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A Preliminary Analysis on Gender Aspects in Transport Systems and Mobility Services: Presentation of a Survey Design

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Abstract: As sustainability is becoming a common practice in planning transport systems and mobility services, the designation and management of gender issues are of paramount importance. TInnGO is a European Project that has developed a network of 10 national Hubs to build the capacity to generate and apply evidence on gender equality and transport issues at the European level. This paper presents the project activities by introducing a relevant framework and exploring user mobility experiences based on gender to identify diversified needs and requirements. This process relies on the combination of a review of current gender-oriented experiences and practices in mobility with focus group activities conducted in four different EU cities. The insights obtained from these activities supported the design of a survey to collect information on socioeconomic, personal, and operational aspects to serve a gender-oriented transport analysis for all the Hubs. These preliminary analyses identified the main issues related to the female mobility experience, namely safety, security, accessibility, and transport reliability. Future research on the data collected through the survey would help operators in successfully improving their mobility offer to women.

Keywords: gender mobility; gender gap; inclusive mobility; travel behavior; smart mobility; mobility survey

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1. Introduction

A good transportation system with different mobility options can significantly impact people's quality of life by enabling them to access desired destinations [1]. Transport systems and their quality influence each individual's choices and the way they organize numerous activities such as work, leisure, social events, shopping, education, and health. Lack of accessibility to the transport network results in unequal opportunities in societies. Social exclusion does not happen because of the absence of opportunities, but because of a lack of access to them [2]. Examples of social barriers include difficulty accessing employment and essential public facilities and services such as health and education and engagement in social and leisure activities [3]. As mobility plays a critical role in developing cities and promotes quality of life for individuals [4], access to the right mobility solutions is positively related to each individual's well-being [5]. Equitable access to opportunities, reduction of negative externalities of transport for all, and representative involvement in decision-making, emphasizing marginalized groups, are essential for the provision of inclusive transport systems [1].

Inclusive mobility could be a critical factor in reducing social segregation [6]. However, many people still suffer from problems related to access to essential facilities such as healthcare or social services [4]. Low-income individuals experience a higher level of

exposure and might face more significant barriers to accessibility, given the financial and location constraints [1]. However, social exclusion is broader than the concept of poverty. It refers to "limits in societal participation and social support as a result of a combination of factors that may include unemployment, low income, discrimination, crime, and poor skills" [5]. Reference [7] classified mobility limitations into physical, geographic, economic exclusion, exclusion of facilities, and/or exclusion related to time and fear.

Mobility patterns have a significant effect on sustainable development and sustainable mobility would undoubtedly entail the reduction of greenhouse gases and other pollutant emissions, lower use of non-renewable resources, and the provision of more significant equity of access to all. According to [8], women are more favorable to transport behavior changes and to adopt solutions supporting a sustainable transport sector. As they appear to be more sensitive to environmental risks and are more prepared to make the behavioral changes required to sustain significant climate change mitigation and adaptation policies, the provision of accessible and sustainable new mobility schemes, such as shared ones [9–11], could help in lowering the mobility impacts, especially on women.

Focusing on gender equity in transport, although research affirms the importance of inclusive mobility as an essential factor for the development of societies, traffic and transport policies still do not respond equally to women's and men's mobility needs [4,6]. The lack of detailed gender statistics, proper identification of the problem, equal involvement of men and women in the decision-making process, Gender Impact Assessments, and the lack of robust data characterizing the lives of women, especially their daily journeys [6], have been identified as primary barriers to the adoption of more gender-equal policies. It is suggested that to tackle these identified obstacles, policymakers could adopt "bottom-up" approaches for the integration of transport innovations as an alternative to the well-established "top-down" practices that apply decisions made by transport, business, and governance stakeholders which are poorly validated by users before their application [12].

This paper aims to contribute to addressing gender issues in the offer of transport services. A knowledge "pool" of gendered mobility behavior and gendered requirements in transport services is generated by reviewing the current gender-oriented practices in transport planning. By exploring the perceptions and attitudes of genders towards mobility services, this paper aims to review current considerations of gender requirements in transport planning practices and present the results of focus group interviews conducted in several cities during which gender experiences were collected from different European countries. The knowledge gained through these two approaches will help in revealing new insights related to gendered transport offer. More importantly, this will form the basis for creating a survey designed to investigate the differences in both travel patterns and in female and male perceptions of the quality of the mobility offers available in a selection of European cities. The data collected will contribute in assessing if the actual transport systems can meet the diversified mobility needs of their users.

This work is being developed in the TInnGO project framework that deals with gender inequalities in mobility opportunities and transport employment [13]. It aims to create a framework and mechanisms for a sustainable game change in European transport using the transformative strategy of gender and diversity-sensitive smart mobility. Moreover, the project relies on the creation of 10 national hubs covering Sweden/Denmark, the UK, Spain, Portugal, Italy, Greece, France, Germany, Romania, Lithuania, and the Baltic states: each hub addresses topics of local importance in gender and diversity-sensitive smart mobility to ensure a link between the developed research to real issues tackled in mobility experiences of different groups [14]. These local experiences feed into the European Observatory (http://transportgenderobservatory.eu/ (accessed on 5 January 2021)), which acts as a data repository, successful practices exchange platform, and policy testing collector.

In the TInnGO project framework, the current paper reviews the relationship between aspects such as the number of journeys performed per day, women's satisfaction with the

transport system, personal characteristics, and transport system performances which will be explored through focus group work. Moreover, to approach the diversity of gender, TInnGO exploits an intersectional perspective. This means that discrimination grounds, such as gender, age, ethnicity, and disability, must be approached as mutually affecting and closely interwoven [15,16]. Intersectionality in TInnGO aims to advance the understanding of gender and mobility by including more variables, which show how transport resources depend not only on age, income, and location but also on time factors and safety issues.

The paper is organized as follows. Section 2 summarizes the state-of-the-art and practice in gender-wise mobility choices and attitudes, perceptions of women on safety and security as well as how their travel satisfaction is currently investigated. In Section 3 the focus group work organized and performed in four participating cities is presented and discussed. Section 4 presents the survey originating from these activities. The paper will end with the main conclusions of this work and the next research activities.

2. Gender Issues in Transport and Mobility

The previous section has introduced the relevance of the gender issues while dealing with transport and mobility. Aspects that, according to the state of the art, affect gender-wise mobility choices and attitudes are now analyzed. After detailing the differences in mobility behavior between genders, safety and security issues are discussed given their relevance in women's mode choice. Such issues are indeed producing a gender-based mobility access gap that needs to be reduced. For this, some best practices in providing technologies and services that can serve gender-equal mobility are already available and will be presented.

2.1. Gendered Differences in Mobility Behavior

The sociodemographic background, including the responsibilities for accompanying people and supply trips, lead to different activity patterns and a gender mobility gap. Women's mobility is generally characterized as more challenging than men's, often because of the complexity of the time–space arrangements women face [12]. Studies show that men often have linear and standard travel patterns (to and from the workplace, without interruptions). In contrast, women frequently have shorter travel patterns, involving other destinations besides the workplace to cover different personal or social needs: schools, hospitals, health centers, and supermarkets are outcomes of the multiple responsibilities they need to undertake in their daily lives, reflective of the role they have in societies. The complexity of mothers' activity patterns may increase due to children's presence, but less so among fathers [17]. Women are more likely to use public transport (PT) than men [18], who in a traditional society make trips to work by car and also get the first right to car usage in a household [19]. The activities women need to perform are time-consuming and entail the need to engage in synchronizing, planning, and coordinating with household members and with the temporal and spatial patterns of public transport availability as well as those of other facilities and services such as shops, schools, and care services, amongst others [18]. All this originates in the creation of far more complex trip chaining for women. Hence, to fully understand gender-based mobility, it is necessary first to frame the institutional and family content in which each individual lives.

The time lost in traveling is often far more penalizing for females, making transit an inefficient choice for women when juggling a high number of activities [18]. The variances observed between the different genders' mobility patterns are exacerbated by other factors such as their families' low income, places of residence, age, or social background. Starting by addressing the geographical question, the difference between rural and urban areas is striking, and, although they have in common the choice of the car as the most reliable and safe mode of transport, in rural areas, the problem becomes more serious because there are practically no efficient alternatives to this mode of transport. According to a European parliament study [20], daily car use is more common in small towns and rural areas, with 58% of the population using a car compared to 38% in large cities.

A Swedish study with participants living in rural areas concluded that the most used mode of transport is the car, characterized as a means of transport that offers flexibility and independence and is considered necessary for those living in rural areas [21]. With a car being essential for an active life and access to basic services, people unable to buy a vehicle or people without a driving license become even more vulnerable in these environments. Older women travel less and over shorter distances in this area, partly explained by the fact that fewer women of these ages hold a driving license than the number of men of the same age with a driving license [22]. As might be expected, women living in rural areas make fewer trips than women of the same age living in urban areas [23].

The main problems in the use of public transportation pointed out in [21] are the distance between home and bus stops or rail stations, the lousy coordination of bus routes, the lack of connectivity between services, the long waiting times, the lack of schedule adjustments during peak hours, the cost of transit, and the safety of the route connecting home to nearest bus stop or station. Additionally, it has been pointed out, across all participants, the lack of conditions at bus stops concerning security and connectivity to other means of transport. Moreover, the absence of a place to park cars or bicycles was another reason for the non-use of public transport. These authors also conclude that other transport options such as car-sharing occur very rarely and are not seen as a reliable option in this type of environment, partly because there is no strong PT system which can manage failures. The lack of access to transport solutions in rural areas makes individuals living there potential candidates for social exclusion, a risk that increases when we look at older individuals. Compared to men of the same age, older women's mobility is more restricted geographically and is more influenced by social factors [23].

It is still relevant today that the intrinsic characteristics of a person shape the way society accepts them. Belonging to a minority ethnic group, having a migrant background, having low qualifications, or simply being a woman makes some individuals more at risk of social exclusion [24]. Gender differences in immigrants' travel experiences have been difficult to characterize due to a lack of data [25]. Still, some crucial shreds of evidence regarding their choices in the mode of transport have been collected. For example, it has been found that immigrants are less likely to own a car than natives, but when they do, the gender gap in car accessibility is wider than the one observed among natives. Immigrants are thus more likely to walk and use public transport than natives regarding soft modes of transport. Cycling appears to be more popular among natives than among immigrants, especially immigrant women.

2.2. Safety and Security in Transport

Transport safety and security are critical factors in women's mobility choices, especially concerning public transport use. Safety can be defined "as the prevention of not intentional accidents—such as floods, earthquakes, and accidents at work, while security is the prevention of intentional unpleasant activities by people, such as robbery, mugging, terrorist activities, . . . " [26]. Safety can also refer to "taking measures to reduce or eliminate the risks of accidents" [27].

In general, women of all ages and backgrounds are more concerned about safety and personal security because they face higher levels of violence as transport users and as transport workers, affecting the choice of transport mode as well as work characteristics. In terms of mobility, females may seek a less efficient or more costly alternative when there is a perceived threat [19]. Reference [27] presents some numbers on this topic, stating that reality and documented research reveals that more than 80% of women and girls have experienced harassment in public and 80% are afraid of being harassed on PT. Although sexual harassment on public transport appears to be a growing problem, there is a high level of under-reporting, with 90% of sexual harassment on public transport being unreported [27].

As a transport worker or women aspiring to work in the transport sector, women are also conditioned by the fear of experiencing violence in the workplace. Bakran, based

on the 2017 survey by the European Transport Worker's Federation, found that 63% of respondents had faced violence, most of them from clients, but 39% from colleagues, managers, or supervisors [27]. Equally worrying is the perception of these women concerning the efficiency of the people or institution responsible: after complaining, 80% of the participants who complained about the incident did not believe that there would be consequences for the perpetrator or that they were contributing to improving working conditions. All these high percentages have to be taken into account when considering women's mobility choices, also for the consequences originating from them. A recent study from the International Labor Organization showed that "limited access to and safety of transportation is estimated to be the greatest obstacle to women's participation in the labor market in developing countries, reducing their participation probability by 16.5 percentage points." [28].

Concerns about personal security might involve changes in the design of transport interchanges and waiting areas, such as, for example, in railway stations, where security issues (crime, violence, strangers, etc.) are perceived as more threatening that safety ones (accidents, etc.) [29]. On the one hand, interventions such as lighting and security cameras seem to have a limited impact on reducing women's fear, compared to formal surveillance by police or transport employees [30]. On the other hand, the inclusion of automated processes that attempt to increase operational efficiency in transport infrastructure, such as ticket automation in train stations, imposes a reduced physical presence of service staff which, from the passenger perspective, may result in passengers feeling less secure as there is no one there to assist, whatever the gender. For example, regarding railway services, women feel both carriages and train stations are vulnerable spaces. On one side, when crowded, harassment could occur; on the other side, when empty, there is no one available to intervene and help in the case of an emergency. A gender gap between perceived and actual perception while dealing with safety and security in railway stations is confirmed by [29]: indeed, women feel less safe. Moreover, this work demonstrates what was observed about the presence of security cameras: they are perceived only by men, thus reducing the possibility of lessening the fear of passing through these places.

In general, sexual harassment on PT can limit women's mobility and employability and can reduce their earning options. This issue becomes even more critical since more women than men tend to depend on public transport to meet their mobility needs. In many countries, restricted mobility can translate into girls missing schools, women not looking for jobs far away from homes, giving up their jobs, or being unable to access healthcare services.

When dealing with private cars, the EU numbers reveal that "only 24% of all road fatalities are women, while the proportion of male drivers killed in road accidents is over 80% in some countries" [27]. This fact seems mainly due to different driving approaches so that perhaps women tend to adapt their behavior to avoid risks. The situation is the opposite among pedestrians: almost twice as many women are killed as men. The reason can also lie in the female tendency (or necessity) of walking more than their counterpart. Furthermore, they tend to make more off-peak and non-work-related trips due to their mobility reasons. As reported in [27], women often modify their behavior to feel safe while walking, for example, avoiding walking at night if they are alone or talking on the phone while walking to feel safer.

The literature review on the safety perception of cycling among women provides similar results [31,32]. The insecurity reported by people living in rural areas on the home-station or home-bus-stop path caused by the low quality of roads on the way to public transport are barriers to both the use of bicycles and PT [21]. Furthermore, sharing public space with cars and other cyclists is a primary concern when using these modes of transport. This gender is commonly known to be more safety conscious and, therefore, a clear separation between bicycles and motorized traffic may be an essential feature for women to consider using it.

Reference [33] is an interesting report collecting useful insights into the safety of micro-mobility. Micro-mobility is defined as "the use of vehicles with a mass of less than 350 kg and a design speed of 45 km/h or less". This document analyzes in detail the safety of powered standing scooters (e-scooters), bicycles, mopeds, and motorcycles, and the traffic safety of pedal cycles, electrically assisted cycles, and electrically powered personal mobility devices, whether owned or shared, in an urban context. Some gendered results are found, such as the over-representation of males in injury statistics that are consistent with ridership data from e-scooter sharing companies in the City of Santa Monica. However, this result could also be due to the higher occurrence of risky behavior by male riders. For example, the document reports that male riders' share in standing e-scooter fatalities is significantly higher than their share among emergency department patients. However, the authors assess that "the higher severity of injuries sustained by men is not specific to the use of e-scooters but already observed across all vehicle types".

2.3. Travel Satisfaction

Many studies of travel satisfaction, as well as commute satisfaction, can be found in the literature. The vast majority of the works focus on how travelers perceive public transport and its quality. The main features in the female evaluation of this service include a sense of security and cleanliness [34], the level of crowding [35], the punctuality, the frequency, and the information [36]. However, it is essential to stress the potential observation of a gap between actual and perceived public transport attributes, as found in [37]. This study investigates 768 real-time stated preferences interviews in Santander (Spain), with 64% of PT users being women. It follows an approach requiring passengers to reflect on the importance of certain fundamental system variables which they may not have considered in a preliminary service quality evaluation.

According to [38], gender is a crucial sociodemographic variable that has been examined in many studies, with mixed results. This work states "that some studies found that gender is not significantly related to satisfaction, while other studies reported significant effects for gender. For example, St-Louis et al., (2014) concluded that gender was a significant covariate of metro and pedestrian satisfaction. Likewise, Higgins et al., (2017) found that males were more likely to be 'very satisfied' with their commutes compared to females (p. 764)". A European study considered 60 items to analyze satisfaction with transport bringing an innovative contribution to the theme [39] with the provision of some innovative features able to investigate aspects usually not tackled in most of the existing studies on quality measures [40]. The approach followed by the authors required the analysis of a very rich dataset of satisfaction-rating questions collected through a European-wide survey to investigate the overall perceived quality of a single journey. The proposed approach helped discover "the underlying patterns of satisfaction ratings for several distinct groups of observations and of variables", that were then combined to generate new indicators able to capture the travel experience of different kinds of users and travel modes. The analysis conducted by the authors helped them extract three specific indicators related to women, namely "WOM1: Safety and security, comfort and staff helpfulness", "WOM2: Integrated tickets and range of fares", and "WOM3: Reliability", highlighting how these elements are relevant in the journey satisfaction perception of this gender.

2.4. Best Practices: Technologies and Services to Serve Gender-Equal Mobility

Various approaches have been applied in different geographies throughout the years to provide better and more inclusive mobility systems. For example, a study in Sweden indicated that one-third of public transport users were available for financial benefits with women engaging more than men with discounted fares. In response, the local government opted for transit fare structures to minimize costs for multi-stop journeys [41] and enhance mobility equity between men and women [42]. In US cities (Philadelphia, Boston and Los Angeles), smartphone apps have been developed and applied as an effective and discrete method for passengers to report suspicious activities through written messages and images

which are forwarded directly to the police. Applications to install alert systems on mobile phones, with various functionalities, allow anyone in a dangerous situation to contact the authorities quickly. Through Global Positioning System (GPS), the authorities can quickly locate these victims. It should be noted that this measure, in conjunction with the presence of staff or police, enhances the feeling of security by users of the transportation system.

For instance, in Bolzano, in Italy, a taxi service for women in the evening hours until night hours, named pink taxi, was implemented in several areas, when public transport becomes less frequent [43]. Taxi services only for women are examples of measures created to give more security in their daily journeys, as it facilitates the movement of women at times that generate more apprehension, such as night time, and at the same time create jobs for women in a section hardly penetrated by them [44]. When using "pink transport", results showed that women felt safer, calmer, and more comfortable (as it was not crowded) compared with PT, and perceived them as cleaner [43]. However, from a social standpoint, several gender-equity defenders consider these approaches as "a step back rather than forward" [41]. A new service related to this concept are the "pink fares" for mobility services who have the benefits of discounted trips for car-sharing service all day long and a daily pass that offers several trips to women. Such a service could facilitate the mobility of women who, as highlighted earlier, have many roles to fulfil in their lives and tend to make more trips than men for social and personal reasons.

Continuing with safety practices to mitigate gender differences and difficulties of vulnerable groups, in France, Germany, and Spain on night bus lines or routes considered dangerous, it is permitted to stop at places without a physical stop. This procedure enables women and children to request to stop anywhere along the way, avoiding long journeys between bus stops and their homes. After the experience, the operators conclude that the savings are minimal and that to offer a better service that makes sense to replace what exists today, the investment in fleet and personnel is not worthwhile [45]. Additionally, changes in the urban environment, such as removing bushes and vegetation in dark access points, could also increase users' security perception. It should be noted that the concept of flexible transport dates back to 1960 and has been trialed in various regions and various forms, always with the goal and under the premise that it would lead to a reduction of PT costs [45].

In the CIVITAS MOBILIS project [46], a set of measures to tackle these issues was developed to improve vulnerable groups' choices when commuting. The lack of connectivity between different transport options is often pointed out in the literature as one reason for not using specific modes of transport or choosing the car over PT. In France, the example of Toulouse could be used to illustrate the type of measures developed by the CIVITAS MOBILIS project. In this city, several actions have been taken to increase connectivity between different modes of transport, the development of dedicated service of carpooling and its integration with other sustainable transport modes such as cycling or public transport as well as the promotion of the bicycle integrated with PT services.

Overall, the transformation of existing means of transport by making them more gender-friendly can be done through specific measures such as:

- creating spaces in buses for people travelling with shopping or small children;
- providing bikes to transport children;
- optimizing the locations of docks for bike-sharing schemes or generalizing dockless bike-sharing.

The overall experience of the countries that have adopted some of these measures has been positive.

3. Focus Group Activities in TInnGO Hubs

Following the bottom-up perspective [12] adopted in the TInnGO project, preliminary information on female mobility behavior and their perceptions were collected. Focus groups and interviews with a selection of women with different characteristics were conducted to explore the needs, thoughts, and feelings related to their mobility experiences.

These activities helped extract information from possible barriers and potential improvements that could serve operators to create a better and more gender-equal transport system. The knowledge collected will serve to design a survey with aspects that can be modeled to explain and predict mobility choices.

To achieve TInnGO objectives, information through interviews and focus groups was collected from four European TInnGO Hubs (UK, Portugal, Spain, and Greece). All these activities took place from September 2019 until February 2020 and followed a common design (Figure 1), with guidelines to assist the discussion conduction. Unfortunately, due to the crisis of the COVID-19 pandemic, it was not possible to conduct focus group activities in many other TInnGO Hubs, mainly in those that had arranged them in the first months of 2020.

Each Hub was in charge of organizing these activities according to their own time planning, targeted age groups, and mobility topics which are the Hub's main focus. Moreover, some Hubs are also dealing with the improvement of the gender dimension in the transport workforce. In this case, the women involved in the focus group may also work in this sector. In any case, the Hubs could ask the participants to discuss their working experience as women in the transport domain. Table 1 presents the main information on the characterization of each sample involved in the Hub activities. As can be observed, the cities of Thessaloniki and Lisbon conducted their focus groups in companies with groups of six women in both cases. The goal was to understand the motivation for using a transport means, the reason to use PT, to evaluate their experience with this mode (bus stops, metro, and train stations) and to obtain opinions about measures to take for improving PT facilities regarding safety and security. In Lisbon, the meeting was conducted in a local mobility and parking company. In addition to questions about the perception of transport system conditions as users, this group of women was invited to describe their experience as women working in the transport sector.

Table 1. Characteristics of each Hub activity and sample.

	Greek Hub	**Portuguese Hub**	**Spanish Hub**	**UK Hub**
City/region	Thessaloniki	Lisbon	Valencia	West Midlands
Period	February 2020	October 2019	September 2019	March 2020
Number of people	6 women	6 women	10 women	3 women
Age	Aver. 35 y.o.	Various	Various	60-93 y.o.
Employment	Consultancy employees	Employees of a public transport authority	Different transport-related sectors	Various/retired
Type	Focus group	Focus group	Focus group	Phone interviews
Mobility Topics	(1) Motivation for using transport means (2) Experience with PT (3) Measures for improving PT safety and security	(1) Motivation for using transport means (2) Experience with PT (3) Measures for improving PT safety and security	(1) Adaptation of transport services Safety (2) Employability from a gender perspective	(1) Transport modes chosen for their mobility needs (2) Main difficulties in modes use

1. ***General questions on commuting:***

❖ Understand the motivation for using a preferred mode of transport

1.1. What form of transport do you use every day?

1.2. Why do you use it?

1.3. How many trips/per day on average do you make?

2. ***Experience as a user in the different modes of transport:***

❖ Understand the motivation for using public transport, private vehicle and new mobility solutions

2.1. Describe your experience using inland public transport - bus, train, taxi?

a) Positive / Negative (reasons for this assessment);

b) Monthly pass;

c) Security inside public transport;

d) Others.

a) What is it like for you to drive? (extract information on comfort, convenience, security inside the vehicle, others)

2.2. What do you think of the new mobility solutions offered in Lisbon such as bicycles and e-scooters? Have you tried them?

a) If yes, try to get as much information as possible (pass, problems, which can improve);

b) If not, why, and try to find out if there is any security issue.

3. ***Experience in bus stops, metro and train stations:***

❖ Understand if security is a perceived issue in the stops/stations

3.1. How do you evaluate security in bus stops, metro and train stations? If there is a strong sense of lack of security in public transports in general and whether this is a reason for not using it or using it less.

4. ***Experience as parking enforcement officers:***

❖ Understand if it affects the behaviour of citizens towards them

4.1. Describe your experience in the use of public space and public transport, when you are in uniform.

5. ***Final question with two options:***

❖ If security was highlighted as an issue

5.1. How could public transport companies improve security?

❖ If security was not highlighted as an issue

5.2. How can public transport companies improve their services?

6. ***Open question:***

6.1. Does anyone want to add anything on the topics discussed?

6.2. What is your view on upcoming vehicle technologies such as the autonomous vehicles?

6.3. What practices do you believe that can overcome the issues you face and you mentioned in your daily mobility? Which of those do you think that are solely related to women and which concern any type of passenger?

Figure 1. Focus group guideline.

In Spain, the workshop was conducted with 10 people from different transport-related sectors and the focus of the discussion was the adaptation of transport services, safety, and employability from a gender perspective. The approach consisted of an assessment of different modes, followed by considering different categories that can be used to classify a means of transport. Examples could be punctuality, security, and comfort, which are elements that could characterize the users' feelings about using the means of transport chosen in the first stage. Finally, an assessment of the role of women in the transport and logistics sector was done.

In the UK's TInnGO Hub, the interviews were conducted with a group of older women living in rural areas. The interviews were done by phone with three women aged between 60 and 93 years old. With this, it was intended to understand which transport options were chosen for their mobility needs and which were the main difficulties in their use, with particular attention to trips and opportunities available to access healthcare and support services. This Hub is the only one that could conduct the planned activities even while the COVID-19 emergency was starting to spread. However, live meetings were converted into phone interviews, with a decrease in the number of women that it was possible to reach.

It should be noted that the focus groups conducted within the project framework were in the context of experiments involving the active participation of citizens or stakeholders. These activities can produce a change in the perception of several factors unknown or poorly evaluated a priori while considering the investigation's focus, i.e., gendered travel habits in the current case. A common approach would require to follow up with the participants regarding their subjective perceptions about the factors investigated during the experiments, to check how much they are prone to change [47]. However, it should be noted that any experiential learning factors have not been considered in the current study, even though each Hub would be free to conduct this kind of activity in the subsequent phase of the project.

3.1. Reported Experience at the Greek Hub

In the TInnGO project, the Greek Hub aims to improve accessibility and customer care, and enhance comfort, safety, and security, focusing on PT and women travelers. This Hub aims to analyze the transport requirements of immigrant women and women with children and the traveling patterns of women using private cars. The Focus Group interviews were conducted in February 2020 in LEVER's headquarters (TInnGO Hub leader for the city of Thessaloniki) with six women employed in company residents of different areas of Thessaloniki's Metropolitan Area, from East to West, with an average age of 35 years, of various marital statuses, social habits, and leisure activities.

During the focus group activity, the women reported a decrease in bus routes and quality in the past decade in Thessaloniki and a public transport system (consisting of bus networks) that presents extreme difficulties and challenges to those who use it daily. However, 3 of the 6 women interviewed use the bus at least once a day. The participants pointed out weaknesses in the bus system such as "delays", "lack of connection in certain areas", and "inappropriate bus driver professional behavior" which results in uncomfortable rides and lack of appropriate solutions for disabled groups (Figure 2). They characterized the transport system as not very reliable, which in their opinion forces many people to choose the car as a means of transport, causing congestion on the main roads of the city.

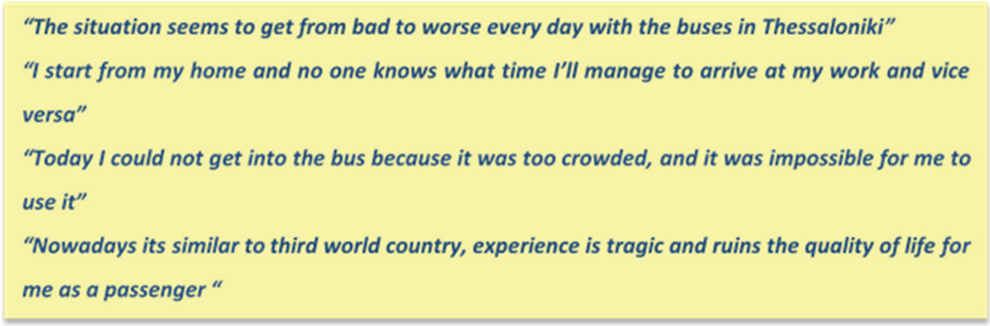

Figure 2. Quotes from the Greek Hub focus group.

3.2. Reported Experience at the Portuguese Hub

The TInnGO Hub in Lisbon focuses on the special needs of different groups of women, safety, and security of women in PT and public spaces, and the functional requirements of different ages and conditions. In this Hub, six women, employees of a public trans-

port authority, formed the focus group participants, representing various ages, marital statuses, and lifestyles. The focus group took place in October 2019 and lasted 3 h. It was coordinated by the Portuguese hub representative and was attended by all the Portuguese TInnGO partners.

The participants considered the public transport service essential in work–home trips. In order to increase the PT supply, the group preferred to use PT over private transport, maybe supported by the measure taken by the government of reducing the price of the annual passes in all Lisbon metropolitan areas significantly, and the fact that this company offers a monthly pass to workers (Figure 3). The use of public transport with trolleys for kids was declared as very uncomfortable.

"Important for working days but also good to use during the weekend"

"Could be more public transport supply"

"To arrive at the centre of the city I prefer the public transport, with a few exceptions during the weekend"

Figure 3. Quotes from the Portuguese Hub focus group.

The experience reported in terms of security was very similar in Greece and Portugal as all women stated that they avoid traveling at night, even though they have never had a bad experience. They consider lighting and the presence of security essential to reduce cases of assault or harassment. Participants in Thessaloniki reported that buses in this city are places where many robberies occur involving mainly older women victims, and they see the buses as unsafe, generating the risk of sexual harassment. In Lisbon, security was an issue for all women. It was expressed that trips in dark hours (with no sunlight) are avoided in general and especially along the train line, in certain areas, because of the security level as perceived at specific stop neighborhoods, which impeded women to travel even when men accompany them (Figure 4).

"I have not felt insecurity in and around bus stops and stations."

"I always have in mind to keep safe and secure bags, personal items, wallet."

"Due to extremely crowded buses I always try not to be touched or feel insecure in terms of sexuality within my presence in a bus. "

"I have seen sexual harassment incidents within a bus. The passengers were the ones that intercepted. "

Figure 4. Quotes from the Portuguese Hub focus group.

The use of shared services such as Uber in Portugal was designated as a safer option than public and private transport because it eliminates the need to look for a parking spot and walk at night from transport stops to home. Additionally, it provides information on candidate drivers and the user can choose among various options. The availability of the driver's data and the route taken also increases the feeling of security.

3.3. Reported Experience at the Spanish Hub

The focus group conducted in the Spanish Hub took place in combination with a workshop on transport and gender held in Valencia in September 2019. This event was aimed at fostering collaboration, interaction, and sharing of different opinions among the participants, also through collaborative tasks on the topics of transport modes assessment, security, and accessibility of transport systems and the work environment in the transport sector.

More precisely, the focus group activities allowed the analysis of the best transport types based on a set of indicators (punctuality, safety, comfort, accessibility, reliability, cost, routes/capillarity, and user-friendliness). The participants were asked to interact with the board and provide an individual assessment through placing colored stickers (Figure 5) under each mobility aspect to express their perception of the experienced service. Black stickers refer to the requirements that the specific service aspect "Needs to be improved", blue represented service aspects that were considered as "Acceptable" and red represented service aspects that were perceived as "Very good". As one would expect, the means of transport that scored best on almost all indicators were private means, private cars, and owned bicycles. Still, they were poorly classified on important and decisive points such as comfort and safety, in the case of the bike, and in terms of cost, in the car's case (Figure 5). Shared modes of transport like shared bicycles or shared scooters are not well perceived in terms of safety, reliability, or user-friendliness; these means are assessed as "difficult to use". This group of people's perception is that they "are not treated with care" or subject to great control, possibly because younger groups of people use them. Concerning routes and capillarity, metro and bus were badly classified, and the use of fixed stops was considered a problem when connecting various modes of transport.

Figure 5. Workshop results on modes assessment in Spanish Hub.

Based on a chosen mode of transport, the metro, an exercise was carried out to characterize an individual's experience in the use of PT at night. The conclusions drawn are that the user feels anxiety and insecurity at almost every stage of the journey. Despite the closed camera system in the metro station and carriages, people experienced insecurity and loneliness. At the end of the workshop, the dissemination of messages on the platforms announcing that passengers are being observed and that there is a security team controlling the places, to try to create a sense of security, was suggested.

3.4. Reported Experience at the UK Hub

The UK TInnGO Hub's focus is to understand and prioritize the addressing of women's transport needs in rural and urban areas to increase policymakers' and operators' interest. Figure 6 shows the results of the telephone interviews about these women's mobility patterns, the modes of transport used, the main reasons for traveling, and the frequency

with which they move out of their homes. It should be noted that the participants surveyed usually travel by car, as passengers and not as drivers, and the travel frequency varies from once a week to once a month.

The women interviewed claimed to know the public transport options available to them and indicated as reasons for not using them the time wasted on the journey and the unreliability of the buses. Two of these three women said they could not travel by PT at night because they felt insecure. They put forward two measures that would make them feel safer, namely the presence of responsible people on the transport and the creation of coaches only for women on the train, as can be observed in Figure 7.

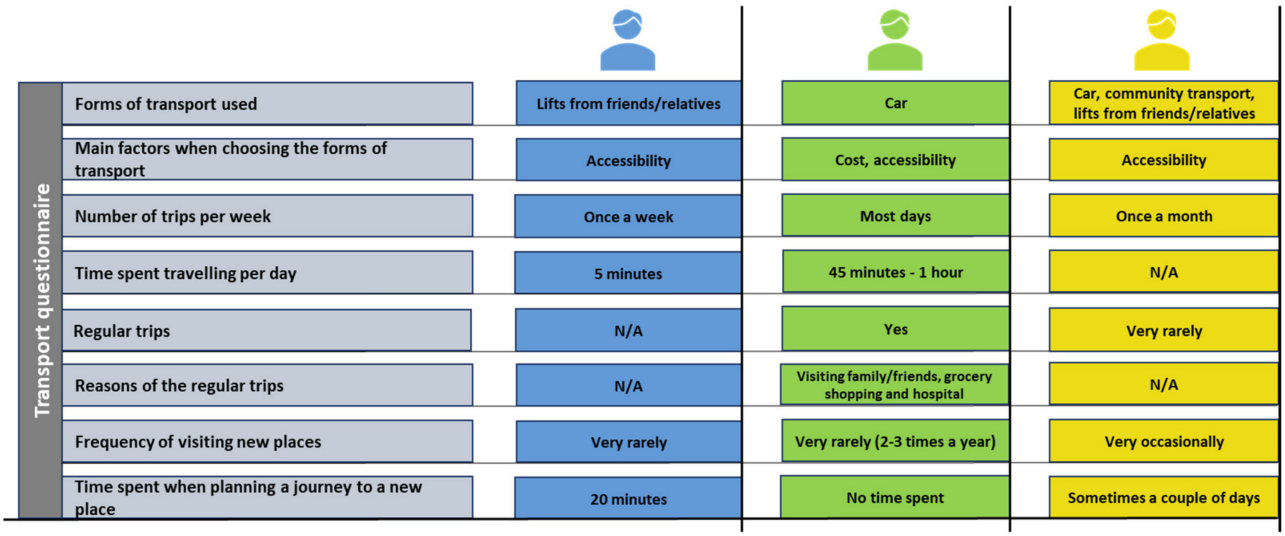

Figure 6. Quotes from the UK Hub focus group.

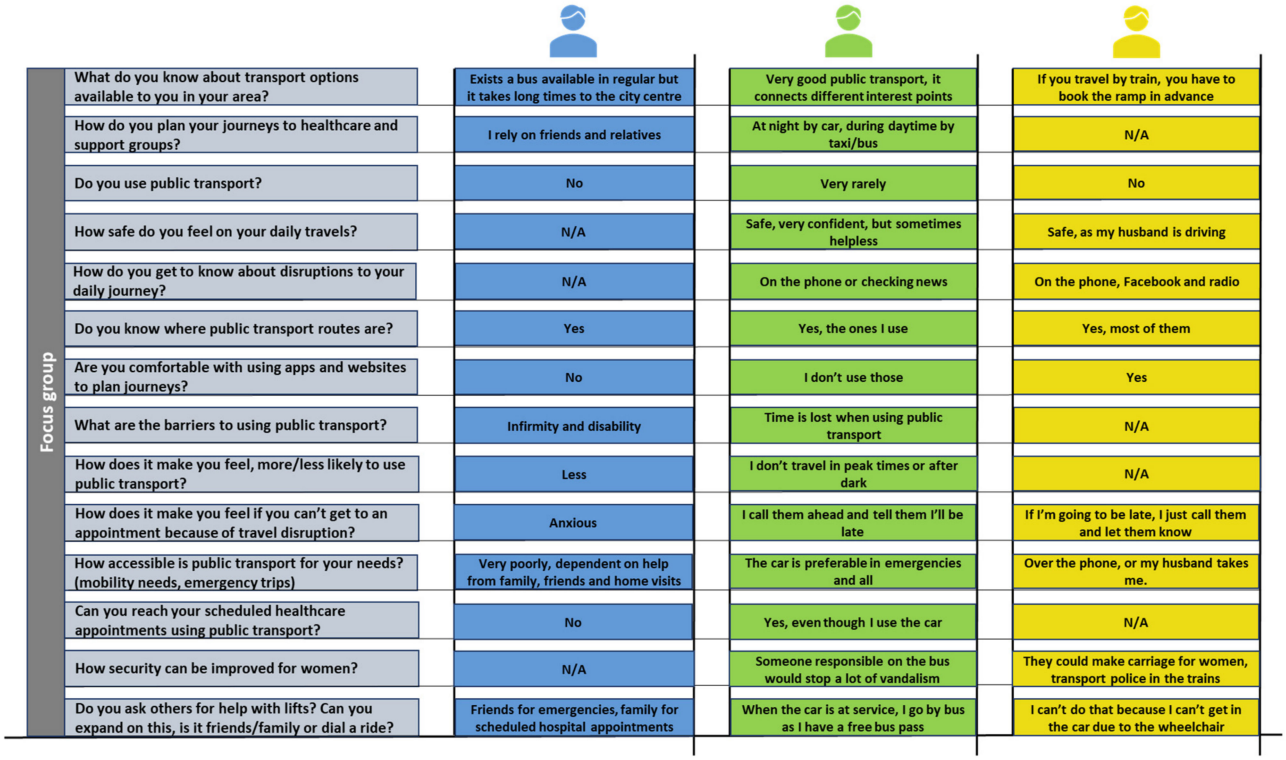

Figure 7. Questions and answers related to the accessibility of older women to healthcare and support services in the UK Hub.

4. Lesson Learned and Survey Implementation

The two previous sections presented an overview of factors characterizing women's mobility choices and experiences according to the literature on the topic and the information collected in the TInnGO Hubs activities. This helped in gaining new insights into the elements worth considering while dealing with a gendered transport offer. The current section aims to summarize the key findings from the interactions with a good number of female travelers in European cities. These findings will inform the design of a survey investigating the mobility patterns and main mobility drivers of the ten TInnGO Hub countries. Both the evidence coming from the literature review and the focus group results contributes to implementing a proper structure and contents for the questionnaire.

4.1. Main Insights from the Focus Group Activities

Table 2 summarizes the main elements resulting from the discussions raised during the focus groups and the phone interviews in the different cities. As described in the previous section, these activities concerned the investigation of specific aspects of the participants' mobility, according to the TInnGO Hubs' interests. This is shown in Table 2, where, for example, many elements refer to the female perception of PT, with this the focus of many Hubs and one of the transport modes most chosen by women (Section 2.1). Among the most sought characteristics of public transport, there is the offer of appropriate routes, the need for proper solutions for disabled users and people traveling with dependents, and, most relevant, reliability. Closer inspection of Table 2 shows other pertinent aspects according to this gender view, such as safety and security, confirming the literature's insights (Section 2.2), mainly while traveling at night.

In more detail, women during the focus groups were asked to make suggestions that could improve the transport system and enhance their experience as users. The measures proposed mostly concern security and accessibility issues:

- Brighter stops for avoiding any kind of attacks and modifications inside buses to customize for vulnerable users such as pregnant women, older women, and women with children;
- Facilitate feedback collection of passengers;
- Improvement in accessibility conditions for elderly and disabled people.
- More attention to schedule and time plan;
- Train drivers to improve their behavior.

All these elements form a good knowledge background that will be used and investigated in other Hub domains. Together with the factors that are seen as relevant for female mobility choices, these issues will be investigated in a survey, as highlighted in the forthcoming section. As a general comment, it is worth observing that, as discussed in Section 3, these activities have been developed before the spread of COVID-19. Therefore, all the information gained refers to the mobility experiences that correspond to people´s behavior in COVID-19-free societies.

Table 2. Main elements influencing female mobility choices according to work done in the Hubs.

Hub	Main Results
Greek	(1) Decrease in the offer and quality of bus routes in the past decade (2) Uncomfortable rides (3) Lack of appropriate solutions for disabled groups (4) Transport system is not very reliable, forcing many people to choose the car as a means of transport (5) Buses seen as unsafe (many robberies occur), generating the risk of sexual harassment
Portuguese	(1) PT seen as a service essential in work–home trips (2) Use of PT with trolleys for kids is declared as very uncomfortable (3) Trips in dark hours (with no sunlight) are avoided in general (4) Shared services (such as Uber) are designated as a safer option
Spanish	(1) Private means score best but poor classification for cost (car) and comfort and safety (owned bike) (2) Shared modes not well perceived for safety, reliability and user friendliness (3) Metro and bus not well ranked for routes and capillarity (4) User feels anxiety and insecurity at almost every stage of the journey while using PT at night (5) Despite the closed camera system in the metro station and carriages, people experienced insecurity and loneliness in them
UK	(1) Despite knowing PT options available, reduced use due to the time wasted on the journey and the unreliability of the buses (2) Users not traveling by PT at night because they feel insecure (3) The presence of responsible people in the transport and the creation of coaches only for women in the train would increase the safety perception

4.2. Survey Design

Thanks to the knowledge gained from the literature review's insights and the Hub activities, a survey was designed. Its objective is to explore the mobility patterns and main mobility drivers of the ten TInnGO Hub countries. The research aims to understand the differences between the mobility behavior of men and women and the perception of the quality of the mobility options available. The data collected will help us to assess to what

extent the available transport systems meet the mobility needs of its users by using an intersectionality perspective.

Figure 8 shows the general structure of the implemented survey. As can be observed, the first part of the questionnaire aims to depict the user's profile: e.g., gender, age, social level, education, ethnic origin, family composition, accessibility to the car. Particular questions, such as "Do you have children living in your household?", "In your family unit, do you live with any dependent person?", and "Which, if any, of the following disabilities do you have?", aim precisely at investigating the mobility characteristics of specific user groups according to the literature review (Section 2.1) and focus group results (Table 2 in Section 4.1).

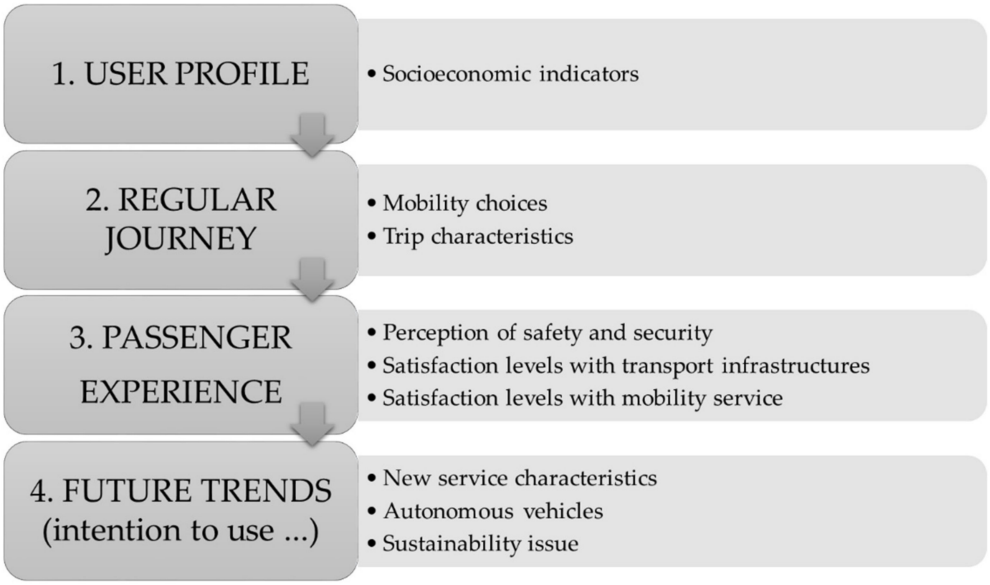

Figure 8. Survey structure.

Then, the focus is on the investigation of mobility habits. The most used travel mode (e.g., motorized and non-motorized, owned and shared) for different activities (e. g. job, commuting, shopping) and some information about the means available are required. This section also collects the trip's features most frequently made in a typical week (stages, modes, reason, payment method). Regarding trip characteristics, specific questions will allow a better characterization of the transport chain (activity patterns) to assess possible differences between women and men as reported in the literature and confirmed during the focus groups (Table 2): "Do you travel with a dependent person on this trip? (children, elderly, caring for disabled people)", "Do you stop regularly along this journey?", "What are the reasons for these stops?".

The following part of the survey explores the passenger experience. This is one of the questionnaire sections based on the input from women involved in the Hub activities, combined with the literature on the topic. Indeed, the two main elements that were considered affecting the gendered mobility choices are safety and security perception and the quality of service/infrastructure provision, as also shown in Table 2.

The perception of safety and security is investigated at all the trip stages (access, egress, on-vehicle). As found both in the literature and during focus groups and interviews, these are among the most relevant elements related to mode choices in a gendered perspective. The satisfaction levels with the transport infrastructure and the mobility service related to the most used transport means are based on the level of agreement with a certain number of statements proposed on a 5-point Likert scale. Furthermore, in this case, the respondents are asked to evaluate many aspects that were identified during the Hub activities. Examples of items provided are the lighting status of paths to transport stops,

bus vehicle design friendliness for kids' trolleys, the connectivity among various modes, and the time reliability (Sections 3 and 4.1).

The last part of the survey aims to explore the intention to use new mobility services to enhance accessibility to transport. In addition to the intention to use self-driving cars and the assessment of environmental sustainability aspects when choosing a mode of transport, new services are hypothesized, particularly related to shared vehicles and public transport. These new policies are consistently derived from the literature review and Hub activities. Part of this data collection activity aims to gather new knowledge that could support operators in successfully improving their mobility offers to women. Therefore, the assessment of the perception towards some innovative measures is relevant. Thus, some concrete examples coming from Sections 2.4 and 4.1 that have been included in the questionnaire are: increase of dedicated space for children in public transports, availability of car seats for children in shared modes of transport, taxi services with female drivers only designated for women, provision of panic/alarm buttons at bus stops/stations or inside PT vehicles.

The survey was planned to be distributed in the TInnGO Hubs cities in spring 2020. However, the COVID emergency forced a delay in the data collection activities and pushed us to reconsider the original plans. Indeed, expecting (and hoping?) that the pandemic would produce changes in people's mobility habits, the characteristics of regular journeys are now going to be investigated in a pre-COVID scenario and in a post-COVID one. A pilot activity started in September 2020, intending to collect the first wave of a limited number of results in the 10 TInnGO Hubs' working-age population. After that, a second, more extensive, wave of results is planned in December 2020–January 2021, when the survey will be spread to a stratified sample of people in the TInnGO cities.

5. Conclusions and Future Work

Increasing women's confidence in transport systems seems to be an essential step in creating a more equal and non-discriminatory model. Moreover, providing an environment in which female customers could feel safe and secure all along their journey is a fundamental point to attract and retain this kind of customer. Understanding all needs is essential to build more effective mobility plans that integrate new mobility solutions into an inclusive and fair transport system. For this purpose, the TInnGO project adopts a modeling approach that embraces multiple methods for understanding women's needs in terms of mobility that could result in better job opportunities, the formulation of new datasets, and the deduction of policy-related conclusions to be employed in future planning.

The work presented in the current paper aims at showing the TInnGO approach. It started from an investigation of the literature on the topic and proceeded with activities in the Hubs. Accordingly, in four countries (Greece, Portugal, Spain, and the UK) a series of focus groups and interviews with a selection of women with different characteristics were conducted to explore the needs, thoughts, and feelings related to their mobility experiences. This approach is the basis for identifying the most pertinent aspects of gendered mobility experience and served the survey design.

The combination of a literature review and field activities through focus groups led to the identification of those elements potentially affecting the female mode choice. For example, the reliability of the service is a relevant factor emerging from the Hub's investigation. Moreover, direct discussion with a group of women confirmed the importance of safety and security while dealing with the gendered perception of mobility. The designed survey investigates various mobility trends in the cities pertaining to different TInnGO Hubs, starting from assessing the characteristics of a regular journey. Then, thanks to the knowledge gained and described in the current paper, the respondents are asked to evaluate various aspects and measures that could characterize the current and future transport offer.

In regards to future research activities, the analysis of the data collected is expected to determine the mixed effect of gender and social, cultural, and other aspects on the respondents' perceptions. By collecting disaggregated data from the various TInnGO

Hubs, transport planners will be able to identify individual needs and cluster citizens according to their requirements. Thus, proper modeling that embraces a multiple methods approach will constitute the basis for mobility service design. Moreover, it will serve the definition of specific policies and interventions to the transport services provided to allow transport planners and mobility operator managers to assess the potential impact of their decision-making outputs. Gender needs at each stage of life (youth, young adults, amongst others) will be designated to contribute to the design of inclusive mobility systems. Future trends in transport and the intention to use possible future measures will be assessed, and the differences between men and women will be analyzed to measure the impact of new services and transport features for gender-equal mobility opportunities.

Finally, it is noted that these views describe mobility experiences in a COVID-free society. The requirements of users during the pandemic might have increased in terms of comfort (e.g., space available per user), schedule reliability, vehicle capacity, and mode choice, and for this reason it was decided not to continue with the focus group activities during the pandemic. However, further work can elaborate on how user requirements, in general, and gender requirements, specifically, have changed due to the pandemic.

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Institutional Review Board Statement: The data collection procedure has been reviewed and approved through Coventry University's research ethics procedure. There are no significant risks associated with participation. The answers collected have be made anonymous and stored encrypted in agreement with Regulation (EU) 2016/679 of the European Parliament on the protection of natural persons concerning the processing of personal data. Answers are analyzed and reported as statistics results (i.e., aggregated with other participant's responses). Thus, replies cannot be identified, and the privacy is self-guarded.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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