Developing Cities for Citizens: Supporting Gender Equity for Successful and Sustainable Urban Mobility

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Abstract. Cities today face unprecedented challenges generated, among others, by climate change, demographic change, economic crisis and technological innovation. The Agenda 2030 sustainable goals aim to create more equitable and sustainable cities which account for all citizens' needs and break down gender stereotypes. The mobility sector is still characterised by an uneven choice of travel modes due to multiple economic, social and cultural reasons. The COVID-19 crisis imposed harsh travel restrictions that had differentiated impacts on the mobility of various user groups, including the gender-defined ones. In this paper, the main social and economic trends, which affect gender demand, are identified along with their main characteristics. An overview of successful pre-pandemic European experiences in the gender planning field is discussed, with the aim of increasing the level of knowledge on the issue, adapting mobility services to meet the needs of all people, rethinking urban mobility and public space planning by incorporating more criteria of accessibility and sustainability, and improving the quality and safety of cycling, walking and public transport routes. For the recent pandemic circumstances, we indicate the facts that led women to experience a differentiated mobility landscape than men. Our research findings highlight the main factors that have led to gender inequality and discuss the gender gaps which emerged. Finally, we provide suggestions for the mitigation of this problem, laying the foundations for defining best practices useful for transport managers and authorities, which also increase both the quality of life and economic and employment opportunities.

Keywords: Gender equity · Urban accessibility · Mobility disparities · Sustainable cities · Sustainable urban mobility

1 Introduction

The recent COVID-19 pandemic and the emerging energy crisis have destabilized the globe economically and socially as well as in terms of health. The transport and mobility

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system has been among the most affected, both because of possible contagions and because of rising fuel prices. Therefore, the outbreak of the pandemic at the beginning of 2020 had a number of negative effects on all the social and economic sectors, changing behavior at various levels and particularly affecting mobility in general and the transport and logistics sectors in both the short and long term.

All modes of transport had an increase in their respective performances in 2021, compared to 2020. In general, a variety of trends emerged compared to the last 'normal' year, with road and rail passenger traffic still declining, while heavy vehicle traffic, on the other hand, exceeded pre-pandemic levels. For example, the measures to curb and stop traffic have had an impact on private mobility and, on the other hand, the need to avoid crowding on public transport has reduced the use of local public transport, encouraging people to use their own vehicles when the long-awaited reopening takes place.

Cities attract people from all walks of life and they are configured not only as an attractor but also as a container of services and a transformer of them [1]. These aspects allow people to exchange values, concepts and practices, allowing cities to become spaces of involvement, regardless of size, density or complexity. Indeed, citizens often create, negotiate and test ideas and solutions in this context, collectively contributing to shape the future urban condition [2]. At times of increasingly uncertainty (due to the pandemic but also to the fear of war), the actions of citizens become fundamental for the planning of urban spaces. The 15-min city concept allows greater involvement of citizens in activities initiated by public authorities and citizen participation regularly offers paths not considered or followed by other actors [3, 4]. In addition, cities try to create a walking friendly environment for their citizens in order to promote sustainable urban mobility [5]. It must be mentioned at this point that Well-Being plays a crucial role in mode choice and in travelers' psychology towards the direction of sustainable urban mobility [6]. The cooperation between citizens, service managers and local administrations allows to put into practice some of the new developments sanctioned by the objectives of the New Urban Agenda [7] which requires more inclusive, responsible and participatory urbanization and planning of sustainable settlements.

The evolution and greater diffusion and availability of new technologies is opening up a particularly wide range of possibilities for citizen participation in addressing complex issues. In particular, technological evolution has allowed citizens to more easily participate in the processes which concern:

- Governing the city
- Investing in the city
- Planning the city
- Making the city

The recent pandemic and the emerging energy crisis have hampered these activities, increasing numerous economic and social criticalities and a growing gender gap in some sectors such as mobility. The contribution of citizens is therefore fundamental for the growth of the city as well as greater attention to the needs of all citizens regardless of social class and psycho-physical conditions. Furthermore, the study of the criticalities and factors that do not guarantee gender equity for sustainable and successful

urban mobility is fundamental for the improvement of the actions and strategies to be undertaken in the short, medium and long term.

This paper performs an extensive literature review aiming to analyze the main factors, which, in terms of mobility, have contributed to an increase in the gender gap and in general the social gap in the last three (3) years. This was a period when the COVID-19 crisis affected personal mobility in various ways among the user groups and vulnerable individuals in particular. The gender gap needs to be narrowed or eliminated as it increases inequality in several areas and has repercussions in daily life (i.e. in social relationships and psychological aspects) but also in the employment and economic sector. This gap must be narrowed even further in the light of strategies that can lead to a recovery from the pandemic phase and the recent energy crisis. This research paper highlights how the gender inequality in transport was recorded in several states before and after the pandemic and attempts to provide in the concluding part some useful findings to better define planning strategies for future mobility in accordance with the sustainable development goals of Agenda 2030.

In the next Sections of this paper, we discuss and synthesize past research findings that pertain to the (a) fundamental differences regarding women's and men's mobility needs, preferences and perceptions (Sect. 2), (b) pre-pandemic initiatives and attempts to narrow the gender inequality gap based on women's transport behaviour findings (Sect. 3), and (c) influence of COVID-19 travel restrictions measures in women's mobility patterns. Our conclusions along with the future research steps are summarized in the last Sect. 5.

2 Background

The concept of gender equity has been considerably researched in the recent decades, paying particular attention to the imbalance in the mobility sector. Numerous surveys have been released to understand the change in modal choices and daily habits before and after the pandemic. A study conducted by [7] points out that women in the European Union prefer to use urban public transport and extra-urban trains (31%, men are 24%), or to travel on foot, while men are more willing to choose private means of transport. In addition, more men (59%) than women (49%) own a private car, although in the last decade the number of women using cars daily has increased.

Gender differences are also highlighted with regard to the reasons for the displacements. Men travel more often for personal purposes, including leisure, while women travel mainly for care and assistance activities. Mobility patterns of women are more complex than those of men. This stems from the fact that women are primarily responsible for care within families (mobility of care). Added to this is that women use public transport more because they are less likely to have a driving license and even more rarely have a car available (one of the aspects that defines the concept of transport poverty) [8, 10]. Because of the more frequent use of public transport, women are more interested in the quality of the service.

Women are also more attentive to environmental issues related to transport and more interested in sustainable mobility (61% against 55% of men), even if they show less enthusiasm than men towards innovative technologies, such as electromobility and automated vehicles. This aversion seems to be linked above all to security issues [11, 12].

There are many reasons that make the transport sector unattractive for women. First, it is perceived as a typically male sector, where women fear of being discriminated against and where there is little attention to the need for reconciliation between private life and work. Furthermore, being a highly male-dominated sector, the equipment and services are not women-friendly. Additionally, there is no particular attention to safety, including violence: it is indeed a sector where sexual harassment is particularly widespread. Another criticality is connected to the problem of skills: the scarcity of women with degrees and diplomas in STEM subjects (science, technology, engineering and mathematics) constitutes a further obstacle for a more substantial presence of experts, given that the technological and engineering skills are of particular importance for transport [13].

Therefore, concrete policies to encourage the entry of women in the sector must be undertaken with more energy, while it is also necessary to promote a cultural and organizational change that contrasts gender stereotypes and promotes the careers of women [14]. At the same time, initiatives are also required to combat harassment and discrimination, even in its most subtle and hidden forms. The greater involvement of women in the sector could lead to greater sensitivity to women's needs and more attention to safety issues.

Several European studies show that there is a shortage of data disaggregated by gender, both in terms of transport use and working conditions. The data referred to are mostly the result of various unsystematic research and pertain to a few countries or allow an analysis only at European level, without being able to go into the specific situations of individual countries. Therefore, greater commitment is needed, particularly in the collection of data and information to explore more in depth a topic that is of interest to everyone.

The reasons behind the differences found in the mobility of the female population compared to the male one, are mostly attributed to demographic factors (aging of the population) and to the division of roles within the labour market and family. These values have undergone enormous growth, due to the restrictions provided by the pandemic and the implementation of teleworking and online teaching. Finally, the presence of elderly people in the family and the need to look after them has also increased the gender gap in travel [15].

Before the pandemic, the female employment rate in Europe, although growing, was still lower than that of men (58% against 70%) [16–18]. Today, women account for the largest share of workers in part-time jobs in Europe and in many other countries around the world. These structural differences are consequently reflected in differences between male and female mobility patterns, which can be summarized in three aspects:

- Mode of transport used,
- Travel purpose, and
- Distances travelled.

2.1 Women and Men Move Differently in the City

Women move more because they are more likely to have part-time jobs and their daily commuting involves numerous places related to housework and childcare [19]. This

involves movement needs within complex cities compared to the traditional home-work journeys. Urban planning has often been the prerogative of male decision makers, who do not always take into account the need to design mobility that recognizes the different needs of the female population, but also of the disabled, migrants or those who do not own a car.

With regard to modal choices, various studies show that men use private vehicles more than women, who, on the other hand, represent the largest share of public transport users and those who travel on foot or by bicycle: the reason of this lies in the lower average economic availability of women to support the comparatively higher costs of a private vehicle.

Women are more inclined to choose sustainable travel modes, from an environmental point of view, and they are generally more inclined to support values related to environmental protection. They consequently have a more positive perception of men regarding regulatory (physical or restrictive) measures implemented in order to achieve sustainable mobility (speed limits, restricted traffic areas or charging schemes) [20].

As regards the travel purposes, women travel less than men for professional reasons but make a greater number of trips to make purchases, to accompany family members or relatives and to carry out activities and functions inherent to family management. Their trips are characterized by a greater dispersion of origins and destinations and they are being carried out mainly outside the conventional peak hours.

Finally, regarding the average distances travelled, it has been found that men cover greater distances than women in almost all age groups. The most consistent differences are found in relation to the trips made for the purpose of work, where the distances travelled by men are greater. The result is an urban system built on car travel and the interests of motorists [21, 22].

2.2 Men Cause More Emissions Related to Transport than Women

Not only does urban mobility often ignore the gender issue, but according to a Swedish research, men's spending causes 16% more emissions harmful to the environment than that of women, despite the fact that the amount spent is practically the same. The explanation is simple: men, moving more by car, spend more money on fuel than women, whose spending is directed towards other sectors [23, 24].

Gender differences in emissions are still poorly understood by scholars, but it would be useful to keep them in mind for the decision-making process to combat climate change. It is therefore crucial to take gender differences into account when aiming to develop solutions that work for everyone. This is a reasoning that is well applicable to the relationship between urban mobility and the gender issue.

2.3 Welcoming Diversity in the Planning of the Urban Fabric

Gender equity and, more generally, inclusiveness in urban mobility assumes a central role in the public debate of many European cities, which are already working for sustainable mobility, discouraging car traffic and offering an efficient public transport system capable of responding to the needs of all citizens.

For some time now, Paris has been aiming to build an urban system capable of enabling residents to reach basic services within fifteen minutes on foot, by bike or by public transport. Important examples of inclusive mobility can be found in the city of Offenbach am Main in Hesse. Here, the residential areas have been connected with a network of cycle paths to the commercial areas and schools in order to promote the sustainable mobility of pedestrians, made up mainly of mothers and children [25, 26]. In Munich, green politicians and social democrats called for a city council hearing on gender planning with the aim of addressing issues, such as the safety of underpasses, the barriers encountered by people with strollers and the duration of traffic lights for pedestrian crossing [26]. Urban mobility will need to be rethought to accommodate diversity in planning processes as happened in Oslo, Norway, where bike sharing docking stations, initially located near downtown offices, were mostly used by men. The spread among women remained limited until stations were also added in peripheral areas and near homes. Inclusive urban mobility, which also directly affects the fundamental principle of equity and accessibility, presents itself as a useful element to rethink urban routes and create cities which are increasingly sustainable and within everyone's reach.

The most "friendly to women" European city is Vienna, Austria, with the creation of the Frauenbüro and a coordination office for planning and building on the needs and requirements of everyday life for women [27, 28]. The Austrian capital has been practicing gender mainstreaming for thirty years, defined by the European Institute for Gender Equality as the (re) organization, improvement, development and evaluation of political processes on gender equality at all levels and phases of decision-making processes. Vienna is classified as the easiest and safest European city for women, since a series of actions on sustainable mobility have been implemented. These concern the expansion of bus stops and sidewalks, thinking about the passage of prams with children, all the public transport network is wheelchair accessible, crossings have been made safer and the lighting of the city has been improved.

3 Sustainable Mobility Choices in Europe Before Pandemic

Since 2015, several research studies have been focusing on gender equality and mobility. In accordance with [29], the EU policy defined as "Gender Mainstreaming" should analyse in depth:

- The obstacles to effective gender mainstreaming,
- The mechanisms of resistance to gender mainstreaming, and
- The steps towards positive change, which gender mainstreaming can produce, even when the results stop before the "transformation".

A 2015 study by [30] focused on gender equity and on what extent both genders cooperate to expand access to paid work and control over material resources, while sharing reproductive care and responsibilities. Building on complexity theory, this paper proposes a theoretical framework for identifying cooperative behaviours within the family and workplace, as well as within broader socioeconomic, political and institutional domains.

In the same year, the UN member states unanimously adopted 17 Sustainable Development Goals (SDGs), as part of the Sustainable Development Agenda, with a planned completion date of 2030. Considering Agenda 2030, the objectives SDG 9, 12, 13, and 15 are related to innovation and infrastructures, to responsible production and consumption, and to climate change, while they all have direct links with transport. The SDG 5, i.e. "gender equality", has particularly powerful connections and an impact on transport.

The main differences in mobility patterns between women and men lie in modal choice and travel distance. Women's practices tend to be related to more sustainable means of transport, while men's practices are tied to more unsustainable transport. A study conducted by [31] analysed the relationship between mobility and gender equity by analysing the relationship between sustainability, gender equity and air transport and making recommendations for a future of transport that is economically, socially, financially and environmentally more sustainable. A study conducted in Portugal in 2015–2016 explored knowledge about women's and men's mobility and time use by considering real-time monitoring of a working day in order to examine commuting patterns. Through the acquisition of data provided by smartphones and/or devices with integrated GPS (trackers), the results highlighted gender disparities in mobility and time use [32]. Similarly, research conducted in Chile, utilising mobile phone data, showed that women visit fewer unique places than men and distribute their time less equally between these places. Mapping this mobility gap onto administrative divisions, the researchers observed a wider gap often associated with lower income and lack of public and private transport options [33].

In 2018, a study conducted by [34] highlighted the health benefits associated with cycling as a means of daily travel. This study investigated the relationship between gender equality and a range of factors using the Gender Equality Index composite indicator and its six main domains (work, money, knowledge, time, power and health), including factors related to violence and women's participation in cycling in the 28 EU member states. The results showed that the main domains of health and work were not related to women's participation in cycling. Women's participation in bicycle transport was associated with the following domains: time, power and violence. The effect of gender equality varied across indicators, with the strongest effect found for time.

As the role of women in the social structure has changed in recent decades, the question arises whether the 'gender' factor still plays a decisive role in the differences in mobility within the working population. Therefore, a Rhône-Alpes regional survey on family travel (2012–2015) and the research conducted by [35] showed that even if gender differences in working conditions and access to private cars are eliminated, differences in travel patterns between men and women would however be observed because the two genders do not have sensitivity to identical factors.

Research on shared mobility conducted in 2018 [36], through a literature review, revealed that most research is focused on assessing its impact on circulation, congestion, environmental factors, car ownership and modal shift. Very little attention is paid to how it impacts access, safety, ease or comfort of mobility for women, whose travel needs are strikingly different from those of men. The information analysed showed that shared mobility is mainly used by men [37], which implies that they are only widening the gender gap in our cities.

A study conducted in 2019 through the creation of interviews and a workshop in Sweden, analysed and correlated the concepts of gender equality, contemporary planning and sustainable "smart" mobility. In particular, it was investigated how the knowledge of gender equality is elaborated in the practice of regional planning. The results revealed that both gender equality and diversity were perceived as difficult in regional transport planning and that more knowledge and experience was needed [38].

A study conducted in Sicily, Italy on a sample of more than 1,000 adult women showed that the presence of children and income characteristics are factors that can influence women's mobility choices, such as the use of public transport, micro-owned/shared mobility or electric bicycles. The critical issues that emerged from this study are related to a different perception of safety on board public and/or shared transport or gender equality considering both the passenger and the driver's point of view [39].

Finally, a study conducted by [40] starts with an examination of gender equality goals in Sweden and suggests exploring the model in an international context through gender impact assessment (GIA) by analysing 10 years of research in transport planning. This GIA model provides insight into how transport planners would be able to assess the achievement of the 2030 Agenda goals or national gender equality targets and could establish evaluation criteria to be used to test the gender equality effects of strategic actions in transport plans sometimes generating potential conflicts of objectives [40].

4 Sustainable Mobility Choices in Europe After Pandemic

Various initiatives for the collection of data disaggregated by gender in transport have been implemented and concluded. The project Diamond provided a European reference tool for obtaining knowledge, recommendations and support on gender inclusion in current and future transport systems. It promoted the analysis of data and strategies to move towards a more inclusive and efficient transport system from a gender perspective. In particular, this project has identified and evaluated specific measures to meet the needs and expectations of women as users of different modes of transport and as workers in the sector [41].

Gender issues are of fundamental importance for the evolution of mobility and transport planning; this issue was analysed by a European project called TInnGO, that developed a network of 10 national HUBs to build capacity to generate and apply evidence on gender equality and transport issues at the European level [42]. The main factors analysed were women's mobility experience, namely safety, accessibility and reliability of transport. After March 2020, there is a large amount of research literature focusing on changing modal choices and mobility habits of users before and after the different pandemic phases [42–44]. A series of studies have generally analysed the impact of the recent pandemic on mobility. It has created enormous inconvenience by causing a sudden decrease in the number of journeys and changes in the choice and use of modes of transport. Furthermore, the effects of this health crisis on the social and economic spheres have exacerbated inequalities between population groups, with women among the most affected groups; a fact that could accentuate the already known gender gap in mobility. A study conducted by [45] defined a strategic assessment of urban mobility from the point of view of sustainability and gender equity in the context of the pandemic through

a SWOT-type analysis, identifying a series of effective strategies to address the mobility scenario urban post-COVID-19. A study conducted in the Barcelona metropolitan area before and after the COVID-19 outbreak focused on gender and equality using data from smartphones. The results showed that gender plays an important role when analysing mobility patterns, as already highlighted in other studies, but, after the outbreak of the pandemic, certain population groups were more likely to change their mobility patterns, for example, highly educated population groups and those with higher incomes [46].

In the post-pandemic phase, several studies have been conducted on micro-mobility and on the use of electric scooters. Empirical findings from Italy showed that there is no heterogeneity in gender and age groups in the sub-categories that represented the people who use, do not use and reject fully the use of scooters in urban areas. While employment status was considered an important parameter in transport planning, these results are partly in contrast with the data of other Italian regions. It was also shown that there was an inconsistency between local and national results. The results suggested that socio-demographic characteristics and public opinion should be investigated in further studies. In addition, a participatory planning process should be carried out to monitor reliable evaluation in urban transport planning [47]. Another study conducted in Sicily showed, through the dissemination of an online survey that age, employment and perceived safety level of micro-mobility modes play the most important role [48]. The literature review found prior to COVID-19, placed much of its emphasis on transport policy, demand management, 'smart' technological interventions and sustainable mobility, while in the post-pandemic phase the focus had to be on the public health aspect of the crisis, rethinking transport and its contribution to post-COVID-19 economic recovery. Recognising the importance of individual behaviour and collective responsibility in protecting personal and public health during the crisis, recent research proposes a new concept of Responsible Transport to help inform and shape transport policy and practical responses to COVID-19. What is new about this proposal is that it incorporates not only environmental considerations with respect to sustainability, but also includes considerations of individual and community health and well-being. It also emphasises the role of the individual as an autonomous and responsible actor in achieving socially desired transport outcomes [49].

A study conducted on 13 different European countries considering both a pre-COVID-19 and a post-COVID-19 scenario focused on the use of the mode of transport defined as Smart Mobility. The results of that survey revealed a greater number of people walking their daily commutes, while a significant decrease in the use of public transport is observed. Although these changes affect women the most, the main reason behind this, is the need for greater security in terms of low risk of contagion, regardless of gender. Furthermore, a specific focus on the use of sustainable transport modes such as shared modes, public transport, walking and cycling with the evolution of smart cities reveals differences that arise when comparing the responses of men and women and the various groups of age [50]. Finally, the new circumstances created by the pandemic have influenced the interdependencies between the objectives of Agenda 2030. In particular, a study conducted by [51] highlighted the additional spillover effects with negative results for the achievement of SDG 5 (Gender equity) but also for SDG 9 (Infrastructure and

innovation) and SDG 10 (Reduce inequalities), SDG 17 (partnerships for the objectives), and SDG 11 (sustainable cities).

5 Conclusion

Women still experience inequality issues when travelling and seeking employment in the transport sector. Due to their lifestyles and daily commitments, women's mobility patterns have significant differences on transport mode choice, travel purposes and distances travelled, when compared to the men ones. However, these differences lead women to develop more sustainable travel behaviours, which pertain to the comparatively greater use of public transport, cycling, walking and micromobility transport services. Promotion of such habits is also associated with the fulfilment of the globally recognized SDGs.

In this paper, we performed an extensive literature review to highlight the spectrum of gender inequality in transport before and after the COVID-19 crisis. In the pre-pandemic phase, our research findings highlight a widespread gender gap in all areas of shared and public mobility across Europe. During the COVID-19 pandemic, gender inequalities in transport sector have been deteriorated in some cases, due to the reduction of public transport services and the general (comparatively higher) fear of women to travel and move on their own amid serious threat of contagion.

Modern societies have realized the requirements to enhance the accessibility of women to transport sector and services. The improvement of soft modes of transport along with public transport services, as well as the employment of ITS (for getting relevant info, alerting for potential security threats etc.) lies in the core of these endeavours. These initiatives, however, are mainly observed in the comparatively wealthier and more developed countries in Europe and worldwide so far. The implementation of a gender perspective at all stages of decision-making, planning and execution is necessary especially in light of the sustainability goals introduced through the United Nations 2030 Agenda for Sustainable Development.

Future research should particularly highlight the differentiated transport needs of women, taking into account the new conditions after the pandemic. Our research has shown that in many cases the perceptions and needs of women are not investigated separately from those of men, and thus there is not enough knowledge about the conditions and potential weaknesses when using transport modes and services. A comprehensive consideration of all these differentiated needs will inevitably lead to the organization of a more resilient and inclusive transport system, which will also meet the sustainable development criteria that have been set in intergovernmental level .

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