

SUSTAINABLE AND SHARING MOBILITY IN EUROPE AND ITALY STRENGTHENED BY THE COVID-19 PANDEMIC. STATE OF THE FIELD AND A POSSIBLE RESEARCH AGENDA

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Abstract

During the spread of the Covid-19 pandemic, many European countries have opted for restrictive measures and policies, which have consequently reduced economic activities, including road transport. This has led to a further decrease in concentrations of air pollution, especially in metropolises (EEA, 2020). Considering the negative impact of fossil fuels on the environment and on human health, it is necessary a radical change in the transport system, which may possibly satisfy both the need for cleaner air and the growing demand for mobility, especially in large metropolises. This decisive shift consists of a green and sustainable transformation, which is already taking place in several European cities. This change demands a coordinated approach, starting from different urban strategies, such as traffic congestion, public procurement of cleaner vehicles, promoting public, sharing, and sustainable mobility (e.g. cycling, sharing transport, adopting low-emission zones, etc.) (EEA, 2019).

Our investigation will primarily focus on the impact of transportation on urban environment, then move to an in-depth literature review on the new forms of mobility, analysing the convergence and divergence in e-mobility in Europe, and the sustainable and sharing mobility in Italy, with a further look at the modifications inducted by the Covid-19 pandemic. In the last section of the paper, we propose two research themes based on the current developments and possible future perspectives for urban spaces and mobility.

Keywords: sustainability; urban transformation; smart mobility; sharing mobility.

1. Introduction.

Although air quality has considerably improved in Europe in recent decades, pollution continues to harm human health and the environment in numerous cities. According to the European Commission, the great majority of European citizens live in an urban environment, and over 60 percent live in urban areas with more than 10,000 inhabitants (European Commission, 2021). As centres of art, science,

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opportunity, and idea exchange, cities - particularly metropolises - are proving to be crucial theatres of future concerns as the urbanisation process proceeds (UN-Habitat, 2020).

Since the spread of the Industrial Revolution, cities are accountable for environmental degradation due to a variety of variables such as air pollution, mobility, waste production, energy and water use, and so forth (Brauer et al., 2015).

Mobility represents a crucial component in socio-economics dynamics of cities as well as in people's daily lives. Mobility is reshaping societies today, and it is both a fundamental phenomenon to comprehend and an essential requirement to participate in social life (Vecchio and Tricarico, 2019).

Nevertheless, the transport network has a negative influence on the environment and human health. Climate forces like CO₂ emissions (the primary driver of global climate change) and non-CO₂ pollutants, including methane, volatile organic compounds (VOCs), nitrogen oxides (NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), F-gases, black carbon, and non-absorbing aerosols (Ubbels et al., 2002), from the combustion of petroleum-based goods, like gasoline, represent the majority of GHGs emissions from transportation¹. Therefore, road transport also contributes to greenhouse gas emissions (Leroutier and Quirion, 2022), which further leads to air pollution.

According to the WHO², air pollution is the fourth leading cause of mortality worldwide, especially in large cities, contributing to make them the epicentres of new respiratory diseases, including new coronavirus (Sars-CoV-2) (UN-Habitat, 2020). Indeed, over 1,430 cities have been hit by the pandemic and over 95 percent of all cases have been identified in urban areas (UN-Habitat, 2020). Therefore, environmental health issues (i.e. air pollution), which are strengthened by transport, have amplified the coronavirus impact, demonstrating how human and planetary health are connected (Hernandez Carballo et al., 2022; Semczuk-Kaczmarek et al., 2022).

Thus, a significant change is urgently needed: the current challenge for local administrations lies in reducing traffic congestion to improve cities' habitability and competitiveness (Demir et al., 2015). Metropolises must get "smarter" by deploying innovative technologies and solutions and adopting a transportation system that meets the demand for population and economic mobility (Di Fazio and Paradiso, 2022) while cutting emissions of climate-changing gases, to prevent environmental

1 Among the factors that affect air quality, one can find anthropogenic emissions of carbon dioxide (CO₂) mainly result from the combustion of fossil fuels for the heating of residential, commercial and institutional buildings, and industrial purposes, also contribute to GHGs emissions, and scientific data suggests that GHGs emissions and environmental pollutants are the primary cause of climate change (World Resources Institute, Rising to the Climate Change Challenge, at <https://www.wri.org/climate>, retrieved on 1st November 2021). The social and economic slowdown induced by the Covid-19 pandemic has led to a short decrease in new emissions, although there is no evident influence on atmospheric levels of GHGs and their growth rates.

2 Specifically, WHO assessed air pollution is responsible for an estimated seven million deaths: World Health Organisation, *Air pollution*, at https://www.who.int/health-topics/air-pollution#tab=tab_1, (Retrieved on 1st November 2021).

degradation. Indeed, *smartness* means for a city to enable its citizens and enterprises to apply new technologies to economise time, to improve individual mobility, to facilitate access to information and services, to save energy and resources, and to participate in urban decision-making processes, with the aim of making life more convenient for all inhabitants (Kunzmann, 2014).

Technological innovation, economic growth, and modernisation, that characterise modern cities (Abu-Rayash and Dincer, 2021), might support policymakers to address issues such as carbon emissions, energy usage, and transportation infrastructure to increase the quality of life in urban spaces (Hall, 2000). They are true incubators of innovation (EUCR, 2020) and crucial hubs for climate action, becoming key areas for sustainable development in addressing the aforementioned urban challenges in the latest years (Buonocore, De Martino, Ferro, 2021). In particular, smart cities represent an attempt to address the challenges faced by large cities (Shamsuzzoha et al., 2021). Table 1 shows the top ten smartest metropolises in the world, according to Smart City Rank (2021), also taking into consideration their population. In the need for more eco-friendly activities, smart cities' policymakers elaborated smarter, greener and digital solutions, which could also be considered best practices for smaller cities, in order to tackle environmental externalities responsibly, effectively, and efficiently.

Smart City		
City	Rank	Population
Singapore	1	5,991,801
Zurich	2	1,407,572
Oslo	3	1,056,180
Taipei City	4	2,731,208
Lausanne	5	448,304
Helsinki	6	1,316,757
Copenhagen	7	1,358,608
Geneva	8	620,131
Auckland	9	1,630,092
Bilbao	10	348,518
Dusseldorf	20	635,046
Riyadh	30	7,387,817
Hamburg	40	1,788,995
Berlin	50	3,566,791
San Francisco	60	883,255
Tianjin	70	13,794,450
Krakow	80	769,307
Mumbai	90	20,667,656

Makassar	100	1,612,249
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Table 1: Smart City Rank 2021 and Population 2021.

Source: our elaboration based on Smart City Index 2021 and World City Populations 2021.

The issue of sustainable mobility represents one of the most debated topics in the context of local, national, and international environmental policies aimed at reducing the environmental impact resulting from the mobility of people and goods. In year 2001, the European Union Council of Ministers of Transport first defined a sustainable transportation system as one that “allows the basic access and development needs of individuals, companies, and society to be met safely and in a manner consistent with human and ecosystem health and promotes equity within and between successive generations”³.

Also Covid-19 emergency showed how cities may take on new responsibilities and find innovative solutions for overcoming extraordinary and ordinary urban mobility challenges. Therefore, by establishing a set of solutions by reducing car traffic and modifying current mobility patterns, air quality in cities can be radically improved and the decarbonisation of road transport can also be boosted, making Europe the first climate-neutral continent in the world. In this context, some European cities have displayed higher capabilities to mobilise and harmonise their services and resources. In this regard, the European Commission called local governments to formulate Sustainable Urban Mobility Plans (SUMP), which provide a vision of urban mobility that should include all the dimensions of urban development, co-produced through the involvement of a plurality of urban actors, including the managers of different sharing mobility services (European Commission, 2013), as well as the evolution of urban infrastructures.

Sharing mobility refers to the gradual shift from private transportation to “shared” vehicles to move from one place to another. Thanks to innovative technology, this peculiar mobility service offers performance similar to private transportation in terms of flexibility, availability and scalability (La Foresta, 2019).

Several cities have already planned these new mobility methods, opting for a variety of services, such as electric public mobility, hosting and investing in private sharing mobility operators, and also modifying the urban structure and infrastructure. Indeed, European local policymakers, especially in the biggest cities (Li et al., 2022), are particularly focusing on sharing mobility (Arias-Molinares and García-Palomares, 2020; Gauquelin, 2020; Wołek, 2018; Refrigeri, 2018; Rode et al., 2015) to better

³ European Commission, *2340th Council meeting - Transport/Telecommunications*, 4-5 April 2001, Luxembourg, at https://ec.europa.eu/commission/presscorner/detail/en/PRES_01_131, (Retrieved on 4 January 2021).

respond to new travel needs that see multimodality and environmental sustainability as its strengths, through the use of advanced technologies that leverage the use of Internet-connected computing devices to build a networking system.

Sharing mobility, due to the interconnection between urban players, territory, and providers, leads to a flexible service model, which might undermine the “infrastructure-based” urban model (Civitas, 2016).

This means that sharing mobility has impacts on physical networks, as it is capable of reshaping people’s paths and directions and, in order to work, needs some infrastructures that inevitably transform urban spaces. Among others, car-sharing and bike-sharing stations, cycle and reserved lanes, interchange car parks, pedestrian areas, etc. (Shaheen and Cohen, 2016; 2018). Thus, one of the most peculiar characteristics introduced by sharing mobility is the high flexibility in the relationship between urban space and physical networks. Hence, sharing mobility is included in the wider context of urban redefinition, by which the city becomes smarter and greener. In this regard, it might be considered both a means and a policy in achieving the objectives of a neutral carbon society for the cities of the future, as they have an important and crucial role in contemporary times, as scenarios for the “green and blue transitions” (Florida, 2020).

This study plans to investigate the policy framework for sustainable and sharing mobility in Europe (1 paragraph), the ongoing mobility trends in Italy (2 paragraph), analysing services and characteristics of the sharing mobility offer, also consider the effective governance, in order to generate virtuous behaviours and a city’s inclination for innovation targeted at improving people’s quality of life. In light of the contemporary trends and the gap we discerned in nowadays research, in the 3 paragraph two research themes are proposed based on the current developments and possible future perspectives for urban spaces and mobility.

2. Smart mobility in Europe

Lockdown measures in businesses, restaurants, entertainment establishments, and workplaces were one of the most visible aspects of the pandemic. Since the level of traffic drastically reduced and urban centres have emptied, global transport emissions were lower but not negligible, especially considering specific areas with high concentrations. Fighting against the pandemic, numerous European countries’ lockdowns and similar measures have resulted in a significant drop in national economies, including a decline in vehicle transport in many cities with a significant reduction in the concentrations of some of the atmospheric pollutants in several European capitals⁴. Because of the drastic reduction in transportation activity while the global Covid-19 pandemic swept across the planet, the EU’s domestic transport emissions fell by 12.7 percent in 2020 in Europe⁵. Lockdowns offered a rare chance to evaluate whether significant changes to production practises and transportation

4 European Environmental Agency (EEA), *Air quality and COVID-19*, Published 04 April 2020, at <https://www.eea.europa.eu/themes/air/air-quality-and-covid19/air-quality-and-covid19>, (Retrieved on 8 February 2022).

regulation could improve metropolitan air quality in European countries (Kerimray et al., 2020).

Nonetheless, a reduction in emissions caused by the pandemic is temporary, as human activities resumed as they were before. Traffic and traffic congestion continue to affect air quality, and poor air quality cost 307,000 lives prematurely in European countries, and more than half of these may have been avoided by meeting the WHO targets on fine particulate matter (PM) pollution⁶.

As the transport sector contributes to the most part of greenhouse gas emissions (Leroutier and Quirion, 2022) - transport emissions are the most significant in Europe and the United States accounting for over 30 percent of total emissions⁷ - and poses an intersectional problem with negative impacts on health, equality, safety, and the environment.

Unprecedented challenges require new thinking, a willingness to innovate and a capacity to experiment and adapt.

The European institutions address the issues related to air pollution thanks to the guidelines that affect the different administrative levels. Among the six priorities of the European Commission for 2019-2024 is that of trying to make Europe the first continent to achieve climate neutrality, becoming a modern and resource-efficient economy. In this regard, the European Green Deal was created as a development strategy by the European Commission to address the complex challenge of transitioning to a productive circular economy in the European Union. The European Green Deal's goal is at least -55 percent GHGs reduction by 2030 compared to 1990 levels and climate neutrality by 2050 can only be reached by implementing more ambitious measures to rapidly reduce transportation's dependence on fossil fuels and work together with efforts to achieve zero pollution and to the advancement of the SDGs of the United Nations. The European Green Deal set the basis for this radical transformation, planning a realistic and resilient decarbonisation pathway that will reduce emissions also generated by transportation activity. In order to meet agreed climate change goals and the transition to a low-carbon economy, targets must include "green" initiatives capable of shaping and adapting to the green and digital transformation into the post-crisis recovery packages to pursue this conversion in earnest and involving a change in the behaviour of citizens to be implemented through different measures such as cycling or pedestrian traffic, as well as public transport and shared mobility.

In late 2020, the European Commission presented a sustainable and smart mobility strategy which defined a roadmap of 82 initiatives grouped into three main pillars:

5 European Environmental Agency (EEA), *Greenhouse gas emissions from transport in Europe*, Published 18 November 2021, at <https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-transport>, (Retrieved on 8 February 2022).

6 Chartered Institute of Environmental Health (CIEH), *Air pollution cut short 307,000 lives across the EU*, available at <https://www.cieh.org/ehn/environmental-protection/2021/november-2021/air-pollution-cut-short-307-000-lives-across-the-eu/>, (Retrieved on 7 February 2022).

7 ENI, *Sustainable mobility*, available at <https://www.eni.com/en-IT/sustainable-mobility/transport-decarbonization.html>, (Retrieved on 10 June 2022).

digitalisation, resilience, and greening of mobility, in terms of both individuals and goods (European Commission, 2020).

In the context of the recovery from this severe emergency, public assistance should help mobility to “build back better” integrating new tools for a radical transformation of transport habits in the EU metropolises and moving to a more sustainable and smarter future. Greening mobility must be affordable for all and be the new licence for the transport sector to grow (European Commission, 2021).

In the context of the opportunities for a clean energy transition for the movement of people, goods, and services, electric mobility could be a “game changer for the future” (Enel S.p.A. and The European House – Ambrosetti S.p.A., 2017), playing a pivotal role as a win-win option for a green recovery. Among the principal aims of the European Commission there is also the expansion of the market for electric and hybrid cars in the next years, despite some critics (Costa et al., 2021; Lattanzio and Clark, 2020). It specifically aims to ensure that citizens have access to the infrastructure needed to charge these vehicles for short- and long-distance journeys.

Additionally, from 2026, emissions trading will be applied to road transportation, taxing pollution, promoting the use of greener energy, and reinvesting in clean technologies. Among the various policies, the EU also called on local governments to formulate territorial mobility design such as Sustainable Urban Mobility Plans (SUMP), which, as aforementioned, include sharing mobility services (European Commission, 2013).

3. Smart mobility in Italy

Over time, Italian governments have been particularly interested in smart and shared mobility trends, where innovative technologies offer chances in using flexible, available and shared vehicles in urban centres.

At the normative level, sharing mobility was conceptually introduced for the first time back in 1998 with the Decree of the Minister of the Environment of 27 March 1998, where the terms “optimal collective use of cars” and “timeshare forms of cars destined to be used by several people” appeared, identifying car-pooling and car-sharing (La Foresta, 2019). For the following years, these two forms of shared mobility have been sharply promoted, with the aim of discouraging the use of private cars and limiting air pollution in cities.

Another important service of sharing mobility, bike-sharing, was socially and territorially introduced almost 20 years ago. The first two cities that inaugurated these sharing mobility modalities were Ravenna and Milan in 2000 and 2001 respectively, according to Osservatorio Nazionale Sharing Mobility (2021). Since then, sharing mobility has seen a progressive increase in both innovation and investments and was backed by various local administrations.

At a citizen level, as pointed out by Osservatorio Nazionale Sharing Mobility (2021), a very hard push was introduced by the invention and diffusion of smartphones and a series of practical, easy and intuitive Apps. In this regard, behavioural economics and

psychology are now discussing the influence of sharing information and smart Apps' impacts on the individual "choice architecture", e.g. the set of environmental elements that influence the way people access and use information so as to determine their decisions (Vecchio and Tricarico, 2019; Kahneman, 2011; Thaler and Sunstein, 2008). Changes in choice architecture may further lead people towards new and smarter sustainable behaviour in terms of mobility. Sophisticated and innovative Apps capable of introducing and informing people about the opportunities of smarter transportation, which indeed sharing mobility is, may nudge people to opt for sustainable choices in their everyday lives. In this respect, ICTs are indeed able to shape human life, choices, and decisions (van Wee et al., 2013).

Their implications and applications in Italy are crucial also to the tourism sector: they allow tourists to know and shape their own tour, may inform them of their destination, as well as other nearby attractions and services, serve better mobility and transportation, also allowing them to connect and interact with other people (Pesonen and Horster, 2012; Mangano and Ugolini, 2017). Along with the increasing usage of Apps and the various applications of ICTs, what is also noticeable is the future and yet already the present impact of the Internet of Things (IoTs)⁸ on mobility (Jell, Baumgartner, Bröring, Mitic, 2018). A recent study by Behrendt (2020) has questioned the research on the relationship between IoTs and mobility as mostly *automotive-driven*, favouring a positive discourse and further research on the relationships between IoTs and more sustainable mobility vehicles. It is not hard to consider that this openness will furtherly lead to more research on the correlations and possible integrations between IoTs and sharing mobility, which still needs to be properly investigated.

Generally, sharing mobility is in constant growth in Italian cities (Di Fazio and Paradiso, 2022). It has registered decreases during the pandemic period, but it seems to have recovered after 2021 (Osservatorio Nazionale Sharing Mobility, 2022). However, one should notice that whereas some of the sharing mobility implementations, such as free-floating e-Kickscooters, have gained great momentum in recent years, some others, probably due to the proliferation of other means of sharing mobility, have drastically lowered, during and after the pandemic.

The year 2020 has seen a drastic decrease in general mobility, but specifically, sharing mobility services have recorded -30,6% in terms of travelled km and -22% in terms of rental services (compared to 2019), although this is a slightly smaller percentage than those registered by other transport sectors, for instance, public railway transportation (-38%) and private mobility (-32,3%) (Osservatorio Nazionale Sharing Mobility, 2021). Car-sharing demand has been more affected by the mobility restrictions due to the pandemic, registering -42% free floating carsharing and -32%

⁸ The term Internet of Things (IoT) generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition (Rose et al., 2015).

station-based. This might also be due to the closure of historic and typical car-sharing operators, in 2020, such as Share'ngo in Milan (operating also in Rome and Florence) or Bluetorino, which operated in Turin and was acquired by Leasysgo⁹ - that consequently expanded its services in Milan and Rome.

Instead, bike-sharing is experimenting with a smaller impact, if one also takes into consideration the rapid growth of e-bike services. Despite this, generally the bike-sharing demand is decreasing as well as services. From 2020 to 2021, Italy lost 2 services in bike-sharing, falling from 39 to 37 (Mantua and Venice lost two services). Whereas, scooter-sharing service, which is almost completely electrified, is diffused in the greatest cities in Central and Northern Italy (Rome, Florence, Genoa, Milan, and Turin) and recorded better trends than bike-sharing in the last period.

According to Osservatorio Sharing Mobility (2021), a new solution for urban travel in Italy is constituted by electric micro-mobility which includes e-Kickscooters. The relatively lower loss percentage in sharing mobility services as well as the lower demand in bike-sharing was due to the rising of the new free-floating e-Kickscooter services and demand, which has reported a great expansion in vehicles, operators and cities' services. e-Kickscooters, in fact, have become the most widely shared vehicle in the country (in 2021 one in three shared vehicles in Italy is an e-Kickscooter), also leading the Ministry of Infrastructure and Sustainable Mobility to issue a new Decree (on 18 August 2022) for the definition of e-Kickscooter usage and calling for proper and specific regulation for the circulation of these electric vehicles in rapid growth. From 2019 to 2020, the number of fleet e-Kickscooter registered a percentage variation of 86,9% (in absolute numbers, from 4,650 to 35,550) in Italy (Table 2). The rapid increase continued for the whole of 2020, increasing by 22% (from 35,550 to 45,900), including far more cities and for the first time in Sicily and Sardinia regions.

	2019	2020	2021	Percentage variation (from 2020 to 2021)
e-Kickscooter	4,650	35,550	45,9	22.55%
Scooter	-	7,3	8,9	18%
Bike	33,372	34,705	27,6	-25.74%
Car¹⁰	8.264	7,282	6,643	-9.6%
Total	46,286	84,837	89,043	4.7%

9 For more information in this regard, on the Leasys website: <https://corporate.leasys.com/italiano/news/leasys-acquisisce-bluetorino>, 17 December 2020 (Retrieved on 2 February 2023).

10 The numbers take into consideration for car-sharing are both the free-floating and station-based fleet vehicles.

Table 2: Fleet vehicles in Italy, 2019-2021.

Source: our elaboration on Osservatorio Sharing Mobility (2021, 2022).

Besides, users seem to really appreciate this particular and peculiar service.

Table 2 not only underlines the constant growth of sharing vehicles, mostly due to e-Kickscooter services as already said but stresses a further and important dynamic when we refer to car-sharing and bike-sharing: these sectors, especially in the last year, are in loss, due to the closing of several operators. Car-sharing, in particular, registers a constant decline period. However, what is relevant is that the sector is rapidly going through a radical transformation, which sees the birth of more electric car-sharing services, such as Leasysgo, which replaced Bluetorino. Leasysgo is a 100% electric operator of free-floating vehicles. This may also be due not to the growing investments in this specific sector but to the people's interest in smarter and more sustainable behaviours, which implies more conscious transportation choices.

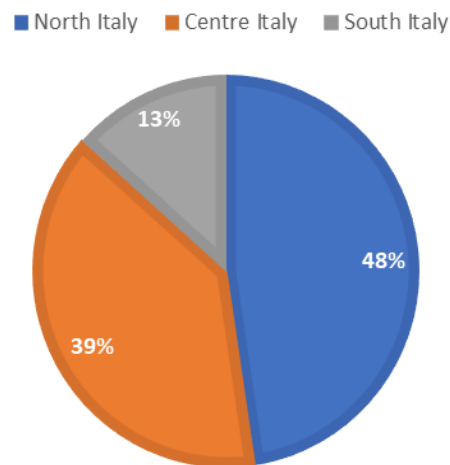
Moreover, the widespread diffusion of sharing e-Kickscooter services and demand in Southern Italy has signified a turn towards a possible homogeneity between the South and North. Indeed, since the implementation of the first sharing mobility project, the North, the Centre and the South of Italy have registered different various percentages, numbers and interests. As shown in Map 1, Milan and Turin are the top cities in Italy for typologies of services (4) and operators (18 in Milan and 13 in Turin). Rome, too, is the most served city in the Centre of Italy, with 16 services. Seven out of 16 provinces with at least two typologies of services are in Northern Italy, although the distribution is not perfectly homogeneous.



Map 1. Concentration of sharing mobility services per cities in Italy (2020).

Source: our elaboration on Osservatorio Sharing Mobility (2021).

Also, in Graph 1 one can see the percentages in the distribution of services per macro-regions in Italy, in 2021. The gap in the offer of services is notably still very deep. Nonetheless, with the introduction of e-Kickscooter services, this difference has slowly decreased over the past two years. Indeed, this particular service has marked a significant turn in the history of sharing mobility, in Italy, also triggering possible urban modifications.



Graph 1. Percentage of services per macro-regions¹¹ (2021).

Source: our elaboration on Osservatorio Sharing Mobility (2022).

4. Research agenda

It is undoubtable that sharing mobility might be considered both a means and a policy in achieving the objectives of a neutral carbon society for the cities of the future, as they have an important and crucial role in contemporary times, as scenarios for the “green and blue transitions” (Floridi, 2020). So far, we have tried to analyse the European policy frameworks at the basis of the reasons why this peculiar mobility should be further analysed and integrated in a proper way; we also provided a few second data, looking at the Italian trends of the past three years. Starting from these, we consider that future research should focus on the main challenges set up by

¹¹ Macro-regions have been merged based on the European division in NUTS1, which comprises North-western regions (Valle d’Aosta, Liguria, Lombardy, Piedmont), North-eastern regions (Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna), Centre (Tuscany, Umbria, Marche, Lazio), Southern regions (Abruzzo, Molise, Campania, Apulia, Basilicata, Calabria) and Islands (Sicily and Sardinia). North-western and North-eastern regions have been merged into the “North” category, and did the same with Southern regions and Islands into the “South”.

sharing mobility in urban spaces and with regard to the future transportation policies addressing global and European targets, providing two major points for future in-depth research on the issue. This is also important when thinking about the gaps identified in the literature and the demands which descend from the current tendencies, mostly influenced by the Covid-19 pandemic - and partially by the energy crisis triggered by Russian aggression in Ukraine, which may lead to delays, if the transition in energy production will be not taken into account properly.

As a proposal, we would like to specifically suggest the following as part of a possible future research agenda.

First, the transformation in urban structure and functions, triggered by the widest implementation of sharing mobility policies. Opting for sharing mobility means a radical re-design of the city, in its structure, people's behaviours and habits, as well as its flows in terms of directions and traffic. As Banister (1995) has pointed out, the evolution of transportation and mobility naturally triggers a transformation of urban areas, making it reasonable to suppose that sharing mobility policies, too, influence the shape and the way of conceiving the city, as much as the structure of the city influences the possible policies and their implementation. The transformations of the city generated by the implementation of such policies and measures are very much complex and characterised by long processes, as they are conditioned by a variety of variables such as the physical form of settlements, environmental constraints, and strategic choices that have been made over time on transport networks (Rode et al., 2017). On the one hand, one has to consider that the physical structure change of a city takes infinitely more time than it does for urban functions. This means that whereas commercial, social and economic activities might easily migrate to other spaces (including cyberspace, as happened during the pandemic), the physical process of reshaping the city and its environment is indeed a long and negotiated procedure. On the other hand, as sharing mobility signifies the shift from an "infrastructure-based" urban transport to a "flexible-services" model, this typology of mobility relates transport users to the urban space in extremely flexible and differentiated forms, because of the tight interdependence and interconnection between private and public services, territorial information, and users (Civitas, 2016). In order to work, however, it needs new infrastructures which inevitably will transform urban spaces and will create new physical networks. Moreover, one has also to consider the highest relationship between sharing mobility and digital technologies: it is of great importance and might have a crucial impact on infrastructures. The expansion of car-sharing and bike-sharing stations, cycle lanes, reserved lanes, interchange car parks, pedestrian areas, e-charging stations, the construction of transmission system operators and other electric and digital facilities will certainly mean the building up of a secure and sustainable power grid, which will consequently reshape the face of urban cities in a more *ICT-friendly* environment (Shaheen and Cohen, 2018; Exner et al., 2020).

Therefore, since sharing mobility might be included in the wider context of urban redefinition, by which the city becomes smarter and greener, it is of higher importance to consider studying and investigating such possible transformation,

taking also into account the already ongoing trends generated by the pandemic (Buonocore, Di Martino, Ferro, 2021).

Second, understanding the relationship between the public and private sectors for shared mobility. Specifically, we refer to the idealisation of new forms of governance for these typologies of services, taking into consideration that the already implemented mobility policies and practices have contributed substantially to creating and feeding inequalities in the cities (Buck and Nurse, 2021; Privitera, 2020).

As we discussed in this paper, local authorities should act as promoters of sustainable mobility, in order to improve the quality of urban life and contain emissions. The literature already stressed that policy approaches aiming at promoting better mobility practices should provide more transport information and mobility choices, in order to shape individual preferences. This furtherly leads to strengthened cooperation between the public administration and private mobility providers.

Vecchio and Tricarico (2019) propose several steps for institutional actors to sustain initiatives in this regard: among others, recognising initiatives provided by corporations and communities that can really improve urban mobility and support development is key for local and public administration. Innovative solutions need to be sustained by public actors, not only with a simple endorsement, but rather with engagement and shared responsibilities (Feitselson and Samuelson, 2004; Stilgoe, et al., 2013).

Investigating new typologies of governance might mean keeping engaged and involving all social, political and economic actors in the re-definition of policies, normative frameworks and urban requirements, in a truly participative process. Shared-use services have enormously emerged, being one of the most rapid changes in transportation, which furtherly mean to policymakers to seize the opportunity to integrate those new mobility options into traditional transit networks in ways that benefit the government, and the private and public sectors. A new type of governance means that shared goals must be at the top of the agenda for all the actors, not just including profit, but rather greater efforts in sustainability and shared prosperity (Jackson, 2011).

Karim (2017) already pointed to the lack of literature and research when regard to public policymaking and the scalable impact of innovative mobility on traditional planning, management and governance, for the traditional forms generally exclude shared mobility trends. Luckily, in the last few years, several Italian cities are trying to include specific services in their SUMP, but more is needed in terms of research and investments when referring to the relationship between public administration and private providers, the engagement of citizens and communities in the normative and policy design, the sharing of data and the analysis of individual behaviour and preferences, and consequently the development, implementation and usage of innovative and smart technologies in transportation.

5. Conclusions

Climate change and environmental challenges, digitalisation, globalisation, and demographic trends are fast-changing global daily lives, and the risks from combining crises of social-ecological change and health pandemics are particularly critical for countries already dealing with a number of drivers of fragility (Quagliarotti, 2021). The Covid-19 pandemic, indicated by Partha Dasgupta as an “SOS signal for the human enterprise, bringing into sharp focus the need to live within the planet’s ‘safe operating space’” (Dasgupta, 2020), has plunged the world into one of its most severe crises in living memory, contributing to increasing poverty and amplifying inequalities worldwide, putting the international system to the test and highlighting the importance of multilateralism and concerted effort in addressing international challenges. Furthermore, the pandemic has changed many habits, including those related to travel. This is demonstrated by the increasing usage of e-Kickscooters, which multiplied during the lockdown and grown exponentially over the months.

Meeting the EU 2030 and 2050 targets is ambitious, but not less necessary, in this regard. The EU policies are fundamental to keep bending the emission trend while recovering from the pandemic. In fact, after two years, the pandemic seems to have given way to a new crisis that potentially leads to an economic recovery based on the two pillars of energy transition and digital transformation. However, with the increase in energy and raw material prices, the Ukrainian crisis poses significant challenges about timing and method of the post-Covid economic and social growth model’s transition plans, which include urban mobility as one of their core components.

Smart mobility is essential in the sustainable development strategies and programs imagined by the European Commission with the Green Deal and the Next Generation EU. Therefore, a “business-as-usual” scenario does not allow meeting the model of development envisaged in the Paris Agreement.

Since sustainable development has become a primary focus of the United Nations’ 2030 Agenda to fully address numerous goals of achieving well-being at several levels, such as people, planet, prosperity, and peace (UN, 2015), in Italy a decisive change is necessary. The process of implementing sustainable and sharing mobility in the country can be boosted by the realisation of effective cooperation between local authorities and private stakeholders, through the promotion of a radical transformation of transport habits since urban mobility shares the greatest responsibility in terms of emissions. As we have highlighted, the lockdown following the Covid-19 pandemic has led to a drastic drop in the concentrations of pollutants. It has been possible to analyse the benefits that could be obtained by reducing air pollution. Therefore, within a vehicle fleet replacement scenario, the penetration of a percentage of electric vehicles also plays a key role in reducing concentrations of local pollutants.

For this reason, it is fundamental to reflect carefully on the challenges that the National Recovery and Resilience Plan (NRRP) - which promotes also the growth of electric mobility - poses to us in this field and on the opportunities it presents.

In conclusion, as stated by the EEA executive director, Hans Bruyninckx, in the following ten years investing in cleaner heating, mobility, agriculture, and industry will benefit all Europeans, especially the most vulnerable, by improving health, productivity, and quality of life. These investments help save lives while also speeding up the transition to carbon neutrality and strong biodiversity¹².

Changes in everyday practices can be encouraged by eliminating economic and cultural barriers that slow-moving the adoption of healthy and efficient behavioural models, in order to establish virtuous practices and urban propensity to an innovation aimed at guaranteeing citizens a better quality of life.

As a result of the Covid-19 pandemic, the evolution of urban mobility in Europe is speeding up, proving to be inevitable and influenced by new elements, as a constantly changing field. These aspects must be promptly analysed by researchers, in order to provide policymakers and urban stakeholders with the necessary tools and scenarios interpretations to design and implement better urban policies and generate best practices.

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¹² Chartered Institute of Environmental Health (CIEH), *Air pollution cut short 307,000 lives across the EU*, at <https://www.cieh.org/ehn/environmental-protection/2021/november-2021/air-pollution-cut-short-307-000-lives-across-the-eu/>, (Retrieved on 7 February 2022).

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