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Cities between smartness and emergencies: exploring the role of e-scooter in the "transition era"

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Abstract

The Covid-19 pandemic hastened the use of technologies that replaced some urban activities, normally based on people interactions, thus significant changes occurred in mobility demand. Recently, also in Italy, for urban short-distance travels, "non-conventional" ways of moving spread, encouraged by governmental measures addressed to sustainable mobility, too. Defined as "urban micro-mobility" including e-scooters, these modalities of moving had a significant success, producing impacts on mobility and urban safety. This study focuses on the analysis of the spread of e-scooters use in Italy, relating both to the pandemic event and to the post-emergency phase. Specifically, this study is articulated into three parts: 1) the overview on urban micro-mobility particularly referred to the use of e-scooters in Italy; 2) the results of direct surveys (questionnaires) addressed to the undergraduate students, considered as a significant age range; 3) the effectiveness of these "alternative mobility" to improve urban sustainability.

Keywords: micro-mobility, e-scooters, Covid-19, university student mobility, urban sustainability

1. Covid-19 pandemic and the impacts on urban mobility

The pandemic event concentrated the attention of scholars that in some recent studies investigated the impacts of the Covid-19 on the organization of urban systems highlighting the relations between the spread of the contagion and the functional system, the social presence, and the spatial perception (Fistola and Borri, 2020).

These sudden changes particularly have affected urban mobility, rightly considered one of the vital functions of the city. The "mobility" among the urban functions is the only one that cannot be *in* a specific space because of its kinetic dynamism that makes it take place *through* the space. Moreover, if mobility is a dynamic urban function, as such, it is highly related to the distribution of other urban activities inside the city and it is made of the physical movement of peoples and goods inside the city.

Due to the Covid-19, the restrictions on displacements, the collapse of tourist flows and the spread of teleworking have rapidly changed the relationship the mobility demand both at urban and international level.

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Remaining at the urban level, we can note that the segment most affected by the pandemic event has been the Local Public Transport (LPT) that represents the main factor of the mobility supply in cities if we only refer to the home-work typology of movements, for instance. Collective transports have been stated as unsafe for the high possibilities of contagion, but rather than to increase the number of rides or means the first solution has been the reduction of the number of passengers that could be carried.

To replace physical flows of movement has been resort to the technologies that have rapidly replaced physical mobility.

By an optimistic perspective, it should be noted that both the switch towards the "virtualization" of some urban activities (Fistola and La Rocca, 2001) and the adoption of "alternative mobility" can be seen as factors of a "positive side" (if one exists!) of the pandemic (Mastrodonato, 2021).

As it concerns the Italian situation, and according to the results of a recent survey conducted by the company Aretè (2021) especially for young Italians, the car remains the preferred means of transport for travel (75% of the sample considered, it was 72% in April 2020), followed by bicycles (8%), motorcycles and scooters (4%) and shared vehicles (3%).

It seems also relevant to note that a substantial push towards urban micro-mobility has been produced by governmental policies aimed at supporting the buying of electric vehicles, especially bikes. During the first phase of pandemic, Italian Government has provided an economic incentive of up to 500 euros for those who intended to purchase a means of "sustainable mobility" such as muscle bikes, e-bikes, and electric scooters, (article 229 of the Relaunch Decree 2020).

This initiative, although strongly criticized, has led to the sale of 350,000 vehicles, with funds of 120 million euros planned. However, the support for the diffusion of electric scooters in many cities represented an urban policy aimed at reducing traffic congestion that could be "easily" implemented.

This new type of moving in the city that can be defined as micro-mobility has also drawn interest of scholars. The Characteristics Object METhod (COMET), for instance, is a multi-criteria group decision-making model pointed out to help a decision maker to organize the problems to be solved, and carry out analysis, comparisons, and rankings of the alternatives *(*Salabun, 2014). The method applied to the purchase of a bike, for instance, allows the buyer to individuate the best model to choose by considering factors as: price, top speed, weight, autonomy (battery life) and motor power expressed in watts (Kizielewicz B. and Dobryakova, 2020). Brezovec and Hampl (2021) recently investigated about new transportation modes (e.g., electric cars, e-scooters) and concepts (shared mobility, Mobility as a Service) to test the attitude of users not to necessarily have to own a private car. Schad et al. shown that multimodal mobility packages help people to change their habits and rethink their mobility behavior. Nearly 90% of all users in their study's sample started using their own car less.

In Europe MaaS initiative have been implemented since the last twenty years especially in Sweden and Finland that have acted as pioneers in introducing and developing MaaS (with UbiGo and Whim project). The concept of MaaS has been largely investigated in sectorial literature (Kamargianni et al., 2016; Ho, et al., 2018).

It envisages a single digital mobility platform (a mobile app) through which the end-users can access all the necessary services for their trips (trip planning, booking, ticketing, payment, and real-time information) and therefore carry-out their journey across a range

of transportation modes based on their own preferences regarding time, comfort, cost and/or convenience (Warwick et al., 2017).

Recently, in Italy in July 2021 the Guidelines for MaaS (2021) have been published and has been introduced in the National Recovery and Resilience Plan to indicate that it will represent a real target to support the transition towards the ecological phase of the next future. At present, Italy has a delay within the global European context referring to mobility preferences.

Nevertheless, in recent time, also Italy has been interested by a real breakthrough of urban micro-mobility due to the diffusion of e-sharing mobility (e-scooter and e-bikes) in cities. The challenge is to make the new supply of mobility services as efficient as the use of private car.

Restictive measures imposed during the lockdown have shown that more space can be made available for walking and cycling, and it is up to local authorities to keep up with it also in the long term. Cities are reducing parking spaces and creating mobility hubs where it is possible to access a variety of shared services like electric car, bike and e-scooter sharing.

2. Alternative mobility modes and services: an overview

Shared mobility, micro-mobility, and Mobility-as-a-Service (MaaS) are different transport service concepts that overlap and interact.

2.1 Shared mobility

Shared mobility can be defined as a subset of sharing economy, that among other, is aimed at disengaging the ownership of cars from its use. Different business models can be indicated under the concept of sharing mobility, including Peer-to-Peer (P2P) vehicle rental, taxi services or ride sharing, and B2C vehicle short term rentals. These services are typically booked via mobile apps and have becoming increasingly popular also in Italy, in the last ten years.

Even when changing type of vehicle, they have some recurring characteristics:

- the payment is related only to the time of use;
- the "culture of ownership" is replaced by the concept of "use as you need";
- the alternative as supplement or substitute of the collective transport system, especially for urban tourists or temporary city-users;
- the promotion of sustainable mobility as the means (cars, bikes, scooters) are often electric or hybrid vehicles.

Services are usually shared through four main modalities:

1. *Bidirectiona*l, with fixed pick-up and drop-off points (station-based); this type of service is usually provided only for car-sharing. Customers book their vehicle at a specific pick-up/drop-off point (parking point) with an app or through a dedicated website, specifying the time of pick-up and the expected duration of use. The user must return the vehicle to the same location where it was picked up (with a few exceptions) and pay for the entire time between the start and end of their reservation. Clearly, this system is the most restrictive for the user, but also the easiest to manage.
2. *One-way*, with fixed pick-up and drop-off points (station-based). This mode is also called point-to-point. The user picks up the vehicle (in some cases even without a reservation), at a pick-up/drop-off point (parking) with an app or via a dedicated website. The user can return the vehicle at any pick-up/drop-off point. The user pays for the distance travelled and/or the time for the journey made and is not bound to

using the same service for the return journey. The management of vehicle relocation by the operator is fundamental, given the directionality that demand may have.

3. *Free-floating*, without pre-established pick-up and delivery points. This mode is usually used for micro-mobility, sometimes for bicycles, but can also be used for cars. The user picks up the vehicle at any point inside the city (there are no fixed pick-up/drop-off points). The app provides the user with information about the nearest vehicle location. The vehicle can also be booked (so it is taken out of the availability for others). The user can return the vehicle at any point in the city. The user pays for the distance travelled and/or the time for the move. Fundamental to this is the management of vehicle relocation.
4. *Peer-to-peer*, with the sharing of one's own vehicle. In this case, private individuals make their vehicle available to share with others and receive compensation when it is rented. Shared vehicles are equipped with technological devices so that they can be booked and used via apps and/or smartcards. If the vehicle is not equipped, the owner also shares the keys to the renters to use the vehicle. The role of the service operator is to manage the online marketplace to connect vehicle owners with users, but not the fleet. In addition, the operator provides vehicle owners with insurance products and keeps a percentage from each rental transaction. Typically, this system, for obvious reasons, is operated as a two-way service: the vehicle must be returned to where it was picked up.

Shared e-scooters normally use the free-floating system. Regarding the spread of these services in Italy, it is necessary to discern between car-sharing, bike-sharing and scooter-sharing.

For car-sharing, the most recent data available refers to 2019 then, to the pre-pandemic period (Aniasa, 2020).

This data shows an increase, compared to the previous year, in the number of members of car-sharing management companies (+21%) reaching about 2.2 million.

The fleet of cars is about 6,300 vehicles, with a total number of rentals of about 11.7 million (+26% compared to 2015). The average rental duration is 32 minutes and the average distance per rental is 7.4 km.

The Italian cities in which these services are widespread are Milan and Rome, with about 9,38 million rentals (over 80% of the total) and about 5,000 vehicles (about 80%), followed at a distance by Turin and Florence.

Car-sharing is also in the following other Italian cities: Naples, Bologna, Parma, Brescia, Savona, Venice, Padua and Palermo.

Bike-sharing services are, obviously, more widespread throughout the territory. The National Observatory on Sharing Mobility has surveyed 31 provincial capitals in which there is a service with at least 80 bikes available. In these 31 cities, the total fleet of bikes has more than tripled from 2015 to 2019, reaching over 5,400 bikes overall. The services offered in these cities are predominantly station-based (19/31); 4 cities offer only a free-floating service, while 7 others offer both types of service. Rentals totaled more than 12.5 million in 2019, up sharply from 5.6 million in 2015.

2.2 Micro-mobility

Micro-mobility is a type of shared mobility that involves only slow and light vehicles such as electric push scooters, bicycles, and scooters.

As a relatively slow mode, it is mainly used for short access and exit trips to and from transport hubs. The vehicles are generally small-sized and they are light enough to be

picked up and dropped off anywhere, without requiring specific park stations. Booking and unlocking of vehicles only work using mobile apps.

2.3 MaaS

Mobility-as-a-Service (MaaS) mainly refers to the booking and information services targeted to integrate all available transport services (from public transport to micro-mobility, and shared mobility). This is most focused on focuses on mobility or travel rather than the transport mode or the service provider, and its importance can be mainly appreciated both as support for new mobility services and as provider of information on the best services available, in terms of cost or travel distance.

An important contribution to the focus of this research is the review by Boglietti, Barabino and Maternini (2021) particularly concerning the impacts of micro-mobility on the urban context. Authors showed that the issue of the impact of e-PMVs (e-Powered Micro Personal Mobility Vehicles) on transport and urban planning is largely explored in scientific literature. Two main themes emerged: the trip pattern and the purposes. Very interesting is the investigation about what kind of urban mobility the e-scooters are going to replace. Even though the investigation refers to American cities we found this issue particularly stimulating for possible further in-depth of this research applying to the Italian context.

At the present state, mainly focussing on urban micro-mobility, the study in this part refers to the state of the art in some Italian cities.

3. Micro-mobility in Italy

Micro-mobility sharing services has recently been emerging as one of the most promising solutions for the spread of sustainable modes of travel in urban areas.

The micro-mobility sharing segment includes three main categories of vehicles:

a) scooter sharing;
b) bikesharing;
c) electric scooters.

The requirements of these vehicles can help to understand what is meant by micro-mobility.

Firstly, it must be considered the relationship with urban space: to be effective, these services must meet criteria of distribution, accessibility and reachability.

Distribution concerns the widespread location of points of service over the urban space.

Accessibility refers to the way in which the service can be effectively used, both in terms of ease of use and in terms of functionality, safety, and comfort of the vehicles.

Reachability is related to the ease of finding the location of the vehicles in the urban area and it is complementary to the previous concepts.

Secondly, the characteristics of the vehicles must meet criteria of lightness (low weight) and, at the same time, reliability and safety.

Finally, the practicability of the route. This last point highlights a fundamental aspect of the definition of micro-mobility as a mode of transport and not exclusively referred to the carrier. Micro-mobility, with reference to this characteristic, must be understood in terms of the length of the route and its conditions of practicability in safe conditions (Fistola et al., 2020).

This study assumed micro-mobility into the framework of the three mentioned points, to interpret the phenomenon of its diffusion both in relation to the supply component and,

especially, to define possible profiles of the demand of electric scooters in sharing in urban context.

In Italy, the spread of micro-mobility can be compared to other European countries, particularly to France that is forerunner in the supply of alternative modes especially for short-distance urban travel, for several years now.

Italian success has been also strongly linked to the distribution of governmental economic incentives, demonstrating that the promotion of sustainability is still very much related to principles of economic development.

The Italian National Observatory for Sharing Mobility, in its 4th report published in 2020, highlights the exponential and rapid growth of the supply of e-scooters sharing services in Italian cities (tab. 1) during the lockdown period.

Table 1. Number of E-scooter in sharing services in Italian cities.

	Dicembre 2019	*Settembre 2020*
Bari	-	1,000
Bergamo	-	300
Cesena	-	200
La Spezia	-	300
Lecce	-	250
Milan	-	6,000
Modena	-	200
Monza	-	400
Naples	-	900
Parma	-	900
Pesaro	-	250
Pescara	-	500
Ravenna	-	350
Rimini	1,000	1,000
Rome	-	11,000
Turin	2,650	3,000
Venezia	-	300
Verona	1,000	1,000
Total	**4,900**	**27,850**

Data from Italian National Observatory for Sharing Mobility, in its 4th report published in 2020 in 18 Italian provincial capitals

As shown in table 1, cities in which the e-scooter sharing services were activated augmented from 3 to 18 in a very short period, with a territorial distribution highly concentrated in the cities of Milan (6,000 units), and Rome (11,000).

It is significant to note how the supply component, in a period of less than twelve months, assumes not only a significant consistency, but also a significant difference between operators (tab. 2) especially in the cities of Milan, Turin and Rome. Naples, until 2020, was the only large city with a single operator (Helbiz) that managed the supply of electric scooters amounting to 900 units, currently present in the central parts of the city. By November 2020, the service intensified adding 250 vehicles by a new operator that has increased the supply in the hilly areas of the city (fig. 1).

For the purposes of this study, the demand-side is significant, and the analysis of data collected in the 17th Report published by ISFORT in 2020, allows for some useful comments.

Data show some characteristics of the demand of e-scooter services in sharing confirming the use of e-scooters for short duration trips (about 10 minutes on average) for a maximum distance of about 1.5 km. Users are composed by the mid-young peoples (up to 40 years) that seem to be the segment more inclined to the use of the e-scooters both in large and in small cities (Audimob Observatory, 2020).

This trend is confirmed also in other European countries such as France, which has a much more consolidated tradition than Italy in the use of sharing services for sustainable mobility and particularly of e-scooters (fig. 2).

Table 2. Private Operators of e-scooters in Italy

	Helbiz	**Bit**	**Bird**	**Circ**	**Dott**	**Wind**	**Voi**	**Lime**
Bari	500	500						
Bergamo		300						
Cesena	200							
La Spezia		300						
Lecce		250						
Milan	750	750	750	750	750	750	750	750
Modena	200							
Monza					200	200		
Naples	900							
Parma	300	300				300		
Pesaro			250					
Pescara	500							
Ravenna	350							
Rimini			500					500
Roma	2,500		2,500		2,500	1,000		2,500
Turin	500	500	500	500	500			500
Venice		300						
Verona	200		500					300
Totale	**6,900**	**3,200**	**5,000**	**1,250**	**3,950**	**1,250**	**750**	**4,550**

Data from Italian National Observatory for Sharing Mobility, in its 4th report published in 2020 in 18 Italian provincial capitals

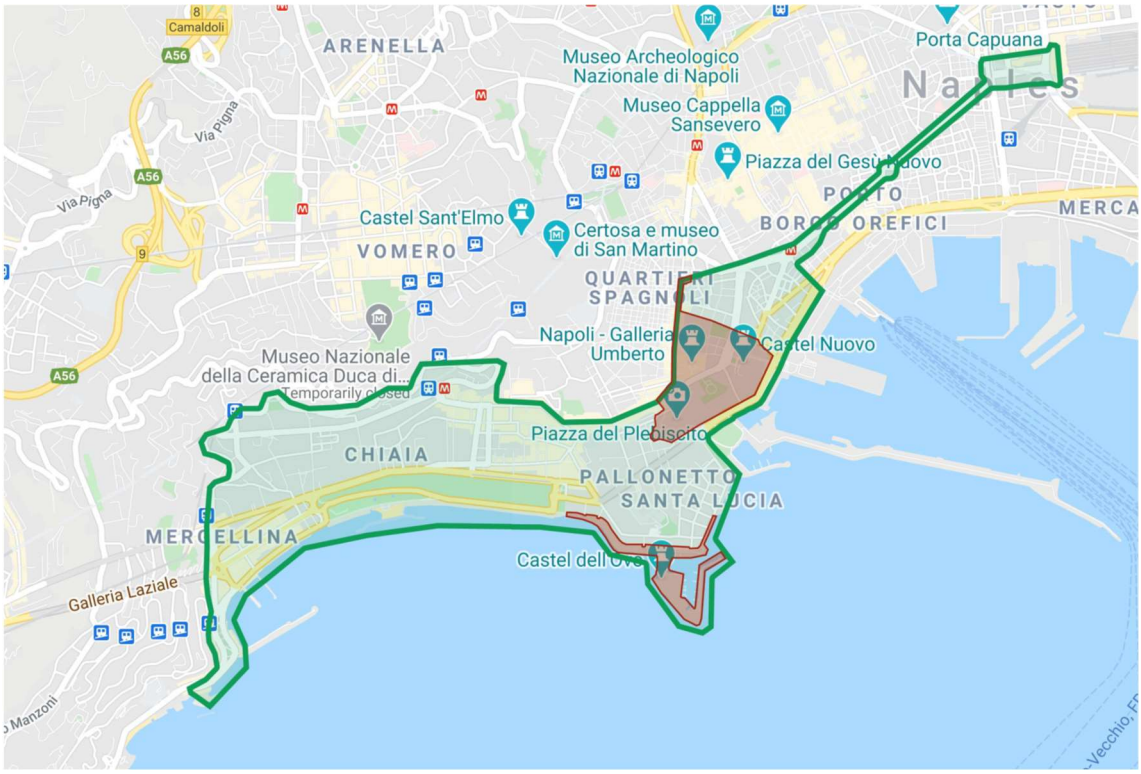

Figure 1: The network of e-scooter in Naples.
Source: City of Naples 2021.

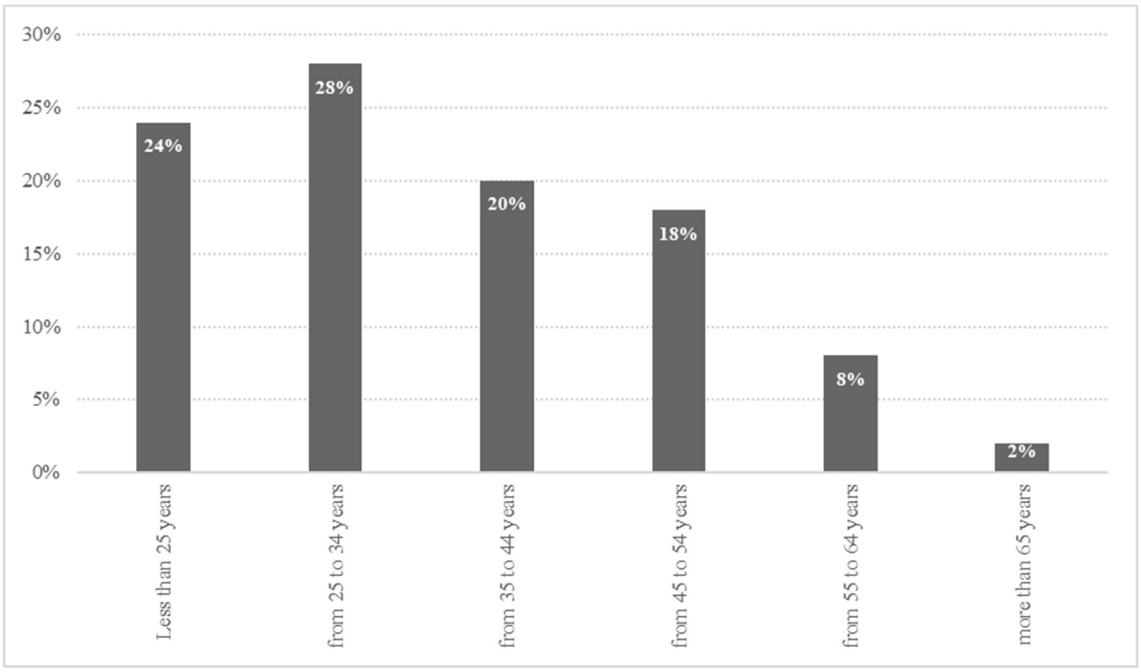

Figure 2: Users of e-scooters per ages in France.
Source: Schultz and Grisot 2019.

The spread of the use of e-scooters in cities raised the problem of safety as many accidents have occurred in the last few months. In Italy, in early 2021, there have been eight victims and the attention for restrictive rules is increasing. The debate on safety

firstly concerns the need to provide travel on mixed routes (pedestrian and cycle paths) and protected lanes, adequately designed to guarantee the same safety conditions as bicycles and pedestrians. Secondly, the need to regulate the use of this means of transport on the road, and by implementing rules that can encourage their use, precisely because of their reduced impact in terms of polluting emissions.

After defining a group of users most interested in the use of e-scooters in the urban environment, also based on surveys developed by observatories dedicated to the phenomenon, this study focused on the population of university students in order to monitor the phenomenon and verify the actual effects in terms of reducing traffic congestion and covid contagion. The student population, after commuters who travel for work, represents the largest share of the population that uses local public transport to reach the place of study.

At the outset, a focus on the new rules introduced for the use of e-scooter has been settled.

4. Recent rules for e-scooters in Italy

The Italian legislator has recently intervened by collecting requests from public opinion, introducing significant restrictions on the use of e-scooters in urban contexts.

The new rules were introduced with the approval of the "Infrastructure Decree" in October 2021 and some of them are now in the new Regulation of the Department of Transportation. The new rules particularly concern the maximum speed of e-scooters on public streets, that reduced from 25Km/h to 20Km/h to limit the risks of accidents due to the lack of control of the vehicle for running speed. Furthermore, it has become mandatory for e-scooters to drive on urban roads where the maximum speed limit is 50 km/h, and it has been forbidden to drive on sidewalks. Large attention has been put to reduce the "wild parking" that really it is causing problems especially to pedestrians as well as to drivers.

According to the new rules, electric scooters cannot longer be abandoned everywhere like it now happens, but they must be left in specific areas dedicated to their parking. This already happens for bicycles and mopeds. Some perplexities arise regarding the decision of sanctioning offenders (who risk up to the confiscation of the vehicle) since, considering the example of incorrect or prohibited parking of the scooter, the fine cannot be carried out in the absence of a license plate and driver.

Further proposals, not yet approved, had been formulated in amendment to the decree law, relating to the provision of brakes and direction indicators to be mounted on scooters, as well as for the extension of the helmet obligation for all drivers (currently limited to minors of 14 years) and for the compulsory insurance.

The debate, in Italy is still on and it seems to address toward hard and restrictive rules in this not very matching polices in other European counties in which the roles for the use of e-scooter are less obstructive and vary from country to county.

Regarding safety for micro-mobility, a new report published by the International

Transport Forum in 2020 finds that:

- e-scooter riders do not face significantly higher risk of road traffic death or injury than cyclists;
- motor vehicles are involved in 80% of fatal crashes with e-scooters and bicycles.
- traffic will be safer if e-scooter and bicycle trips replace travel by car or motorcycle.
- the fast-paced evolution of micro-vehicles challenges governments to put in place safety regulations that are future-proof.

The report, thus, suggests ten recommendations for policy makers, city planners, operators and manufacturers (ITF, 2021):

1. Allocate protected space for micro-mobility
   Create a protected and connected network for micro-mobility. This can be done by calming traffic or by creating dedicated spaces. Micro-vehicles should be banned from sidewalks or subject to a low, enforced speed limit.
2. To make micro-mobility safe, focus on motor vehicles
   The novelty of e-scooters should not distract from addressing the risk motor vehicles pose for all other road users. Where vulnerable road users share space with motor vehicles, speed limits should be 30 km/h or less.
3. Regulate low-speed micro-vehicles as bicycles
   Micro-mobility can make urban travel more sustainable. To prevent over-regulation, low-speed micro-vehicles such as e-scooters and e-bikes should be treated as bicycles. Faster micro-vehicles should be regulated as mopeds.
4. Collect data on micro-vehicle trips and crashes
   Little is known about micro-vehicles' safety performance. Police and hospitals should collect accurate crash data. Road safety agencies should collect trip data via operators, travel surveys and on-street observation. The statistical codification of vehicle types must be updated and harmonised.
5. Proactively manage the safety performance of street networks
   Many shared micro-vehicles possess motion sensors and GPS. These can yield useful data on potholes, falls and near crashes. Authorities and operators should collaborate to use them for monitoring and maintenance.
6. Include micro-mobility in training for road users
   Training for car, bus and truck drivers to avoid crashes with micro-vehicle riders should be mandatory. Cycle training should be part of the school curriculum. Training programmes should be regularly evaluated and revised.
7. Tackle drunk driving and speeding across all vehicle types
   Governments should define and enforce limits on speed, alcohol and drug use among all traffic participants. This includes motor vehicle drivers and micro-mobility users.
8. Eliminate incentives for micro-mobility riders to speed
   Operators of shared micro-mobility fleets should ensure their pricing mechanisms do not encourage riders to take risks. By-the-minute rental can be an incentive to speed or to ignore traffic rules.
9. Improve micro-vehicle design
   Manufacturers should enhance stability and road grip. Solutions could be found in pneumatic tyres, larger wheel size and frame geometry. Indicator lights could be made mandatory and brake cables better protected.
10. Reduce wider risks associated with shared micro-mobility operations

The use of vans for re-positioning or re-charging micro-vehicles should be minimized, as they impose additional risks on all road users. Cities should allocate parking space for micro-vehicles close to bays for support vans.

5. Comparing the use of e-scooters by university students in Campania: the case of Naples and Benevento

This part of the study considers university students among the elective users of e-scooters both for the age and for the target of their travel in cities. These specific typology of "urban actor" have been assumed as "ideal users" also for their ability to the use of apps on smartphones that can be seen as the real divisor between different generation of users for age.

Due to the restrictions imposed covid-19 pandemic the home-study travel made by university students have been analyzed. Surveys have been addressed to 200 university students at University of Sannio of Benevento (Unisannio) and University of Naples "Federico II" in Naples, in Campania region (South Italy).

The "Federico II" is one of the oldest public universities in the world based in Naples, the "Unisannio" is a small university, founded twenty years ago, based in Benevento. The two universities are significantly dissimilar for the number of students population: about 80,000 students at "Federico II", about 5,500 students at "Unisannio", in 2020.

Moreover, while in Naples there is currently an active mobility service on e-scooter sharing, provided by more than one company, in Benevento recently the municipality has signed for a pilot project not yet started that will provide about 200 e-scooter in sharing there is still no such service. For this reason, referring to Benevento, answers to the questionnaire have been assumed to evaluate the future potential demand.

The survey used Google Forms and was structured in three blocks of questions.

The first block is targeted to collect the profile of respondents (age, genre, status).

The second aims at collecting information about the habit of respondents to use their car for home-study trips. The third block investigates propensity of respondents to use alternative modes of travel and their level of knowledge about these alternative modes (how to get vehicles, how is their cost, etc.).

Mainly attention has been dedicated to understanding if and how the pandemic phenomenon has impacted the modes of travel of the respondents, with the intention of accompanying the interviewee to the subsequent questions focused on the specific means of transport in question.

Before the introduction of the block of questions referring to the mode of transport, some demands have been proposed again in different form to verify the real propensity of respondents to use e-scooters considering the distance they should have made, and the time needed to do.

The survey also was targeted to investigate the frequency of use, the perception of safety in driving the vehicle and the awareness of the so-called "ease of use" given by the availability to find the vehicle anywhere in the city and by consulting applications on smartphones, and by the possibility to leave the vehicles without warning about the need to find out a specific area to park the vehicles.

The questionnaire also allowed the respondents to participate in the definition of future conditions for improving the sharing mobility services. This part of the survey particularly aimed at the definition of actions to integrate to the decisional processes by the administrators. The questionnaire in fact invites the respondents to express a general

opinion on urban micro-mobility in sharing, both to be the services a response to limit the contagion of the virus, and as solution for reducing urban traffic congestion.

6. The results of the survey: evaluations and considerations

The first results of the survey show that the composition of the sample is characterized by an almost equal distribution of genre, with a majority (72.1%) of respondents in the 19-23 age range, belonging to households of 3 or more members (over 96% of respondents). Most of the students responding belong to the University of Naples and around 13% to Unisannio.

In most cases, students are off-site and they live in outlying municipalities or in the province. This condition could configure the need for an interchange in the mode of travel, with a first segment of reaching the university campus and a subsequent move to the university for which the electric scooter may represent the elective means.

The results of the survey showed that most of respondents (74.6%) have the possibility of using a car for their urban travel, 21.4% a motorcycle, 21.4% a muscle pedal bike and 4.5% a pedal assisted bike. Only 4 respondents (2%) have electric scooters. 16.9% of respondents stated that they have not private vehicles for their urban travel. Most of the respondents declared e-scooters very useful: 40.8% consider them useful for any type of urban travel, 24.9% consider them useful for occasional travel, 11.4% consider them as a means of travel supplementary to public transport (to go to stations). Only 2% of respondents considered e-scooters not very useful at all, while 20.9% declare to be unable to evaluate.

The impact of the pandemic on travel habits was significant: only 21.4% of respondents said they had not changed their travel habits, while 78.6% had (36.3%, only partially). The greatest impact was on the use of collective transport system, considered the most dangerous for the purposes of contagion. In fact, taking out the interviews of those who did not even use public transportation before, 25.6% of respondents said they no longer used public transportation and 53.9% said they had greatly reduced their use, 20.5% said they used it as much as before.

On the usage side, 20.4% of respondents used micro-mobility vehicles, 31.8% never used them even though the service was available in their city, and 45.8% did not use them because they were not available in their city.

The propensity to use e-scooters shows positive values shared between those most willing to use scooters occasionally (42.3%) and habitually (39.3%); 18.4% would not use e-scooters at all, proclaiming a certain reluctance because they consider the unsafety of e-scooters. The correlation between the propensity to virtualize urban functions and the propensity to use e-scooters offers some important food for thought.

As shown in Figure 3, the percentages of propensity to virtualize city functions is higher for students inclined to use e-scooters; this result may indicate how this means of transport is perceived as one of the "smart" innovations implemented during the pandemic emergency.

These results represent some initial useful evaluation while the study is still in progress. Further developments are expected to be even more significant for the targets of the research in this field.

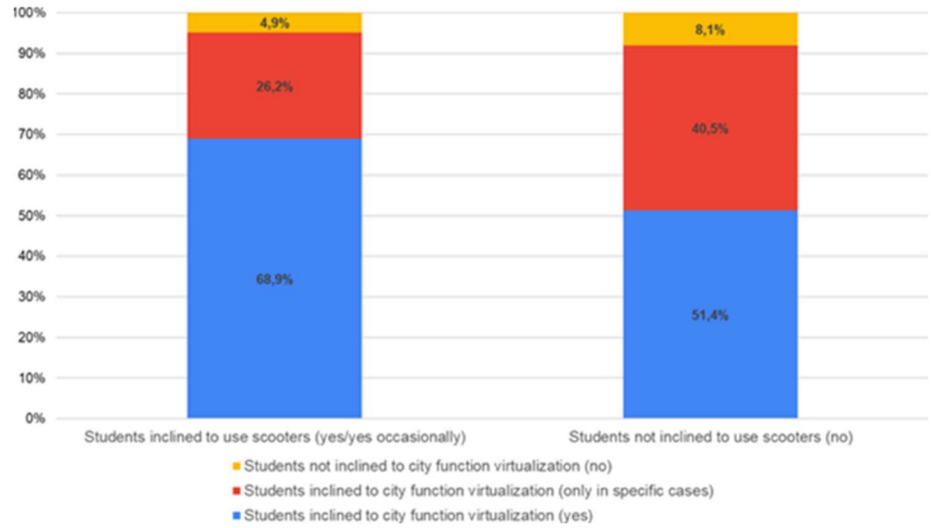

Figure 3: Comparation between propensity to use scooters and propensity to virtualize city functions

Source: Authors.

7. Micro-mobility and the city: first conclusive consideration towards integrative scenarios for urban sustainability

In the first general evaluation of the results of this study, it seems possible to assume that e-scooter in sharing can represent an effective mode of "smart" urban travel for university students which often need to quickly move between departments, study rooms or classroom also integrating the use of LPT. The present supply of services in Naples or Benevento could expand its use among students applying a general reduction of costs (for unblocking vehicle and hourly rate). It is also evident the contribution to the levels of urban livability and sustainability in the move related to the reduction of emission of exhaust gases in the urban environment, even if, as is known for all vehicles that use electricity (almost all produced through fossil fuels), it is a "shift pollution". Another element that should be strongly pointed out is the consistent demand for dedicated lanes for urban micro-mobility, which would allow a considerable increase in safety during displacement and help to avoid improper behavior related to speed, the use of sidewalks both for walking and for "wild parking" of the vehicles.

Further steps of this study will expand the case studies considering other cities in which the university students are a significant part of the demand of urban mobility. This is expected to make possible to elaborate a possible classification of the "effectiveness" of micro-mobility services in sharing in terms of real contribution to the "ecological transition" and, thus, towards sustainable states for urban life.

The main target for authors is to contribute to the achievement of an integrated approach between urban planning and mobility planning towards a "less cars city " model.

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