

Article

Challenges and Strategies for Post-COVID-19 Gender Equity and Sustainable Mobility

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Abstract: The COVID-19 pandemic has forced countries around the world to take unprecedented measures to contain it. In particular, its impact on mobility has been enormous, causing a sudden decrease in the number of trips 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 aggravated inequalities between population groups, with women being one of the most affected groups, which may accentuate the already known gender gap in mobility. Based on these premises, we carried out a strategic analysis of urban mobility from the perspective of sustainability and gender equity in the context of the pandemic, identifying a set of effective strategies to address the post-COVID-19 urban mobility scenario. To this end, based on the review of the literature and expert opinions, we carried out a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis that allowed us to formulate 16 strategies after careful consideration of the weaknesses, strengths, threats and opportunities encountered. Our results provide useful recommendations for making successful policy decisions on post-COVID-19 mobility planning towards a more sustainable, equitable and safe model.

Keywords: gender equity; mobility; COVID-19; sustainable urban mobility; SWOT analysis; strategies



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1. Introduction

Proper planning of mobility and transport policies is essential to ensure equity of access to goods and services.

Over the years, many authors have deepened their understanding of the relationship between gender and mobility, finding significant differences between men’s and women’s mobility habits and noting the importance of introducing a gender perspective in the analysis and design of mobility plans [1]. Gender mainstreaming aims to avoid the creation of barriers for women and also promotes equality. Mobility and transport policies must be aimed at achieving a more efficient and sustainable use of transport modes, while guaranteeing road safety. In other words, mobility policies must simultaneously respond to three fundamental issues: equality/equity, environmental sustainability and road safety.

However, the mobility landscape, and especially urban mobility, has changed dramatically in recent times. On the one hand, this is due to the emergence of new, more sustainable modes of travel, driven by the development of new technologies applied to transport (car sharing, personal mobility vehicles, etc.) [2,3]. On the other hand, due to the crisis caused by the COVID-19 pandemic, whose impact is having a devastating effect on many areas of daily life and on mobility, the collapse in urban mobility has been spectacular. To tackle this virus, from March 2020 most countries in the world began to adopt measures that reduced social and economic activities and restricted mobility, causing a sudden drop in the number of trips and changes in the choice and use of transport modes [4].

The effects of this situation may aggravate the vulnerability of certain population groups already identified in previous studies. COVID-19 has highlighted the worsening social and economic inequalities that have emerged in recent decades [5]. Women in particular are among the groups most affected by this crisis [6].

The question is, how is the pandemic affecting the different mobility of men and women? COVID-19 and the measures to contain it have serious social and economic repercussions that can affect mobility according to gender. The gender gap in mobility is widely known; studies on women's mobility have been carried out in the USA since the 1960s, driven by feminist researchers. This gender perspective, which was interested in how women moved around the city, revealed different practices and experiences in mobility patterns in women compared to men. However, there is a need to better understand the travel patterns of men and women in the context of the pandemic in order to provide sound recommendations for mobility planning towards a more sustainable and inclusive model. In this regard, gendered analysis of urban mobility, which is currently undergoing a rapid transformation, is of great interest.

Based on a review of the literature and expert opinions, this study carries out an analysis of urban mobility from the perspective of gender, with the aim of identifying effective strategies to achieve greater equity and sustainability in post-COVID-19 mobility. For this purpose, we use Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis, which is a very valuable tool in strategic analysis. This technique helps to organise and analyse information and to formulate strategies based on strengths and opportunities, while eliminating weaknesses and threats. We focus our study on developed countries in general, according to the Human Development Index (HDI) [7].

Under the following sub-headings, we review the literature on the topic at hand. First, we briefly describe the gender differences in everyday mobility to lay the basis for our strategic analysis. Then, Section 1.2 reviews the effects of COVID-19 on everyday mobility. Subsequently, Section 1.3 discusses the most relevant effects of the pandemic on women's mobility. This review of the literature will allow us to carry out a SWOT analysis in the later sections of this paper to identify the challenges and strategies for gender equality and sustainable mobility in the post-COVID-19 era.

1.1. Gender Differences in Everyday Mobility

It is known that there are significant differences between the mobility patterns of men and women [8]. The geographical, social and cultural context may influence the mobility habits of the population and, consequently, whether these gender differences are more or less pronounced [1]. However, the literature published over the years has identified some common patterns or trends in developed countries.

In general, women's daily mobility in terms of space is less than that of men, especially for commuting, as evidenced by studies in the US [9] and Israel [10]. Women's mobility is concentrated around the home compared to men's more extensive mobility, enabling women to use more sustainable modes of transport, according to a study that reviewed the literature on mobility and gender [1] and the results of other studies in Spain [11,12]. However, women are more mobile (more journeys per day) because of the chain of tasks they perform on a daily basis, reported by studies in Spain [12,13]. In fact, also in Spain, it was found that domestic responsibilities play a major role in women's mobility, regardless of their status (education, work, family or residence) and increase gender gaps, whatever the reason for the trip [11,14].

Regarding the use of transport modes, studies carried out in different parts of Spain (Catalonia, Madrid and Andalusia) have shown that, although for men and women the private vehicle (PV) is the most popular option, women show a more sustainable pattern of mobility by travelling more frequently by public transport (PT) or on foot, while men opt more for private means, regardless of their personal, social and economic conditions [11–13,15,16]. Furthermore, when there is only one car in the family, it is usually the man who uses it every day, according to studies in the UK [17] and Spain [18]. However, it is widely recognised that adult women with children in the household are highly dependent on the car compared to other women in developed societies, such as in Germany [19] and Poland [20]. This is a time of increased domestic and career responsibilities, so the car can be a solution to the time constraints of fulfilling all required activities [11,12]. Still, a

survey in German cities found that women have less access than men to resources related to mobility in urban areas [19].

On the other hand, a study conducted in Germany on men's and women's attitudes towards sustainable mobility found that, although women are more concerned about environmentally friendly mobility and use fewer cars, women with a minor child in the household prefer conventional car transport [19]. In relation to e-mobility, the mentioned study found that, although women with one child have lower incomes, they are willing to spend more money than men to purchase battery-powered electric vehicles (BEVs). However, in practice, it has not been observed that BEVs present an attractive solution for most women, one of the reasons for the unattractiveness being the rejection of the innovative technology of these vehicles. Men, however, have long adopted electric vehicle sharing [19].

As we can see, the mobility habits of people, in relation to gender, depend on physical, economic and social conditioning factors. The integration of these into the study of urban mobility refers to the concept of motility, developed and defined by Kaufmann as the capacity of entities (e.g., goods, information or persons) to be mobile in social and geographic space, or as the way in which entities access and appropriate the capacity for socio-spatial mobility according to their circumstances [21]. Its dimensions (access, aptitude and appropriation) are fundamentally linked to the social, cultural, economic and political processes and structures in which mobility is embedded and put into practice.

1.2. Effects of COVID-19 on Everyday Mobility

The COVID-19 pandemic continues to exert a great impact on everyday mobility. Since March 2020, social distancing measures adopted in cities around the world to contain the virus have led to a sudden decrease in traffic in cities, as well as to changes in the use and attitudes to different modes of transport. Additionally, the reasons for travel during confinement have been logically modified, with work being the most important purpose, according to a study carried out in Spain [4].

Although the volume of traffic has decreased in cities, a shift from public transport to individual transport has been observed, given its provision of better social distancing and lower risk of virus transmission.

Studies in countries such as Spain [4,22] and Germany [23] on the impact of COVID-19 on urban mobility highlight the increase in private car use compared to other modes. In fact, the effect of the greater dependence on private vehicles can be seen in the sales of second-hand cars over 15 years old in Spain and the United States, which soared in the summer months of 2020, with the view of purchasers being to returning to school or work, as an individual mobility solution at a more affordable price [24].

As for public transport, its use has been particularly affected by issues of fear of contagion. Feelings of stress and anxiety caused by the use of public transport during the pandemic in the spring months of 2020 were significantly high, with these feelings increasingly spreading even beyond the months of strict confinement, according to a study conducted in Sicily (Italy) [25]. A widespread collapse in demand for public transport by more than 90% from pre-pandemic levels has been observed in many cases around the world [4,26,27], and a study conducted in A Coruña (Spain) found that recovery of demand from months of containment is slower than for other modes of transport [22]. On this issue, CEOs of public transport companies operating in the Lombardy region (Italy) believe that demand is still far from returning to pre-COVID-19 levels and will remain so, even in the medium term [28]. In this regard, it is important to note that the introduction of interpersonal distancing on board vehicles to tackle the COVID-19 pandemic is not a sustainable measure for public transport companies in the medium to long term, as evidenced by Coppola and De Fabiis [29]. A similar trend has been observed in the case of taxis in China, which have suffered a sharp decline in demand. In addition, the characteristics of taxi travel (time, speed, reason for travel, etc.) have changed significantly due to strict pandemic control policies [30]. Director-generals of transport-

related industries, mobility sector consultants and public transport companies operating in the Lombardy Region (Italy) recognise the importance of maintaining local public transport, not only to preserve a strategic sector for urban mobility, but also because the failure of urban public transport would lead to the collapse of the overall urban transport system, as an uncontrolled increase in car journeys could lead to a high level of traffic congestion with serious consequences for the environment and for people's quality of life [28]. In this regard, a study in Spain points out that more studies are needed that link the effects on mobility to specific activities and user groups so that future policies and measures to promote a return to public transport can be better adjusted [22].

A greater trend towards walking for shorter trips or the use of bicycles has been found during the COVID-19 pandemic in Italy [6], Germany [23] and Greece [31]. Bicycles and personal mobility vehicles (PMV) have also taken on a predominant role in meeting recommendations for social distancing to avoid the risk of contagion. A study in Santander (Spain) found that cycling and scooter travel had decreased during quarantine, mainly due to restrictions that required large numbers of people to stay indoors and only allowed workers to travel for essential activities that they could not perform from home. However, the proportional reduction was less than that observed for public transport or even for walking [4].

A study conducted in Australia has indicated that, overall, there has been a reduction in the use of Mobility-as-a-Service (MaaS), which includes shared modes of transport (bicycles, scooters, cars, etc.), and their integration with public transport. This has aroused the interest of researchers regarding the role that MaaS could play after COVID-19 and, in particular, in rethinking public transport in its broadest sense as a central part of MaaS [32]. With regard to bicycle-sharing services, some were discontinued during periods of home confinement, but once they were able to resume, demand for these services increased in line with the increase in traffic volumes in the cities like A Coruña (Spain) [22]. People feel that bike sharing is not as safe as walking or using a private car in times of COVID-19, but it can be a safer option compared to using a taxi and especially using public transport. Furthermore, according to a study conducted in Greece, it may become a preferable alternative for certain specific groups of people in pandemic settings, such as those who previously rode in private cars as companions and those who are already registered users of such bicycle-sharing systems [33].

Moreover, the importance of developing vehicles with autonomous driving technology to provide transport services for both people and goods and greater protection against viruses has been noted in countries such as Israel [34].

In terms of urban planning for sustainable mobility, the COVID-19 pandemic has generated interest in recovering the city of proximity, also known as the city of 15 min. This is a city configuration that allows access to all the services necessary to carry out daily activities in a maximum time of 15 min, promoting the use of soft modes of transport (bicycle, walking, etc.) in the face of excessive dependence on motorisation [35]. Furthermore, based on a study conducted in Sicily (Italy), there is a positive opinion on the use of micro-mobility (PMV, bicycles, walking, etc.) during pandemic situations [25]. It should be noted that mobility restrictions to stop the transmission of the virus have led to a reduction in the length of journeys, with intra-urban origin-destinations. Proximity mobility (15-minute city) favours pedestrian mobility and other soft modes, which is positive for the environment and citizens' health.

Concerns about the risk of contagion and mobility restrictions are changing consumer habits. According to a study reviewing data from different e-commerce companies and from different countries, there has been a large increase in e-commerce due to the pandemic, which could affect consumer behaviour in the future [36]. This trend reduces the movement of people in cities but also increases the circulation of vehicles for the urban distribution of goods.

The increase in teleworking during COVID-19 has also influenced the decrease in mobility. In addition, a study surveying Sicily (Italy) found that the population is in favour

of maintaining teleworking after confinement to reduce their travel needs and maintain their isolation [25]. A study carried out in Spain suggests that it may be interesting to monitor changes in travel production habits: the increase in telework, whether travel patterns will change for leisure, shopping, etc. [4].

In short, the effects of COVID-19 on the use of different modes of transport lead us to consider what mobility will be like in cities once this crisis is over.

1.3. Effects of COVID-19 on Women's Mobility

COVID-19 is not only affecting people's health by causing hundreds of thousands of deaths and millions of infections worldwide; its advance is also aggravating inequality and poverty. The economy has come to a standstill because of the containment measures put in place in most countries. The overall impact of the crisis caused by the pandemic is expected to increase and widen income, gender, racial and ethnic inequality [37].

These social and economic repercussions of the COVID-19 pandemic could affect mobility differently according to gender, as will be described later in this section.

Different public administrations have collected and analysed mobility data during the pandemic through the positioning of mobile phones [38,39]. However, these data do not provide information on people's characteristics (gender, age, modes of transport, reasons for travel, etc.). Similarly, published data on the impact of COVID-19 on public transport use do not differentiate by gender [26].

Given the lack of gender-disaggregated mobility data and based on the social and economic impact of the pandemic, we can point to the most relevant effects on female mobility: Less economic capacity for transport, more mandatory travel and less time available for journeys.

Less economic capacity for transport. Gender inequality in employment and income has increased as a result of the coronavirus outbreak. Studies on the impact of the pandemic on the labour market show that women have been more severely affected than men [40,41]. COVID-19 has a greater impact on industries and occupations with high proportions of female employment, such as the hospitality sector, which differs from previous economic crises where the employment consequences fell much more heavily on men [42]. More women than men are employed in low-wage or precarious jobs, which are the most affected by the pandemic. Not only have these workers been forced to take unpaid leave to a greater extent, but many of them have also been laid off [40]. Women have also experienced a greater reduction in working hours than men, moving from full-time to part-time work, and are even more likely to have lost their jobs [40,41]. In addition, there is the high prevalence of women in the informal economy [43], a sector that has been particularly hit hard by the pandemic and whose workers have been unable to receive the government financial support available to workers in the formal economy who have reduced their working hours or lost their jobs [44]. Even in the most protected sectors such as the civil service, the economic position of women has been worsened by the pandemic crisis [40]. All these negative effects result in the loss of women's economic resources for travel, leading to a reduction in the number and distance of journeys and the possibility of using more expensive modes of transport. For example, women are much more dependent on public transport than men, especially in the case of single-parent families, as they are less likely to have a car due to financial reasons. In countries where mobility restrictions have been tightened, public transport has been reduced or even eliminated. This makes life more difficult for women who depend on these services and need to travel to perform everyday activities (work, doctor's visits, shopping, etc.) [45].

More mandatory travel. Women play a greater role in sectors that require their presence at work, such as health and social service activities, hotels and restaurants and domestic work (cleaning, caretaking, etc.) [46]. In addition, women have greater difficulty accessing the internet and electronic devices for teleworking in vulnerable households with precarious jobs or in the informal economy (mostly dominated by women). Despite advances in digital technology in recent years, there is still a marked and widespread

gender inequality in terms of access to and ownership of digital devices, digital fluency and the ability to make meaningful use of technology [47]. There are indications that more men than women will find it easier to adapt to the changing work environment during the COVID-19 crisis, as more male than female workers are employed in occupations suitable for teleworking [42]. This means that women have greater need to travel for work. However, women's mandatory travel during COVID-19 is not only determined by the work reasons described above, as domestic responsibilities (shopping, taking children to the doctor, etc.) also weigh heavily on women's mobility needs [13]. There is evidence that women have experienced greater mobility than men during the pandemic—for work purposes, to do certain essential jobs and to provide food and other essential items for their families—and also used public transport more often than men [48].

Less time available for journeys. In addition to the usual difficulties of work-life balance and lack of co-responsibility faced by women, there are also additional activities such as home study for children and/or caring for the elderly. The increase in the chain of daily tasks means that women have less time to carry out all the activities required and, consequently, less time to make the necessary journeys. The closure of schools and day-care centres during periods of home confinement has affected women more than men because of increased childcare needs [42]. Single-parent families in particular have been hit the hardest, with the majority of them headed by women (85%) [49]. These single mothers are less likely to have access to other sources of childcare because of measures of social isolation, reducing their ability to combine work and childcare at home [42]. Even among more privileged professions, such as teaching and academia, women are likely to bear a greater burden of the pandemic because of their greater domestic responsibilities, undermining their chances of career progression and future earning potential [42,50]. On the other hand, there is evidence that personal experiences of confinement are also different between men and women. Women were more concerned about childcare while men were more concerned about paid work and the economy, which can potentially contribute to a future widening of the gender pay gap in the crisis recovery process [51].

Having noted the main effects of COVID-19 on female mobility, there is the question of whether the impact of the pandemic will be long-lasting. Looking further ahead, some studies have shown that the economic downturn caused by the coronavirus has serious implications for gender equality and that women's employment and income will be more severely affected than men's, not only during the crisis but also in the run-up to recovery [40,42]. Ignoring the different impacts of the COVID-19 crisis on women and men will aggravate the inequalities already observed in mobility. We consider this to be a critical time for this study, and its timing will allow us to anticipate these negative consequences.

2. Materials and Methods

Based on the review of the literature in the previous sections, we carried out a SWOT analysis of urban mobility from the perspective of sustainability and gender equity in the context of the coronavirus pandemic. This analysis allows us to identify strategies to achieve a sustainable and inclusive model of post-COVID-19 urban mobility.

Since its introduction by Heinz Weihrich in 1982, Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis has been a valuable methodology for formulating strategies at the business unit level, and is particularly useful for strategic analysis.

This analysis allows the strategic diagnosis of a company to be established. Its objective is to specify, in a matrix, the strong and weak points of the company (expressions of its competence or capacity to generate and sustain its competitive advantages), as well as the external threats and opportunities, and, from their interaction, those strategies that, in a coherent way, make it possible to achieve an adequate adjustment between the internal capacity of the company and its external competitive position. SWOT analysis tries to identify to what extent the current strategy of the organization, and more specifically its strengths and weaknesses, is relevant and enables it to face the changes that are taking place in the economic environment. The SWOT matrix was defined by Koontz and Weihrich as a

conceptual structure for systematic analysis which facilitates the comparison of external threats and opportunities with the organisation's internal strengths and weaknesses [52].

Following the above scheme and considering urban mobility as a "business", we have established its weaknesses, threats, strengths and opportunities, which are listed in the next section of this paper. For each of these terms, we will utilize Rowe's definition [53] and extend the meaning of the original, applicable to a company or organisation, to the sector under analysis. It should be mentioned that SWOT analysis has been used before in studies in the field of transport and mobility, for example, in the analysis of the characteristics of urban mobility in Thessaloniki (Greece) [54], the logistics services in Andalusia (Spain) [55] or the alternative fuel vehicles sector in Poland [56]. However, this tool had not been used to identify strategies to achieve both sustainable and equitable urban mobility.

The concept of weakness (W) includes any limitation, defect or inconsistency in the organization that constitutes an obstacle to the achievement of the objectives and leads to a decline in the quality of management.

Threats (T) are considered to be those circumstances or situations in the environment that are unfavourable to the company. They can be a barrier to market exit or mobility within the industry, be some kind of restriction or change concerning the isolation mechanisms available to the company to maintain its strategic position or can concern the sources of the company's income or benefits.

Strength (S) is understood as any element that is favourable to the company internally and may consist of a resource or capacity that the organisation could use to achieve its objectives and improve its competitive position based on the improvement of its internal management.

Finally, opportunities (O) refer to any circumstance or situation in the environment that is potentially favourable to the organisation under study. They can be a market need, a trend in the environment or some kind of change that can improve the position of the company.

In our case, where we are doing a strategic analysis on urban mobility from the perspective of sustainability and gender equity in the context of the COVID-19 pandemic, strengths and weaknesses are those intrinsic and present characteristics that determine our object of study, while opportunities and threats are those extrinsic or future elements or circumstances that may affect it.

From the identification of the weaknesses, threats, strengths and opportunities, an initial SWOT matrix was constructed.

To validate the results obtained, the initial SWOT matrix was contrasted by incorporating the opinion of leading professionals and experts from the sectors of transport, sustainable mobility and gender, through a presentation of the topic and a round table discussion, from which the final SWOT matrix was defined.

Once the definitive SWOT matrix was obtained, we proceeded to determine the possible strategies (Stg) to be adopted, which required, as an initial step, the choosing of a strategic taxonomy. In this respect, due to its applicability to the case under study, García Falcón's proposal was selected. Results are suggested by the intersection of rows and columns of the SWOT matrix (as shown in Figure 1), which gives rise to four possible types of strategy [57]:

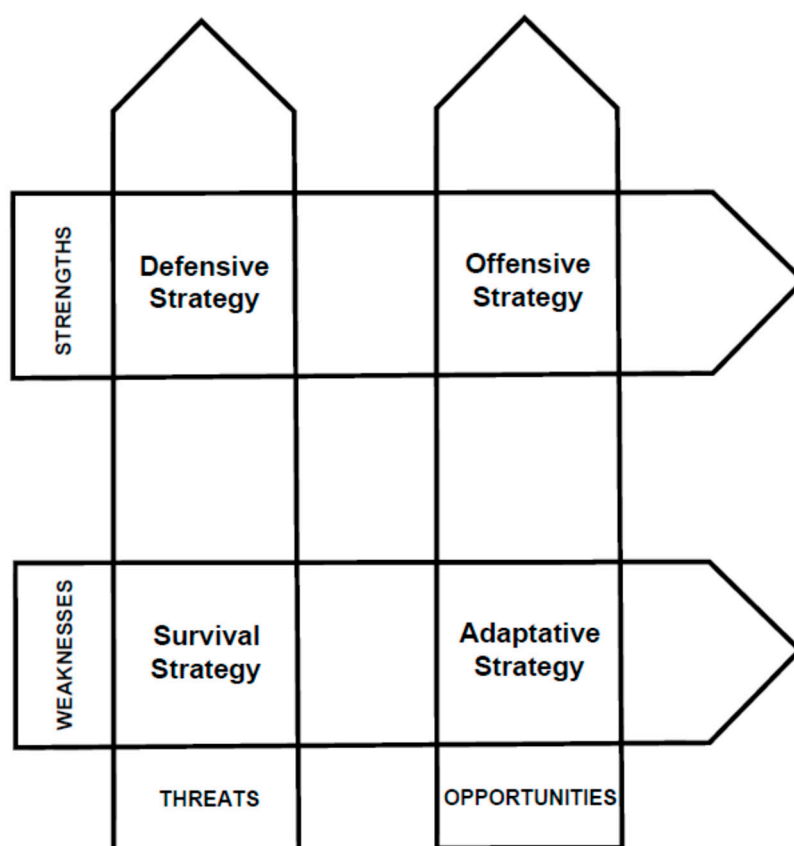


Figure 1. Strategies derived from the Strengths, Weaknesses, Opportunities and Threats (SWOT) matrix (source: Own elaboration from García Falcón, 1987).

Survival strategies (W-T strategies) are focused on reducing weaknesses and avoiding threats.

Adaptative strategies (O-W strategies) try to overcome weaknesses by taking advantage of opportunities.

Defensive strategies (S-T strategies) try to overcome threats with strengths.

Offensive strategies (S-O strategies) use strengths to take advantage of opportunities.

3. Results

3.1. SWOT Analysis

In our work, as already indicated, based on the bibliographical and documentary study carried out in the previous sections, it is possible to identify the following weaknesses:

W1. Women's increased need for mobility (number of trips), caused by the chain of tasks they perform on a daily basis.

W2. Women are more likely to be displaced due to their predominance in sectors of work that require presence (care, health, commerce, cleaning, etc.).

W3. The heavy burden of domestic responsibilities on women's mobility, regardless of their status (education, work, family or residence), increasing gender gaps, whatever the reason for the journey.

W4. Lack of gender-disaggregated mobility data. Different public administrations have collected and analysed mobility data during the pandemic, but they do not provide information on the characteristics of people (gender, age, modes of transport, reasons for travel, etc.).

W5. Lack of gender-sensitive mobility policies; in particular, ignoring the different impact of the COVID-19 crisis on women and men will aggravate the inequalities already observed in mobility.

W6. Rigid working hours, which cause traffic congestion at peak times and also make it difficult for women to reconcile family and work life.

W7. Hourly concentration of inflows and outflows around attractive travel centres such as nearby schools or workplaces and business and industrial parks.

W8. More women conditioned to use slower modes of transport due to their poor access to mobility-related resources in urban areas and low economic capacity compared to men.

W9. Majority use of the private vehicle as a mode of transport by both men and women.

W10. Men opt more for the use of private vehicles regardless of their personal, social and economic conditions. In fact, in households with only one private vehicle, its daily use is mainly by men, depriving women of the opportunity to use it for certain trips that would have been more appropriate.

W11. The digital divide that denies many women equal opportunities for teleworking and prevents them from enjoying the benefits of future technological innovations in mobility.

For the sector studied, the following threats can be listed:

T1. Decreased use of PT due to fear of exposure to risk. There is an increasing spread of feelings of stress and anxiety caused by the use of public transport during the pandemic, which may extend even beyond the months of strict confinement.

T2. Strengthening the culture of PV use in the post-COVID-19 era, both by men, whose travel pattern is characterised by excessive use of the private vehicle, and by other people who were previously more sustainable transport users and who have moved on and may continue to use PV, with the consequent risk of decreasing the sustainability of mobility in urban areas.

T3. Increase in sales of older, high-polluting second-hand vehicles, which are a danger to Sustainable Development Goals (SDGs).

T4. Increased confinement of women due to care tasks and domestic responsibilities in the post-COVID-19 era, which may increase the mobility gap and, therefore, the labour and wage gap. This will, especially, negatively affect single mothers and families who cannot combine work and childcare at home.

T5. Decrease in the already lower economic capacity of women for transport due to their employment in mostly precarious jobs, which have been especially affected by the COVID-19 crisis. More women are employed in low- and medium-wage jobs than in high-wage jobs. In addition, women's employment has been more affected than men's by the COVID-19 crisis. Women of all ages have experienced a greater decline in working hours than men and more have lost jobs as a result of the crisis caused by the pandemic, with consequent reductions in earnings.

T6. Cultural prejudices towards technology by certain sectors of the population, in many cases featured by women, may prevent their use for teleworking or transport.

T7. Slow recovery in demand for public transport to pre-pandemic levels.

T8. Lack of coordination between equality and sustainability policies for mobility in cities; this becomes particularly relevant at a time when the COVID-19 crisis has compromised expectations of employment, economic and social stability and growth. The reduction of inequality and the improvement of the environment must be tackled jointly.

Following this study, the following strengths can be listed:

S1. Greater productivity of women during their multipurpose journeys as they try to satisfy different reasons for travelling (shopping, work, picking up their children, etc.).

S2. Shorter distances of female journeys, mainly in the workplace, are the model to follow because of their lower environmental impact and reduced resource consumption.

S3. Recognition of the female travel pattern as being more sustainable, because, to a greater extent than men, women travel by public transport or on foot.

S4. Non-work travel takes place in an environment closer to the home regardless of gender.

S5. Flexible working hours in some companies that are committed to work-life balance. In addition, giving employees the possibility to be flexible in their arrival and departure times reduces traffic congestion at peak hours. Another option is to accumulate the number of weekly working hours into fewer days, for example, into four days, eliminating the need for commuting on one day. This helps to reduce the number of trips in cities.

S6. Effective reorganisation of public spaces for more sustainable modes of transport, speed limitation on certain lanes, exclusive lanes for PT, etc.

S7. Existence of new modes of transport (PMV, PMV/bike sharing, etc.) that can be used in combination with PT regarding last mile travel.

S8. Existence of carsharing, carpooling and driven transport vehicles (Uber, Cabify, etc.), which make mobility possible by replacing dependence on PV for certain journeys.

S9. Increase in walking, cycling and PMV during the pandemic, which promotes sustainable mobility within the city.

S10. Increase in e-commerce during the pandemic, which reduces the number of trips in cities.

The following opportunities are identified for the sector under consideration:

O1. The “15-minute city” concept, which makes it possible to travel around the city using soft transport modes and access all relevant services in a short time.

O2. Intelligent use of electronic commerce to acquire products or services that are not available in local or neighbourhood markets and avoid unnecessary travel, taking advantage of economies of scale in the urban distribution of goods.

O3. More ecological last mile distribution. A greater number of companies are opting for low-polluting vehicles for the urban distribution of goods.

O4. Development of autonomous vehicles for PT. Autonomous vehicles are more energy-efficient, provide greater road safety by avoiding the human factor and have lower overall costs.

O5. Development of autonomous vehicles and drones for parcel delivery, which reduces cost, eliminates human error and promotes contactless deliveries.

O6. Extension of the use and recognition of the advantages of teleworking and videoconference meetings.

O7. Development of new technologies applied to transport, which will make it possible to better plan personal mobility, facilitate and encourage the use of new modes of transport (PMV, PMV/bike sharing, etc.) and promote safety against COVID-19 and road safety.

O8. Effective development of mobile payment in PT and other transport services such as PMV, PV and bike sharing.

O9. Increased perception of road safety through better planning of public spaces that can encourage the use of soft modes of transport.

O10. Increased awareness among local policymakers and planners of the need to rethink urban spaces for sustainable mobility (improving cycling, walking, etc.).

Table 1 below shows the SWOT matrix obtained.

3.2. Deployment of Strategies

Once the SWOT analysis had been carried out, the deployment of applicable strategies to achieve a post-COVID-19 urban mobility model that addresses gender equity and sustainability was undertaken.

Table 2 shows the strategies obtained according to the taxonomy indicated in the previous section, detailing the weakness-threat, weakness-opportunity, strength-threat and strength-opportunity relationships that exist among them.

Table 1. SWOT matrix.

Weaknesses			Threats	
W1	Women's increased need for mobility	T1	Decreased use of public transport (PT) due to fear of exposure to risk	
W2	Women's more predominance in sectors of work that require their presence	T2	Strengthening the culture of private vehicle (PV) use in the post-COVID-19 era	
W3	Greater influence of domestic responsibilities on women's mobility	T3	Increase in sales of second-hand vehicles	
W4	Lack of gender-disaggregated mobility data	T4	Women's increased confinement due to domestic responsibility in post-COVID-19 era	
W5	Lack of gender-sensitive mobility policies	T5	Decrease in women's economic capacity due to their precarious jobs	
W6	Rigid working hours	T6	Women's cultural prejudices towards technology	
W7	Hourly concentration of inflows and outflows	T7	Slow recovery in demand for public transport	
W8	Women's conditioning to slower modes of transport	T8	Lack of coordination between equality and sustainability policies for mobility	
W9	Majority use of the private vehicle			
W10	Men opt more for the use of private vehicles			
W11	Digital divide			
Strengths			Opportunities	
S1	Greater productivity of women during their multipurpose journeys	O1	The "15-minute city" concept	
S2	Shorter distances of female journeys	O2	Intelligent use of electronic commerce	
S3	Recognition of the female travel pattern as more sustainable	O3	More ecological last mile distribution	
S4	Non-work travel takes place closer to the home	O4	Development of autonomous vehicles for PT	
S5	Flexible working hours in some companies	O5	Development of autonomous vehicles and drones for parcel delivery	
S6	Reorganisation of public spaces for more sustainable modes of transport	O6	Advantages of teleworking and videoconference meetings	
S7	Existence of new modes of transport	O7	Development of new technologies applied to transport	
S8	Existence of carsharing, carpooling and driven transport vehicles	O8	Effective development of mobile payment in transport	
S9	Increase in walking, cycling and personal mobility vehicles (PMV) during the pandemic	O9	Increased perception of road safety to encourage soft modes of transport	
S10	Increase in e-commerce during the pandemic	O10	Increased political awareness to rethink urban spaces for sustainable mobility	

Table 2. Matrix of strategies for post-COVID-19 gender equity and sustainable mobility.

		Threats								Opportunities									
		T1	T2	T3	T4	T5	T6	T7	T8	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10
Weaknesses	W1								Stg15	Stg13									
	W2																		
	W3				Stg4														
	W4								Stg1										
	W5								Stg2										
	W6																		
	W7																		
	W8				Stg4	Stg4													
	W9																		
	W10			Stg8						Stg13									
	W11						Stg5												
Strengths	S1									Stg13									
	S2									Stg13									
	S3																		
	S4																		
	S5																		
	S6	Stg9							Stg9										
	S7								Stg10										
	S8		Stg16																
	S9									Stg13									
	S10									Stg14	Stg14			Stg12					

Below is a brief description of which situation leads to the selection of the strategies deployed and specifies the relationships from which they arise.

Stg1 (W4-T8). Conduct gender-sensitive analysis and research, disaggregating data and drawing conclusions by gender regarding the impact of COVID-19 or other crises or the introduction of new modes of transport, which help to identify possible measures to improve changing mobility while addressing issues of sustainability and equality.

Stg2 (S3-O10; W5-T8; W5-O10; W5-O7). Take into account the gender perspective in the design of mobility policies, such that different mobility patterns and the real possibilities of using new modes of transport are considered. The female travel pattern, recognized as more sustainable, should inspire mobility policies that orient the male travel pattern, based on the private vehicle, towards the use of more sustainable modes of transport.

Stg3 (W6-O6; W7-O6; S5-O6). Promote flexible timetables and teleworking; plan timetables, entry and exit to workplaces or travel centres (schools, business parks, etc.) to avoid crowding.

Stg4 (W8-T5; W8-T4; W3-T4). Implement mechanisms of co-responsibility from all spheres, administrations, companies and households to improve work-life balance for women and allow them greater freedom in their choice of mode of transport.

Stg5 (W11-T6; W11-O6). Articulate measures to address the digital divide, providing women with access to communication technologies that enable them to telework and use technologies applied to mobility; avoid taking measures that widen already existing inequalities.

Stg6 (S1-O7; S1-O8). Promote the use of technology to programme mobility. This will reduce fear and promote rational use of transport, which is essential for multipurpose mobility that is eminently female, make it easier to find optimal routes, suggest travel alternatives, prevent over-concern, make it easier to make safe payments, without physical contact, facilitate the use of shared PMV, and satisfy the different reasons for travelling.

Stg7 (S4-O10; S6-O10). Redistribute public space to prioritise active mobility, making sure that the necessary distances are provided for women who are regular walkers and attracting potential male users.

Stg8 (W9-T3). Limit the number of lanes for private vehicles, speed and parking. Optimally plan the direction of traffic and longer journeys, as well as the correct distribution network of alternative fuels that stimulate the acquisition of low-polluting vehicles.

Stg9 (S6-T1; S6-T7). Improve the safety of the PT to restore confidence in it. Faster lanes to reduce exposure time to contagion while improving the time efficiency of PT in order to increase its competitiveness with other modes of transport. Regulate peak hours to avoid congestion. Study and scale schedules of generating points and trip attractors. Increase the number of buses at peak times and on peak lines. Adopt extreme cleaning and ventilation measures to prevent contagion. Prohibit the use of PT without masks.

Stg10 (S7-T7; S7-O9; S7-O10). Facilitate the intermodality of PT with bicycles or PMV. Appropriate combination of PT with other transport modes makes it a viable option, especially for women during their characteristic multipurpose journeys, which can minimise the need for a PV. To do this, different and specific spaces are required to ensure PT speed and road safety for bicycles and PMV.

Stg11 (S8-O7; S8-O8). Facilitate the use of taxis and chauffeur-driven vehicle services (Uber, Cabify, etc.) for the most vulnerable population groups and provide transport services on demand to areas with low population density. For example, through subsidies for women who have low financial resources, do not have a car or are living in dispersed areas, as well as providing on demand minibus services via mobile apps.

Stg12 (S7-O4; S10-O5). Accelerate the introduction of vehicles with autonomous driving technology in cities. By being auto-driven, such vehicles help to minimise physical contact between people, reducing the risk of contagion in pandemic contexts. They can be used to transport people and can be complemented by individual modes of transport such as PMVs or bicycles. They are also considered useful for the transport of goods as they could meet the demand for contactless deliveries.

Stg13 (W1-O1; W10-O1; S9-O1; S1-O1; S2-O1). Redesign cities based on compact and dense urban models, with a mix of land uses that save travel, through urban and land use planning. The physical proximity of spaces promotes social cohesion and accessibility by shortening distances required for citizens' daily activities (work, shopping, schools, etc.) and facilitates the use of soft modes of transport such as cycling or walking. This configuration of the city is particularly useful for women taking their characteristic multipurpose trips and to attract male car users.

Stg14 (S10-O2; S10-O3). Encourage efficient and sustainable e-commerce by locating urban goods distribution centres at strategic points in cities and facilitating the acquisition by companies of vehicles powered by low-polluting fuels for urban goods distribution. In addition, the use of e-commerce by women could simplify multipurpose travel involving certain purchases.

Stg15 (W2-T8). Undertake employment policies that favour the incorporation of women in occupations that can be developed through teleworking, reducing their obligatory trips for work reasons, and contributing in turn to the sustainability of cities by reducing the number of trips.

Stg16 (S8-T2). Offer carsharing and carpooling services in cities, which can make mobility more sustainable by replacing dependence on private vehicles for certain journeys, thus weakening the culture of mobility based on private vehicles, especially among men and middle-aged women with children at home, who use private vehicles to a greater extent. In the case of these women, carsharing operators should analyse the specific needs of women and the purposes for which they use carsharing services (work, shopping, picking up/carrying children) in order to adapt them to these needs.

After detailing the strategies, Table 3 ranks them by importance in accordance with the number of relationships from which they are derived (weight). We can see that Stg13 is the most relevant strategy, as it is the result of three strength-opportunity relationships classified as offensive strategies that use the strengths identified in the SWOT to take advantage of the opportunities. This strategy also appears as a result of two weakness-opportunity relationships or defensive strategies in which threats are dealt with using the strengths. It is followed in order of importance by Stg2, which is the result of four relationships (2 W-O, 1 S-O and 1 W-T). Stg3, Stg4 and Stg10 arise from three relationships each. Most strategies (Stg5, Stg6, Stg7, Stg9, Stg11, Stg12 and Stg14) are identified by two relationships. Finally, the remaining four strategies (Stg1, Stg8, Stg15 and Stg16) have one relationship each. In addition, as a guideline, the strategies have been evaluated according to their difficulty of implementation (low, medium, high) in terms of time and budget required. However, this is only an approximation as the real calculation would require a detailed study of the individual cases, which is beyond the scope of this paper.

Table 3. Rating of strategies according to their importance.

Code	Weight	Strategy	Difficulty
Stg13	5	Redesign cities based on compact and dense urban models, with a mix of land uses that save travel	high
Stg2	4	Take into account the gender perspective in the design of mobility policies	medium
Stg3	3	Promote flexible working hours, teleworking and time planning	low
Stg4	3	Implement mechanisms of co-responsibility from all areas	medium
Stg10	3	Facilitate PT intermodality with bicycles or PMV	medium
Stg5	2	Articulate measures to address the digital divide	medium
Stg6	2	Encourage the use of technology to programme mobility	medium
Stg7	2	Redistribute public space to prioritise active mobility	high
Stg9	2	Improve the safety of PT to restore confidence	medium
Stg11	2	Facilitate the use of taxis and chauffeur-driven transport services	medium

Table 3. Cont.

Code	Weight	Strategy	Difficulty
Stg12	2	Accelerate the introduction of autonomous driving technology vehicles in cities	high
Stg14	2	Encourage efficient and sustainable e-commerce	medium
Stg1	1	Conduct gender-sensitive analysis and research	medium
Stg8	1	Limit the number of private vehicle lanes, speed and parking	high
Stg15	1	Undertake employment policies that favour the incorporation of women in occupations that can be developed through teleworking	medium
Stg16	1	Offer carsharing and carpooling services in cities	low

4. Discussion

The COVID-19 pandemic is an unprecedented situation that has affected all areas of our lives. Everything points to the fact that post-COVID-19 mobility will be different. There is evidence that there has been a large increase in e-commerce due to the pandemic that could affect consumer behaviour in the future [36], which reduces the number of trips in cities. Additionally, a study that surveyed the Sicilian population found that the population is in favour of maintaining teleworking after confinement to reduce their travel needs and maintain their isolation [25]. In addition, the effect of the health crisis will increase the already known gender differences. Some authors anticipate that the economic downturn caused by the coronavirus has serious implications for gender equality and that women's employment and income will be more severely affected than men's, not only during the crisis but also in the run-up to recovery [40,42].

Based on a review of the literature and expert opinions, this study carried out a SWOT analysis of urban mobility from the perspective of gender, with the aim of identifying effective strategies to achieve greater equity and sustainability in post-COVID-19 mobility. We focussed our study on developed countries in general.

Our results indicate that the most relevant strategy is to redesign cities according to compact and dense urban development models with a mix of land uses that save travel (Stg13). This urban planning approach is not new. It is based on the recovery of the traditional model of the compact and sustainable Mediterranean city [58], as opposed to the dispersed urban model, which is a consequence of the development of the car industry and mass motorisation, and in which there is greater dependence on private vehicles [59]. This strategy takes advantage of the uncertainty of one of the strengths that has become more evident during the health crisis, namely S9 (Increase in walking, cycling and PMV during the pandemic, which promotes sustainable mobility within the neighbourhood). Walking, cycling and PMV are forms of mobility that allow people to move around while maintaining social distancing. Pedestrian mobility must be the main form of travel and must be guaranteed in view of the value that "proximity" or short-distance travel has taken on. Mobility by bicycle, PMV, etc. is a major alternative that requires more attention, especially in cities where it is "uncomfortable" to travel on foot but where these modes of transport are perfectly accessible, for which it is essential to identify protected routes [25]. The consolidation of these forms of soft mobility must be accompanied by actions aimed at urban redevelopment to facilitate their use, which is in line with Stg7 (Redistribute public space to prioritise active mobility). In this sense, some studies have mentioned the opportunity presented by this crisis as a starting point for inducing a profound urban transformation towards sustainable mobility and the resilience of cities in the face of such a changing environment [6,60]. This strategy also favours the productivity of women during their characteristic multipurpose journeys by shortening distances and can also attract male car users.

Another of the most important strategies we have developed concerns the consideration of the gender perspective in the design of mobility policies (Stg2). The need to take gender differences into account in mobility policy and planning had already been

identified in many studies prior to the pandemic [1,11,13,20]. In the context of COVID-19, it becomes even more important because of the worsening inequalities between men and women caused by the pandemic [40,41]. In order to make the best policy decisions, gender analysis is of great importance in the study of mobility (Stg1), with the female travel pattern being one of the key strengths in the design of urban mobility (S3). On the other hand, the recent emergence of new forms of mobility (electric, shared, PMV, etc.), together with the development of new technologies applied to transport, requires a better understanding of potential users in order to avoid factors that might lead to gender inequalities in access to these new modes of transport. A study showed that mobility policies should focus on the differences between men's and women's attitudes to different modes of transport in order to promote sustainable urban mobility and not focus solely on aspects related to domestic responsibilities [19].

Likewise, the promotion of flexible timetables and teleworking, as well as time planning (Stg3), has been identified as another key to achieving sustainable and equitable urban mobility. This strategy is based on one of the great strengths found in the SWOT analysis. In the labour field, flexible working hours (S5) and teleworking have been implemented to a large extent. These measures have been practically imposed by the pandemic, but both companies and their employees have been able to see the benefits of this reorganisation, thus becoming one of the opportunities detected in the SWOT analysis (O6). The adoption of this strategy means a great improvement in the reconciliation of family and work, especially for women if it is complemented by Stg5 (articulate measures to tackle the digital divide) and Stg15 (undertake employment policies which favour the incorporation of women in occupations that can be developed through teleworking). By reducing the number of work-related journeys, these strategies also prevent traffic congestion at peak times.

The implementation of co-responsibility mechanisms from all spheres (administrations, companies and households) is also considered fundamental (Stg4). The United Nations considers Gender Equality as one of the Sustainable Development Goals. Although progress has been made in this regard in recent decades, gender differences still exist, and the COVID-19 pandemic could reverse what little achievement has been made [61]. The balanced sharing of domestic tasks and family responsibilities gives women the same opportunity to prosper as men, narrowing the wage gap and allowing them, among other things, greater freedom in their choice of mode of transport.

On the other hand, concern about the risk of contagion is changing consumer habits and is leading to the development of new technologies applied to transport (PMV, carsharing) and innovations such as home delivery systems, as well as technologies to manage mobility and make it more accessible and safe, avoiding queues, crowds and physical contact in the means of payment. These developments are closely related to Stg6, which proposes promoting the use of technology to programme mobility. They can also benefit the intermodality of public transport with the bicycle or PMV, which has been identified as another of the most important strategies (Stg10). The new digital application of Mobility-as-a-Service (MaaS) for journey planning that combines all these trends of shared mobility with public transport, together with the establishment of reduced fares, could increase the use of sustainable transport modes, contributing to social distancing, as it avoids the user having to use public ticket machines, queue to buy a ticket, handle cash, etc. It could also provide opportunities for savings in transport costs for operators and users [25]. In fact, a study revealed that CEOs of transport-related industries and mobility consultancies believe that the COVID-19 crisis may be a catalyst to develop new products aimed at modal integration (e.g., scooters) and new innovative mobility services [28]. The appropriate combination of these modes of transport through MaaS applications makes MaaS a viable option, minimising the need for private vehicles and ensuring its convenience for women on their characteristic multipurpose trips. On the other hand, and in a broader sense, one study suggests that, after the pandemic, MaaS could go from being only a multimodal offer to becoming a multiservice offer. In other words, it could include non-transport services,

such as discounts on purchases in certain shops and offering users the opportunity to see transport as a set of services that can be adapted to individual needs and circumstances [32]. These initiatives not only encourage soft mobility, but also support the mode of transport most affected by the pandemic—collective public transport. For this reason, it is advisable to adopt Stg6 and Stg10 together with Stg9, which refers to improving the safety of PT against COVID-19 to restore confidence in it. A study indicated that variables such as the cleanliness and hygiene of public transport vehicles, as well as their occupancy levels, could become more important in measuring perceived quality, highlighting the need to formulate policies that not only maintain economic exploitation in itself, but also try to distribute demand at peak times to avoid congestion [4]. However, occupancy levels enforced by interpersonal distancing measures on board vehicles are unsustainable for public transport companies in the medium to long period [29].

As we see in the preceding paragraphs, it is advisable to adopt several strategies simultaneously. This implies the joint and coordinated implementation of several measures to generate synergies and complementarities. In other words, the effect of a package of measures exceeds the sum of the effects of each measure implemented in isolation. On this issue, previous studies have shown that the combination of strategies and measures can effectively contribute to the achievement of sustainable mobility objectives [62–64].

The increased use of private vehicles during the pandemic brings into focus the threat of a possible entrenchment of the culture of using this mode of transport (T2). There is concern that progress towards sustainable mobility has stalled and we have returned to the same proportions of motorised transport found more than a decade ago [4]. However, the COVID-19 pandemic can also be seen as an opportunity for change towards a sustainable mobility model. Local policy makers and planners are more aware of the need to rethink urban spaces for sustainable mobility (O10). A study in Italy indicates that the aim is to make up for lost time and launch a green revolution that will rapidly decarbonise urban transport by improving cycling and walking in cities [60].

The strategies identified in our analysis have the potential to reduce gender inequality and improve access to goods and services in cities without compromising health and the environment. In other words, they all address both the issues of gender equality and the sustainability of urban mobility. This takes care of T8 on the lack of coordination between equality and sustainability policies for mobility in cities. More research is needed on urban mobility from gender perspectives to reveal practical implications into the field of transport and mobility planning, and offer policy recommendations. This is particularly relevant at this critical time, as the way governments choose to deal with the COVID-19 crisis may entail a major risk of intensifying fundamental inequalities that will further entrench market capitalism as the prevailing global model, compromising sustainable development [5].

The results of this study are a valuable tool in making policy decisions in a mobility scenario which is as complex, changing and sensitive to multiple environmental circumstances as the pandemic. Moreover, strategies can be easily adopted in different urban contexts by implementing the relevant actions or measures in each territory.

Although our findings may seem a little premature as we are currently engaged in the third wave of the COVID-19 pandemic, we believe it is essential to anticipate, lay the foundations and provide guidelines for redirecting policies taking into account the effects of the pandemic on people's mobility habits and on the increase in inequalities between population groups, and between men and women in particular, which could persist in the post-COVID-19 era.

5. Conclusions

COVID-19 is exerting a profound effect on all areas of our lives. In particular, its impact on mobility has been enormous. The social distancing measures adopted in all countries to contain the virus have led to a sudden decrease in the number of trips and changes in the choice and use of transport modes [4]. It is essential to take action in anticipation

of future developments and needs in transport and mobility policy and planning [22]. Furthermore, the impact of this health crisis on the social and economic spheres has aggravated inequalities between population groups, with women recognised as one of the most affected groups [40]. The impact of policy decisions on vulnerable groups of the population, such as women, needs to be considered in order to ensure that their needs are addressed and to overcome the current economic and social crisis [65].

Based on these premises, this paper has carried out a strategic analysis of urban mobility from the perspective of sustainability and gender equity in the context of the pandemic, identifying a set of effective strategies to address the post-COVID-19 urban mobility scenario.

To this end, a SWOT analysis was carried out based on the literature review and on expert opinions. SWOT analysis is appropriate for the purpose of the study as it is a technique that helps to organise and analyse information and formulate strategies based on strengths and opportunities, while eliminating weaknesses and threats.

Although there is a great deal of information showing the breakdown of mobility during the pandemic, the absence of gender-disaggregated data makes it difficult to study and make sound decisions.

The strategies developed in our work can be of great help in facing a scenario of mobility in full and accelerated transformation, redirecting it towards a post-COVID-19 model that is more sustainable, equitable and safe.

As future lines of research that may emerge from this work, we propose carrying out additional studies based on quantitative techniques that allow measurement and follow-up to compare the before and after of the strategies recommended in this study, through the definition of the appropriate indicators by gender, in order to provide a more in-depth knowledge of which strategies have a greater impact on the achievement of gender equality and the sustainability of post-COVID-19 mobility.

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