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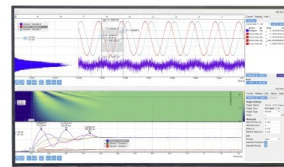
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Continue to Share? An Overview on Italian Travel Behavior before and after the Covid-19 Lockdown

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Abstract The mobility scenarios have been modified by the COVID-19 pandemic. Catastrophic and health events cause strong repercussions on daily activities and related mobility habits. In Italy, as in other contexts, we have witnessed a period of lockdown that has led to an almost zero travel. This work shows an overview of the changes in mobility choices before and after the COVID-19, with particular attention to sustainable forms of mobility such as shared mobility. It can reduce the use of private vehicles if properly incentivized and can be enhanced within the different forms of urban mobility, adopting ad hoc strategies and encouraging the active participation of the population in the assessment of critical issues and solutions towards sustainability. First results, analyzed at national level, provide a basis for future research steps on the assessment of the perceived safety by users in the use of different forms of mobility before and after the pandemic.

Keywords :COVID-19, mobility choices, sharing mobility, national data

INTRODUCTION

The evolution of mobility is closely linked to the needs of users and the evolution of urban and non-urban contexts. In particular, it is necessary to find the right balance between transport demand, i.e. users, and supply characterised by all the infrastructures and services available within a context. In the last decade, several technologies have been put in place as ITS sensors and systems [1,2] to improve travel and introduce the concept of mobility as a service (MaaS) [3]. Various calamitous events [4,5,6] or war [7] or pandemics [8], however, often put a strain on the balance between transport supply and demand.

The Coronavirus has confronted the entire world with one of the most complex challenges of recent years, changing habits and lifestyles [9] due to the need to respect social distancing in order to avoid contagion. In the short and medium term, after Phase 2, a series of strategies have been put in place by politicians and managers of the economy must be able to manage critical issues in the short term while at the same time developing a new vision for the future. From the point of view of sustainable mobility, low environmental impact mobility alternatives are to be promoted, trying to privilege walking through appropriate spatial analysis [10] and requalification processes [11]. In addition, strategies have been disseminated to promote the design of cycling infrastructure and the acquisition of electric mobility, which are low-polluting ways to increase social equity [12,13,14]. These strategies have been pursued considering sustainable planning process [15] forms of design [16], also integrated and linked to the analysis of aspects such as costs and safety [17,18,19,20] but also through a series of survey campaigns aimed at investigating the different travel habits and at the same time promoting a greater involvement of the population in urban planning and transport choices in the coming months [21,22,23]. All the strategies implemented have the objective of protecting the health and safety of people while travelling by promoting sustainable forms of mobility through the evaluation of service levels of infrastructure and [24] or through the definition of safety substitutes or parameters [25,26] or social [27,28] or through the implementation of mobility optimisation models [29], in order to improve the performance of cities [30,31]. In order to limit travel, many companies enabled to activate smart working have immediately encouraged and implemented the possibility to work remotely, reducing the risk of contagion [32] and becoming an innovative method for companies.

The transport system found itself having to restart by exploiting the resilient aspect of transport demand, i.e. the ability to adapt after a stressful/traumatic event, reorganizing daily activities and lifestyles [33]. At national level as

well as in different European contexts a drastic reduction in the use of public transport has been observed due to social distancing and also due to widespread fear among the population [34].

Among the forms of mobility encouraged in order to reduce the use of the private vehicle there are the use of the bicycle, the sharing-mobility (especially electric)[35,36,37] and the micro-mobility. Each of them allows to solve some problems related to short, medium and long-distance trips ensuring a low environmental and noise pollution [38]. These mobility choices will also help the economic aspect of travel by allowing those who have lost their jobs and who cannot keep the costs of a private vehicle to be able to move around sharing or with electric vehicles purchased at reduced prices. These choices of transport modes have been accompanied by political strategies aimed at improving infrastructure and services, thanks to various contributions and European funds.

The present work shows an analysis of the choices of transport modes before and after the COVID-19 pandemic, paying particular attention to shared mobility and variations in choice related to reasons for travel and the perception of safety. The results set the basis for deeper analysis on public transport and shared mobility by providing several ideas for the review and drafting of urban traffic plans and urban sustainable mobility plans.

After a short introduction this work focuses on shared mobility and shows at national level how different forms of transport were chosen by users before and after the pandemic, dwelling on the concept of safety related to the analysed forms of transport with particular reference to shared mobility. The results of this first preliminary survey are supportive for future research steps.

THE EVALUATION OF SUSTAINABLE TRANSPORT STRATEGIES AFTER COVID-19: SOME CONSIDERATIONS ON SHARED MOBILITY

Local governments are implementing a series of strategies in agreement with transport service companies in order to ensure an increase in sustainable mobility and a reduction of private vehicles with potential damage to the environment due to transport congestion. A package of 5 sustainable and concrete measures to rethink mobility in post COVID-19 cities have been taken so that citizens can protect themselves from the virus and to move in and out of the urban area i.e:

- safer public transport through monitoring;
- controls and turnstiles to quota the entrances;
- ensure safety distances and require more resources to achieve this;
- more bikes and new cycle paths in urban areas;
- the request to strengthen sharing mobility - mainly electric cars, bicycles, e-bikes, electric scooters and scooters - through agreements with companies to have more means of transport in the city and in more neighbourhoods at much lower costs; inviting citizens to scrap their cars and choosing sustainable mobility and green bonuses;
- encouraging smart working, by starting a dialogue with the Government to provide tax benefits for companies and workers who decide to focus on agile work and community mobility management.

The most efficient alternatives to the private car in the city, for those who do not want to take public transport, will have to become all means of sharing: cars (better electric), bicycles, e-bikes, electric scooters and scooters. Municipalities will have to make agreements with companies to have more means of transport in more districts, at much lower cost. Resources will be needed, but the service can be very successful and partly pay for itself. In any case, money will be well spent to strengthen the service (with control, sanitization and redistribution of vehicles in different times and places in the city) because we will have offered sustainable mobility to millions of citizens cheaply. In particular, Italy is one of the most developed countries for shared car sharing mobility, which during the lockdown has witnessed a reduction in use of -60%, with peaks as low as -70%.

Sharing mobility, as defined, focuses on the concept of sharing in order to optimize resources. Sharing which is a concept in antithesis to that of "social distancing" that the current emergency phase has introduced but which can coexist by adopting appropriate security measures.

The present work investigates at national level the trend of the different forms of transport post COVID-19 and in particular the forms of shared mobility and the perception of security that users have post-pandemic.

INFLUENCING FACTORS OF TRAVEL BEHAVIOUR AND STATISTICAL ANALYSIS ON NATIONAL DATA

This section reports the results deriving from the survey carried out by the National Observatory of Sharing Mobility during the period between the lockdown and the first initial reopening phase (20th April – 10th May 2020).

The survey involved over 12,000 people and was spread throughout the national territory through numerous dissemination channels: municipalities, agencies and public transport companies, associations, etc. The main aim of the survey was the investigation of travel behavior before the emergency COVID-19, the detection of the attitude to using different transport systems after the emergency COVID-19; the registration of the perceptions about perceived security and safety associated to the different transport systems, considering the emergency and the knowledge of the hygienic procedures carried out.

Table 1 summarizes the main area of investigation and influencing variables of travel behavior before and post lockdown. Some evidence can be drawn on the variables to be taken into account which appear to influence mobility behavior generally and above all following the COVID-19 pandemic.

TABLE 1. Main areas of investigation and influencing variables

Main area of investigation	Influencing variables
Socio-demographic data	Age; Gender; Residence municipality
Working conditions	Employment typology Employment status during the lockdown Work municipality
Mobility habits	Alternative transport modes Pre lockdown and post lockdown travel behaviors
Safety perception	Private transport; Public transport; In sharing
Focus Sharing mobility	Related to Coronavirus emergency Related to use during last year

With reference to socio-demographic data, the variables that can most influence the mobility attitudes are certainly the age, the gender and the municipality of residence. Regarding the age, it is a variable to consider since the car ownership can depend on it (e.g. less widespread among young people for economic reasons or even since under 18 years and so without driver license possession).

Moreover, from the point of view of the danger and effects of the virus, people over the age of 65 have been declared most at risk, and this could butt in their current choices of mobility and choice of alternative transport modes. Regarding the gender numerous studies attest to the influence of this variable on mobility choices and depending on the context of analysis is always interesting investigate of dependency from it. Finally, the municipality of residence is influential because depending on the size of the city, the land use and the available transport alternatives are variable (e.g. in cities with high population density the transport alternatives related to shared mobility are greater). Moreover, this variable plays a fundamental role in this particular situation because the diffusion of the pandemic wasn't uniform both in the national territory and worldwide, with a more elaborate number of cases more concentrated in some areas (e.g. in the North of Italy, especially in Lombardia Region).

Another fundamental aspect to detect regard the working condition. Indeed, the job and economic sectors have been the hardest hit by the pandemic situation. It is essential to know the type of employment, e.g. private or public sector; the municipality associated to the workplace, in order to know the entity of the travel than to the place of residence; finally the job condition during the lockdown, since who had the opportunity to work from home in smart working, has been able to benefit from not having to move from home to go to work, with a consequent saving of time and money, whereas for those who, not being able to work physically has met with difficulties of an economic nature. Among travel behavior constitutes the critical aspect to investigate concerning the transport sector, as the mobility has undergone major changes as a result of this emergency. First of all, it is good to be aware of the various transport alternatives available which are certainly influencing users' mobility choices. Moreover, to have a correct panoramic of real changes on mobility habits, it needs to realize a deep analysis in relation to the variability of travel behavior pre e post lockdown (e.g. the weekly frequency of travel following the smart working policies). Also the motivation associated to the travel is not negligible, since work and leisure trips have very different characteristics in terms of flexibility, punctuality, daily time slot, etc. The pandemic has also had an impact on safety perception. Certainly, this has led to a decrease in the use of public transport in favor of the private vehicle, to lead up some transport companies their transport services (e.g. reducing some public transport lines or to suppress them

at all). It is interesting to investigate the safety perception related to the shared mobility, which in many cities is a very good alternative transport, replacing the private car but also as feeder of public transport. At this regard, focusing on sharing mobility, it needs to investigate first of all on its use and associated motivation during the last year to have a real understanding of the change recorded following the spread of COVID-19, and on the propensity to use shared vehicles after the social confinement. From this comes the need to analyze the point of view related to the connection between the sharing mobility and the conditions of safety, (i.e. awareness of the cleaning operations carried out by operators, the usefulness of making offers and the exclusive use of the car, the use of personal protective equipment on board of shared transport means).

With reference to the survey of the Nation Observatory of Sharing Mobility, the analyzed was characterized by an almost equity of gender distribution (i.e. 55% male and 45% female) of different age groups (e.g. 0,6% under 18 years old; 18% of 18-25 years; 26,4% of 26-35 years; 19,6% of 36-50, 26,6% of 51-60 and 8.7% with more than 60 years old). As the occupancy, almost 50% of interviewees were workers, 30% were students, while the rest were free professions, pensions and the unemployed. With reference to the municipality of residence, more than 50% of the sample came from cities with more than 500,000 residents and the rest evenly distributed between cities with a range of population variable between 2000 and 500,000 residents. This last aspect, as previously stated, influences the perspective related to the use of shared mobility, as in big cities the sharing solutions (e.g. car sharing, bike sharing) are more widespread and integrated with each other, but at the same time the safety perception can be more in crisis.

The main survey results are mentioned below following their elaboration with the aim of highlighting the comparison between private and public transport and different solutions of shared mobility on the most emerging variables from the previous analysis. Considering the two different travel motivations (i.e. work and leisure) there has been a greater of private car compared to other transport means. Moreover, with regard to systematic trips, the private transport is associated with the public transport; while for leisure trips walking is considered a viable alternative. Figure 1 shows the propensity to continue to use the same means of transport employed during pre-COVID conditions. In general, there is a global reduction in the number of people who will continue to use the same mean of transport, also with regard to private car, indistinctly for both work and leisure trips. This may result from the fact that from a first explanatory analysis, it was registered that more than 70% of workers started working from home following DPCM 8/3/20, modifying its daily trips accordingly. Moreover, from the comparison between private and public transport (Fig. 1a), it emerged the substantial reduction of people who will continue to use public transport (i.e. it can be observed less that 50%), since this mean of transport is associated with the maximum degree of sharing. It is interesting the findings related to the shared mobility options, which, although present, are less affected by this reduction in use.

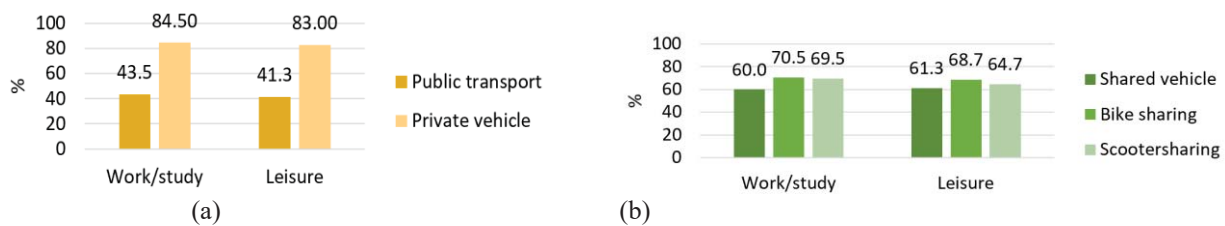


FIGURE 1. Percentage of users that have a propensity to continue to use the same means of transport (a) private and public transport (b) shared transport modes

The figure 2a shows the percentage of people that will use technological solutions to avoid moving (e.g. smart working, on-line shopping, etc.). It is noted that also in this case public transport is the one associated with a higher value, because technological solutions could be useful to book the service, know the number of people on board and have information about the service in general.

Figure 2b represents the judgement on safety perception, expressed in applying a 5-step Likert scale, about different transport modes both for users and non-users. As is clear that it is, private transport (i.e. global judgement equal to 4.4) is considered the safer mean, followed by the various alternatives of sharing mobility, and finally the public transport (i.e. global judgement equal to 1.8) with a clear distance in terms of judgment.

Analysing the results broken down by user and non-user there is a very small difference of opinion in the case of private transport (i.e. less than 0.1). Considering the shared transport alternatives, this difference is more accentuate (i.e. around 0.4-0.6), because in this case the experience of using the service appears to be influential, as it has been tested and it is possible to have more account of the operations of management following the emergency.

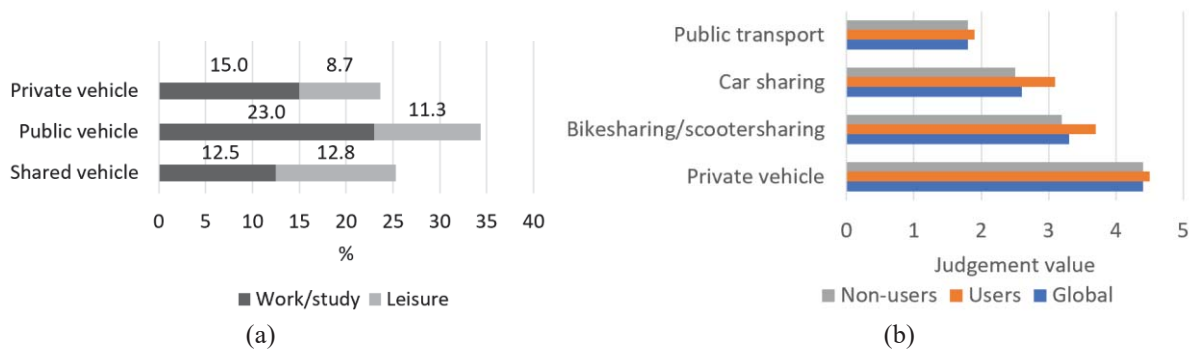


FIGURE 2. (a) percentage of people that will use technological solutions to avoid moving; (b) judgement on safety perception

DISCUSSION AND CONCLUSIONS

The evaluation of post COVID-19 mobility choices has been addressed in a preliminary way in the present work, focusing on the likelihood of using private, public and shared transport (in its various forms) after the pandemic. The purpose of the national survey was to detect travel behavior before the emergency COVID-19 and the attitudes to using different means of transport after the emergency COVID-19, related to the use of technologies and perception for their own safety, with focus on shared mobility alternatives, in order to identify strengths and weaknesses to define new strategies. With regard to travel choices, after confinement a variation was observed in the propensity to use the same transport mode used before the confinement. There are those who have decided to limit the performance of the various work and leisure activities also through the use of technologies (use of smart working platforms, or booking of on-demand services, etc). Who, instead, will continue to move, since the work needs require it, he'll still be looking for safer travel options for his health. This latter aspect may be critical as it tends to consider the own car as the safest means, not considering the high pollution rate that is generated, which can lead to premature deaths. At national level it has emerged that sharing mobility will not contest the users habits, continuing to a large extent to use the means in sharing. There will be a reduction in the demand for overall mobility. Therefore, various strategies should be considered to mitigate the problems of moving also in case of pandemic from now on and to allow to promotion of short, medium and long-term actions in cities for the development of sustainable solutions. Moreover, greater participation by different categories of population should be envisaged (i.e. students, commuters, retired, etc.) to better know the critical issues affecting the different modes of transport and influence the demand of different categories of citizens. The present work lays the foundations for future research steps focusing on an extension of the variability investigated and on a targeted analysis related to regional and urban areas, with particular reference to the cities most affected by the virus.

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