TInnGO

Transport
Innovation
Gender
Observatory

Deliverable 7.1

Presentation of modelling framework of gender-disaggregated mobility

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Abstract

The understanding of all needs is essential to build more effective mobility plans that integrate new mobility solutions into an inclusive and fair transport system. Moreover, to increase women's participation in the transport sector, there are several barriers that need to be overcome the gender gap, including stereotypes that are especially difficult to eliminate. For this purpose, TInnGO project adopts a modelling approach that embraces multiple methods for the understanding of women's needs in terms of mobility that could reflect in better job opportunities, the formulation of new datasets and the deduction of policy-related conclusions to be employed in future planning.

Contents

Abbreviations

AV: Automated Vehicle

BEV: Battery Electric Vehicle

CAV: Connected and Automated Vehicle

DRT: Demand Responsive Transport

EV: Electric Vehicle

GAP: Gender Action Plan

GPS: Global Positioning System

ITF: International Transport Forum

MaaS: Mobility as a Service

P2P: Peer To Peer

PT: Public Transport

1. Introduction

TinnGO project deals with the topic of gender inequalities in mobility opportunities and transport employment. It aims to develop a framework and mechanisms for a sustainable game change in European transport using the transformative strategy of gender and diversity sensitive smart mobility. Contemporary challenges in the transport ecosystem and women's mobility needs are explored, creating a route for Gender Sensitive Smart Mobility in European Transport, which considers the diversity of different groups.

Close collaboration with the cities of Lisbon (Portugal), Valencia (Spain), Copenhagen (Denmark), Vilnius (Lithuania), Hannover (Germany), Thessaloniki (Greece), Ile-de-France (France), Turim (Italy), Alba Iulia (Romania), West Midlands (Northampton, Coventry and Birmingham - United Kingdom) will ensure the link of the developed research to real issues tackled in mobility experiences of different groups. Experiences in the 10 European cities will be feeding a European Observatory developed for TinnGO, which will act as a data repository, successful practices exchange platform and policy testing collector.

The work presented in this deliverable builds on the insights provided by Task 4.1 and the identified issues of gender and diversity in transport. Building on this knowledge as well as the knowledge produced in our surveys, the work to be presented is threefold, covering socioeconomic, personal and technical aspects. After designating these aspects, we will feed into GAPs, which target the restrictions originating at the transport system and help to facilitate Gender Smart Mobility, taking into account the diversity of user needs. Perceptions and attitudes of marginalized groups in transport will be analyzed towards the topics of mobility, safety, and security, employment, and sustainability. The impact of stereotypes on transport opportunities and employment in the transport sector will be assessed. Additionally, the relationship between aspects such as frequency of trips, number of trips performed per day and satisfaction of women with the transport system and the characteristics of the people and the transport system will be analyzed using bivariate and simulation models. An obstacle to a sustainable transport system is moreover that although environmental issues constitute a significant issue worldwide, people are little aware or adequately informed about the environmental impact of their transport behaviour. It is time to start quantifying the impact of transport footprint to passenger choices by estimating the preferences of different types of passengers.

1.1 Objectives

This deliverable aims to contribute to two of the project´s goals: objective 1 (O1) - “Assessment of the specific transport requirements of diverse groups of women” and objective 5 (O5) – “Creation of opportunities for the development of gender-sensitive smart mobility products and services”.

By reviewing the current gender-oriented practices in transport planning, a knowledge “pool” of gendered mobility behaviour and gendered requirements in transport services will be generated and therefore, help to build the framework of O1.

Moreover, the advent of new technologies for transport services and the upcoming vehicle technologies undoubtedly will change the mobility opportunities in societies in the near future. Such developments will be reviewed and analyzed under the scope of their potential to bridge existing gender inequalities in mobility and employment and to prevent future ones. This analysis will contribute to O5.

Therefore, by exploring the perceptions and attitudes of genders towards new mobility services, this deliverable aims to:

- Review current considerations of gender requirements in transport planning practices;
- Identify modelling approaches to gender-focused transport studies;
- Identify inequalities in mobility employment opportunities;
- Present the results of focus group interviews conducted in the TinnGO hubs during which gender experiences were collected among different European countries;
- Design a survey to assess gender differences in mobility perceptions, satisfaction, preferences and intentions in the TinnGO hubs;
- Present the modelling framework of mobility behaviour and intention to use new services.

It should be highlighted that this deliverable builds on previous work of the EU project – METPEX, which looked at the whole passenger journey and designated multi-modal Key Performance indicators for passenger experience.

1.2 Structure

The current deliverable is organized as follows. After this introduction, Section 2 presents background research and knowledge on gender issues in transport employment and mobility opportunities. Section 3 presented expected changes to be seen in future transport systems and explores their impact on gender equity issues in transport. The fourth part (Section 4) presents the methodological framework and finally, in Section 5, conclusions and the next steps are described.

2. Background research on gender-issues in transport

A good transportation system with different mobility options can have a significant impact on individuals' quality of life by enabling them to access desired destinations (Boisjoly et al., 2017). Transport systems and their quality influence the choices of each individual 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 (Preston et al., 2007). Examples of social barriers include the difficulty in access employment and essential public facilities and services such as health and education, and the engagement to social and leisure activities (The Social Policy Research Unit, 2000 in Angy, et al., 2013). As mobility plays an essential role in developing cities and promotes quality of life for individuals, access to good mobility solutions is highly related to well being of each individual (Delbosc and Currie, 2011; Thynell, 2016). Equitable access to opportunities, reduction of negative externalities of transport for all, and representative involvement in decision-making, all of these with an emphasis on marginalized groups, are essential for the provision of inclusive transport systems (Boisjoly, 2017).

Inclusive mobility could be a key factor in reducing social segregation, but many people still suffer from problems related to access to essential facilities such as health care or social services (Lucas, 2004 in Thynell, 2016; Gauvin, et al., 2019). Low-income individuals experience a higher level of exposure and might face more significant barriers to accessibility, given the financial and location constraints (Boisjoly, G., 2017). However, social exclusion is broader than the concept of poverty and 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" (Delbosc and Currie, 2011).

Church (2000) cited in Angi, et al. (2013) and Delbosc and Currie (2011) classified mobility limitations into six categories:

- **Physical exclusion:** occurs when physical limitations hinder the accessibility of the movement of people or specific groups, such as vehicle design, the lack of facilities for the disabled, or the lack of information about the travel schedule;
- **Geographic exclusion:** occurs when settlement location prevent someone or some groups from accessing transportation services, for example, the suburbs that have limited accessibility
- **Exclusion of facilities:** occurs when the distance and the availability of existing public facilities hinder a person or group of people from accessing the facility.

- **Economic exclusion:** occurs when the cost to travel inhibits a person or group of people to access facilities or work that affects earnings.
- **Exclusion related to time:** occurs when the need of time to do other activities such as: raising children, caring for sick family members, reducing the availability of time to travel
- **Exclusion related to fear:** occurs when the fear of personal safety, inhibits a person from using public space or public transportation.
- **Exclusion of space:** occurs when spatial arrangement inhibits a person or group of people to access public spaces, such as the VIP waiting room at the station.

Focusing on the gender equity in transport, although research affirms the importance of inclusive mobility as an important factor for the development of societies, traffic and transport policies still do not respond equally to women's and men's mobility needs (Thynell, 2016; Gauvinet al., 2019). 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 (CIVITAS Wiki, 2016) and the lack of robust data characterizing the lives of women, especially their daily journeys (Gauvin et al., 2019) have been identified as main barriers to the adoption of more gender-equal policies. It is suggested that in order 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 poorly validated by users before their application (Jain, et al., 2011).

The next section summarizes the state-of-the-art and practice in gender-wise mobility choices and attitudes, perceptions of women on new and sustainable mobility services as well as their position in the transport industry.

2.1 Gendered mobility behaviour

The sociodemographic background, including the responsibilities for accompanying 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 due to the complexity of the time-space arrangements women face (Jain et al., 2011). 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 other personal or social needs: schools, hospitals, and health centres, supermarkets as an outcome of the multiple responsibilities they need to undertake in their daily lives, reflective of the role they have in societies. Mothers' activity patterns complexity may increase due to the presence of children, but less so among fathers (Scheiner and Rau, 2017). Women are more likely to use public transportation (European Parliament, 2012) than men,

who in a traditional society make trips to work by car and also get the first right to car usage in a household (Singh, 2019). 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, care services, amongst others (European Parliament, 2012). All this originates in the creation of a trip chaining far more complex to women as it can be seen in Figure 1. Hence, to fully understand gender-based mobility, it is necessary first to frame the institutional and family content in which each individual lives.

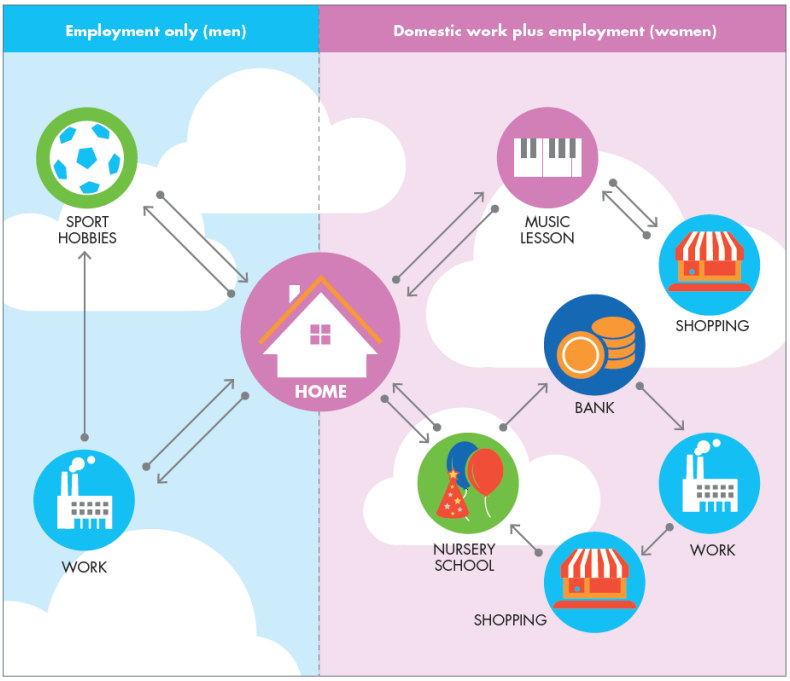

Figure 1 - “A normal day for a woman from Western Europe”
(Source: based in Lehner-Lierz, U., 2003 in CIVITAS Wiki Consortium, 2016)

For example, Finland is characterized as a country with a profile of the most permissive parenting norms, the highest levels of social trust and the most gender-equal work-family arrangements (Craig and Tienoven, 2019), as opposed to Italy or Spain that have a predominant male breadwinner model, in which childcare is almost entirely assigned to women (Cutillo and Centra, 2017; Craig and Tienoven, 2019). Unlike these countries and most of Europe, Portugal, for example, does not fit into any of the traditional models, the 'modern equitable model' or the male breadwinner one (Oliveira, 2014; Matias et al., 2012). According to these authors, even though in the labour market, there is not much difference in the participation of women and men, the Portuguese society is characterized by a traditional gender division where women do the majority of domestic and caring chores. In 2015, Perista, et al. (2016) surveyed time-use by men and women in Portugal, and it showed that the participation

of men in household chores and care work is on average 2 hours and 38 minutes and for women on average 4 hours and 23 minutes, as it can be seen in Figure 2. Adding to these lack of opportunities a more competitive job market associated with an increase of working hours and an almost permanently contact with the workplace makes the balance between personal and professional for women even more difficult.

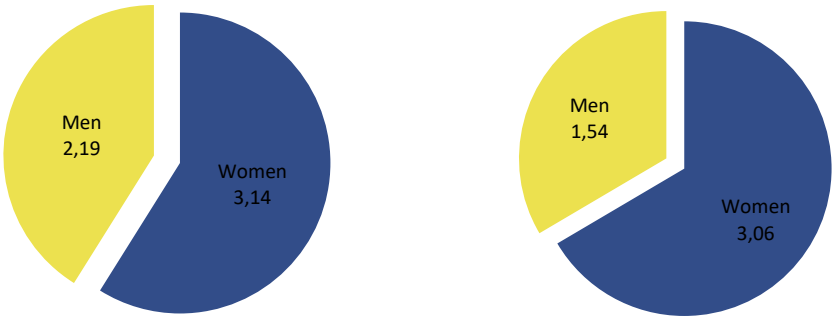

Figure 2 - Average time of unpaid work on the last working day by gender concerning care work and household chores in hours and minutes (Source: Perista et al., 2016)

Therefore, the time lost in travelling is often far more penalizing for females, making public transport an inefficient choice for women when juggling with a high number of activities (European Parliament, 2012). Figure 3 shows the differences between men and women in terms of the use of urban public transport in Europe.

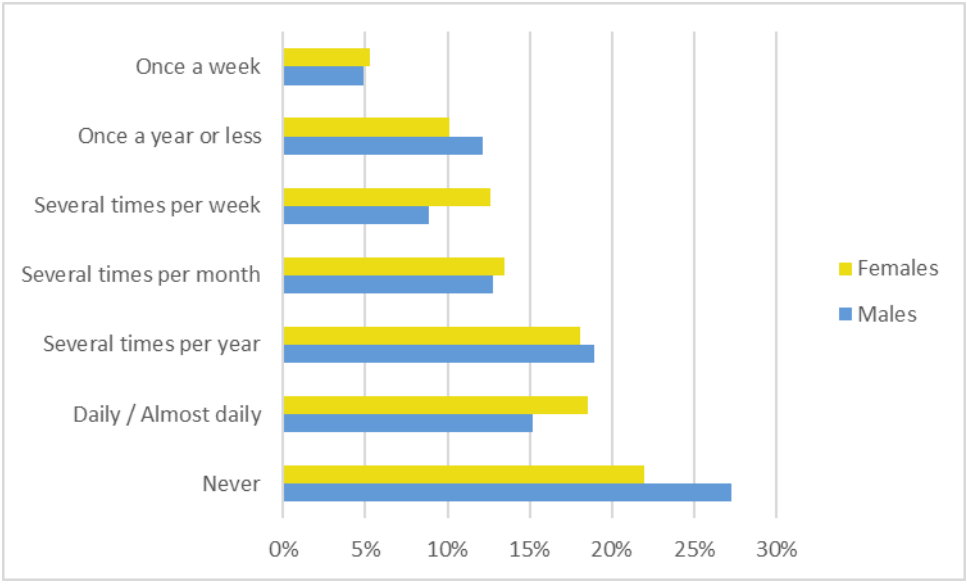

Figure 3 - Frequency of travel by urban public transport (Source: The Flash Eurobarometer Survey, 2013)

Therefore, having access to private transport has been seen as a critical factor to increase women's mobility and economic inclusion. Nevertheless, some beliefs still remain on the stereotype of women being seen as bad drivers, unable to cope with stressful situations requiring rapid decision making on the road. Beliefs initially intended to maintain "women in their place and protect them from the corrupting influences present in society and in themselves" (Berger, M.L., 1986). Figure 4 shows the females' transport modes choices in Europe, and the car seems to be on top of the majotity of the countries.

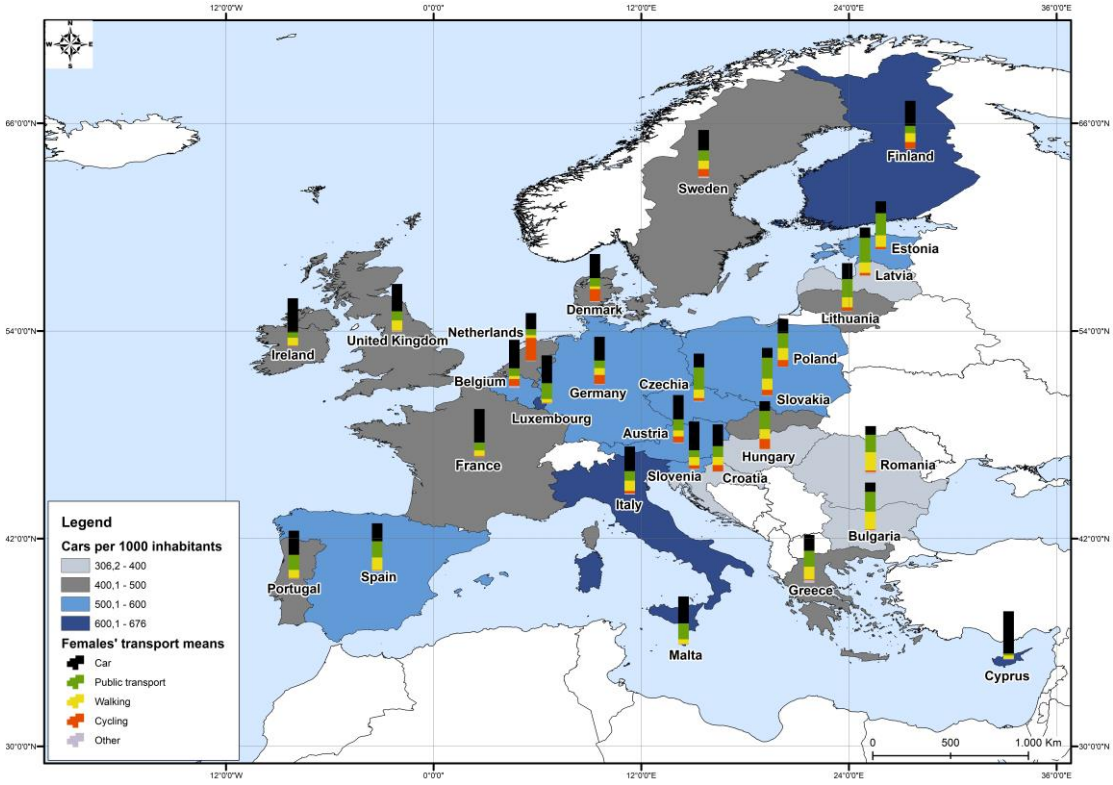

Figure 4 - Females' transport modes
(Source: The Flash Eurobarometer Survey, 2013)

Regarding soft modes of transport, again women are not recognized as frequent cyclists, mainly due to vast gender inequalities in the division of time between women and men concerning the different roles assigned to them by society; carrying shopping and travelling with kids impede biking. Thus, the development or improvement of cycling networks that connect to shops, services, and schools within local neighbourhoods could increase rates of transport cycling among women (Bourke et al. 2019). Furthermore, females seem to perceive this mode less appealing for longer distances due to the risk of arriving sweaty at the destination, mostly when it is a job place (Kawgan-Kagan and Popp 2018). Moreover, women cyclists are found to have a greater fear of traffic compared to males (Chataway et al., 2014). These findings entail

the risk of women cyclists being understood as a minority group, and this could put at risk gendered sustainable transport planning by ignoring some potential users (Prati, 2018).

A similar trend is observed for bike-sharing, green, and innovative transport mode. Despite its increasing popularity all around the world, empirical data reveal that, though the gender gap may vary across bike-sharing programs, bike share users are disproportionately male (Wang and Akar, 2019). Women seem to be more influenced by the environment and the infrastructure, seen as the spatial characteristics of bike share stations, the length of off-street bike routes, the number of benches and bicycle racks and intersection density (Wang and Akar, 2019). At the same time, the bicycle proposed by the provider can lead women to refuse to join this service due, for example, to its weight (Ma et al., 2020) or the absence of baby saddle (Zhang et al., 2015).

Discussions in the literature on shared mobility reveal that it can lead to a reduction in car trips and car ownership but rather complements public transport. This aspect could be a reason for the low attraction found among women users: in fact, they travel mostly by transit and drive much less than men (Singh, 2019). While talking about shared mobility, it is worth investigating the female perception towards car-sharing. In general, take-up of this mode is higher among men than among women (del Mar Alonso-Almeida, 2019), and the costs of car-sharing compared to car ownership play a bigger role for female users than for male (Kawgan-Kagan and Popp 2018). At the same time, car sharing can be recommended when the travel range is 15,000–18,000 km per year and for shorter trips (del Mar Alonso-Almeida, 2019), namely the features characterizing women's daily mobility and activities. Moreover, as also said in the previous paper, "another reason why car-sharing may suit women is that they often drive a household's second car and, due to the last financial crisis, new materialists cannot (or do not want to) spend money on a second car".

Ride-hailing is another shared mode gaining success in cities all around the world. Women seem interested in the service, despite the fear that could be expected from travelling with unknown people. However, some providers are trying to shed light on these issues to help to prevent them through a multi-faceted approach (ITF, 2018). For example, technology can increase accountability for crimes committed. GPS tracking, trip arrangement through apps, driver and rider feedbacks and law enforcement outreach are examples of actions that could be of interest for potential female costumers.

Among the different travel modes, Demand Responsive Transport (DRT) seems to be of interest for women mobility. DRT systems are a mean of public transport that falls between private car usage and conventional PT which aims at combining the benefits of busses and their higher occupancy rates with the greater comfort levels of taxi services (Avermann and Schlüter, in press). Following the standard definition, DRT is a system being publicly accessible to all groups and not focused on one particular age group or special characteristic. This service

is different from a taxi because fares are charged per customer and not per vehicle. Furthermore, the DRT system changes according to variations in demand and is provided by low capacity vehicles like vans as opposed to large buses. Broome et al. (2012) tested a flexible bus system in a rural area of Australia. They concluded that changing from fixed to flexible routes has benefits for the entire population and not only for the elderly, but especially for the latter segment since the distance between homes and bus stops is a critical factor in providing an age-friendly service.

The differences observed between the mobility patterns of the different genders is exacerbated by other factors such as the low income of their families, 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 the European parliament study in 2015, daily car use is more common in small towns and rural areas, with 58% of the population using it against 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 considered necessary for those living in rural areas (Berg and Ihlstrom, 2019). With the car as essential for an active life and access to basic services, people unable to buy a car or people without a driving license become even more vulnerable in these environments. Older women travel less and over shorter distances in this areas, partly explained by the fact that fewer women of these ages hold a driving license compared to the number of men of the same age with a driving license (Plazinić, et al., 2014). As might be expected, women living in rural areas make fewer trips than women of the same age living in urban areas (Su and Bell, 2012).

The main problems in the use of public transportation pointed out in Berg, and Ihlstrom (2019) study are the distance between home and bus stops or rail stations, the bad 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 public transport and the safety of the route connecting home to nearest bus stop or station. Additionally, it was pointed out, across all participants, the lack of conditions at bus stops concerning security and connectivity to other means of transport. Moreover, the lack of a place to park cars or bicycles was another reason indicated 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 public transport system that supports any failure. 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.

The mobility of older women compared to men of the same age is more restricted geographically and more influenced by social factors (Su and Bell, 2012).

It is still today a fact that the intrinsic characteristics of a person shape the way society accepts them or not. Belonging to a minority ethnic group, or having a migrant background, having low qualifications or simply being a woman make some individuals more at risk of social exclusion (IRS, 2015). Gender differences in the travel experiences of immigrants have been difficult to characterize (Assum et al., 2011) due to lack of data but some important 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. Regarding soft modes of transport, immigrants are thus more likely to walk and to use public transport than natives and cycling appears to be more popular among natives than among immigrants, especially immigrant women.

In Annexe I, Table 3 is presented a literature review of contents dealing with the female perception and the use of different modes.

2.2 Perceptions of 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,..." (Candia, Pirlone, and Spadaro, 2019). Safety can also refer to "taking measures to reduce or eliminate the risks of accidents" (ITF, 2018).

In general women of all ages and backgrounds are more concerned about the 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 (Singh, 2019). ITF (2018) presents some numbers on this topic, stating that reality and documented research reveals that more than 80% of women and girls experienced harassment in public and 80% are afraid of being harassed in public transportation. 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 (ITF, 2018).

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.

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 do not believe that there will be consequences for the perpetrator or that they are 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. 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 labour market in developing countries, reducing their participation probability by 16.5 percentage points.” (International Labour Office, 2017).

Concerns about personal security might involve changes in the design of transport interchanges and waiting areas. 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 surveillances by police or transport employees (Hortelano et al., 2019). 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 to 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 as vulnerable spaces. On one side, when crowded, harassment could take place; on the other side, when empty, there is no one available to intervene and help in case of emergency.

In general, sexual harassment in public transport 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 numbers in the EU 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” (ITF, 2018). This fact seems mainly due to different approaches towards driving so that perhaps women tend to adapt their behaviour to avoid risks. The situation is opposite among pedestrians: almost twice as many women are killed as men. The reason can also lie to the female tendency (or necessity) of walking more than their counterpart. Besides, they tend to make more off-peak and non-work related trips due to their mobility reasons. As reported in ITF (2018), women often modify their behaviour to feel safe while walking, for example, avoiding to walk 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 (Kawgan-Kagan and Popp, 2018, Benedini et al., in press). The insecurity reported by

people living in rural areas on the home-station or home-bus-stop path caused by the poor quality of roads on the way to public transport are barriers to the use of bicycles and public transport (Berg et al., 2019). Also, sharing public space with cars and other cyclists are major concerns 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 especially important feature for women to consider using it.

ITF (2020) 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 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, 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 behaviour by male riders. For example, the document reports that the share of male riders 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”.

In Annex I, Table 2 literature review on how women perceive safety and security in different mobility choices are shown.

2.3 Attitudes towards the adoption of new mobility services

Many new mobility services have appeared in recent years in cities as part of the solution in dealing with sustainability and liveability challenges. The already cited shared modes are part of these new approaches, while they are commonly seen as elements at the basis of the Mobility as a Service (MaaS) concept. MaaS is defined as “a service offered to the user in a single mobile app platform, which integrates all aspects of the travel experience, including booking, payment, and information both before and during the trip” (Alonso-González et al., 2020). Cooperative intelligent transport systems and connected automated driving are two other elements that can contribute to wealthy, clean, spacious, liveable, healthy, and accessible cities. We think it is also worth inserting the electric vehicles in this framework, seeing them as an innovation in the mobility offer.

As already observed, women tend to have more non-work related trips, travel off-peak hours and use more flexible transport modes. As a consequence, shared mobility or mobility as a service could attract more female than male users when given better alternatives to private transport. Commonly, women’s lower rate of motorization forces them to use public transport,

walk and cycle (Ortega Hortelano et al., 2019). Gender equality can be enhanced through the improvement of women´s accessibility to the transport network, to private and more flexible mobility services (Singh, 2019).

In previous sections, many results have already been found for the shared modes (bike sharing, car sharing), so we would like to avoid repetitions. Therefore, our primary focus is on the innovative technologies and the new development in the automotive offer (CAVs, EVs). On the one hand, some studies on MaaS revealed that women could be potentially interested in this new mobility service mainly because of their low preference for driving (Caiati et al., 2020) and less need or will for car ownership (Liljamo et al., 2020). On the other hand, other researches on women reveal that innovative technologies are not part of their daily mobility. As observed by Kawgan-Kagan and Popp (2018), a more pragmatic attitude towards cars can be explained with other priorities due to female double load, i.e. household tasks, childcare and work.

However, gender seems to influence beliefs to new vehicle technologies and preferences concerning their adoption. Ortega Hortelano et al. (2019) reports that women hold less favourable attitudes toward emerging technologies and perceive higher risks than men. This facet may be explicitly linked to the characteristics of new technologies and how they impact different individuals, but also to a more general concern about robots. These broad comments seem confirmed by Hohenberger et al. (2016) who declared “Women tend to have a lower willingness to use AVs than men because they anticipate higher anxiety from riding in an AV”. At the same time, the low interest in adding partial and full automation to the vehicle is not necessarily detrimental. According to Bansal et al. (2016), it could mean that women are more risk-averse and tend to use new technologies once these are operational and consolidated. While considering EVs, various works in the literature reveal that the female interest towards them is lower compared to the male counterpart. Once more, this perception could be related to a significant scepticism about the readiness and reliability of EV technology and infrastructure (Berkeley et al., 2018) and a general lower ownership of this kind of vehicle (Sovacool et al., 2019).

The issue of safety and sustainability is commonly raised when dealing with AVs. Some benefits are assumed, such as having the ability to avoid collisions without requiring human reaction time or to smooth traffic flow patterns to reduce excess energy consumption or emissions (Djavadian et al., 2020). Besides, according to Kulmala (2010), “the significant and positive parameter of behavioural change toward safe driving indicates that the attitude of trying to improve current driving safety level is associated with respondents’ higher preferences for autonomous vehicles”. Such kind of drivers may find it challenging to improve driving safety by themselves and consequently tend to rely on advanced technologies (Jiang et al., 2020). Havlíčková et al. (2019) identify, after a literature review of surveys mapping public opinion on

CAVs, more socio-demographic factors associated with the degree of awareness regarding this subject: age; place of residence, level of education and gender, and refers to the gender as the dominant factor. These authors found out that at the same time that women do not believe that the improvements in traffic safety will come into reality and do not want to install automation technologies seniors are also reluctant to use these transport solutions. It is in the most vulnerable groups with the most potential for the use of these technologies that we see the highest resistance, which may mean that how these innovations are advertised has to be changed and be more focused on these groups.

In Annexe I, Table 5 some insights on the interest of women towards these innovations in mobility are presented.

2.4 Attitudes towards sustainability

Sustainability “has proven to be a slippery concept but engages the idea of meeting the needs of the present without compromising the ability of future generations to meet their own needs” (Hanson, 2010). Mobility patterns and the transport sector have a significant effect on sustainable development since the transport sector is one of the main drivers of economic and social growth, energy consumption and pollution. Sustainable mobility would undoubtedly entail the reduction of greenhouse gases and other pollutants emission, lower use of non-renewable resources, and the provision of more significant equity of access to all. As stated in Hanson (2010) “the means for moving toward these goals are myriad and include alterations to fuels, vehicles, land use patterns and mobility practices (e.g., increased use of non-motorized modes such as walking and biking; reduced travel; or substituting communication for physical mobility)”. As Saif et al. (2019) say “the sustainability of transportation, environmental condition of an area, public health and economic condition of residents can be raised by shifting from private transport to the public transportation, walking and cycling”, but for this to happen the transport system has to be prepared to receive all the users and be able to respond to their needs.

Previous research suggests that women are more concerned with sustainability issues than men (Alonso-Almeida, 2019) and are also recognized as being more likely than men to adopt sustainable travel behaviours (European Parliament, 2012). Innovative concepts of sustainable urban mobility such as car-sharing with and without battery electric vehicles reveal another part of the gender mobility gap: besides being full-time employed and well-educated, most of the current users are male (Kawgan-Kagan and Popp, 2018). While taking more significant family and household responsibilities, women can be role models for the future generation and creating a shift towards sustainable transport since parents have an impact on children travel behaviour (Kawgan-Kagan, 2015).

Hanson (2010) proposes a fruitful discussion on two related problems with the connection between gender and mobility to sustainability. For the author, women's mobility characteristics can be associated with two of the three dimensions of sustainability. It can be related to environmental and economic sustainability; however, the third dimension, that is, social justice and equity, remains un-addressed and un-redressed. Therefore, the overarching generalization (women's mobility is less than men's) remains, along with all the inequality of access it implies. This observation seems especially pertinent since women's travel patterns remain more complicated than those of men. Moreover, a concern for equity in mobility and access leads straight to the observation that to assess equity it is necessary to know if, when and where women's lower (or equal or greater) mobility level indicates preferences or limitations.

Women, therefore, tend to be greener not only because they have limited access to cars, but due to their different attitudes towards mobility (e.g. being more concerned about risk than men). Moreover, it has been known for a long time that women are more environmentally interested and express more criticism of automobility than men do (Scholten and Joelsson, 2019). Similarly, the work of Ortega Hortelano et al. (2019) reports that women are also more willing to limit their car use than men and show more support for environmental issues. Besides, they are more positive towards measures aiming at car reduction, such as improving and expanding public transport, probably due to their frequent use of this mode.

According to Scholten and Joelsson (2019), women are more favourable to transport behaviour changes and to adopt solutions supporting a sustainable transport sector. Data collected investigating public attitudes towards different solutions to achieving climate objectives confirms that. On the whole, women are more likely than men to support or accept sustainability and green economy policies (CIVITAS WIKI, 2016). They appear to be more sensitive to environmental risks and more prepared to make the behavioural changes required to sustain significant climate change mitigation and adaptation policies.

In Annex I Table 4 literature review related to sustainability awareness of women with some modes of transport are presented.

2.5 Perceptions and satisfaction with mobility experiences

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 travellers perceive public transport and its quality. The main features in the female evaluation of this service include a sense of security and cleanliness (Abenoza and Susilo, 2017), the level of crowding (Börjesson and Rubensson, 2019), the punctuality, the frequency and the information (De Oña et al., 2014).

According to Gao et al. (2018), gender is a crucial socio-demographic variable that has been examined in many studies, with mixed results. On the one hand, several studies state that gender is not significantly related to satisfaction. On the other hand, others report significant

links with 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 commuting was more likely to be 'very satisfied' for men than women.

The EU project METPEX (A Measurement Tool to determine the quality of the Passenger Experience) brought an innovative contribution to the theme (Woodcock et al., 2018). Its main aim was the provision of some innovative features able to investigate aspects usually not tackled in most of the existing studies on quality measures. In particular, satisfaction was examined when using in their journey, both motorized and non-motorized transport modes, such as riding a bicycle or walking. Moreover, this project also focused on analysing the perspective of particular groups of travellers, such as women, people travelling with children, and physically challenged individuals.

In order to discover underlying patterns of satisfaction ratings for several distinct groups of observations and variables, a survey with 60 questions, covering all different aspects that might influence the overall perceived quality of the single journey, was launched in 8 European cities, collecting more than 6000 replies. By using the satisfaction rating questions, it was possible to obtain three specific indicators for women respondents. These three indicators have been renamed following the elements characterizing them, and they resulted in "WOM1: Safety and security, comfort and staff helpfulness", "WOM2: Integrated tickets and range of fares" and "WOM3: Reliability" (Diana et al., 2017). As it could be easily grasped merely looking at those labels, the evaluation was based on characteristics commonly associated with PT.

In Annexe I Table 6 literature review related to the topic are presented in further detail. It should be observed that not so many studies differ according to gender.

2.6 Employment

As shown before, insecurity and the fear of aggression in public spaces are aspects that limit women´s mobility choices and therefore, it differentiates the experiences of men and women when using the transportation systems (Gauvin, 2019). Furthermore, there are gender differences in travel patterns related, mainly, to social gender roles in employment and family (Craig et al., 2019), which will affect not only women's employment conditions but also income levels and mobility needs (CIVITAS Wiki, 2016).

The increase in women's participation in the labour market has made it evident that transport systems are poorly inclusive (CIVITAS, 2016; Baslevent and, 2016). Considering the lack of mobility solutions that fit everyone's needs, the most vulnerable groups tend to be the most disadvantaged: low-income families, women who accumulate caregiving and household tasks with a paid work schedule, older women and people living in rural areas, are examples of such groups (Su and Belle, 2012; Delbosc and Currie, 2011; CIVITAS, 2016; Thynell, 2016).

These restrictions have led women to adopt a different approach regarding employment options when compared to men.

A general overview proposed in the document edited by the European Parliament in 2012, reveals that “women are more likely than men to work at home, less likely to have a mobile workplace”. Moreover, they seem “less likely to engage in work-related overnight travel, and less likely to engage in ‘extreme commuting”, defined as a one-way commute of 90 minutes or more. If women start businesses, they locate them closer to home compared to men, and their spatial range regarding activities is smaller in comparison with men. Such limitations are probably associated with time constraints in women’s day planning, juggling trough home care and activities associated with caring for others, such as children or elderly, as it can be seen in Figure 5 (Craig and Tienoven, 2019; Jain et al., 2011; U.S. Bureau of Labor Statistics Current Population Survey, 2016). Additionally, unforeseen situations related to these activities are usually handled by women (Craig and Brown, 2016).

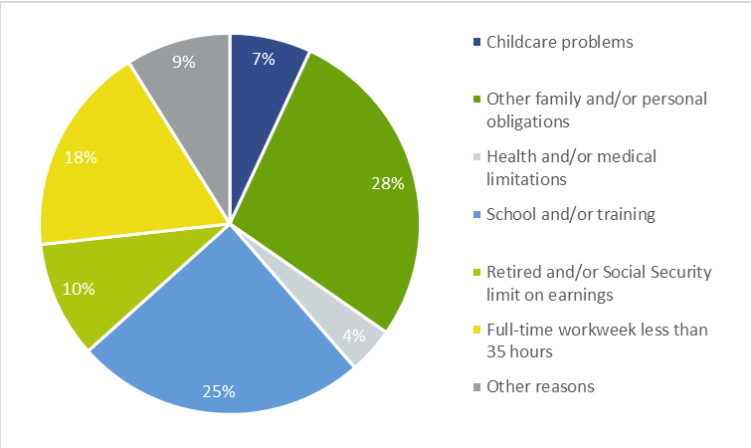

Figure 5 - Females' main reason for working part-time in 2016
(Source: U.S. Bureau of Labor Statistics Current Population Survey, 2016)

The transport sector is one of many in which the weak women representation shows evidence of occupational segregation, may be affected by its operations of working in shifts and with higher spatial mobility such as drivers, conductors or on-board personnel, which might be considered obstacles for women with high caring responsibilities. According to EUROSTAT’s Labour Force Survey, the share of women working in the EU transport sector is no more than

22% while the share of women working in the entire European Union is approximately 46%, in line with the evidence in Figure 6 and 7 (Giannelos, et al., 2018).

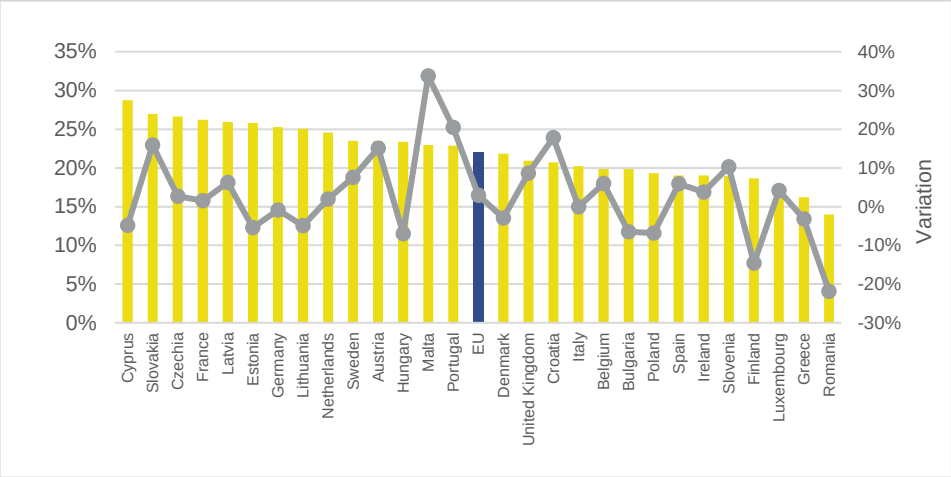

Figure 6 - Women employed in the transportation sector in 2017
(Source: European Commission, Eurostat Labour Force Survey, 2018b)

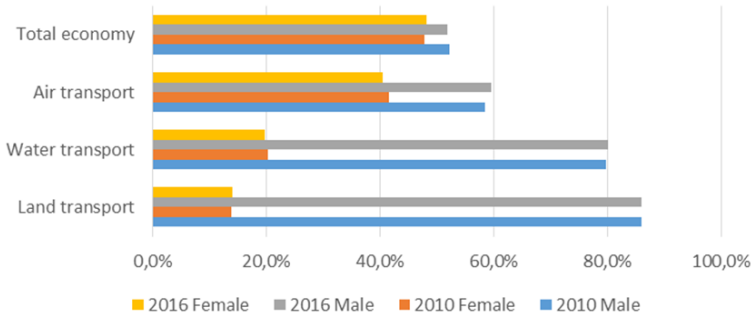

Figure 7 - Gender structure of employment in the transportation sector
in the EU in 2010 and 2016
(Source: Giannelos et al., 2018, based on EUROSTAT Labour Force Survey, 2017)

Therefore, and bearing the overload of unpaid responsibilities women bear, this gender is mainly concentrated in those occupations stereotyped as “women’s work”, and those units who already work in the field may interface a negative approach toward oneself. Female workers usually are expected to maintain a high level or even outdo their daily work tasks in a male-dominant workplace in comparison to their male colleagues (ITF, 2002).

2.6.1 Barriers for women employment in the transportation sector

In recent years many transport companies have launched various female-oriented attraction strategies with the purpose to open industry for women workers (European Comission, 2002). However, there are still significant barriers to overcome in order to narrow that employment

gender gap. According to Turnbull, P. (2013), a woman's career in the transport sector has the following stages: Attraction -> Selection -> (initial) Retention -> (probable) Interruption -> Re-entry (resumption) -> Realisation, as it can be observed in Figure 8.

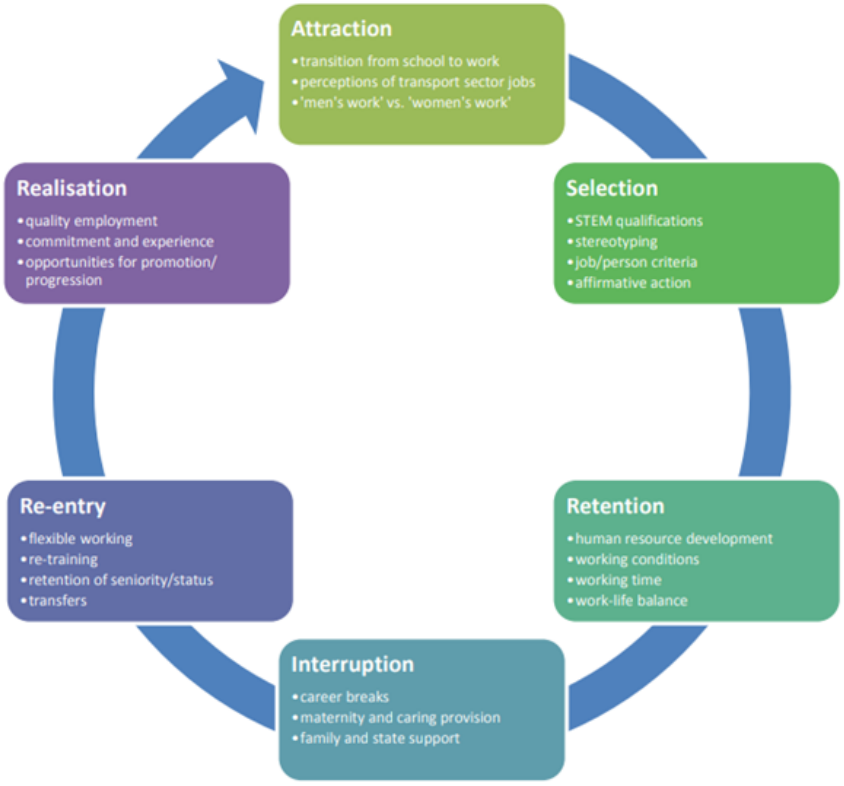

Figure 8 - Women's Career Cycle in the Transport Sector
(Source: Turnbull, 2013)

Hence, the initial inflows of female workers may fall away in the longer term due to low retaining efforts or lack of opportunities for career development and potentially initiates the shortage of female workers in the transportation industry. According to Alexander (2020) the major barriers for women regarding employment in the transport sector are barriers to recruit, to retain and to develop their careers.

In Annexe I Table 6 information on the topic was collected and categorized, according to Alexander (2020) classification regarding the barriers women face during their career in the transport sector.

2.6.2 Incentives

According to EU law, equality between women and men is one of the fundamental principles (European Comission, 2020). That is why the institutions of EU have reinforced this principle with plural legal documents which oblige the member states to reinforce this principle

as well since all EU countries are subject to the common legislation. In 1957 the principle of equal pay for equal work was included in Article 119 of the Treaty of Rome, equality between women and men has gained in importance as an EU policy area (Prpic et al., 2019). Since then, many directives and articles of the treaties and legal documents have been developed by narrowing and specializing the domains of this general matter (Schonard, 2019). Even though the existing content of EU legislation is satisfactory; its implementation has been rather slow. The need for consistent and effective enforcement is necessary (Prpic et al., 2019).

At the same time, the problem of lack of female workers in the transport sector is not new. In fact, some companies have already applied some measures themselves addressing this issue, and its best practices and experiences have been gathered and shared in the "Women's Employment and Gender Policy in Urban Public Transport Companies in Europe – WISE II (2016)" report. Additionally, other initiatives such as the Women in Transport – EU Platform for change and the Women in Transportation (WiT) initiative of the Asia-Pacific Economic Cooperation (APEC) forum have also produced relevant documents to help to boost women employment in the sector (Nathan Associates Inc., 2017; Giannelos et al., 2019). For example, the APEC Women In Transportation Data Framework and Best Practices Initiative presents a framework for benchmarking and following the involvement and impact of women in the sector, from leaders to users and information in on-going efforts from businesses and governments (Nathan Associates Inc., 2017).

From the reports mentioned above, and in the context of gender policies, the best practices and positive experiences were divided into four main categories:

- Company policy: the awareness-raising, the commitment to gender equality starting at management level, professional approach, inclusion and participation of all staff members in the common goal, reshaping the image of the company and promoting women leadership;
- Evaluation of the current situation: goal-setting, strategy and measures to reach them, through gathering the data on female employment in the company and by using it for planning the best company approach;
- Staff recruitment and development: balance recruitment approach towards gender, communication with female workers, cooperation with education institutions, equal training opportunities and equal opportunities to pursue the higher positions in the company;
- Good working conditions: training on equal opportunities, combating stereotypes at management level and among employees, suggest family-friendly work conditions and flexibility, equal pay for male and female colleagues, ensure safety at work and adjust the inventor and workplace;
- Cultivation of changes: evaluate and supervise the plan to reach the previously set goals.

3 Future trends in mobility and transport systems

3.1 Mobility

The perception of mobility is changing, and new forms of displacement are gaining more weight in today's society. Smooth modes of transport are increasing their presence in people's daily travel planning in urban centres, bicycle-based vehicles are growing, electric-assisted and non-electric, and also vehicle sharing is getting more popular (Katona et al., 2020). Nevertheless, the major revolution in the transport system is being made possible by advances in technology, and the global penetration of smartphones, that many believe to be the most significant innovation in the transport sector in the last decade (Wong et al., 2020). Technology is identified as a key element in the enabling of sharing services and autonomous driving systems (Webb, 2019). “Drops in driving among millennials, and attitudinal changes in cars no longer being held as a status symbol” (Wong et al., 2020), contribute to making room for new modes of transport, or new approaches to existing ones.

Talking about mobility in the future is also talking about mobility as a service (MaaS), a concept already cited in section 2.3 and that can be characterized as connectivity between new or renewed transport services, via mobile applications, focused on the needs of an individual and improving their connectivity to services (Pangbourne et al., 2020). Wong et al., 2020, characterized MaaS as shared mobility, modal integration, and as an enabler of network efficiency.

Future transport systems are envisioned as personalized, automated, and passenger-centric. Nevertheless, because of our small-scale individual activities, the promise offered by new mobility offers of sustainability may be threatened and the opposite effect, increasing greenhouse gas emissions, traffic congestion problems, urban air, and noise pollution (Pangboune et al., 2020). Moreover, MaaS could also increase and create social exclusion of more vulnerable groups, as the low-income population may experience complications in paying for these new forms of mobility and will be subject to having as the only options, inaccessible or inconvenient modes of transport (Inclusion, 2018; Pangbourne et al., 2020).

MIND-SETS project (2016)[1] has made a review of the modes of transport included in the concept of shared mobility. This concept covers a wide range of mobility options, carsharing, car-pooling, microtransit, and bicycle sharing or on-demand ride services. From the analysis of available methods, the authors concluded that shared mobility is growing but that users have remained the same and belong to a very poorly diversified socio-economic group. It characterizes carsharing users as:

[1] http://www.mind-sets.eu/

- “Well-educated;
- Young adults, predominantly between ages 25 and 45;
- Living as single-person or childless-couple households;
- Living in middle or middle/upper-income households;
- Living in carless or single-car households;
- Relatively heavy users of non-car forms of urban transport such as PT, walking, and cycling.”

It has not been possible so far to understand whether changes in the behaviour of these users group can be extrapolated to the rest of the population. It is not clear if this rise boosted by the increasing use of mobile applications and modelling capacity has reached its limit, that is, its group-target or only the “early adopters” that will be followed at the proper time (MIND-SETS, 2016).

While dealing with future trends in mobility, it is not possible to cite AVs. The introduction of AVs can affect people's behaviour positively as it enables users to behave like passengers and to take advantage of travel time for activities such as working, eating, reading and watching movies, navigate on the internet, amongst others (MIND-SETS, 2016). Ashkrof et al. (2019) mention that users with different characteristics value different aspects of the journey they need to make, users' concerns include in-vehicle time, walking time, waiting/searching time, and travel costs (tickets, fuel and parking costs). According to the authors, this new reality could increase peoples’ tolerance to long travel times, and especially longer commutes. This situation can itself lead to longer distances travelled, and, indirectly, to more urban sprawl that could result from people moving out of city centres, but also companies. Additionally, people could also become more tolerant of “wasting” time during congestion, and this may lead to higher traffic in peak hours (Ashkrof et al., 2019). Furthermore, AVs are supposed to increase safety, traffic fluidity, capacity, accessibility, and alleviate congestion by using technologies, for instance, to avoid traffic jams (Ashkrof et al., 2019). Consequently, it becomes crucial to understand how users value their time and what the impacts of these changes on their future mobility patterns. Nevertheless, its full potential has not yet been achieved, since it has not reached its state-of-the-art.

The 2018 European project INCLUSION[2] aimed to characterize the most vulnerable groups of users and areas, based on interviews and workshops conducted in 6 cities from 6 different countries, tried to illustrate the main problems of the transport system and understand the challenges in providing integrated transport supply. To classify the user needs, they identified four critical layers:

[2] http://www.h2020-inclusion.eu

- Layer 1 is composed of “Essential requirements,” the availability of transport services;
- Layer 2 addresses “Basic requirements” that, according to the authors, consist of accessibility, safety, affordability, reliability, and connectivity;
- Layer 3 is about “Specific needs”, needs that address a specific group of users, for example, the presence of staff assistance or flexible tariff;
- Layer 4 is the “Added value needs”, characteristics that add value to the transport service, like good conditions in the pedestrian environment or parking areas next to stations.

Understanding the needs of people in their daily commuting is essential to build more effective mobility plans that integrate new mobility solutions into an inclusive and fair transport system. Therefore, data should be collected regarding patterns of mobility and needs, disaggregated as much as possible, but mainly by gender, place of housing, and social condition. Only from this information is it possible to design measures adapted to the reality of each individual. Uteng (2019), states that it is necessary to take different measures according to the context in question, in particular, to distinguish between measures taken in urban, suburban, and rural areas.

3.1.1 Best practices - Technologies and services to serve gender-equal mobility

Throughout the years, various practices have been applied in different geographies for the provision of 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 to discounted fares; in response, the local government opted for transit fare structures to minimize costs for multi-stop journeys (Peters, 2013) and enhance mobility equity between men and women (Hasson and Polveloy, 2011). 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 the mobile phone, with various functionalities, allow anyone in a dangerous situation to contact the authorities quickly and through 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 (Civitas, 2020). 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 (Granada et al., 2016). When using pink-transports, results showed that women felt safer, calmer, more comfortable (as it was not crowded) when compared with PT and also perceived them as being cleaner (Civitas, 2020). However, from a social standpoint, several gender-equity defenders considered these approaches as "a step back rather than forward" (Peters, 2013). A new service related to this concept is the "pink fares" for mobility services who have the benefits of discounted trips for the service of car-sharing all day long and a daily pass that offers several trips to women. Such a service could facilitate the mobility of women which was 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 (Garcia, 2020). This procedure enables women and children to requested to stop anywhere along the way, avoiding long journeys between bus stops and their homes (Garcia, 2020). After the experience, the conclusion reached by the operators is 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 does not pay (Wong et al., 2020). Additionally, changes in the urban environment, such as the removal of 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 in 1960 and has been experimented in various regions and various forms, always with the goal and under the premise that would lead to a reduction of PT costs (Wong et al., 2020).

With the increase of available technology to all people, regardless of their social class, the development of new technologies could make former thought out solutions viable. Digital platforms to improve and facilitate the management of requests by operators, and to make it easier for users to request the service and AVs, for example, to decrease labour costs could be seen as key instruments when considering flexible mobility alternatives (Wong et al., 2020). As mentioned in Berg et al. (2019) and Kanota et al. (2020), the autonomous solutions operating as a taxi can be a solution for low-density areas, in conveying children to school, hospital trips, or specialized transportation services, for instance, to people with disabilities.

In the CIVITAS MOBILIS project (2009)[3], a set of measures to tackle these issues were developed to improve the choices of vulnerable groups when commuting. The lack of connectivity between different transport options is often pointed out in the literature as one of the reasons for not using specific modes of transport or choosing the car over PT. The example of Toulouse, in France, could be used to illustrate the type of measures developed by the

[3] https://civitas.eu/content/mobilis

CIVITAS project (2009). 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.

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 the bike-sharing scheme or generalizing dockless bike-sharing.

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

It should be highlighted that the survey developed in this task, aims at understanding the users' receptivity to new measures, in the ten cities, part of the consortium.

3.2 Employment

The barriers for female employment in transport industry partly are of social nature, and some transport companies have already been adapting their capabilities to integrate women in their labour force besides in clerical jobs. Although the progress is slow and the results may not look satisfactory, it is necessary to keep up reducing the gap regarding men and women workers in the transport industry.

The current forecast identifies a growing demand for a young workforce to replace ageing and retired staff and to cover present and future transport needs which could be challenging for this ‘old’ industry (Christidis et al., 2014).

Due to the relevance of this topic, in TInnGO project, it has also been studied in WP9. For example, in the Deliverable 9.1 “Identification of current and future issues in the employment of women in SM” and Deliverable 9.2 “Modelling and forecasting of gender employability for pilot cities”.

3.2.1 Future employment

In 2014, Christidis et al. have done an analysis of labour supply and demand in transport employment and three main issues and tendencies were identified on the short-term (until 2030):

- Transport is expected to create new jobs, resulting from an increase in transport activity, even though productivity in the sector is presumed to continue growing;

- The current workforce in transport has a high average employee age, which in most modes is foreseen to continue rising. As a result, high numbers of retirements are envisaged in all transport modes, more than 60% of new jobs will correspond to the replacement of retired staff;
- The turnover in transport jobs, especially in mobile jobs, is particularly high. It is estimated that more than 16% of recruitment will be due to job openings because of staff turnover.

Moreover, the analysis suggests that demand will grow at different rates, according to occupational groups and skill levels, as can be seen in Figure 9. It is expected that mobile positions present the most significant turnover in the overall due to staff lower average retirement age and high turnover, especially in certain positions such as long-distance vehicle drivers (Christidis, et al., 2014).

In some cases, this could result in differences between demand and supply for a specific occupation and skill combinations, in particular, market segments with specialised job content and long-duration education and training. Nevertheless, the main challenge would be the adjustment of existing staff with a specialisation that is no longer needed. According to Cedefop's European skills and jobs survey, employees face a constant challenge to learn new things to keep up with rapidly changing skill demands. The survey finds that almost half (47%) of EU adult workers have seen the technologies they use change since they started their job; 21% also consider it very likely that several of their skills will become outdated in the next five years (European Centre of the Development of vocational training, 2015). This challenge could be one of the reasons why the attraction of more female workers should be one of the priorities for transport companies as well as the professional development programs for current workers.

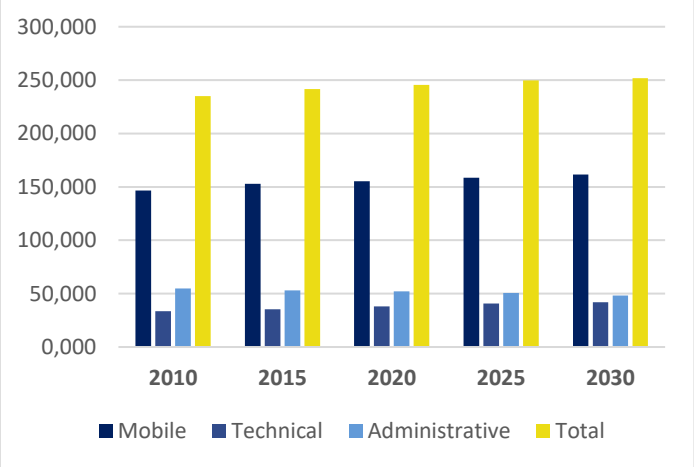

Figure 9 - Estimates of staff turnover by occupational group in the EU-28 (Source: Christidis, et al., 2014)

The same authors also identify another challenge for future employment perspectives in the transportation sector. While in theory, the retirement of older employees in transport will allow their substitution with younger, higher-skilled employees, the falling attractiveness of jobs in transport may be an obstacle in attracting sufficient employees with the appropriate skills (Christidis, et al., 2014). In general, it is evident that in ageing economies, as labour forces shrink and talent shortages emerge, women's integration into the economy is key to promoting dynamism (Daly, 2007).

The results presented in TInnGO Deliverable 9.3 shows that companies are aware of the limitations deriving from the absence of women, mainly in technical domains. The demand for this STEM (Science, Technology, Engineering and Maths) professionals is expected to grow by around 8% by 2025, much higher than the average 3% growth forecast for all occupations. Therefore, future recruitment of STEM professionals could help to overcome the existing gender gap and produce benefits in terms of equity and efficiency (Pirra, Carboni and Diana, 2020).

Thus, the process of increasing the interest of women in STEM disciplines should start to be promoted in early ages. Nevertheless, it is known that the combined effort of companies with education institutions, in particular universities, and secondary schools can make a significant impact in women's choices regarding these type of professions by giving examples and positive experiences to help deconstruct the existing stereotypes. In general, promotion actions to increase young women and female students' interest in STEM-related careers take place in public events, workshops and webinars.

3.2.2 The continuity

The gender equality promotion in all sorts of employment sectors is a challenging task which cannot be fully accomplished in a comparatively short period. Social prejudice or stereotypes that the women or male-dominant companies confront, they tend to be durable over time and are especially difficult to eliminate (Hamilton and Sherman, 1994).

According to Rothbart (1981), stereotypes may shift over time, influenced by existing beliefs. Therefore, the author presented two forms of stereotype change: the bookkeeping model and the conversion model. In the first one, "stereotypes are continually open to revision as new pieces of information, either confirming or disconfirming, are received; stereotypes change gradually if there is a steady stream of disconfirming information" leading to smaller changes in the future (Rothbart, 1981). In the second one, "stereotypes change suddenly in response to highly salient and critical pieces of disconfirming information" leading to no future change (Rothbart, 1981). Nonetheless, if new information puts in jeopardy the stereotypes, both models would engage in substantial changes creating new ones (Rothbart, 1981; Powell, et al. 2002).

This is one of the reasons why it is important to continue to apply effective measures to deconstruct existing sociocultural bias and build new narratives. Good practices, role models and examples are essential for reforming the general view of this industry and its members (Wai-Ling Packard, 2003). In other words, the essential changes and reorganization of the actors of the industry are as important as social changes.

3.2.3 Company policy and reorientation

It is important to note that the legal base along with the advisory material on gender discrimination and segregation is being spread worldwide under the Treaty on the Functioning of the European Union (TFEU), the Directive 2006/54/EC, the Directive 79/7 of 19 December 1978, the Directive 92/85 of 19 October 1992 and the European Commission project "Equality Pays Off". However, the effective application of EU law on equal pay at national level currently remains one of the biggest challenges and is crucial for tackling the pay discrimination and gender pay gap effectively (European Union, 2016).

In that sense, companies must understand the positive outcomes of changing their policies to include women and other vulnerable groups in their workforces, contributing to increasing the society's wellbeing. Although some companies have already started or are gaining momentum of reorientation, there still is space for further improvements to narrow those gender differences. While the emphasis is already put on social responsibility, it is vital in the future to inform the companies on the other benefits of being gender tolerant as well. The European social partners in the urban public transport sector (UPT), the International organisation for public transport authorities and operators (UITP) and the European Transport Workers' Federation (EFR) have identified the most significant positive outcomes to increase the attraction of female workers (European Union, 2016):

- Strengthening women employment in urban public transport - benefits: More women mean more talents integrated into the company, a broader view on innovation, more additional and complementary skills like people-orientation or communicative skills of women;
- More women working in typically male-dominated sectors usually improves the working conditions for all: it contributes to a better work environment and sense of respect and thus an improvement of the attractiveness of the job;
- The demographic change creates a problem for companies, and they cannot afford to do without women;
- It is a matter of equal opportunities: more women in public transport contribute to enhance the image of public transport companies and the sector (European Union, 2016).

The evidence on positive outcomes of female inclusion to the various male-oriented sectors should not be questionable. According to the World Economic Forum, there is a correlation between gender equality and GDP per capita, the level of competitiveness and human development (World Economic Forum, 2014). Steinberg and Nakane (2012), show that a one standard deviation increase in the education level in OECD countries is associated with a three percentage point increase in female labour force participation. Despite these positive results of women employment in the sector, there still are countries (even in Europe) which apply legal restrictions on women's employment in the transport sector (Iqbal, 2018). Following this, the companies and governments might address unequal gender distribution in their companies not only because of their social responsibility but to also harness the expected economic benefits of a more diverse workforce.

In Annex I Table 7 provides a literature review about measures for recruitment, retaining and development for women in the developing transport sector.

4 Behavioural modelling framework

Following the bottom-up perspective adopted in TInnGO project, primary information on mobility behaviour of women and their perceptions was collected. Therefore, information was collected from groups of women with different characteristics through interviews, focus groups and workshops in four European TInnGO Hubs (UK, Portugal, Spain, and Greece). The goal of these activities was to explore the needs, thoughts and feelings related to their mobility experiences, to extract information from possible barriers and potential improvements that could serve transport operators to make the transport system better and more gender-equal.

4.1 Focus group design and phone interviews

All the activities took place from November 2019 until February 2020. Regarding the focus groups and interviews, they followed a common (but flexible, according to the Hubs issues to be studied) structure as it can be seen in Figure 10. Unfortunately due to the crisis of the COVID-19 pandemic, it was not possible to perform other activities that were scheduled for March 2020 in the remaining TInnGO Hubs.

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 transports;

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 10 - Focus group guidelines

The results of these activities will help revealing information on the specific transport requirements of women and also assess their perceptions towards new technologies. In this way, insights on mobility behaviours will be extracted to design a survey with aspects that can

be modelled to explain and predict mobility behaviours. Consequently, the data collected will assist in the design of the survey to be later on applied to all the hubs.

4.1.1 Reported experience in the Greek Hub

A study performed by the Hellenic Institute of Transport (HIT) and the University of Thessaly in three major Greek cities (Athens, Thessaloniki and Volos) showed that men and women prioritize the quality of a set of service indicators differently, with women giving higher importance on all quality indicators compared to men.

In the TInnGO project, the Greek Hub aims to improve accessibility, customer care and, enhance comfort, safety and security all with focus on public transport and women travellers. Therefore, the hub aim at analyzing the transport requirements of inmigrant women and women with children, and also the travelling patterns of women using private cars. During the project, it will be focusing on the role of women as passengers on aspects of paramount importance, such as accessibility, customer care, comfort and security.

In order to assist in the TInnGO survey design, focus groups were conducted in February 2020 in LEVER's headquarters, the 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, participants reported a decrease in the offer and quality of bus routes on 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 as it can be observed in some women's quotes in Figure 11.

"The situation seems to get from bad to worse every day with the buses in Thessaloniki"

"I start from my home and no one knows what time I'll manage to arrive at my work and vice versa"

"Today I could not get into the bus because it was too crowded, and it was impossible for me to use it"

"Nowadays its similar to third world country, experience is tragic and ruins the quality of life for me as a passenger "

Figure 11 – Quotes from the Greek Hub focus group

The group pointed out weaknesses in the bus system such as "delays", "lack of connection in certain areas" and "inappropriate bus driver professional behaviour" which results in uncomfortable rides and lack of appropriate solutions for disabled groups. Even though three

of the six participants use the bus at least once a day. Furthermore, 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.

The perception of Thessaloniki participants was that many robberies occur in bus stops and that the primary victims are older women. Moreover, they feel that the risk of sexual harassment inside the buses is high. This group of females also stated that they avoid travelling at night, even though they have never had a bad experience. To overcome this issue, they suggested adding more lighting to bus stops and the presence of security.

4.1.2 Reported experience in the Portuguese Hub

The TInnGo hub in Lisbon focuses on the special needs of different groups of women, safety and security of women in public transport and public spaces and the functional needs of different ages and conditions.

In order to assist in the TInnGO survey design, focus groups were conducted in October 2019, in EMEL's headquarters, the TinnGO hub leader for the city of Lisbon, a local mobility and parking company with six women that work for the company with different ages, marital status and lifestyles. In addition to questions about the perception of transport system conditions as users, it was also asked these participants to describe their experience as women working in the transport sector.

The participants considered the public transport service essential in work-home trips, and it was necessary to increase PT supply, as it can be observed in Figure 12. In general, the group preferred to use public transport over private transport. In this case, their choice seems to be influenced in the one hand, due to a specific measure taken by the government of reducing the price of the PT passes in the Lisbon Metropolitan Area (AML). On the other hand, by the practice of EMEL in paying its workers their monthly PT pass. Additionally, these women stated that the use of public transport with trolleys for kids was very uncomfortable in public transport modes.

"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 12 – Quotes from the Lisbon Hub focus group

In Lisbon, security was an issue for all women participants. It was expressed that trips in dark hours (with no sunlight) are avoided in general and especially along some specific train lines, in certain areas, to avoid being assaulted or sexually harassed when men do not

accompany them, as it can be observed in Figure 13. Like Greece, these women consider lighting and the presence of security essential to reduce cases of assault or harassment.

"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 13 – Quotes from the Lisbon Hub focus group

The use of shared services such as Uber was designated as a safer and more comfortable option when comparing to both public and private modes of transport because it eliminates the need to look for a parking spot and walk at night from transport stops to home. Additionally, these type of applications provides information about the drivers (name, foto, customers' ranking) and the journey itself on real-time, increasing the feeling of security.

Moreover, as female workers of a transport company, they were asked about their experience working in a mostly male-dominated sector. How they felt when carrying out their daily parking enforcement duties. These women expressed their disappointment, as they have the perception that they are usually subject to more aggressive reactions than their male colleagues when giving parking tickets. Throughout their day, they also felt that people, in general, look to them in a suspicious and judgmental look when travelling in PT in their uniforms, as it can be seen in Figure 14.

"The lady who passes parking tickets"

"I was harassed and insulted because of my job"

"Parking enforcement officer isn't an authority like the police"

"With EMEL uniform I feel the eyes focused on me in public spaces"

Figure 14 – Quotes from the Lisbon Hub focus group

4.1.3 Reported experience in the Spanish Hub

The TInnGo Hub in Valencia focuses on adapting service provision for women, safety and security issues and women´s employment and working conditions. Their main objective of the Spain Hub will be to improve the situation of women concerning transport services: safety and security and working opportunities.

In order to assist in the TInnGO survey design and the hub's goals, a workshop was conducted on the 24th of September of 2019 in Valencia by ITENE, the TinnGO hub leader for the city of Valencia, a Technological Center in the fields of packaging, logistics, transport and mobility. The event aimed at discussing the possibilities of adapting transport services, safety, and employability, from a gender perspective, as it can be observed in Figure 15.

Figure 15 – Activity announcement

The workshop was comprised of two parts, and it had ten participants from different transport-related sectors. During the first part, the Vice-President of the Regional Government introduced the topic, followed by a presentation of the TInnGO project and the Spanish hub made by ITENE. In the second section, more dynamic and collaborative, activities were planned to foster collaboration, interaction and sharing of different opinions among the participants. These activities were:

- Public transport assessment;
- Security and accessibility in transport analysis;
- Work environment in transport investigation.

Through this workshop to the best types of transport based on a set of indicators (punctuality, safety, comfort, accessibility, reliability, cost, routes/capillarity and user-friendliness) were analyzed. As one would expect, the means of transport that scored best on almost all indicators were private means, private cars, and private bicycle, but they were poorly classified on important and decisive points such as comfort and safety in the case of the bike and, in terms of costs in the case of the car, as it can be observed in Figure 16.

Figure 16 – Workshop results on PT assessment

Shared modes of transport like shared bicycles or shared scooters were not well seen in terms of safety, reliability, or user-friendliness; these modes of transport were characterized as “difficult to use” and the perception of this group of people is that they “are not treated with care” or subject to great control, possibly because younger groups of people use them. In respect to 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.

Based on the chosen mode of transport, the metro, an exercise was carried out to characterize the experience of an individual in the use of public transport 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 in them. The participants suggested that the dissemination of messages announcing that passengers are being observed in the platforms could be a measure adopted to increase the sense of security.

The main objective of the last activity was to analyze the role of women employees in the transport and logistics sector and assess how to increase the percentage of women employed in these fields. This stage focused on the following topics: education, working conditions and services adaptability to vulnerable groups. Additionally, participants could suggest other topics to be discussed. From the debate, a set of measures emerged intending to improve the transport sector with a gender-perspective approach, as can be seen in Table 1.

Education	Working conditions	Services adaptability	Other
Female referents visualization	Equity opportunities and salary	Empathy	Create a community/network that provides visibility and knowledge of sector data
Gender education at school and home	Grants to the employer who hire women	Understanding	Skills training. Converse skill
Values education	Upgrade the facilities with a gender perspective	Possibilities for a more diverse group of people	Equal policies
Visits at schools by referents to give a speech	Training for all, in inclusive language	Lower handles for disabled people	
Student visit companies and offer internships	Family conciliation for men and women	Citizen's perspective (including the most vulnerable ones)	
Gender education for teachers	Flexible timetables		
Projects in all educational stages (stereotypes, roles, equality)	Internal formation to provide access to women to a department with less gender balance		
Common school games (playground/dining room)	Gender and equity education to the managers		
Promote STEM degrees among female students	Equity plans		
Education is empowerment	Opportunities: diffusion and visibility		

Table 1 – Actions required to increase women presence in the transport and logistic sectors

4.1.4 Reported experience at the UK Hub

In the TinnGO project, the UK Hubs' focus is to understand and prioritize the addressing of women's transport needs in rural and urban areas, to increase the interest of policymakers and operators.

In order to assist in the TInnGO survey design, telephone interviews were conducted between March and April 2020 by the West Midlands Hub to three women with ages between 60 and 93 years old living in rural areas. The goal was 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 options available to access healthcare and support services. Moreover, the researchers wanted to understand what were the sensations when using the chosen modes of transport, and regarding public transport, what the perception of the quality and security of available routes and the extent to which available public transport meets their

needs. Figure 17 shows the results of the telephone interviews about the mobility patterns of these women, the modes of transport used, the main reasons for travelling, 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.

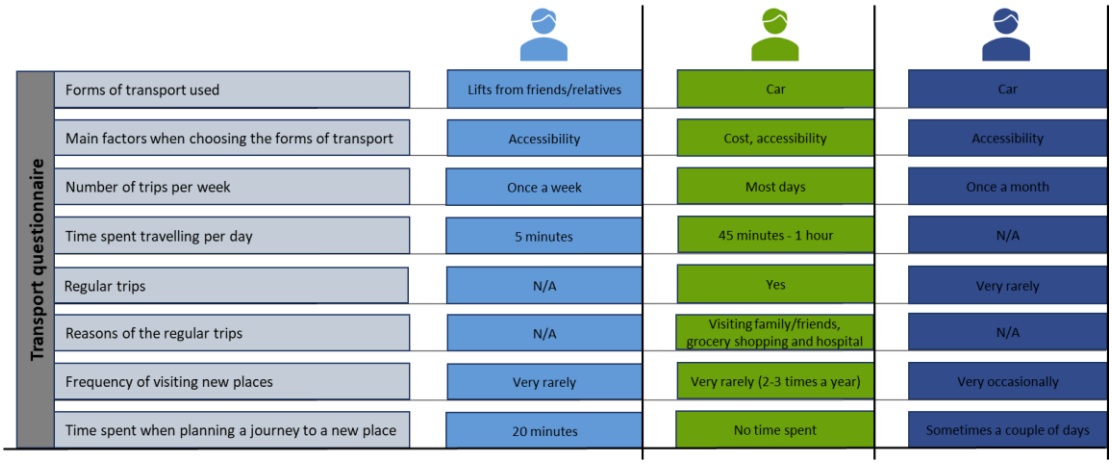

Figure 17 – General questions and responses about transport choices and needs

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 that they could not travel by PT at night because they felt insecure and they put forward two measures that would make them feel safer, the presence of responsible people in the transport and the creation of coaches only for women in the train, as can be observed in Figure 18.

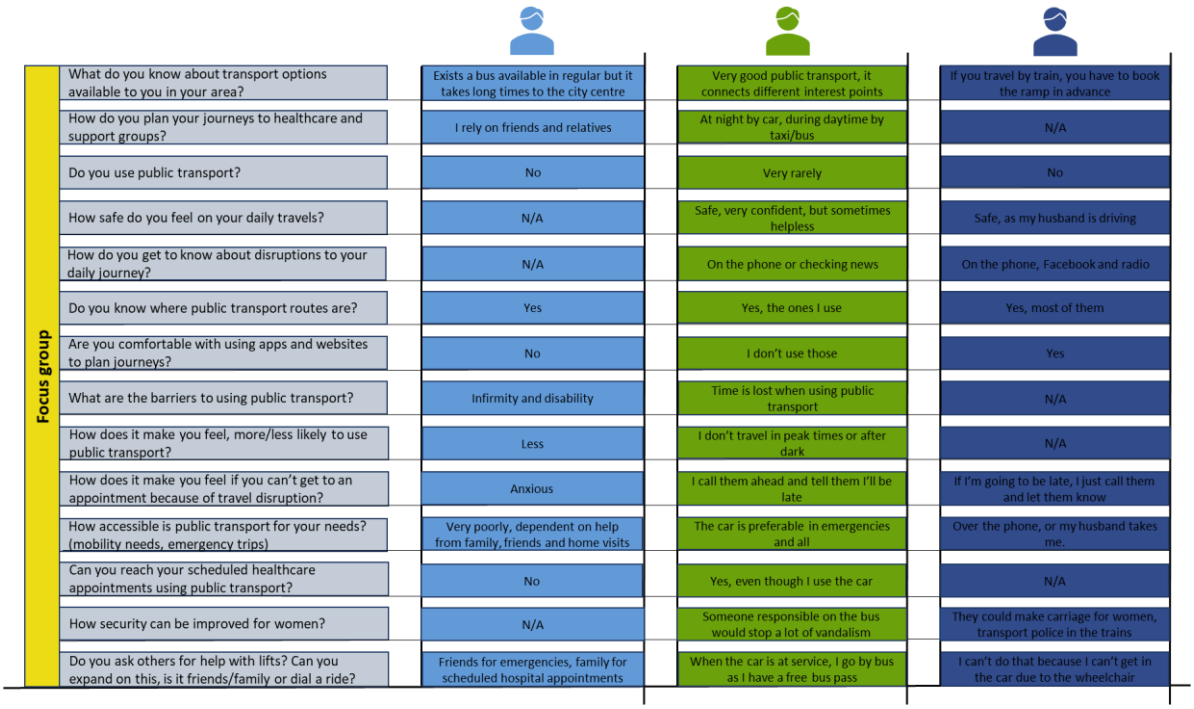

Figure 18 – Questions and answers related to the accessibility of older women to health care and support services

4.1.5 Conclusions

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

- Presence of security officers in stations, bus stops and inside vehicles;
- Brighter stops for avoiding any kind of attacks and modifications inside buses to customize in vulnerable users like pregnant women, women with children and elderly women;
- Allowance of feedback from passengers;
- Improvement in accessibility conditions for elderly and disabled people;
- More attention to schedule and time plan;
- Train drivers to improve their behaviour.

4.2 Survey design

This study aims to explore the effects that the intrinsic/ socio-economic/ background characteristics of an individual have on the way they move and how they affect their ability to integrate into society and access employment opportunities. Therefore, the role of the transport system in different environments will be explored, the way the same transport system affects

individuals with different attributes and the impact of these attributed on perceptions and evaluations of this transport system will be analyzed.

Consequently, the objective of this survey is to explore the mobility patterns and main mobility drivers of the ten hub countries involved in this project and understand:

- what are the differences between the mobility patterns of men and women;
- what are the differences in terms of the perception of the quality of the mobility options available;
- to what extent the available transport system meets women's mobility needs.

The survey builds on the information obtained through the focus groups, telephone interviews and the workshop, besides relevant literature review such as the METPEX project, as mentioned previously. Its design aims to encompass all indicators that can characterize mobility experiences in European cities and measure perceptions of the mobility and transport system, satisfaction with them, and the intention to use new services. Motorized and non-motorized modes will be analyzed for their service infrastructure and characteristics to the population, and gender requirements and differences will be identified. 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 to gender-equal mobility opportunities. Disaggregated information on each user will be collected using the most common journey as a basis:

- socioeconomic indicators (e.g. gender, age, social level, education, ethnic origin, family composition, accessibility to the car);
- mobility choices (e.g. modes used for commuting, shopping, amongst others), the possible alternatives and the reasons behind the choices;
- trip characteristics (e.g. travel time, stops included);
- perception of safety and security at all the trip stages (access, egress, on-vehicle);
- satisfaction levels with the transport infrastructure (e.g. lighting status of paths to transport stops, bus vehicle design friendliness for kids trolleys);
- satisfaction levels with the mobility service (e.g. connectivity, time reliability);
- intention to use new mobility services that could enhance accessibility to transport (e.g. shared services with autonomous vehicles);
- perception of specific features included in transport systems to increase safety and security (e.g. use of operator applications to communicate security risks on-vehicle);
- employment opportunities of women in the transport industry;
- employment conditions and satisfaction of women within the transport industry.

With this last set of questions, the aim is to understand what the perceptions of different groups of people regarding possible measures to improve the current transport system. Additionally, the research team will try to understand what is failing in disseminating some relevant measures that could impact positively vulnerable groups. Finally, the employment status between men and women will be analyzed.

The data collection will occur through campaigns via web and smartphone applications and will be launched and managed by the platform developed and employed in the METPEX project. Furthermore, each hub will provide data on employment and other economic factors.

The data collection aims to comprise a European database on gender experiences in mobility, perceptions of new technologies and their potential impact, and women´s opportunities for employment in the transport sector. It will allow the development of models that will identify differences in gendered experiences.

4.3 Modelling gendered mobility behaviour

Based on the insights of the literature review, the review of past practices, the focus groups, interviews and the workshop the most pertinent aspects to gendered mobility experiences and employment opportunities have been identified. The survey application serves the collection of disaggregated data on citizens which can help transport planners identify individual needs, cluster citizens according to their requirements and a modelling that embraces multiple methods approach can constitute the base for mobility service design per citizen cluster.

At first, in a European level, citizen clusters will be identified based on their satisfaction with the mobility systems they have available and their characteristics and their intention to use new mobility services that could enhance their experiences. A cluster analysis will be applied to explore possible cluster. Then underlying factors will be identified for the perceptions of people of the current and the envisioned future systems based on a factor analysis. The level of satisfaction with the current systems and the expected level of engagement with new technologies will be modelled. The methods, in this case, include bivariate and predictive models. The results are expected to identify the mixed effect of gender, social, cultural and other aspects on the perception of the respondents.

In a second level, attention to each TInnGO hub will be given. By focusing on each city, it will be easier to identify needs when comparing the experiences of people with the same availability of transport options and mobility opportunities. At this point, specific policies and interventions to the transport services provided will allow transport planners and mobility operator managers to assess the potential impact of their decision-making outputs. The close collaboration of the research team and the TInnGO hubs, which have the knowledge of the specificities of each city and have a common sense of cultural issues, will allow the proper interpretation of the results of the modelling approaches. Cluster and factor analysis, bivariate

and predictive models will be complemented by an agent-based approach in which the impact of possible changes in the transport system will be assessed based on current mobility data in each city.

5. Conclusions and discussion

Increasing women's confidence in the use of transport systems seems to be an essential step in the creation of a more equal and non-discriminatory model, which involuntarily does not discriminate. The dissemination of campaigns regarding gender violence in public spaces and offers, for example, a number where victims can call seems to be an option to increase awareness and confidence of all users of the various modes of transport. Additionally, it is necessary to assure lively waiting areas in which they could feel comfortable, appropriate street lighting along the way to the next stations, friendly drivers and PT staff they trust. The sharing of good practices and experiences between the competent bodies, and cooperation between the various countries is also a solution. The provision of an environment in which female customers could feel safe and secure all along their journey is a fundamental point to attract and retain females customers. Such goals could also be achieved involving women at all levels of public transport development, as decision-makers, planners, as well as civil society leaders to understand better and address their daily concerns.

In general, PT is perceived as a very reliable option despite the dependency on the schedule: the use of apps and online services to check the times beforehand seem to be rather everyday habits (Kawgan-Kagan and Popp 2018). The main issues are related to the physical barriers related to travelling with this means (Hasson and Polevoy, 2011). The lack of storage space for strollers and the difficulty of bringing packages into the vehicle and storing them is mainly affecting women, due to the reasons behind their journeys. These issues cause them to avoid using PT when travelling with children, commonly because of a lack of (private) space for children, no barrier-free stations, and all the equipment that they need to take with them because of the children (Kawgan-Kagan and Popp 2018).

It should be noted that one of the main barriers of accessibility is the lack of connectivity between different modes of transport, mobility solutions need to be integrated and thought out together to increase the choices available. Thinking about mobility in the future only as user-centric may prove to be the enemy of inclusiveness and environmentally friendly solutions and according to Uteng (2019), it is especially important to distinguish between rural and urban areas. Thus, all solutions must be regulated and integrated into the bigger picture (Pangboune et al., 2020; Wong et al., 2020). Nonetheless, the lack of knowledge about mobility patterns and the needs of all users remains a barrier to the policy-making process. The mobility of a place must be planned to take into account all angles and with the participation of the whole

mobile population, mainly by the most vulnerable groups, since they are the ones who are most subject to the least effective modes of transport (CIVITAS, 2016; Inclusion, 2018; Pangbourne et al., 2020).

In addition, the evolution and availability of the technology are changing the transport sector, and with it, the options for shared mobility are expanding, and the use of autonomous modes of transport in both passenger and freight is already a certainty in the future (Wong et al., 2020). With the expansion of cities and the changing mindsets of new generations, modes that have less impact on the environment and do not require commitment from the user are becoming increasingly popular (Kanota et al., 2020). Furthermore, safety will be one of the aspects that will benefit the most from technological development by, for instance, making easier to victims to report incidents, to authorities to locate them and to hold criminals accountable for their behaviour, increasing thus, the security perception of users, especially the most vulnerable ones (ITF, 2018).

Therefore, mobility plans should be more specific, produced according to the characteristics of each location and taking into consideration the advances of technology. Therefore, TInnGO project aims at producing tools and reports that can help the competent authorities in the decision-making process.

Regarding women's participation in the transport sector, there are several barriers when accessing job opportunities, but also to maintain and grow as female transport professionals. The change in society in the allocation of roles to specific genders is still a barrier to building a fair system, since women have a double burden, while men are used to sticking more with their breadwinning role, rather than taking equal responsibility for household and family work (Scheiner and Rau, 2017). Changing these mentalities and behaviours should be encouraged through education and the increase of awareness of gender disparities. An Italian study demonstrates that most women without educational qualifications live with their families and rely on other people to drive them (Cristaldi, 2005). Instead, graduates from secondary schools or universities are commonly using a broader range of means of transport.

The most relevant information on the topic has been developed mainly in the last decade, according to the proposals of a few ground sources: “Promoting the employment of women in the transport sector - Obstacles and policy option” (Turnbull, 2013), the program “From Membership to Leadership – Advancing Women in Trade Unions” (ETUC), Women in Transportation (Hanson and Murakami (2010) and Attracting and Retaining Women in the Transportation Industry (Godfrey et al., 2019).

Moreover, it is vital to understand that future employment will be associated with the ability to quickly learn new skills for the employee and the efforts to ensure the possibility to develop the staff for the employers. Hence, broader training programs, along with the gender-oriented inclusion, will significantly influence further employment tendencies.

International experience shows that poor accessibilities to transport can be an outcome of poor planning as well as a cause and a product of economic and social disadvantage and exclusion. Nevertheless, without proper and detailed gender statistics, correct identification of the problems, equal gender involvement in the decision-making processes, appropriate gender impact assessments and robust data that characterise women's lives and their daily commuting, it is not possible to improve planning with a gender perspective approach (CIVITAS, 2016; Gauvin et al., 2019).

The understanding of 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, TInnGO project adopts a modelling approach that embraces multiple methods for the understanding of women's needs in terms of mobility that could reflect in better job opportunities, the formulation of new datasets and the deduction of policy-related conclusions to be employed in future planning.

6. Annexe I

The following tables collect reviews of material related to the topics treated in chapters 2 and 3.

Source	Transport mode	Results	Country
Twaddle, H., Hall, F., Bracic, B. (2010)	Bike	Because safety is a considerable concern for potential cyclists, women particularly, the occurrence of falls and collisions will be analysed to determine if the frequency of either is related to the gender or age of the cyclist.	General
Kawgan-Kagan, I.; Popp, M. (2018)	Bike	Although the respondents like the flexibility of being able to spontaneously go to places, there is another safety issue that comes along with sharing the public space with cars and other cyclists.	Berlin, Germany
Benedini, D.J., Lavieri, P.S., Strambi, O (in press)	Bike	Certain segments, such as women, find the bicycle lane separation more important than other segments, but no group prefers to ride in mixed traffic. It is also known that women are more safety conscious and, therefore, a clear separation between bicycles and motorized traffic may be an especially important feature for women to consider the use of bicycles.	Brasil
ITF (2018)	Car driving	In road safety, for example, while the EU has made major progress over the past decades, far more men than women are killed in road crashes: only 24% of all road fatalities are women, while the proportion of male drivers killed in road accidents is over 80% in some countries. There are many reasons for this, but one important element is perhaps that women tend to adapt their behaviour to avoid risks.	General
del Mar Alonso-Almeida, M. (2019)	Car-sharing	Trust, utility and safety as important issues for women in this new form of mobility	General
Fyhri, A., Johansson, O., Bjørnskau, T. (2019)	E-bikes	Older women have been suggested as a group with particular high risk while riding e-bikes Females who cycle longer distances and who use an e-bike are more likely to be involved in accidents. E-bikes have the ability to accelerate faster than conventional bikes, which could be a factor contributing to explain the elevated risk for females we have found E-bikes run at a higher average speed than conventional bicycles, particularly among women. Moreover, women are more at risk on e-bikes than on conventional bicycles. Hence, the increased speed may be an important risk factor behind the higher risk of women on e-bikes. If women are more prone to be scared away from cycling by an accident than males, this will have the result that female accident victims will systematically report a lower exposure than their male counterparts, which again will artificially inflate females' relative risk. The same would hold for e-bike users vs. conventional bike users. There was a slight tendency for women to reduce their cycling more than men following from an accident, but this was not significant	Norway
IRS (2012)	Private vehicles	The question of safety also arises with regard to the design of car parks	General

Bakran, M. (2018)	PT	Women tend to use public transport more than men and may feel exposed to physical aggression, sexual harassment or other unwelcomed behaviour	General
Hasson, Y., Polevoy, M. (2011)	PT	Personal security – Studies from outside Israel indicate that women are less willing to use public transportation after dark. Bus stops that are outside residential areas, in bad or remote neighborhoods, or in empty parking lots all affect a woman's decision about how and when to use public transportation	General
IRS (2012)	PT	Safety and security in public transport are also crucial issues that disproportionately affect women. To take account of safety problems, women should be allowed to use public transportation closer to their final destination, even if outside the normal bus stops, in the evening and at night. The provision of adequate lighting is also especially important in this respect. Awareness campaigns aimed at both bus drivers and passengers should also be promoted to improve women's safety.	General
Yavuz, N., Welch, E.W., (2010)	PT (train, transit)	Findings from this study indicate that, compared with men, experience with safety problems tends to affect women's perception of safety the most in the transit environment. In addition, female passengers tend to be concerned about social incivilities in the transit environment, while they are less likely to be comforted by the presence of video cameras. Accordingly, increasing periodic random police or security personnel presence, employing greater enforcement of the rules on the train and/or in the stations, preventing overcrowding in transit vehicles, preventing loitering and soliciting and other social incivilities, and making operators and customer assistants/staff more available and visible to handle such problems when they occur may help to alleviate concerns about safety more for women.	Chicago, USA
Singh, Y.J. (2019)	Ride hail	Even though there is not enough research on the impacts of ride-sourcing, there have been reports of some considerable safety setbacks as cases of drivers sexually assaulting female passengers have emerged from across the globe. These have led to increasing demand for safe transport services for women and many women-only ride-hailing services (exclusively women drivers and passengers) have been launched in various countries	General
IRS (2012)	Walking, PT	As women walk and use public transportation more than men, the existence of pathways in cities, as well as safe pedestrian crossings, is very important for both safety and comfort; bus stops and the paths leading to bus stops must also take account of women's needs, and in particular accessibility to transportation vehicles and safety.	General
ITF (2018)	Walking	Among pedestrians, however, almost twice as many women are killed as men. Women walk more than men and tend to make more off-peak and non-work related trips. Women are more vulnerable to violence and harassment in public spaces. Often, women modify their behaviour to feel safe walking, e.g. don't walk at night or alone or talk on the phone while walking	General

Table 2 Review of material concerning safety and security

Source	Transport mode/ mobility service	Results	Country
Prati, G. (2018)	Bike	The wider body of evidence is of a strong relationship between overall levels of bicycle use and women's cycling. Indeed, women's participation in transport cycling in high-cycling countries may be due to their relatively high-quality cycling infrastructure. In comparison with men, women are more likely to make escort trips or travel with heavy objects. These trip characteristics are all less suited for bicycle travel. The birth of a child is associated with a larger decrease in bicycle use among mothers than fathers	General
Sottile E., Meloni I., Piras F., Diana M., Pirra M. (2020)	Bike	Barriers to bicycling appear to be particularly acute for women who continue to take significantly fewer trips by bike than men while several studies found males are more likely to cycle than females	General
Bourke, M., Craike, M., Hilland, T.A. (2019)	Bike	Findings suggest that perceptions of neighbourhood cycling convenience is positively associated with transport cycling in women but not men. Therefore, to increase rates of transport cycling in women it may be effective to develop or improve cycling networks that connect to shops, services, and schools within local neighbourhoods. Findings also showed that there was an association between perceived descriptive norms and transport cycling which was not moderated by gender	Melbourne, Australia
Kawgan-Kagan, I.; Popp, M. (2018)	Bike	Biking seems a feasible and healthy option to go to nearby places. For further trips, there is a problem that leads to arriving sweaty at work.	Berlin, Germany
Twaddle, H., Hall, F., Bracic, B. (2010)	Bike	Previous literature specifically dealing with commuting by bicycle found that women are more likely than men to identify feeling unsafe as a cycling problem Women tend to commute by bicycle less frequently than men do in countries where bicycle commuting accounts for a small portion of the total number of trips made. However, this is not the case in countries such as the Netherlands, Denmark, and Germany, where commuting by bicycle accounts for a large portion of total trips made, and women cycle as often as men do	General
Chataway,E.S., Kaplan, S., Sick Nielsen, T.A., Prato C.G. (2014)	Bike	Fear of traffic is significantly related to gender, car frequency use and number of monthly cycling hours. Male cyclists are linked to lower fear of traffic in comparison with female cyclists	Brisbane, Copenaghen

Benedini, D.J., Lavieri, P.S., Strambi, O (in press)	Bike	Females present lower cycling frequency propensities for both work and non-work purposes. As discussed earlier, multiple studies indicate that women are less likely than men to use bicycle as a transportation mode (in countries where the mode share of bicycles is low), but research also shows even when they do, they are prone to lower frequencies. Women who foresee financial benefits as a motivating factor of bicycle use, have a higher propensity to undertake non-work purpose trips by bicycle than other women or men.	Brasil
Wang, K., Akar, G. (2019)	Bike sharing	The spatial characteristics of the surrounding environments at bike share stations, in terms of bike share and bicycling facilities, land use and built environment characteristics, public transit services, may influence the gender disparity in bike share usage.	General
Wang, K., Akar, G. (2019)	Bike sharing	We find that the length of off-street bike routes, number of benches and bicycle racks, intersection density, and green space are significantly and positively associated with the proportion of bike share trips made by women Our findings suggest that female bike share riders are more sensitive to traffic conditions and are less likely to make bike share trips for commuting as compared to their male counterparts. Both the number of bus stops and the number of subway entrances around bike share stations are negative predictors of the proportion of female bike share trips. The results imply that men may be linking bike share usage with public transit services more often than women	New York city, USA
Zhang, L., Zhang, J., Duan, Z.-Y., & Bryde, D. (2015)	Bike sharing	The bike-share service in the city of Zhuzhou introduced cycles with a baby saddle that helped parents carry children to school, parks, markets, etc.	Zhuzhou, China
Ma, X., Yuan, Y., Van Oort, N., Hoogendoorn, S. (2020)	Bike sharing	A gender disparity in Mobike commuters is revealed. Females are less likely to use Mobike for commuting. The unpopularity in female commuters toward Mobike may be due to heavy bicycle weight. To design a lighter bicycle may help to reduce the gender gap in Mobike commuting use	Delft, Netherlands
Singh, Y.J. (2019)	Car sharing	Newer services are offering compact electric cars that often have an occupancy of only two, which is also a deterrent for many	General
Kawgan-Kagan, I. (2015)	Car sharing, e-car sharing	The analyses of mode choice, the use and evaluation of e-car sharing as well as the attitudinal variables suggests that female early adopters tend to use car sharing services in the original meaning as an additional part for urban mobility and not for testing car models as much as men do	Berlin, Germany

del Mar Alonso-Almeida, M. (2019)	Car sharing	Women purposes for which they use car sharing services: shopping, transporting or accompanying children or others It seems that women feel generally safe when using car sharing services, more research into P2P car sharing involving more than two actors is required. Women use car sharing services to feel satisfied and because they want to be more careful about purchases and spending Take-up of car sharing is greater among men than among women. Car sharing use is recommended when the travel range is 15,000–18,000 km per year, use of a private car being better otherwise, and female drivers typically have smaller annual mileage than male drivers. Women's daily activities nowadays entail multiple destinations and they have to manage more complex trip choices than men due to their traditional social role: they typically having greater responsibility for the home, shopping and childcare. Women's trips are typically shorter but more numerous than those of men, whether independently, as half of a partnership, or as a family. Another reason why car sharing may suit women is that they often drive a household's second car and, due to the last financial crisis, new materialists cannot (or do not want to) spend money on a second car.	Germany/General

Kawgan-Kagan, I.; Popp, M. (2018)	Car sharing	Missing child seats is a common issue for families with smaller children An analysis of female early adopters of car sharing with and without battery electric vehicles showed an average age of 33 years, with an academic degree, full-time employment There was a bigger income gap between male and female early adopters, indicating that the costs of car sharing compared to car ownership play a bigger role for women than for men. A significant difference in mode choice: women used bikes more often and combined it with car sharing. Because more women than men use public transportation (PT), the combination of car sharing with bike riding or PT calls for further analysis. Although expected due to women's lower incomes compared to men, potential financial benefits of using car sharing with and without BEVs do not balance the needs women have for their daily mobility All our respondents talked about common issues they expect to face if they use car sharing – especially with children. They all said it is an environmental friendly way of transport but cannot imagine it as a part of their mobility. Car sharing services either with or without BEVs do not seem to be feasible with children because of several aspects. For none of the respondents, a financial benefit would balance the deficits of the use of car sharing with or without BEVs	General, Berlin (Germany)
Avermann, N., Schlüter, J. (in press)	DRT	The findings that demand responsive transport services are used significantly more by women cannot be confirmed in this case since genders in our observed study area are roughly evenly distributed at around 50% each. This might be due to the fact that in this particular case of rural Germany safety aspects might be not as relevant for women compared to larger cities. Therefore the added (safety) benefits from using a DRT compared to a regular bus service might not be that great. Another possibility to look at this finding is that the added benefits only really come to fruition if the options are between normal public transport and DRT rather than between car usage and DRT. If the existing bus transport service is so bad that (female) customers rely either way on the car there would probably be no relevant added safety benefit of using a DRT system. This could explain why we could not find any significantly higher usage by female customers.	Germany
Degele, J. et al. (2018)	E-scooter sharing	Three quarters of the e-scooter sharing customers are male, so interesting gender-related differences might exist to target in a segmentation The distribution of ride lengths in meter per gender displayed in Fig. 4 proves that gender hardly has any influence on usage patterns	Germany

Aguilera-García, A., Gomeza, J., Sobrino, N. (2020)	Moped scooter sharing	Gender and age would represent two critical variables, since most occasional and habitual users of scooter-sharing are males and aged from 26 to 34.	Spain
Kawgan-Kagan, I.; Popp, M. (2018)	Private car	We found that the practice of driving a car in urban traffic is another obstacle to overcome Car use was mainly because of transporting larger goods or being accompanied by children For respondents that grew up in a rural area, it was totally normal do get a driver's licence as soon as they were old enough. The combination with a car equalled access to greater freedom of movement. This is a common effect due to the poor coverage with public transportation schemes in rural areas We found two crucial factors of car ownership for women from urban areas: Routine (I always had a car) and responsibilities for others (children and/or parents in need). Latter includes aspects of safety, capacity, and watching them.	General
Dill, J., McNeil, N., Howland, S. (2019)	Private car	Women were less likely to reduce their use, as were people with inflexible work schedules. The number of children in the household negatively affected likelihood of reduced use	Portland, Oregon
Vance, C., Peistrup, M. (2012)	Private car	Several studies have found evidence for so-called patriarchal constraints in dictating first-choice of car use by men. Children and childbearing responsibilities seem to be of particular relevance as a mediating factor in this respect. While women are less likely to use the car than men, car access is equalized with the presence of children in the household	General/ Germany
Kawgan-Kagan, I.; Popp, M. (2018)	PT, technology	Women try to avoid using PT with children, which is not feasible due to a lack of (private) space for children, no barrier-free stations and all the equipment that they need to take with them because of the children PT is perceived as a very reliable option. The dependency on the schedule is not seen as problematic because our respondents use apps and online services to check the times beforehand. This helps to anticipate the situation in the first place and be prepared to waiting times Using a stroller is another issue: Some stations are not accessible with a stroller, so they would have to carry it up and down the stairs. In addition, they are afraid, that there would not be enough space in a train or bus	Berlin, Germany
Hasson, Y., Polevoy, M. (2011)	PT	Physical barriers: These prevent women from having easy and convenient mobility via public transportation while carrying small children, children's strollers, and packages. Part of the problem is the lack of storage space for strollers and the difficulty of bringing packages into the vehicle and storing them conveniently.	General

Habib, K.N (2019)	Ride hail/taxi	A taxi is preferred by older people, but younger people prefer Uber, and there is no gender difference in such a pattern	Toronto (Canada)

Table 3 Review of material concerning mobility choice set

Source	Transport mode/ mobility aspect	Results	Country
Kawgan-Kagan, I.; Popp, M. (2018)	Car driving	Urban women are more environmentally concerned although while women prefer going by car if there are children below the age of 12 years.	General
Kawgan-Kagan, I. (2015)	Car driving, PT	Women show greater awareness of environmental issues and have a more positive attitude towards ecological measures like reducing car use and using PT	General
Hanson, S. (2010)	Car driving, PT	Women's travel looks more like sustainable mobility than does men's travel: women travel shorter distances, make less use of the car and more use of public transit	General
del Mar Alonso-Almeida, M. (2019)	Car sharing, sustainability	Women may be attracted to car sharing by the promise of lower pollution and more efficient use of vehicles 2018).	General
Sovacool, B. K., Kester, J., Noel, L., Zarazua de Rubens, G (2019)	EV	Women reported higher levels of environmental awareness, as well as stronger preferences for safety and convenience, especially when they drive or own family cars	North Europe
Efthymioun, D., Antoniou, C. (2016)	EV, Car sharing	The results of a study that was conducted in San Francisco between 1996 and 1998 show that women who are attracted by electric car-sharing are mainly driven by environmental incentives, while men because they found the technical perspective of the service interesting, revealing that the system should not only be functional, but also have technological and environmental aspects	San Francisco, USA

Table 4 Review of material concerning sustainability awareness

Source	Transport mode/ mobility service	Results	Country
Barbour, N., Menon, N., Zhang, Y., Mannering, F. (2019)	AV, safety	The socio-demographic estimation results indicate that males were found to be less concerned about the safety of shared automated vehicles.	USA
Jiang, Y., Zhang, J., Wang, Y. (2020)	AVs	Gender does not matter to decisions regarding ownership	Japan
Berliner, R. M., Hardman, S., and Tal, G. (2019)	AVs	Men are early adopters of new vehicle technologies who, for example, are more likely to be interested in purchasing fully automated vehicles (AVs) than women	California, USA
Hohenberger, C., Sporrle, M., Welpe, I.M. (2016)	AVs	Women tend to have a lower willingness to use AVs than men because they anticipate higher anxiety from riding in an AV	General
Bansal, P., Kockelman, K.M., Singh, A. (2016)	AVs	Women are also less willing to pay for adding partial and full automation to their next vehicle. This lack of willingness for AV is not necessarily detrimental since it could mean that women are more risk-averse and tend to use new technologies once these are operational and consolidated.	USA
Kawgan-Kagan, I.; Popp, M. (2018)	BEVs	BEVs are perceived as being easy to handle but due to a lot of innovative technical features, they seem less attractive to women, they do not match the pragmatic approach of urban women's mobility	Berlin, Germany
Berkeley, N., Jarvis, D. and Jones, A. (2018)	EV	Women are more sceptical about the readiness and reliability of EV technology and infrastructure than men. This may be linked to levels of interest in technology generally, and vehicle technology in particular, but could also reflect personal safety concerns linked to the perceived potential to be left 'stranded' by the lack of reliability or range of an EV.	UK
Sovacool, B. K., Kester, J., Noel, L., Zarazua de Rubens, G. (2018)	EVs	Women have less driving experience of electric vehicles (EV) and interest in owning an EV compared to men. Women attached more importance to ease of use, safety, cost and environmental impact and charging option than the range an EV can drive, which was important to me	North Europe
Sovacool, B. K., Kester, J., Noel, L., Zarazua de Rubens, G (2019)	EV	Men reported greater usage rates for cars and EVs, greater chances of ownership, and greater distances travelled every day via a private car. Quantitatively, most of these show a statistically significant, yet modest impact on differences between the mean for men versus women. The exception with a very strong effect is stated EV ownership, for which twice as many men as women own an EV	North Europe

Caiati, V., Rasouli, S., Timmermans, H. (2020)	MaaS	Females are more likely than male to subscribe to MaaS, although the difference between the estimated coefficients is relatively small, but significant. A possible explanation of this finding could be related to the fact that women tend to have a greater pro-environmental responsibility and have less intrinsic preference for driving than man	Netherlands
Liljamo, T., Liimatainen, H., Pöllänen, M., Utriainen, R., & Viri, R. (2020).	MaaS	Men were clearly more often familiar with MaaS compared to women, as 27.2% of men and 14.6% of women stated having heard or read about MaaS. On average women express less need or will for car ownership, if a competitive mobility package would be available, compared to men.	Finland

Table 5 Review of material concerning new mobility services

Source	Keywords	Results	Country
Manzi, G. & Saibene G. (2018)	Bike sharing	Women are less content than men with regard to both general and everyday technical aspects of the service, with a huge gap for the former. This is due mainly to the weight and functioning of the bikes, which are considered heavy and difficult to handle when picking and dropping them from/to the locks by female cyclists	Milan, Italy
Börjesson, M., Rubensson, I. (2019)	PT	Women are less satisfied with crowding and deem it more important than men. Women's lower satisfaction and higher importance might be a result of a more negative experience of crowding, due to security. The risk of harassments and unwanted touching probably increases with crowding. Moreover, women are on average shorter than men, and shortness make crowding more of a nuisance, making it hard to reach poles and grab handles, not having free sight lines when standing among taller people.	Stockholm, Sweden
Abenoza, R.F.; Cats, O.; Susilo, Y.O. (2017)	PT	Sense of security and cleanliness are important factors in determining travel satisfaction for women	General
De Oña, R., López, G., De los Rios, F.J.D., Oña, J., (2014)	PT (bus service)	Cluster 1 defines a passenger that is women, young, that travel for studies reasons, that their trips are frequent, using a consortium pass, and they do not have available a private vehicle. For this sort of passenger, the most important variable was the Punctuality In the case of Cluster 2, represented by middle age women, travelling frequently for occupation reasons and using the consortium pass, the most important variables were the Frequency and the Information	Granada, Spain
Lois, D., Monzon, A., Hernandez, S. (2018)	PT, safety	Our data shows gender differences in safety perception since women (particularly younger women) feel less safe inside the interchange	Madrid, Spain (Moncloa transport interchange)

Table 6 Review of material concerning satisfaction with mobility choices

The nature of the barrier	The source	The type of barrier
Lack of Job Opportunity Outreach	• Alexander, A. (2020) • Giannelos, I. et al. (2018) • Wai-Ling Packard, B. (2003)	Recruiting Women • Lack of women in visible management roles, limiting the ability to see potential • Negative perception of the job either through or driven by social prejudices that associate the specific job

		with a lower quality of life, lack of career development, the expectation that experience is expected for certain jobs in the sector or other unappealing characteristics. This is a barrier for both genders. However, the expectation of poor career prospects discourages especially newcomer employee groups • The lack of female role models which creates difficulties for men and women to envision women working in the transport field
		Retaining Women • Senior leadership positions predominately filled by men • Wage gap: gender discrimination in terms of wages, also resulting from unequal career prospects. Another driver for the wage gap is the fact that often women are employed in different positions than men which can be in less paid jobs or part-time positions.
		Developing Women Lack of awareness of the qualification process for promotions
Social Factors	• Alexander, A. (2020). • Giannelos, I. et al. (2018) • Pazy, A., Oron, I. (2001) • Pinarowicz, J. et al. (2011)	Recruiting Women • Traditional perceptions of gender roles (e.g., male versus female jobs);

		• Social belief that females are less suitable to perform the tasks demanded by the specific transport profession or that females would not fit in a male-dominant workplace.
		Retaining Women • Lack of support for women and Lack of development programs to enhance women's leadership skills. • Poor or none mentorship options to help women to enter and retain their position in the workplace. • Belonging to the female minority in the corporation opens the opportunity to appear so-called a token effect.
		Developing Women • Traditional ideas about women's roles in the workplace and lack of advancement opportunities (e.g., flat organizational structure) • Training lack of (visibility of) training opportunities for women to gain the relevant skills needed for the specific professions. This can also consist of a barrier for further career development and retention in the sector for women already in transport professions
Culture (Masculine)	• Alexander, A. (2020)	Recruiting Women

	• Singh, R. et al. (2013)	Masculine culture in some areas (e.g., operations) and a culture that does not incorporate or support women
		Retaining Women Exclusion, lack of support, sexist “jokes” or repeated sexual invitations.
		Developing Women • Masculine culture that has the perception that women are not as committed to the job • Male workers are having difficulties in accepting directions from women.
Safety Concerns	• Alexander, A. (2020) • (UITP) and (ETF) (2016) • Giannelos, I. et al. (2018)	Recruiting Women Fear of job requirements (e.g., operating a bus)
		Retaining Women • Phenomena of verbal and physical violence by third parties in urban public transport. • Safety concerns arise in transport modes where workers are vulnerable to violent behaviour. • Sexual harassment or sexual violence against women by colleagues, clients or managers as well as not desired physical contact
Inflexibility Regarding Accommodating Personal Responsibilities and poor adjusting of equipment and amenities	• Alexander, A. (2020) • Giannelos, I. et al. (2018) • UITP and ETF (2016)	Recruiting Women • Inflexible work schedules, little schedule control or changing working locations that do not support

		responsibilities outside of work • Lack of segregated dressing rooms, appropriate medical and toilet facilities as well as expected low the level of hygiene at these facilities.
		Retaining Women Lack of desired benefits (e.g., maternity leave and access to childcare) and Inflexible schedules and child leave policies.
		Developing Women Lack of desire to move into supervisory or management positions

Table 7 The major barriers for women to begin, maintain and develop the work in the transport sector

Category	Strategy
Attracting Women	• Conduct outreach about transit careers in schools. Communicate about transit careers in the community. Improve the image of transit as a career. Make the argument for gender balance as a core union priority. Review current hiring practices for gender-based stereotypes. Outline goals for recruiting women. • Recruitment policy: Address and welcome specifically women directly into the company. Negotiation of a recruitment procedure between the trade unions and workers' representatives. • Work-life balance: Introduce working time models that allow a better reconciliation of work and social/family life which include instruments allowing for the integrating of an individual's wishes and needs.
Retaining Women	• Address culture change. Improve organizational policies for addressing safety and health concerns (as an employee and as a transit user). Provide training and developmental support. Initiate networking opportunities. Improve accommodations for responsibilities outside of work. • Health and safety at work: Adapt occupational health & safety, workplace ergonomics, workplace security, and provide appropriate facilities like toilets, canteens, lockers, break rooms and changing rooms. • Equality in wages: Analyse the "gender pay gap" and develop policies to eliminate it. • Working culture and gender stereotypes: Change the corporate cultures from a male working culture to a diverse culture, sensitise the management on gender stereotypes and unconscious bias and include management, trade unions and workers representatives in the activities.

Developing/Advancing Women in Transit Careers	• Provide mentoring opportunities (or networking guidance). Outline steps to career development within transit work roles. Consider work assignment equality. • Qualification and training: Recruit young women for professional education, assure equal access for women to vocational training and avoid a “glass ceiling effect”. • Encourage the support of minority-focused scholarships, internships, and awards to increase the recruiting talent pool.
Overarching Strategies to Support Women in Transit	• Incorporate imagery or messaging of women in transit. Develop internships, apprenticeships, and pre-apprenticeships focusing on women. Establish a transit Women’s Action Council. Acknowledge women’s contributions to the transit industry. Reduce safety and health concerns. • Corporate policies: Set clear & measurable targets and develop instruments to implement them with a top-down approach. • Engage men to build a consensus for balanced gender representation. • Build union organization so that women’s activism, involvement, decision-making roles exist at all levels of the union. • Conduct or participate in recurring surveys to understand the effectiveness of the cultural diversity efforts in place. • Provide gender-disaggregated data.

Table 8 Measures for successful future recruitment, retaining, development

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