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Public Perception of Electric Scooter Use in Sicily: Analysis of Post-Pandemic Opinions

TIZIANA CAMPISI[a*], EMRE KUŞKAPAN[b], MUHAMMED YASIN ÇODUR[c], CHIARA VIANELLO[d,e], GIULIA DE CET[d]

a. Faculty of Engineering and Architecture, University of Enna Kore, Cittadella Universitaria 94100 Enna, Italy
b. Engineering and Architecture Faculty, Erzurum Technical University, 25050 Erzurum, Turkey
c. College of Engineering and Technology, American University of the Middle East, Kuwait
d. Department of Industrial Engineering - University of Padova, 35131 Padova, Italy
e. Department of Civil, Environmental and Architectural Engineering - University of Padova, 35131 Padova, Italy

ABSTRACT: Urban mobility is a current and hot topic for local administrations, and not only due to the numerous road accidents in urban areas, often caused by the incorrect behaviour of scooter drivers. The diffusion of electric scooters occurred, above all, after the pandemic. While on the one hand, social distancing has forced many to re-evaluate traveling by car, there are many citizens who have adopted innovations such as pedal-assisted bicycles and, above all, electric scooters – the latter being the protagonists of a real boom. In addition to ensuring fast travel and ease of use, the electric scooter and its use have sparked public debate regarding safety and apparent deregulation. Very often in Italy and beyond, the use of electric scooters is associated with a perception of fear and scepticism about micro-mobility, as well as the diffusion of some models relating to sustainable mobility. This derives in part from the previous characteristics of the vehicles produced and manufactured in China that do not comply with the law, and in that case, are truly dangerous. But given the recent rules at both the Italian and European levels, we are very often protected against products that do not comply with the laws, and therefore, we have greater road safety. The recent legislation on use on Italian roads has changed the characteristics of users, vehicles, and infrastructures in which to circulate.

The safety of the electric scooter has been a long-debated topic, especially since this vehicle has seen a boom in sales and rentals since 2020, thanks to the incentives for the purchase and the willingness of Italians to use public transport less and less. To define the choice of an electric scooter as a sustainable modal choice, it is necessary, beyond safety, to investigate the perception of users in terms of gender equity, use in the first and last mile, and perception in terms of green transport modes. Starting from this, a survey was implemented, and subsequently, a descriptive statistical analysis was conducted on about 550 users in the metropolis of Palermo in Sicily. The results related to the period 2019-2022 showed that the electric scooter is certainly a practical and green vehicle but must be driven with the same attention we pay in cars or motorcycles. The chi-square analysis defined the trend variations connected to the users' psychosocial parameters according to the user's gender and age. The scenario shows the need for timely interventions, above all to protect vehicle users but also pedestrians who are often involved in accidents due to the use of vehicles on sidewalks. The survey shows that scooter users are the first to request more safety, starting with the creation of protected lanes such as cycle paths or dedicated areas.

KEYWORDS: E-scooter; user perceptions; sustainable and safe mobility; statistical analysis

1. INTRODUCTION

Mobility in Europe and Italy is evolving, becoming more sustainable and shared. Although there was a setback in the registration of electric cars in the first part of 2022, the industry is pursuing several strategies by developing new models and promoting the spread of recharging infrastructure.

The cities where shared mobility is most commonly used are Milan and Rome, but Palermo and Naples are also making strides in this area. Last year also witnessed the widespread use of scooter-sharing services, a segment that alone accounted for half of the total rentals made in Italy (17.9 million), more than doubling the previous year's performance with an offer of over 35,000 scooters. The 24 cities where the service was active in 2020 were joined by another 15 in 2021 (Benevento, Brindisi, Cagliari, Catania, Frosinone, Grosseto, Imperia, Novara, Padua, Palermo, Piacenza, Prato, Ragusa, Reggio Emilia, Teramo). The use of shared scooters is also booming, returning to 2019 demand levels in 2021 (+5 %) with an offer of about 9 thousand scooters.

In 2021, new cities were added where the service is available (Benevento, Bergamo, Grosseto, La Spezia, Lecce, Pescara, Taranto). The Italian scooter-sharing fleet is almost entirely electrified.

By 2020, shared e-scooter services had arrived in Palermo with around 14,000 units, and by 2021, they had also expanded to Catania. They are gradually spreading to other Sicilian cities.

In various European contexts, such as Italy, electric scooters fall into the category of light mopeds and are considered similar to bicycles in traffic: it is compulsory to use lanes, cycle lanes, or, in the absence of these, to ride on the edge of the right-hand lane.

An electric scooter (or e-scooter) is generally defined as a two-axle vehicle with a single electric motor, equipped with handlebars and no seat.

Although there is an increasing number of shared electric scooter services in Sicily, there is also some reluctance among certain user groups. This reluctance is related to safety concerns as well as psychosocial factors. The present work is the first step in an investigation conducted in Palermo to assess certain aspects (including psychosocial ones) that have affected the use of electric scooters in the aforementioned metropolis from the pre-pandemic phase to 2022. A study conducted in 2019 during the initial roll-outs of electric scooter services in Italy indicated that about 35 % of the surveyed Italians (CAWI interview, a sample of 1143 units representative of the Italian population aged 18+) consider

electric scooters dangerous, and the perceived lack of safety is lowest among those under 34 years of age (YouGov, 2019) The majority of users also emphasized the need to establish specific laws for electric scooters in 2019, and this was particularly highlighted by individuals who had already used electric scooters for hire.

The study also analyzed the propensity to use scooters, showing that more than half of the respondents were interested. Finally, the main reasons for use recorded were:

1. the possibility of getting around faster,
2. the possibility of causing less pollution (replacing the use of private motor vehicles and/or public transport with electric scooters). Specifically, 50 % of Italians agree that electric scooters are the best solution for sustainable mobility, and
3. perception of scooters as status symbols and a fun and stylish means of transport.

These results prompted this research to investigate some of these aspects in the Sicily region, including other sustainability-related variables such as gender equity. In particular, the research aims to define the main perceptions of e-scooter users, considering the metropolitan city (Palermo) where shared e-scooter services have recently become widespread, and where unregulated use of such means of transport occurs periodically, as will be better defined in the following paragraphs.

The results were described and discussed in the final part of the text. The sample of users analyzed was chosen from experienced scooter users, i.e., those who use a scooter more than twice a week for commuting.

The variables analyzed were both socio-demographic and perceptual, through the definition of judgments on a Likert scale. These judgments relate to a series of actions aimed at achieving the goals of the 2030 Agenda, i.e., sustainability, gender equity, and compliance with current regulations.

Data processing was carried out through statistical calculation and evaluation of the chi-square test of independence to determine whether two categorical or nominal variables are correlated. The results were described and discussed in the final part of the text.

2. BACKGROUND

The shared e-scooter is a relatively new mode of transportation in the European and global context. The distribution of demand for mobility in e-scooters and the diffusion of e-scooters in Europe is highly heterogeneous due to a series of factors, including economic and psychosocial factors characterizing mobility demand, as well as infrastructure characteristics and services that shape mobility offerings. The characterization and use of these infrastructures are also closely connected to the regulatory framework, which is still lacking in many European countries, such as Italy.

Since Italy is one of the countries with the greatest lack of legislation and high accidents related to the use of scooters, this work has focused on this context, particularly the Sicily region, which is also characterized by numerous incidents of vandalism. The study conducted by Petzoldt, Ringhand, Anke, & Schekatz (2021) highlights the need for structured e-scooter policy education that addresses users, focusing on rules awareness and motivation for adherence.

Safety concerns and the potential reduction in physical activity due to substituting walking and cycling with e-scooting have been analyzed by Sanders, Branion-Calles, & Nelson (2020). This study characterizes trends in barriers and benefits related to e-scooter usage within a professional population, revealing significant demographic differences, particularly concerning barriers. Additionally, it indicates that electric scooters are often associated with traffic safety concerns, particularly for women, and difficulties in finding available equipment when needed.

Regarding psychosocial aspects, several studies have emphasized the importance of analyzing the social and psychological factors that often lead to the breakdown or non-use of these means of transport (Guo & Zhang, 2021; Kuşkapan, Çodur, & Atalay, 2021; Kuşkapan, Sahraei, Çodur, & Çodur, 2022). Key factors considered in recent studies include sociodemographic information (such as age and gender), user behavior, travel purposes (commuting or leisure), and economic factors affecting the convenience of using electric scooters compared to private cars.

Infrastructure characteristics are closely tied to urban planning, maintenance, and the regulatory evolution regarding e-scooter usage in urban areas. A study by Fazio, Giuffrida, Le Pira, Inturri, & Ignaccolo (2021) characterized priority networks for electric scooters in the metropolitan city of Catania using a multi-criteria analysis based on GIS data. The study indicates that the current infrastructure is inadequate for e-scooter use.

In terms of services, recent years have seen a rise in sharing services, overshadowing rental services and private e-scooter purchases (Campisi. Akgün, Ticali & Tesoriere 2020a; Campisi, Akgün-Tanbay, Nahiduzzaman & Dissanayake, 2021a; Campisi. Nikitas, Al-Rashid , Nikiforiadis , Tesoriere & Basbas (2022). The Sicilian regional context also features significant gender and social disparities regarding potential e-scooter users (Campisi, Basbas, Skoufas, Tesoriere & Ticali, 2021b; Campisi, Skoufas, Kaltsidis & Basbas, 2021c).

A study by Campisi, Nahiduzzaman , Ticali & Tesoriere (2020b) analyzed the attitudes and perceptions of frequent electric scooter users in Palermo, a southern Italian metropolis. The study explored various associations between variables, including socio-economic factors linked to hiring propensity and safety perception.

The COVID-19 pandemic accelerated the adoption of technological innovation, replacing certain urban activities that typically relied on direct human interaction. The diffusion of "urban micro-mobility" systems, including e-scooters, had an immediate impact on Italy. A study analyzed the diffusion of e-scooters in Italian cities following the pandemic event, aiming to assess their effectiveness in the post-emergency phase (Fistola, Gallo, & La Rocca, 2022).

During the pandemic, Europe witnessed the growth of scooter-sharing services as e-scooters were perceived as a safe mode of transportation, respecting social distancing guidelines, and reducing the risk of COVID-19 transmission.

Regarding the past two years, the top 10 Italian cities for shared mobility include Milan and Rome, both for available fleets, rentals, and kilometers traveled. Palermo ranks fifth. A questionnaire was implemented and administered to a sample of Sicily residents, and subsequent statistical analyses were conducted to analyze the trends of various parameters.

3. THE DEVELOPMENT OF E-SCOOTER IN ITALY

Shared mobility is growing steadily in Italy, with the cities of Milan and Rome leading the way. In 2021, the use of shared transport services (cars, scooters, bicycles, scooters) has returned to pre-pandemic levels: trips made by this mode have increased by more than 60 % (Degli Esposti, Mortara, & Roberti 2021; Li et al., 2022).

Several studies show that fleets are growing and becoming lighter, smaller, and electric in fact, more than 80% of rentals involve a micro-mobility vehicle (Şengül & Mostofi, 2021; Liao & Correira, 2022).

In comparison with Europe, our cities hold significant positions in the European shared mobility index. Milan ranks

as the first European city for shared vehicles per inhabitant, with Rome in fourth place. Milan also comes in fifth for the absolute number of vehicles on the road, immediately following Paris, Berlin, and Hamburg. Additionally, Milan secures the third spot for bicycle usage, following Paris and Barcelona, while Rome takes the lead in the growth of scooter-sharing rentals between 2021 and 2022.

Various strategies implemented by local and national authorities aim to increase the modal share of public and shared transportation in all Italian cities over the next five years. Scooter sharing services have experienced widespread adoption, accounting for half of the total rentals made in Italy (almost 18 million). However, this phenomenon has raised concerns due to often reckless and irresponsible usage by users, leading to a high number of accidents that now surpass those involving scooters (2.07 accidents per every 100 thousand kilometers, compared to 1.72 for mopeds).

The Government has responded by introducing a series of rules, effective since 2021, that have brought changes to the Highway Code. These changes include a reduction in speed from 25 to 20 kilometers per hour in pedestrian areas, a ban on parking on sidewalks, the requirement for municipalities to identify parking areas, prohibition of traveling on sidewalks or against traffic, and mandatory use of reflective jackets after sunset. Additional rules include the prohibition of transporting other passengers, animals, and objects, with mandatory helmets for minors and optional helmets for others. While these rules contribute to user safety, they only partially address safety concerns, ranging from infrastructures to services and user conduct of electric scooters.

The absence or incomplete presence of dedicated design for spaces used by scooters presents specific safety problems for users. These users are often compelled to navigate connecting areas between permitted zones where safe circulation for these vehicles cannot be guaranteed. Establishing an infrastructural network (potentially shared with other modes of transportation) that grants accessibility to main points of interest and encourages integration into the public transport system is crucial for ensuring the sustainable development of this mode. Simultaneously, careful attention must be directed towards safety in the usage of these new vehicles, encompassing both physical safety concerning the risk of accidents and security in relation to the threat of vehicle theft.

To safeguard the safety of bicycle and scooter users, public administrations should implement dedicated maintenance and monitoring systems to ensure the evenness of pavements. Even minor irregularities on the running surface can lead to severe falls for this category of users.

Italian cities are gradually implementing strategies to accommodate new micro-mobility options, primarily through infrastructural changes aimed at improving urban decorum and ensuring pedestrian and driver safety. Enhancing infrastructure is a key tool at the disposal of cities to regulate and ensure the effectiveness of shared micro-mobility services.

In addition to the Highway Code, which treats electric scooters similarly to electric bicycles, specific ordinances from Municipal Police departments in different cities regulate the use of electric scooters and outline permitted activities on the roads. Electric scooters are allowed exclusively on cycle paths, cycle-pedestrian paths, within restricted traffic zones (ZTL), and on urban roads where the existing speed limit of 50 km/h is in effect. However, usage on sidewalks or spaces designated for other vehicles or pedestrians is prohibited. Furthermore, it is forbidden to transport other individuals, bags, or objects that obstruct safe vehicle operation, to use mobile phones (unless securely fixed to the handlebar), or to use portable music players. Additionally, using an electric scooter under the influence of drugs, alcohol, or medications that may compromise safe operation, as well as using the vehicle for competitions, off-road excursions, or stunts of any kind, is prohibited. An ongoing challenge of the current regulations pertains to the classification of electric scooters as bicycles.

This classification, coupled with the insufficient availability of cycle paths, pedestrian areas, and combined cycle-pedestrian zones in many Italian cities, often results in bicycles and scooters sharing roadways, potentially leading to hazardous situations. Unfortunately, consistent enforcement is frequently lacking, and the consequences are evident. Notably, for the first time, there are more provincial capitals with at least one shared rental service (62) compared to those without (46). Milan and Rome continue to lead the ranking of the top 10 cities for shared mobility in terms of available fleets, rentals, and kilometers traveled.

Recent additions to these services include Turin, Florence, Palermo, Naples, Verona, Bologna, Rimini, and Bari. This number is expected to increase in the near future to promote a modal shift and enhance the role of stations as central hubs for accessing and returning shared vehicles (José Vinagre Díaz et al., 2023).

Some national and international rankings highlight two main factors arising from the economic analysis of this sector. The first factor is the significant growth in overall turnover, which reached 130 million euros in 2021. The second factor involves a comparison of costs between shared mobility and private transportation, with shared mobility demonstrating favorable results, leading to annual savings of up to 3800 euros (Osservatorio Sharing Mobility, 2022).

Additionally, there are notable environmental benefits associated with shared mobility, which boasts a remarkable 94% emission-free rate.

Furthermore, the primary usage of micro-mobility vehicles among Italian public transport users is for direct point-to-point transportation (52 % of interviewees). On the other hand, 40 % of respondents combine the use of public transportation with temporary rentals of micro-mobility vehicles (Moovit, 2019).

4. THE IMPORTANCE OF USER PERCEPTIONS FOR BETTER E-MOBILITY

In recent years, a number of studies have been conducted to assess users' perceptions of last-mile mobility and short-distance travel.

Special emphasis was placed on analyzing the factors that define transportation demand and those that can impact users' perceptions, both from endogenous perspectives (such as service characteristics and socio-demographic traits) and exogenous perspectives (such as the applied service context and technological use). The primary modes of transportation under investigation include walking, cycling, and micro-mobility.

In the context of micro-mobility, a study by Amirnazmiafshar & Diana (2023) explored the perceptions of users and non-users regarding shared mobility systems. This investigation considered opinions, attitudes, and practical comprehension using a multi-criteria analysis approach coupled with the Bayesian best-worst method. Aspects such as traveler safety, cost, and accessibility were evaluated. The findings revealed that user ratings for the criteria generally exceeded those of non-users, except for the cost of scooter-sharing services, suggesting potential underestimation by non-users.

Another study, centered on a survey of residents and workers in County Dublin, examined socio-demographic and travel-related factors influencing vehicle choice in the context under scrutiny. The outcomes delineated the attributes of existing and potential future demand for electric scooters. The study indicated that individuals would be willing to in-

crease their daily travel expenses to access shared e-scooter services. Younger and higher-income individuals without private cars or driving licenses exhibited a greater inclination toward e-scooter usage, with shorter trips (reduced distance and time) associated with opting for the e-scooter mode (Carroll, 2022).

Factors encompassed in models analyzed by Guo & Zhang (2021) encompass socio-demographic data, user behavior, trip objectives, and health indicators. The results of these models identify various factors that significantly influence shared e-scooter use. These factors include user gender, helmet utilization, exposure to shared e-scooters, e-scooter ownership, usage locations, opinions on speed limits, and travel intentions.

Factors contributing to the substitution of cars indicate that shared e-scooters have the potential to compete with TNC/taxi services. Lower costs and social/entertainment-oriented trip purposes, along with multi-vehicle households, contribute to the substitution of private vehicles.

User perceptions can be analyzed not only through questionnaires but also by collecting data from specific applications on smartphones and tablets. Thus, media technologies play a crucial role in the adoption of transportation technologies. A notable study conducted by Ratan et al. (2021) investigated how the perception of mobile apps for e-scooters (considered as communication technology) influences the intention to use e-scooters (considered as transportation technology). This investigation considered various specific perceptions related to e-scooters, such as ease of use, usefulness, safety, environmental impact, and enjoyment, as well as the context of use (geographical landscape) and demographic factors (age and gender).

The research findings demonstrated that the perceived ease of use of the mobile app is correlated with the intention to use e-scooters. This effect is further influenced by the perceived usefulness of the e-scooter. Notably, this relationship holds even when accounting for factors like the perceived ease of use of the e-scooter itself and other influences on e-scooter usage. Therefore, it is possible to distinguish in a general and non-exhaustive way the variables that influence the choice of use of electric scooters considering what is described in Figure 1.

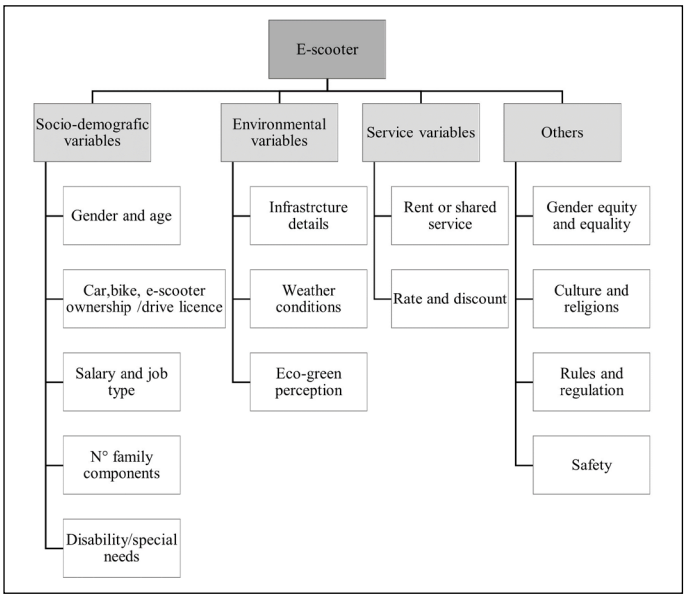

Figure 1. Some variables useful for e-scooter mode description.

While certain studies assert that e-scooters present an environmentally friendly solution for congested urban areas, other studies present conflicting findings and emphasize safety concerns. An analysis conducted by Kopplin et al. (2021) delved into the factors impacting the utilization of e-scooters from a consumer standpoint by employing a unified theory of acceptance and use of technology. As a result, various e-scooter services were examined within the context of alternative mobility options, revealing that they are primarily perceived as enjoyable items, with perceived safety concerns acting as a deterrent to their usage.

Concerning the ecological and technological perception of micro-mobility and the advancement of IC-type technologies, a study was carried out in Northern Europe to determine how both users and non-users of shared micro-mobility perceive the environmental aspects of e-bikes and shared e-scooters. This study also explored how the evolution of IC technology impacts the adoption of shared micro-mobility. The outcomes demonstrated that users view themselves as innovative and regard shared micro-mobility as relatively environmentally friendly, whereas non-users do not share this perception.

Furthermore, the results highlight a correlation between environmental knowledge, environmental attitudes, and green perceptions (Flores & Jansson, 2021). Particularly, several studies conducted within the past three years have identified factors contributing to the diffusion of electric scooters in major Italian cities. Table 1 outlines the principal factors influencing users' choices regarding scooter usage in Italy.

Factors	Region / city	Reference
Attitude and perception of users	Palermo	(Campisi et al., 2020b)
Influence of public opinion	Palermo	(Campisi et al., 2020a)
Ownership and rental or sharing service	Palermo	(Campisi et al., 2021a)
Rules and regulations	National context	(Scorrano & Danielis, 2021)
Built surrounding	Naples	(Fistola et al., 2021)
Economic aspect	Rome	(Carrese et al., 2021)
Green vision	Palermo	(Campisi et al., 2021b)
Gender gap	Sicily	(Campisi et al., 2021c)
User mobility behaviour	Trieste	(Scorrano, 2021)
MaaS	Catania	(Fazio et al., 2021)
Environmental aspects	Milan	(Longo et al., 2021)
Safety, Comfort, and Chaos perception at Shared Space	Palermo	(Akgün-Tanbay et al., 2022)
Technologies and ICT	Rome	(D'Andreagiovanni et al., 2022)
Theft and vandalism	Palermo	(Campisi et al., 2022)
MaaS	Padua	(Baldassa et al., 2022)
Vibrational behaviours of vehicles/pavement irregularities	Brescia	(Ventura et al , 2022)
Safety	90 Italian cities	(D'Apuzzo et al., 2022)
Safety and Helmet use	Rome and province	(Cittadini et al., 2022)
Land use, Socio-economic variables and terrain-related variables	90 Italian cities	(D'Apuzzo et al., 2022)
User propensity (from private vehicle use to e-scooter)	Rome	(Nigro et al., 2022)

Table 1. Literature analysis on factors influencing electric scooter users in Italy 2020-2022.

5. METHODOLOGY

This research delved into an Italian context grappling with several challenges associated with the usage of electric scooters. The study was conducted by selecting a sample of frequent users of these transportation modes, accomplished through the administration of a questionnaire.

The collected variables encompass socio-demographic aspects, which are among the key factors characterizing various studies in the sector's literature. Additionally, the study involved variables related to users' perceptions, assessed on a Likert scale, regarding sustainability, gender disparity, and adherence to regulations. To analyze the data, the chi-square test was employed, given the research's focus on a random sample, where observations were determined to be independent of each other. The null hypothesis posits the independence of the variables being examined.

In summary, Figure 2 shows the steps of the research conducted.

The study is situated in the island context of Sicily, characterized by the recent emergence of shared mobility services, including electric scooters. Currently, only the cities of Palermo, Catania, and Ragusa actively offer shared services.

In a broader sense, the urban landscape across various Sicilian cities contends with inadequate road and railway infrastructure. Public transport services in some cities exhibit inefficiency, and a significant issue arises from the extensive reliance on private vehicles, leading to road congestion on major routes across all nine Sicilian cities, particularly during peak hours.

Further complications involve a conspicuous absence of adequate parking spaces for private vehicles, especially within urban centers. This underscores the necessity to encourage the development of new parking areas to promote intermodality.

The analysis was conducted through calibration, survey administration, and subsequent statistical analysis of the obtained results. Ultimately, the chi-square test of independence was employed to assess the potential correlation between two categorical or nominal variables. Specifically, judgments on the Likert scale, pertaining to the primary factors influencing perceptions of scooter usage in relation to age and gender trends, were evaluated.

The initial segment of the online questionnaire, comprising two sections, was implemented, and administered from October to December 2022. The first section concentrated on socio-demographic variables, encompassing gender, age, income, employment type, and inquiries about ownership of cars, bicycles, and scooters.

6. RESULTS

The sample of users who habitually use owned or shared electric scooters is 545 units of which 455 are male against 74 female and 16 are gender neutral. Age sees more than half of the sample (52 %) belonging to the adult age range, i.e., 31-50 - The remaining part of the sample is distributed in a similar way for the 18-30 (20 %) and 51-65 (24 %) instead a percentage of only 4 % is over 66 years of age. As far as work is concerned, an almost constant distribution was obtained with a slightly higher value of office workers (31 %), followed by freelancers (29 %) and then other jobs (26 %).

Instead, the percentages for students and pensioners are similar and around 6-8 %. Over 307 users have a low average salary of around 1001-1500 euros per month while only 47 interviewed have a salary of more than 2000 euros. Finally, from the point of view of the possession of the various means of transport, almost all the sample (98 %) owns a car and about 70 % own a bike, while lower percentages are recorded for the possession of scooters (28 %).

The second session of questions instead focused on the perception that users have regarding a series of critical issues that must be dealt with and resolved to pursue the objectives of the 2030 agenda. asked the sample to give their opinion and their agreement about:

1. the possibility of using scooters as a complementary means of transport for the first and last mile,
2. the eco-green vision of the use of electric scooters,
3. gender equality in transportation (equal use for men and women) concerning the use of scooters, and
4. the need for stricter regulations to make the use of electric scooters in Italy safer.

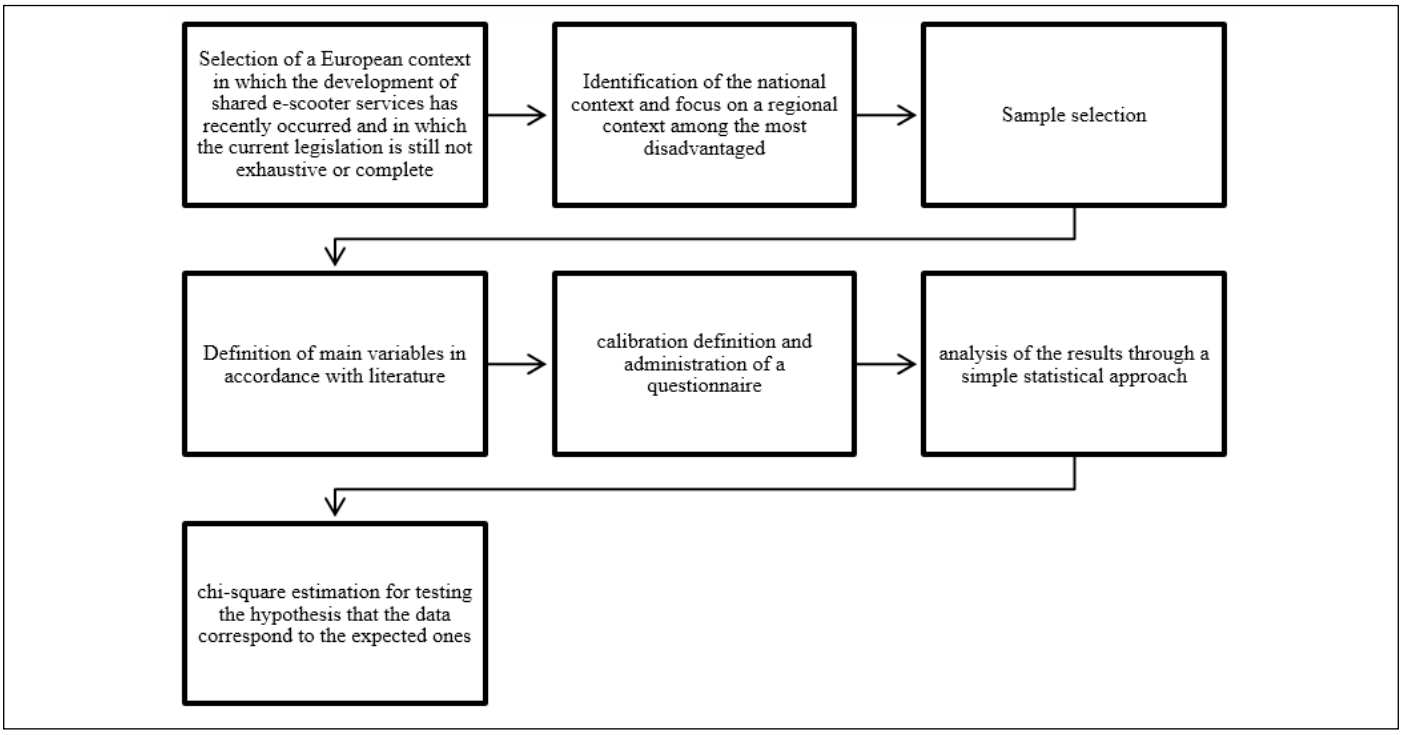

Figure 2. Main steps of the conducted research on e-scooter.

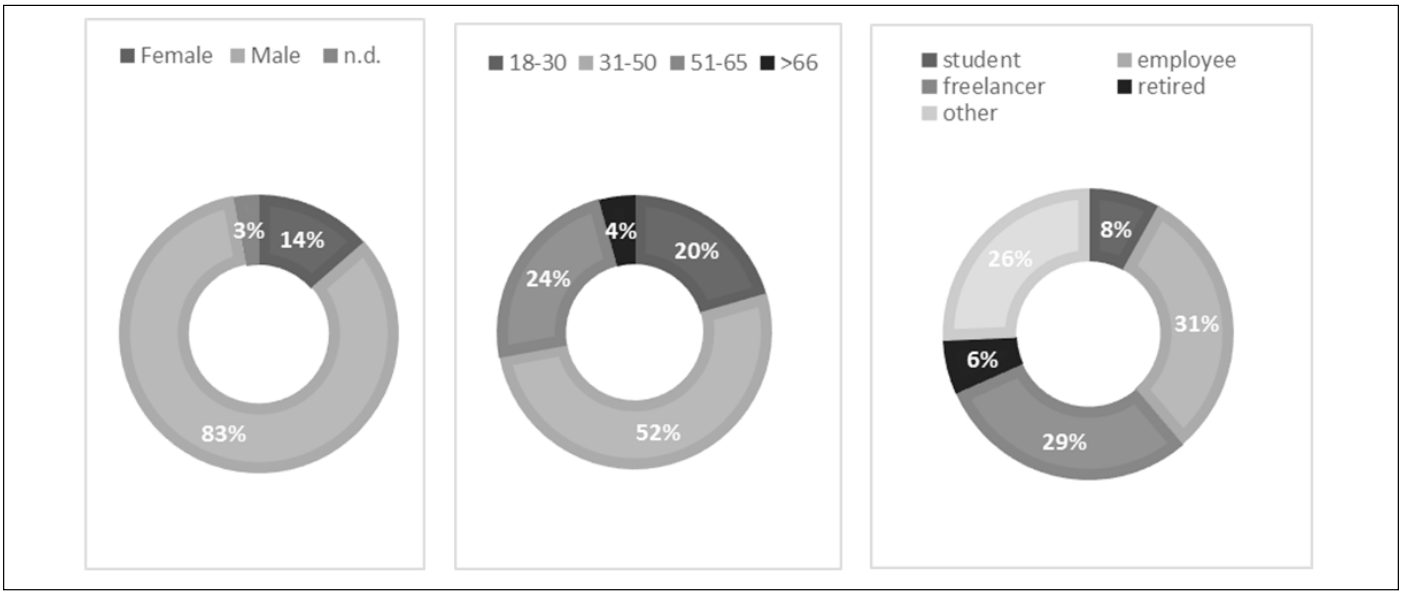

Figure 3. Distribution of investigated socio demographic variables of questionnaire (respectively gender, age, and job).

The distributions shown in Figure 3 have been obtained.

To summarise, it emerges that about 280 users partially agree and about 36 totally agree with using the scooter as a complementary means of transport to public transport, especially in the first and last mile of the journey. More than 300 users partially agree in maintaining that the scooter is an eco-green vehicle, above all due to the electricity supply still coming from the combustion of oil for several cities. Over 267 users disagree in hypothesizing the presence of gender inequality in being able to use scooters. However, we recall that most of the sample is male. Finally, nearly 300 users partially agree that they still need more restrictive rules to protect the safety of users on board scooters and that I share spaces with them like pedestrians.

6.1 Chi square results

The present research investigated the associations between the gender of the users and the propensity to judge in section 3, obtaining what is briefly described in table 2.

Gender	Chi square	p < .01	p < .05	p < .10
Last mile use	38.0559	Significant	Significant	Significant
Eco-green use	30.3786	Significant	Significant	Significant
Gender equality users	72.8393	Significant	Significant	Significant
Need of regulations for safe	9.6396	Not Significant	Not Significant	Not Significant

Table 2. Interdependence between gender variables in section 1 / all variables in section 2.

Therefore, the association between the gender variance and the first three perception variables is significant, whereas the association with increased regulations for safer use is not.

Similarly, the age range was investigated with the 4 questions proposed in section 2 of the questionnaire, obtaining the data summarised in Table 3.

Only the use for first and last mile travel is significant when correlated with the age of the users.

Furthermore, the a ssociation between age and perceived gender equity is non-significant.

For the other variables there is a non-significance for p < .01 instead a significance for p < .10

Age	Chi square	p < .01	p < .05	p < .10
Last mile use	100.5902	Significant	Significant	Significant
Eco-green use	22.2818	Not Significant	Significant	Significant
Gender equality users	15.8862	Not Significant	Not Significant	Not Significant
Need of regulations for safe	21.8701	Not Significant	Significant	Significant

Table 3. Interdependence between age variables in section 1 /all variables in section 2.

7. DISCUSSION AND CONCLUSION

The advantages of electric micro-mobility are readily apparent and substantial. Foremost among these is the issue of sustainability, along with the convenience of maneuvering through city traffic and sidestepping parking challenges. These strengths, coupled with an escalating focus on environmental concerns and planet preservation, have propelled a swift and significant expansion of electric micro-mobility within urban centers in recent years. This trend continues to surge, witnessing an increasing presence of electric bicycles and scooters populating city streets. Yet, electric micro-mobility represents just one facet of an expanding e-mobility sector, encompassing not only scooters and e-bikes but also encompassing all other electric travel alternatives, spanning from cars to public transport and the burgeoning wave of sharing services.

The landscape transformed with the advent of lockdowns, restrictions, and the emergence of more agile and adaptable working practices, such as remote work. These factors have substantially altered our routines, not only in professional domains but also in the realm of transportation. Between 2020 and 2021, the number of commuting workers dwindled, accompanied by a reduction in average kilometers traveled. Furthermore, even the patterns of using public transport for urban commuting have undergone changes, as individuals sought to avoid enclosed and crowded spaces.

Optimistically, this transformation has served as a catalyst in 2020 and 2021 for an existing trend, resulting in a remarkable surge in electric micro-mobility sharing. While sharing

mobility, including four-wheeled vehicles, may have experienced a downturn due to lockdowns, fleets of electric scooters and shared electric bicycles have flourished, with the former leading the charge and providing a substantial boost to the realm of electric micro-mobility.

An analysis of the literature within Italy reveals that certain cities such as Rome, Milan, and Palermo have been subjects of study for a few years now. These studies have delved into factors characterizing users, the services offered by diverse shared mobility providers, and more specifically, e-scooters.

It becomes evident that the inclination to utilize electric scooters is tied not only to socio-demographic variables but also to perceptions and heightened awareness of sustainability and the preference for environmentally friendly transportation choices. Moreover, some studies have highlighted how the legislation, which had been incomplete for years, has given rise to challenges, particularly failing to curtail the number of accidents. These accidents are often attributed to incorrect infrastructure usage, non-compliance with protective gear, and especially excessive travel speeds.

Therefore, this study aimed to analyze the Sicilian context and explore the interconnected relationship between socio-demographic, psycho-social variables, and factors related to the service.

The findings reveal an increasing inclination among users to view the electric scooter as an eco-friendly travel solution, particularly for covering the last mile of their journeys. Consequently, both national and local institutions must initiate a series of measures to promote multimodality and decrease the reliance on private transportation for trips spanning less than 1.5 km. Despite progress, the absence of a comprehensive standard underscores certain gaps linked to responsible user conduct and uncertainties regarding urban usage, irrespective of the user's gender or age.

The interplay of specific socio-demographic variables, such as age and gender, in relation to perception variables of shared mobility services underscores the importance of considering pricing strategies. Furthermore, it emphasizes the necessity for enhanced training and information dissemination pertaining to the use of electric micro-mobility. By doing so, this mode of transportation can become more widely adopted and integrated into everyday choices.

CREDIT AUTHOR STATEMENT

Campisi: Conceptualizaion, Methodology, Software, Formal analysis, Investigation, Data Curation, Writing - Original Draft. **Kuşkapan**: Writing - Review & Editing. **Çodur:** Supervision. **Vianello:** Writing - Review & Editing. **De Cet:** Formal analysis, Data Curation, Writing - Original Draft.

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