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Structuring the evaluation of the inclusion of women within the transport sector: A use case study based on the inclusion diamond model

Gemma Molero[a,*] , Sara Poveda-Reyes[a], Chris Blache[b], Rawad Choubassi[c], Ludovico Boratto[d], Maria Chiara Leva[e], Francisco Santarremigia[a]

[a] AITEC, Parque Tecnológico, C/ Charles Robert Darwin, 20, Paterna 46980, Spain
[b]GENRE ET VILLE, 69 Rue Haxo, Paris 75020, France
[c]Systematica Srl, via Lovanio 8, Milan 20121, Italy
[d]EURECAT, C/ Bilbao 72, Barcelona 08005, Spain
[e]Technological University Dublin, Grangegorman lower, Dublin D07 H6K8, Ireland

Abstract

The transport sector is a sector dominated by men. Social norms and conducts have hindered the development of women under equal opportunities. Women have dealt with discrimination in recruitment procedures in job positions that have been historically developed by men or have suffered more sexual harassment in public transport than men. Women participate in different roles within the transport sector. In this paper, a series of goals and fairness variables for women's inclusion are defined according to the DIAMOND methodology for four different real-world scenarios: as users of public transport infrastructure, as users of autonomous vehicles, as users of bicycle sharing services, and as workers in railway companies and freight transport companies. Further developments will focus on the analysis of gathered data, the definition of inclusion factors, and the assessment of the other vertexes and layers of the inclusion diamond model.

Keywords: women, transport system, inclusive transport, gender, fairness, inclusion diamond.

[*] Corresponding author. Tel.: +34-961-366-969.
E-mail address: gmolero@aitec-intl.com

1. Introduction

Women interact with the transport sector in many different ways. Historical differences and a society mainly managed by men are the core reasons for current differences in women's inclusion in the transport sector and in many other facets of life. Crabtree and Nsubuga (2012) analysed how safe women feel in different countries. In Europe, 55% of women said they felt safe walking alone at night compared with 75% of men. In addition, 45% of women in the EU have experienced sexual harassment at least once during their lifetime, and 13% have experienced a harassment incident in the last 12 months (European Union Agency for Fundamental Rights 2014). Feeling safe and secure is fundamental in order to achieve a fair inclusion of women in the transport system.

With the aim of reducing these differences, the EU is putting a lot of effort into the analysis and development of measures for a higher and fairer inclusion of women in the transport system. According to the DIAMOND methodology (developed in a previous study, Santarremigia et al. 2019), interaction with the transport sector can be studied from six different perspectives which correspond with each of the six vertexes of the diamond structure. These vertexes include analysis of the interaction of women as users of transport infrastructure and business models, for example as users of public or private transport, as drivers of vehicles, and as job holders today and tomorrow. Several studies have analysed gender differences and unfair issues within these three roles of women in transport; these are briefly analysed below.

1.1 Gender differences as users of transport infrastructure and business models (public transport and vehicle sharing)

More than 50% of the world's population live in cities. Public transport is an essential service that serves millions of people daily and plays an important role in the economic and social life of both men and women in cities (FIA Foundation 2017). Different genders show different mobility patterns. In Europe, women are more dependent than men on public transport networks, of which they make greater use. In France, for example, men only use public transport for 10% of their trips, and two-thirds of passengers on public transport networks are women; this proportion is the same in other European countries such as Sweden (Duchène 2011).

The issue of gender exclusion related to public transport systems for women results from a combination of distance, inadequate transport, and limited ways of communicating (Cass et al. 2005). The inadequate infrastructure of public transport and fears for personal safety prevent greater use of public spaces and/or transport services (Albeniz and Alonso 2009). Women as users of public transport who have distinct safety and security needs are often fearful of certain transit environments and frequently adjust their behaviour and travel patterns to avoid them (Loukaitou-Sideris 2014). The safety issue for trips by women arises in all countries and particularly for trips on public transport. Railway stations and connection corridors to the subway, bus, etc. can be a high cause of anxiety related to safety perception, and lack of comfort and accessibility. More adaptation of infrastructure and services to women's needs is a key issue (Duchène 2011).

In a number of countries (Japan, Brazil, Egypt, Mexico, India, Belarus, Philippines, and Iran), vehicles reserved for 'women only' have been introduced to combat sexual harassment (Duchène 2011; Bagheri 2017). In the light underground railway in Manila, for example, the first two carriages are reserved exclusively for women and children (Duchène 2011). These types of actions can create a momentary sense of relief for women, but also somehow create discrimination and do not solve the security problem because women can be harassed in other public spaces (e.g., stations).
Some studies have been developed to analyse the main problems in public stations. For example, in a transport project developed in Liaoning (China), women defined some of the main problems of bus stops in their city, which were: lack of security when using buses, poor lighting, long waiting times due to infrequent services, and lack of paths and pedestrian crossings to access bus stops (Duchène 2011).

Therefore, transport infrastructure, design, and services are a means to improving the general well-being of people by facilitating access to economic and social benefits, and thus should be designed to best meet the needs of people in general and individuals in particular, taking into account gender, age, identity, culture, and ethnicity in ways that are equitable, affordable, and responsive to all groups.

On the other hand, vehicle sharing has emerged in the last few years as an intermediate mode of transport (electric cars, rickshaws, bicycles, mopeds, scooters, etc). The use of vehicle sharing is slightly higher among those who use a car in combination with public transport and trains (Fiorello et al. 2016). This result suggests that car sharing is not necessarily perceived as a solution to optimise the use of the car, but rather as an additional mobility opportunity which is sometimes more convenient than public transport. Cities such as Paris and Milan have a high penetration of car and bicycle sharing, while in other cities, such as Berlin or Shanghai, bicycle sharing is more developed (Knupfer et al. 2018). Bike sharing systems nowadays can use pickup points or docks, or dockless bicycle systems. The dockless business model has recently spread across several countries for shared vehicles such as cars, electronic scooters, and electronic motorcycles. Even on-demand mini-buses are being driven in cities such as Berlin and New York (Knupfer et al. 2018). In fact, car sharing seems to be perceived more like a complementary option rather than an alternative model, where sharing replaces owning a personal car (Fiorello et al. 2016).

In terms of mobility behaviour and preferences between men and women, there are also differences related to the adoption of technology or sensitivity to environmental issues. In general, European women are slightly more aware of environmental concerns than men (Mohai 1992; Momsen 2000; McCright and Xiao 2014). This will have an impact on the use of shared vehicles or the adoption of ‘clean’ vehicle options. For instance, female early adopters use battery electric vehicles more often and evaluate handling battery electric vehicles (BEVs) as a more positive experience (Kawgan-Kagan 2015).

Therefore, a more efficient location of pickup–return points for vehicles (bicycles, electric cars, charging points), planning and distribution of fleets based on user needs (especially women), and providing user-friendly systems, are key to reducing inequalities. Addressing gender in both equipment planning and organisation could boost the use of bicycles and electric cars by women.

1.2 Gender differences in vehicles

The academic literature has highlighted differences in driving behaviour between men and women, and gender specific use differences (Balkmar 2018; Hanson 2010). There are significant differences between men and women with regard to the means of transport they use. In all European countries, fewer women than men own or use a car. In Sweden, 70% of cars on the road are owned by men (FIA Foundation 2017; Balkmar 2018), and men are responsible for 88% of traffic violations (Balkmar 2018). In general, men tend to demonstrate more aggressive and risky driving behaviour than women, causing more collisions and injuries to other road users (Balkmar 2018; Dourado et al. 2017).

New systems for the development of autonomous vehicles try to better adjust to the different characteristics of both men and women. Object recognition systems need to be adjusted to different ethnicities, so that pedestrians can be detected regardless of their skin colour. For example, Wilson et al. (2019) showed that object recognition systems have shown accuracy problems when detecting pedestrians with darker skin tones. The researchers determined that the bias was probably caused by two things: too few examples of dark-skinned pedestrians and too little emphasis on learning from those examples. Currently, the priority of research on vehicles with dynamic control is to make driving easier and safer.

In addition, rolling stock manufacturers have asked for the participation of women in the design of new vehicles to adapt rolling stock to the needs and expectations of women and the persons they accompany, notably children and elderly people (FIA Foundation 2017). In the same way, manufacturers of automotive electronic control units (ECUS) have detected the need to make vehicles intelligent by recognizing the gender and age of the driver, and adapting electronic functionalities and vehicle dynamics to the individual. Consequently, it seems necessary to take women’s needs into account not only for the design of infrastructure or services, but also for vehicle design.

1.3 Gender differences in employment for the transport sector

In the EU, only 22 % of transport workers are women (European Commission 2019). In all countries, there are far fewer women working in transport-related jobs, such as road maintenance or bus or truck drivers, which are seen as being ‘men’s work’ (Duchène 2011). However, there are other job positions directly related to the transport and mobility sector.

From the different economic activities included in the NACE (*Nomenclature statistique des activités économiques dans la Communauté européenne*) classification, four different categories have been identified as categories in which people working in the transport and mobility sector can be employed. These are: transport and storage; professional, scientific, and technical activities; public administration and defence; and education (Eurostat 2019). Of these categories, transport and storage is the economic activity in which fewer women are employed in the EU: only 22.2% of women in 2017. Figure 1 shows the evolution of employment in the transport and storage sector for both men and women from 2008 until 2017. It shows that the number of women employed in the transport and storage sector from 2008 until 2017 did not change significantly, as well as the difference in employment between women and men, around two million women compared to nine million men (Eurostat 2019). In the sectors of professional, scientific, and technical activities, as well as in public administration, the percentage of employability of both women and men is quite similar for both genders: 52% men and 48% women. Regarding education, 72.5% of employees working in education during 2017 in the EU were women. However, this percentage is a general percentage in education and not specific to those employed in education of subjects related to the transport and mobility sector.

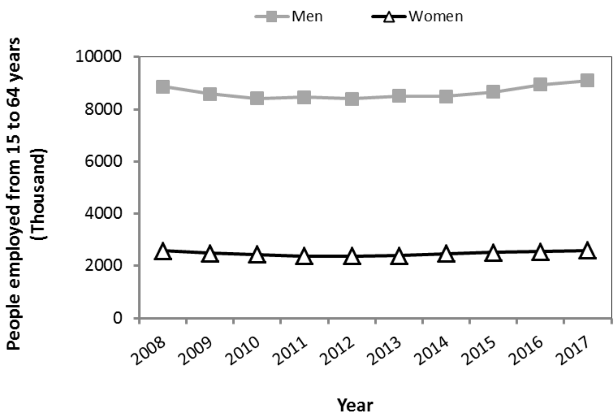

Figure 1. Men and women working in the transport and storage sector from 2008 to 2017 (Eurostat 2019).

Regarding participation in transport-related jobs, detailed and accurate statistics on the employment of women in the transport sector are hard to come by, especially for specific transport modes such as maritime, ports, inland waterways, civil aviation, roads, and railways (Turnbull 2013). Recently, Ortega Hortelano et al. (2019) have published some statistics comparing the situation of women in 2008 and 2018 for different transport related jobs: land transport, water transport, air transport, and warehousing and supporting activities (see Table 1). The results show how the situation did not change over the past ten years, and women continue to be a minority in the transport sector, except for air transport, where the percentage of women is similar to that in the economy overall. Moreover, transport is a sector replete with unattractive features and practices which pose significant barriers to the retention of women such as: sexual discrimination, the absence of basic amenities, safety and security, and wage disparities or unequal pay (Hudson 2018). Also, some studies have shown that a career in rail does not appear to be an attractive proposition to women or that it is difficult for them to be hired in this sector; for example, specialized job positions such as engineer represent only 2% of the total job positions in train companies (Women in Rail 2015). Also, access for women to road maintenance, technical professions, or even to bus or truck driver positions is limited; in Europe, only 10% of bus drivers are women (Duchène 2011). One of the obstacles highlighted to explain the lack of women drivers is the question of working hours, especially in the case of women lorry drivers. Also, social norms in developing countries often prevent women from working in the transport sector. This is all the more true in the case of long distance freight haulage (Duchène 2011).

Regarding the presence of women in transport research, data shows that women are underrepresented in jobs linked to transport science and engineering, such as science and engineering professionals (ISCO-08, Code 21) and science and engineering associate professionals (ISCO-08, Code 31) (Ortega Hortelano et al. 2019). The share of women working as transport science and engineering associate decreased from 12.3% (in the period of 1995-2007) to 11% (in the period of period of 2008-2014); while the share of women working as science and engineering professionals increased from 12% (1995-2007) to 12.5% (2008-2014) (Ortega Hortelano et al. 2019).

The aim of this paper is to define how to address the analysis of women's interaction in four areas of the transport system: as users of railway infrastructure, as users of bicycle sharing services, as drivers of autonomous vehicles, and as jobholders in a transport company. The term use case will be used in the paper to refer to the study of each of these four areas of the transport system. The DIAMOND methodology, developed by the authors in a previous study, was used for the definition of use cases and the structuring of further analysis of data. Section 2 introduces the methodology followed. Section 3 gives definitions of each use case and how to apply the DIAMOND methodology in each of them, and Section 4 presents the final conclusions.

Table 1. Ratio of male to female employees and share of female employees in the transport sector (%, 2008-2018) (Reproduced from Ortega Hortelano et al. 2019**).**

Transport mode	2008	2018
Land transport	6.3 (13.7% female)	6.2 (13.8% female)
Water transport	4 (19.9% female)	3.8 (21% female)
Air transport	1.4 (41.8% female)	1.3 (43.9% female)
Warehousing & supporting activities	3.1 (24.5% female)	3 (25% female)
Economy as a whole	1.2 (44.9% female)	1.2 (46.2% female)

2. Materials and Methods

The DIAMOND methodology was used to define the four use cases which are the focus of this paper, to structure the data to be gathered, and to determine how they were analysed (see Figure 1).

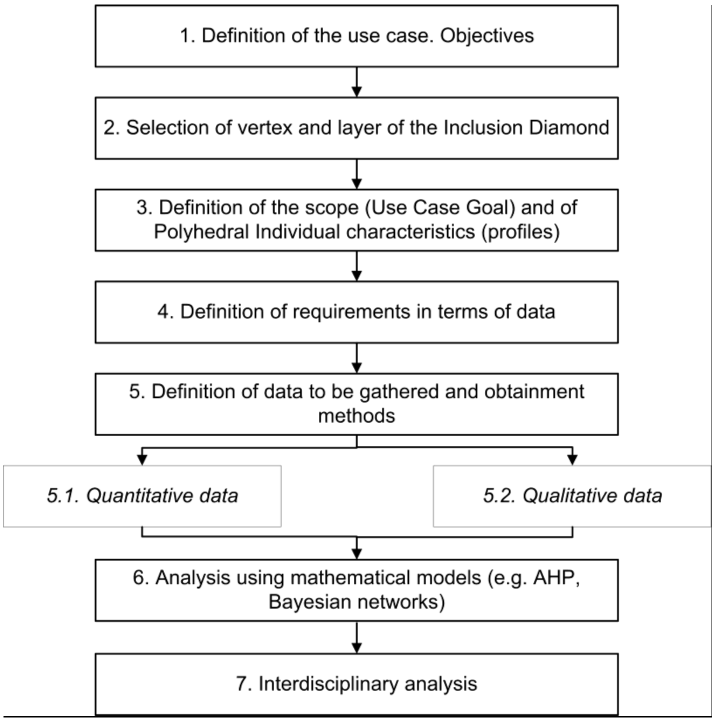

Fig. 1 Definition of use cases according to DIAMOND methodology

The DIAMOND methodology is intended to help provide actionable knowledge for overcoming gender related unfairness in transport. This methodology represents the transport system and its interaction with men and women by two graphical structures: the inclusion diamond (ID) and the polyhedral individual (PI). The ID represents the different transport scenarios of today and tomorrow. On the other hand, the PI is in the centre of the ID and represents the user (individual) of the transport system with a set of characteristics influencing the behavioural patterns of this individual as a user of the transport system, including: gender, age, education, disability, family, ethnicity, religion, economic level, and sexuality and appearance. The ID and PI structure works as a use case generator in a methodological and structured way by selecting vertex and layer of the ID and by creating different profiles through the PI as women cannot be handled as a unified group of people. This methodology allows the evaluation of the interaction of different women profiles (e.g. age, education, ethnicity, family, etc.) in the transport system through the analysis of both quantitative and qualitative data by the development of an intersectional and interdisciplinary analysis; where gathered data will be analysed by a specialized team of experts in psychology, sociology, economics, technology, and ethnography. This allows a wide analysis of data from different perspectives, from a social perspective but also taking advantage of the new insights that computer science tools can bring.

Four use cases were defined using the DIAMOND methodology, understanding in this work the concept "use case" as a field of study in the transport system: 1) railways and public transport infrastructure, 2) autonomous vehicles, 3) bicycle sharing fleet management, and 4) recruitment of women in railways and freight – CSR protocols. Figure 1 represents the methodology followed for the definition of each use case.

3. Results and Discussion

3.1. Definition of use cases and selection of ID vertexes and layers

Table 2 shows the objectives of each use case (Step 1 of the methodology) and their corresponding vertexes and layers of the ID representation (Step 2, see Figure 1).

Table 2. Objectives defined for each use case from a gender perspective and corresponding vertexes and layers of the DIAMOND – ID representation.

Use case	Objectives	Vertex/es of the ID	Layer/s of the ID
1. Public transport infrastructure. Railways	To understand women's needs in terms of accessibility, convenience, comfort, security, and safety approaching and inside a station.	V1. Transport infrastructure and business models today.	L3. Public transport
		V4. Transport infrastructure and business models tomorrow.	L1. New technologies L2. New business models
2. Autonomous vehicles	To understand the different emotions women on board the automated cars to enhance the in-vehicle women experience, while increasing acceptance.	V2: Vehicles today	L1. Road transport
		V5: Vehicles tomorrow	L1. Road transport
3. Bicycle sharing fleet management	To validate the DIAMOND model for the understanding of women's needs in the planning of pickup–return points for vehicles.	V1: Transport infrastructure and business models today	L3. Public transport
		V4: Transport infrastructure and business models tomorrow	L1. New technologies
4.Women recruitment in railways and freight – CSR protocols	To validate the DIAMOND model for the understanding of women's needs in participation in job positions.	V3: Polyhedral Individual as job holder today	L4. On-site professional jobs L5. Off-site professional jobs
	To propose measures to end discriminatory hiring, unequal payment, etc. in the railway, freight transport, and logistics sectors.	V6: Polyhedral Individual as job holder tomorrow	L4. On-site professional jobs L5. Off-site professional jobs
	To develop new CSR protocols including the redefinition of job positions, design of work framework, or new training content for companies' managers and workers.		

For Use Case 1, 20 stations of the FGC (*Ferrocarrils de la Generalitat Catalana*, Spain) and 20 stations of the ZTM (Poland) will be used to gather necessary data from users and stations in order to develop stations where women can feel safer, hence increasing their usage. Urban and city stations will be considered in the study. In Use Case 2, differences between genders in terms of emotions when using autonomous vehicles will be evaluated using a simulator and measuring physiological (e.g. heart rate, galvanic skin response) and emotional factors based on the arousal/valence approach (Larsen et al. 2008). A total of 40 women and men will participate in the study. Use Case 3 is focused on the design of pickup and return points for bicycle sharing; more concretely, on women users of bicycle sharing in Paris. A total of 40 stations will be analysed in different parts of Paris (north, south, east, and west). Use Case 4 is focused on the evaluation of recruitment processes and CSR protocols in the transport sector. All the statistical data needed for the analysis of this use case will be collected from different areas of Europe, representing the north, south, east, and west. Any quantitative data that are not available in databases (e.g., percentage of women working in warehouses, etc.) will be collected by direct contact with transport companies: for example, the subway, tram, and bus services of the transport system of Warsaw (Poland); the bus system of Dublin (Ireland); the railway company of Barcelona (Spain); and 10 companies involved in freight transport and warehouses in Spain.

3.2. Defined goal for each use case

In order to evaluate gender inclusion in the transport sector, it is necessary to define the use case goal for the study of each transport area or use case (Intrafocus 2014; Banu 2018; Roy et al. 2000). The use case goal of each use case can be seen in Table 3. The development of measures related to the inclusion factors are expected to increase the value of the identified use case goals and subsequently a fair inclusion of women in the transport sector.

Table 3. Use case goal for the evaluation of gender inclusion in each use case.

Use case	Use case goal[1]
1. Public transport infrastructure. Railways	% of women using public transport during peak and off-peak hours.
2. Autonomous vehicles	% of acceptance level of autonomous driving by women.
3. Bicycle sharing fleet management	% of women sharing bicycle fleets.
4. Women recruitment in railways and freight – CSR protocols	% and level of women on-site and off-site employed.

[1]Design criteria weighting more than 80% for this use case goal will be considered to be design factors which suggest several improvements for public transport infrastructures because 80% of these considered design factors usually lead to a majority of the results, outputs, or rewards (Koch 1998).

3.3. Definition of profiles for the analysis of each use case

In the early stages of a gender study it is necessary to concretize the characteristics of the persons to be included in the study. Sometimes, depending on the use case, a broad spectrum of the population will be needed, while other studies may focus on a concrete portion of the population (e.g., women older than 65 with a disability). The definition of the different profiles or PI characteristics to be evaluated for each use case (Step 3 of the methodology) can be seen in Table 4.

Table 4. Profiles evaluated for each use case.

	Use Case 1 Stations	Use Case 2 Autonomous Vehicles	Use Case 3 Vehicle sharing	Use Case 4 Employment and CSR protocols
Gender	Woman	Man, Woman	Woman	Man, Woman
Age	All	18-40, >40	All	Working age
Ethnicity	Not applicable[1]	Not applicable[1]	Not applicable[1]	Not applicable[1]
Religion	All	All	All	All
Education	All	All	All	All
Family	All	All	All	All
Disability	All[2]	All[2]	All[2]	All[2]
Economic level	All	All	All	All

[1] This characteristic will not be considered because in some countries such as France it is not possible to classify people by ethnicity (race); in this case, this data won't be collected. [2] According to ICF 2001 (World Health Organization 2007).

Table 5. Data collection methods, quantitative and qualitative data to be gathered, and methods used for the evaluation of gender inclusion in each use case (UC), and corresponding vertexes and layers of the Inclusion Diamond (ID).

UC	ID	Data collection methods	Quantitative variables	Methods of analysis - quantitative data[1]	Qualitative variables	Methods of analysis qualitative data [2]
1	V1, L1	Literature review Focus group Questionnaire Datasets[4] Social media[4] Laboratory simulation tests[3]	1. Sociodemographic characteristics of users. 2. Customer satisfaction index. 3. Level of service. 4. Nº security incidents. 5. Nº security measures (CCTV, agents). 6. Surrounding security level (from 1, minimum, to 5, maximum).	Bayesian networks	Design criteria of stations for peak and off-peak working hours.	Multi-criteria decision methodology, AHP.
	V4, L1& L2		-	-	Criteria influencing the infrastructures and business models of the future (e.g., hyperloop stations).	
2	V2, L1		1. % acceptance level for women as users of autonomous vehicles 2. Heart rate. 3. Galvanic skin response 4. Breath rate	Bayesian networks	Subjective evaluation of the system by people participating in the simulations.	Emotional indicator: arousal/valence approach
	V5, L1		-	-	Criteria for the definition of the vehicles of the future (e.g., hyperloop), including automation, or flying cars from a gender perspective.	Multi-criteria decision methodology, AHP.
3	V1, L3		1. Travel patterns (origin–destination, dates and time, km travelled, travel time) 2. Territory (demography, jobs, economy) 3. Travel fare 4. Number of stations and charging points	Bayesian networks	Design criteria influencing in the number of women users of bicycle sharing by time period during the day.	Multi-criteria decision methodology, AHP.
	V4, L1& L2		-	-	Criteria influencing the infrastructures and business models of the future (e.g., hyperloop stations).	-
4	V3, L4& L5		1. % of women recruited on site 2. % of women recruitment for off-site professional transport jobs 3. Average interprofessional wage 4. Income per person 5. Nº children/family	Bayesian networks	Criteria influencing in the number of woman recruitment of the transport system.	Multi-criteria decision methodology, AHP
	V6, L4& L5		-	-	Criteria influencing on-site and off-site job positions of the future.	

[1]Quantitative methods are used for the analysis of quantitative data (those variables which argument is a number). [2] Qualitative methods are the methods used to quantify qualitative information. [3] Only for Use Case 2 – Automated vehicles, a simulator will be used to gather data from users regarding their behavior and emotions in various situations.[4] This is a data collection method that can only be used to analyse present situations, and then it applies only to vertexes: V1, V2 and V3.

3.4. Data requirements for the study of each use-case

After the definition of which portion of the population is the focus of the study and which is the goal, variables or parameters to be obtained for an appropriate assessment are analysed. These variables can be quantitative (e.g., distances, travel time, number of children, etc.) or qualitative (e.g., safety perception). Table 5 shows the variables or parameters to be evaluated and the methods used to gather and analyse data in each use case for both current (vertexes V1, V2, and V3) and future scenarios (vertexes V4, V5, and V6). On the one hand, for the evaluation of quantitative parameters, machine learning techniques, such as Bayesian networks (Cooper and Herskovits 1992; Molero et al. 2019) will be used for the obtainment of dependencies. On the other hand, the weighting of qualitative data is done using multi-criteria decision-making methods, such as the analytic hierarchy process (AHP) (Saaty 1987; Molero et al. 2017; Santarremigia et al. 2018; Hervás-Peralta et al. 2019) for the prioritization of criteria affecting each use case. Data collection tools include an analysis of the state of the art, focus groups, questionnaires and lab testing in a static driving simulator (for Use Case 2). The analysis and prioritization of both quantitative and qualitative data together, followed by the interdisciplinary analysis, will allow the definition of a series of inclusion factors for each use case.

5. Conclusions and further development

Over the years, social norms and conducts have slowed down the development of women under equal opportunities. The transport sector is one of the sectors in which historical, social, and also physiological issues slow down the inclusion of women. Within this paper, four different roles (defined as use cases in the paper) of women in the transport system were defined according to the inclusion diamond of the DIAMOND methodology; these are: as users of railway infrastructure, as users of bicycle sharing services, as drivers of autonomous vehicles, and as jobholders in a transport company

Within this paper, for each use case, quantitative and qualitative variables for the evaluation of the inclusion of women in the transport system were identified. The analysis of gathered data for each variable through machine learning techniques, multi-criteria decision-making methods, and an interdisciplinary analysis will allow the definition of inclusion factors that will help in the definition of inclusion measures and generate tools to boost women's inclusion for each use case. Finally, the use case goals to be monitored to assess women's inclusion for each use case were defined. Further developments will focus on the analysis of gathered data, the definition of inclusion factors, and the assessment of the other vertexes and layers of the inclusion diamond model. Also, fairness for each use case will be defined and priorities will be established to help policy decision-makers.

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References

Albeniz, A., Alonso, A., 2009. Criterios de intervención y debate desde la perspectiva de género para el municipio de Getxo. http://www.getxo.eus/docspublic/igualdad/castellano/documentacion/propuestasintervencion_getxo1_hk.pdf..

Bagheri, N., 2017. Tehran's subway: gender, mobility, and the adaptation of the "proper" Muslim woman. *Social & Cultural Geography*, 9365, 1–19.

Balkmar, D., 2018. Violent mobilities: men, masculinities and road conflicts in Sweden. *Mobilities*, 13(5), 717–732.

Banu, G.S., 2018. Measuring innovation using key performance indicators. *Procedia Manufacturing*, 22, 906–911.

Cass, N., Shove, E., Urry, J., 2005. Social exclusion, mobility and access. *Sociological Review*, 53(3), 539–555.

Cooper, G.F., Herskovits, E., 1992. A Bayesian method for the induction of probabilistic networks from data. *Machine Learning*, 9(4), 309–347.

Cooper, G.F., Herskovits, E., 1992. A Bayesian Method for the Induction of Probabilistic Networks from Data. *Machine Learning*, 9, 309–347.

Crabtree, S., Nsubuga, F., 2012. Women Feel Less Safe Than Men in Many Developed Countries. *GALLUP*. https://news.gallup.com/poll/155402/women-feel-less-safe-men-developed-countries.aspx.

Dourado, J.F., Pereira, A.T., Nogueira, V., 2017. Personality and driver behaviour questionnaire: Correlational exploratory study. In

Dell'Acqua & Wegman, ed. *Transport Infrastructure and Systems*. Taylor & Francis Group, 787–793.

Duchène, C., 2011. Gender and Transport. *OECD. International Transport Forum.*, 11, 1–18..

European Commission, 2019. Mobility and Transport. Social Issues. What do we want to achieve? *Europe's Growth Challenge*. https://ec.europa.eu/transport/themes/social.

European Union Agency for Fundamental Rights, 2014. *Violence against women: An EU-wide survey*, http://fra.europa.eu/sites/default/files/fra-2014-vaw-survey-main-results-apr14_en.pdf.

Eurostat, 2019. Employment by sex, age and economic activity (from 2008 onwards, NACE Rev. 2)-1000. http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsq_egan2&lang=en.

FIA Foundation, 2017. *Ella se mueve segura - She moves safely - FIA Foundation*, https://www.fiafoundation.org/connect/publications/ella-se-mueve-segura-she-moves-safely.

Fiorello, D. et al., 2016. Mobility Data across the EU 28 Member States: Results from an Extensive CAWI Survey. *Transportation Research Procedia*, 14, 1104–1113.

Gheorghiu, R., Andreescu, L., Curaj, A., 2014. Dynamic argumentative Delphi : Lessons learned from two large-scale foresight exercises, 5th International Conference on Future-Oriented Technology Analysis (FTA) - Engage today to shape tomorrow Brussels, 27-28 November 2014 , 1–13.

Hanson, S., 2010. Gender and mobility: New approaches for informing sustainability. *Gender, Place and Culture*, 17(1), 5–23.

Hervás-Peralta, M. et al., 2019. Improving the Performance of Dry and Maritime Ports by Increasing Knowledge about the Most Relevant Functionalities of the Terminal Operating System (TOS). *Sustainability*, 11(6), 1648.

Hudson, C., 2018. Sharing fairly? Mobility, citizenship, and gender relations in two Swedish city-regions. *Journal of Urban Affairs*, 40(1), 82–97.

Intrafocus, 2014. *Key performance indicators. Developing meaningful KPIs*, https://www.intrafocus.com/wp-content/uploads/2014/09/Developing-Meaningful-Key-Performance-Indicators-V7.pdf.

Kawgan-Kagan, I., 2015. Early adopters of carsharing with and without BEVs with respect to gender preferences. *European Transport Research Review*, 7, 33.

Knupfer, S., Pokotilo, V., Woetzel, J., 2018. *Elements of success: Urban transportation systems of 24 global cities*, https://www.mckinsey.com/business-functions/sustainability/our-insights/elements-of-success-urban-transportation-systems-of-24-global-cities.

Koch, R., 1998. *The 80 20 principle. The secret of achieving more with less*, London: Nicholas Brealey Publishing.

Larsen, J. T., Berntson, G. G., Poehlmann, K. M., Ito, T. A., Cacioppo, J. T., 2008. The Psychophysiology of Emotion. In M. Lewis, J. M. Haviland-Jones, & L. Feldman Barrett (Eds.), Handbook of emotions (3rd ed., pp. 180–195). New York: The Guilford Press.

Loukaitou-Sideris, A., 2014. Fear and safety in transit environments from the women's perspective. *Security Journal*, 27(2), 242–256..

McCright, A.M. & Xiao, C., 2014. Gender and Environmental Concern: Insights from Recent Work and for Future Research. *Society and Natural Resources*, 27(10), 1109–1113.

Mohai, P., 1992. Men, women, and the environment: An examination of the gender gap in environmental concern and activism. *Society & Natural Resources*, 5(1), 1–19.

Molero, G. et al., 2019. Key factors for the implementation and integration of innovative ICT solutions in SMEs and large companies involved in the multimodal transport of dangerous goods. European Transport Research Review, 11:28, 1-16.

Molero, G.D. et al., 2017. Total safety by design: Increased safety and operability of supply chain of inland terminals for containers with dangerous goods. *Safety Science*, 100, 168–182..

Momsen, J.H., 2000. Gender differences in environmental concern and perception. *Journal of Geography*, 99(2), 47–56.

Ortega Hortelano, A. et al., 2019. *Women in European transport with a focus on Research and Innovation*, Luxembourg: Publications Office of the European Union. https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/women-european-transport-focus-research-and-innovation.

Roy, R. et al., 2000. A framework to create key performance indicators in knowledge management. In Proc. of the Third Int. Conf. on Practical Aspects of Knowledge Management (PAKM2000) Basel, Switzerland, 30-31 Oct. 2000.

Saaty, T.L., 1987. The analytic hierarchy process: what it is and how it is used. *Mathematical Modelling*, 9(3), 161–176.

Santarremigia, F.E. et al., 2018. Railway safety by designing the layout of inland terminals with dangerous goods connected with the rail transport system. *Safety Science*, 110, 206–216..

Santarremigia, F. E. et al, 2019. Women inclusion in the transport system by applying a novel structured methodology: The inclusion diamond and polyhedral individual model. *In 6th International Conference on Women's Issues in Transportation "Insights, Inclusion, and Impact: Framing the Future for Women in Transportation",* 10-13 September 2019, Irvine, California (pp. 1–9).

Turnbull, P., 2013. *Working Paper No . 298 Promoting the employment of women in the transport sector - Obstacles and policy options*, International Labour Organization; International Labour Office-Sectorial Activities Department. https://www.ilo.org/sector/Resources/publications/WCMS_234880/lang--en/index.htm.

Wilson, B., Hoffman, J., Morgenstern, J., 2019. Predictive Inequity in Object Detection. http://arxiv.org/abs/1902..

Women in Rail, 2015. *Women in Rail: Industry survey*, http://womeninrail.org/news/women-in-rail-industry-survey-2/.

World Health Organization, 2007. *International Classification of Functioning, Disability and Health- Children & Youth Version*, Switzerland: WHO Press. http://www.who.int/iris/bitstream/10665/43737/1/9789241547321_eng.pdf.