 500 electric cars available to its subscribers [65].

Despite having only three active carsharing platforms, Turin is one of the main carsharing markets in Italy [67] and its current carsharing system is perceived as efficient and useful [68]. In 2020, a total of 557 free-floating shared vehicles were available in Turin with 266,027 members, who used the shared cars 1,002,327 times during the year, and a total of 324 station-based electric shared cars with 12,779 members, who traveled 114,128 times with the shared cars [60], as also reported in Tables 1 and 2.

Although a significant share of the population has become a member of carsharing services, from approximately 1.3 million estimated daily trips in Turin, carsharing satisfies only a tiny portion (0.4%), while private vehicles and public transport cover 53.7% and 28.6% of the trips, respectively [32]. Carsharing members own on average 1.29 private cars, which is not significantly different from the average ownership of private cars by non-members (1.40) [67]. Moreover, 75% of carsharing members use a private car at least once a week [69]. Hence, carsharing might still not be seen as a mobility alternative for some users of private cars in this city, and as a result, the mobility habits of the carsharing members might not have changed, yet [67]. The trends of the membership and usage of the free-floating carsharing services illustrated in Figure 1 show that becoming a member does not necessarily mean regular usage of the service. In fact, carsharing subscriptions are (almost) free in Italy [69] and therefore a large number of carsharing subscribers are not active in using the service.

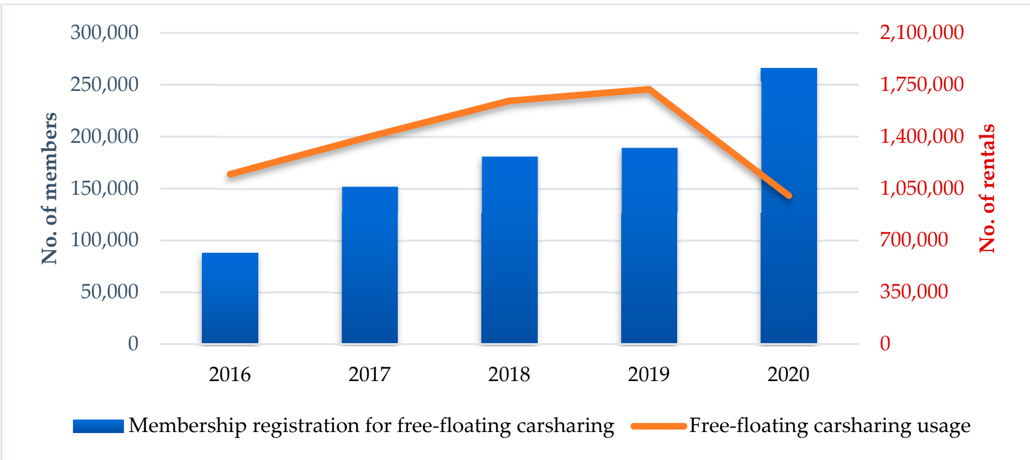


Figure 1. Free-floating carsharing usage and membership registration in Turin [60].

The members of carsharing services in Turin are mainly young males, who live in high-income and small households with a low number of private cars per member owning a driving license and a high number of workers [68]. Two main carsharing user profiles including university students and workers are detectable [69]; however, carsharing is not likely used for systematic trips, such as work or school [68]. These services are more likely to substitute for private cars rather than trips using public transport in Turin [70] and seem to be attractive for urban trips in congested streets, which are characterized by long durations and short distances [68]. Despite the large growth potential of carsharing in Turin, the market share of these services is expected to remain low in the near future, in comparison with private cars, public transport, and walking [68]. Lack of knowledge about carsharing among non-members of these services and inadequate advertising and marketing campaigns for carsharing has been highlighted in research conducted by Chicco et al. [67] as contributors to the low market share of carsharing in Turin.

5. The COVID-19 Pandemic Implications for Carsharing in Italy and in Turin

The COVID-19 pandemic dramatically impacted the mobility sector in Italy. Mobility toward workplaces, public transport nodes, and retail activities is estimated to have decreased by 60%, 76%, and 80%, respectively, during the first months of the pandemic lockdown [71]. To promote sustainable mobility during the pandemic period, EUR 5 million was granted by the Italian Government in 2020 to finance subsidies for purchasing bikes and scooters [25]. The restrictions imposed on mobility also affected the demand for carsharing, but with different rates for free-floating and station-based services. In comparison with 2019, the year 2020 marked a reduction of −48% and −34% for the rentals of free-floating and station-based carsharing, respectively [60].

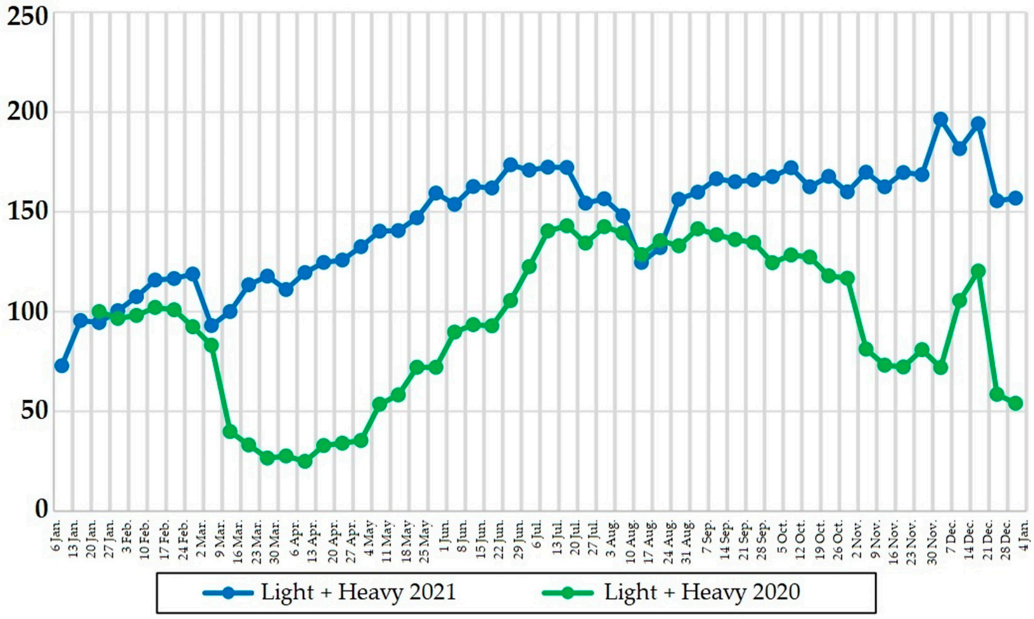
With the gradual recovery of economic activities after the lockdowns, the use of shared mobility services began to rise again. However, carsharing had a lower recovery in comparison with other shared mobility services. While scooter-sharing and bike-sharing have now settled above the pre-COVID levels, between September and October 2021, carsharing had a sign of recovery in line with the model of the use of the service in the autumn and winter months [60].

Based on recent statistics, the number of free-floating carsharing rentals in Italy continued its reduction after the pandemic, reaching 5.7 million rentals, following an 8.6% reduction in comparison with 2020 and a 52% reduction in comparison with the year 2019 [21]. However, the number of station-based carsharing rentals, the kilometers traveled by free-floating carsharing, and the kilometers traveled by station-based carsharing in 2021 experienced an increase in comparison with the year 2020 (22.2%, 8.8%, and 13.6%, respectively) that is a sign of recovery in the carsharing services after the pandemic [21]. Still, the total number of station-based carsharing rentals in 2021 is 19% less than in 2019, and the total kilometers traveled by free-floating and station-based carsharing in 2021 are 37% and 22% lower than that of 2019, respectively [21]. Furthermore, as Table 3 shows, although free-floating carsharing in Italy is growing in terms of the duration and distance of journeys, the duration and distance of trips made by station-based services in 2021 are still at a lower level in comparison with 2020 [21], highlighting the need for more attention from policymakers.

Table 3. Average distance and duration of using carsharing in Italy [21].

	Free-Floating Carsharing		Station-Based Carsharing	
Year	Average Rental Distance (km)	Average Rental Duration (minute)	Average Rental Distance (km)	Average Rental Duration (minute)
2019	7.4	32.6	25	178.6
2020	8.3	40.2	25.8	217.8
2021	9.9	43.7	23.9	197.9

Specifically in Turin, as shown in Figure 2, the trend of the weekly road traffic in 2021 in Piedmont, including both light- and heavy-duty vehicles, was recorded to be above that of 2020 except in January (as there was no pandemic outbreak announced in January 2020) and in August. This shows an overall increasing trend in weekly traffic in Piedmont by the gradual recovery of economic activities after the pandemic. Therefore, as society moves towards post-pandemic normal life, the transportation and mobility needs of the people change again, and this time, might have a different trend in comparison with the pre-pandemic era due to potential changes in the travel behavior and new habits and also precautions to avoid contamination.



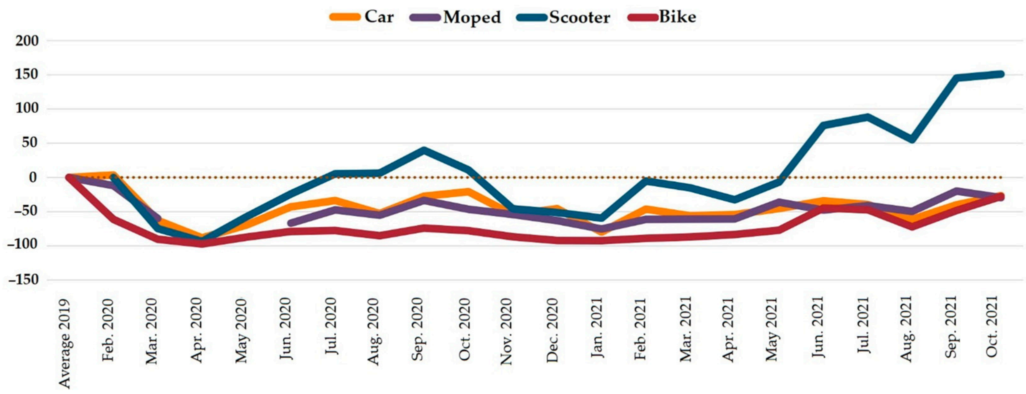
Base 100: the value of the week of 22–28 January 2020

Figure 2. Weekly road traffic (light- and heavy-duty vehicles) in Piedmont (February 2020–December 2021) [72].

Based on Figure 3, by October 2021, carsharing, moped-sharing, and bike-sharing were still below the 2019 average, but scooter-sharing maintained a positive trend in Turin, as in other Italian cities [60]. The growth of scooter-sharing usage despite the pandemic crisis can be mainly linked to the expansion of the offers by service providers and a strong appreciation from the users. Considering shared mobility services offered within the whole country in general, the COVID-19 pandemic has resulted in an expansion of these services, albeit slightly, rather than affecting them significantly negatively [60]. Scooter-sharing, which is now almost entirely electrified, was already present and consolidated at the end of 2019 in Italy and its growth is higher than other shared mobility services. During the first year of the pandemic, scooter-sharing became the most widely shared mobility service in Italy and recorded the highest number of rentals in 2020 with approximately 7.4 million scooter rentals and 14.4 million kilometers traveled [60]. In 2021, a strong diffusion of scooter-sharing was observed, and these services experienced a 143% growth in the number of rentals, reaching 17.8 million, and recorded half of the total rentals of shared mobility services in Italy [21]. This confirms the change in the consumption behavior of the people during and after the COVID-19 pandemic, which requires re-drafting consumers' willingness to use shared platforms in the transportation sector [73] and re-visiting policies to promote and incentivize using sustainable modes of transport.

In 2021, a total of 5,855,555 km were traveled during 845,323 trips made using free-floating carsharing in Turin, which was made possible through 537 shared cars owned by 2 free-floating carsharing service providers [21]. While the rate of rotation for free-floating carsharing in Italy was 2.9 rentals per vehicle per day in 2021, this rate in Turin was 4.3 [21].

Considering the role carsharing can play in reducing the number of privately owned vehicles being used by the citizens, and the positive outcomes it can have on the improvement of traffic, congestion, and air pollution [74,75], it is crucial for researchers in the field of transportation to analyze (i) the key reasons leading to the low usage of carsharing after the pandemic, and (ii) the potential policies and programs supporting the growth of carsharing usage in the post-pandemic era in the Italian cities, and more specifically in Turin, as one of the most pollutant cities in Europe [27] to support transitioning towards sustainability.



Carsharing: Enjoy, Sharenow, BlueTorino for 2020, LeasysGO for 2021; **Moped-sharing**: only one operator; **Scooter-sharing**: BIT Mobility, Bird, Dott, Wind, Helbiz, Lime, VOI; **Bike-sharing**: TOBike and Movi.

Figure 3. Daily rentals of shared mobility services in Turin based on index numbers (base: average 2019) [60].

6. Concluding Remarks and Future Research Direction

This communication article tried to highlight the impact of the COVID-19 pandemic on carsharing in an Italian context and the potential benefits of carsharing that have been lost due to the pandemic's implications for the transport sector. Hence, an overview of (i) the role of carsharing in urban traffic, (ii) carsharing services in Italy before and after the pandemic, and (iii) the impacts of the pandemic on carsharing services were presented and discussed. The study showed that the usage of carsharing in Italy is still below its pre-pandemic level even after returning to normal life. Moreover, there are still gaps in the academic literature and industry-related reports regarding the actual impacts of the pandemic on carsharing and the potential solutions in this regard.

On this basis, the potential research gaps for further research were identified as a research agenda to support sustainable mobility and incentivize using shared mobility services, calling for action on three main subjects. First, although the general impact of the pandemic on transportation in Italy and Turin has been considered by various researchers, the literature still lacks adequate research on the main reasons for the reduction of carsharing utilization even after returning to normal lives in Italy. Second, as carsharing can support the reduction of traffic and improve air quality, it is highly recommended that researchers study the potential policies to support the growth of carsharing usage in Turin (and other Italian cities) and provide solutions to help decision makers push the usage of carsharing to a level higher than that of before the pandemic. Finally, the impact of the provided subsidies and support by the Italian government during the pandemic to purchase bikes and scooters on the adoption of shared mobility options, especially carsharing, for the post-pandemic era needs to be studied to identify potential opportunities and challenges for shared mobility developments.

In this communication article, we used available literature published online to provide the current status of carsharing services in Italy considering COVID-19 implications. However, the provided insights are limited to academic publications and industry-related reports. Hence, using qualitative methods, including surveys and interviews with carsharing users and carsharing service providers, may provide some extra insights into the topic.

Author Contributions: Conceptualization, formal analysis, investigation, resources, writing—original draft preparation, visualization, Z.S.E. and M.R.; Conceptualization, formal analysis, writing—Review and Editing, S.D.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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