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Gender and Equality in Transport. Proceedings of the 2021 Travel Demand Management Symposium

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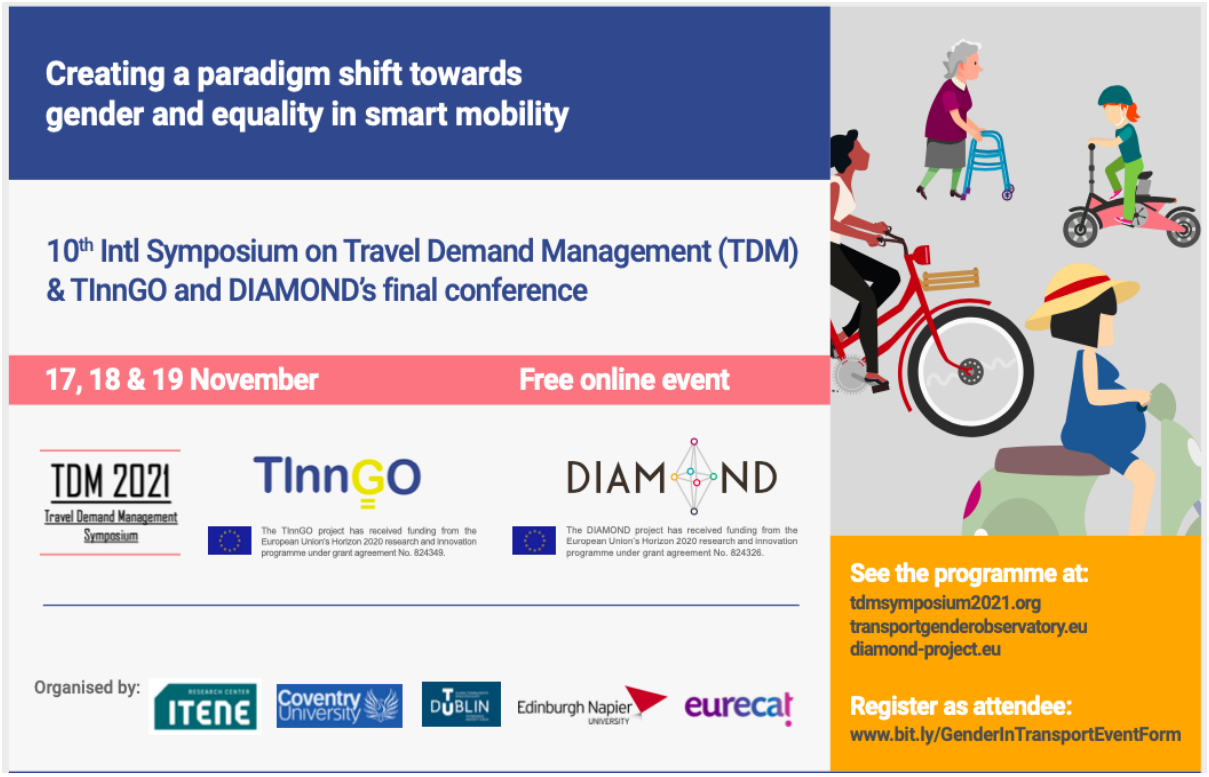
Proceedings of the Travel Demand Management TDM Symposium 2021:

Gender and Equality in Transport

10TH INTERNATIONAL TRAVEL DEMAND MANAGEMENT (TDM) SYMPOSIUM IN CONJUNCTION WITH TINNGO AND DIAMOND FINAL CONFERENCE

E-Proceedings

17-19 November 2021



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Creating a paradigm shift towards gender and equality in smart mobility

Programme

10th Intl Symposium on Travel Demand Management (TDM) & TInnGO and DIAMOND's final conference

17, 18 & 19 November **Free online event**

TDM 2021
Travel Demand Management Symposium

TInnGO
The TInnGO project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 824349.

DIAMOND
The DIAMOND project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 824326.

See the programme at:
tdmsymposium2021.org
transportgenderobservatory.eu
diamond-project.eu

Register as attendee:
www.bit.ly/GenderInTransportEventForm

Organised by: ITENE Research Center, Coventry University, TU Dublin, Edinburgh Napier University, eurecat

DESCRIPTION

Data, tools and new approaches are needed to **achieve diversity and gender equality** in **transport and mobility**, which has traditionally been a male-dominated sector. The HORIZON 2020 call, MG-4-3-2018 on demographic change and participation of women in transport funded the **DIAMOND** and **TInnGO** project to create gender and diversity sensitive data, methodologies and tools to achieve gender equality in transport.

TInnGO and DIAMOND European projects will hold their final conference from November 17th to 19th 2021 jointly with the 10th International Symposium on Travel Demand Management Symposium under the theme "Creating a paradigm shift towards gender and equality in smart mobility".

During this free online event, TInnGO and DIAMOND experts will present the final outcomes of both projects, external specialists will present their research studies and keynote speakers will significantly contribute to develop and drive forward synergy between academics, researchers, policy makers and the industry.

OBJECTIVES

- To share new ideas and conceptual approaches on gender and diversity in transport and mobility sectors.
- To analyse the impact of the Covid-19 pandemic in the mobility patterns.
- To advance how new trends in mobility, such as the autonomous vehicle, can represent a challenge but also an opportunity for inclusivity.
- To present practical tools that help key stakeholders both to identify gender and diversity gaps and implement measures to close these gaps.
- To demonstrate how TInnGO and DIAMOND projects have been engaging with different stakeholders to boost a paradigm shift in the mobility sector in Europe.
- Show how these analyses, Gender and Diversity Action Plans (GaDAPS), new designs and practical tools can help increase diversity in transport, both through education and employment.

TOPICS FOR DISCUSSION

- Users attitudes and mode choices towards transport.
- Covid-19 impact on travel demand.
- Inclusivity in automated mobility.
- Safety and security in different aspects of mobility.
- Data and intersectionality: new methods and approaches.
- Inclusivity for transport planning and design.
- Women and diversity in cycling.
- Users of public transport: new approaches looking at gender related issues.
- Self-assessment platforms for service operators on fairness and inclusivity, open data.
- Inclusion for employability & entrepreneurship in transport.
- Gender equity in education and research for transport.

TARGET AUDIENCE

- **Policymakers** involved in the definition of mobility plans at local, regional, national or European level.
- **Experts from universities, research centres and other academic institutions** that are specialised in transport from a gender and diversity perspective.
- **Specialised journalists** in gender and/or transport from all European countries that are interested in learning new tools and approaches and using new information sources.
- **Companies starting to implement measures in gender equality and enterprises** committed to the topic.

#TDMSymposium
#GenderInTransport
#DIAMONDconference
#TInnGOconference
#DIAMONDandTInnGO

Wednesday, November 17th

GMT Time / CET Time

08.15-09.45 / 09.15-10.45	**OPENING PLENARY: Welcome addresses, keynote and brief introduction**		
08.15-08.30 / 09.15-09.30	Conference opening	Introduction to the TDM Symposium and the TInnGO & DIAMOND final conference	Wafaa Saleh, Chair of the TDM Symposium Maria Chiara Leva, Co-chair of the 2021 TDM Symposium and DIAMOND Dissemination Manager Andree Woodcock, TInnGO Principal Investigator
08.30-08.45 / 09.30-09.45	Welcome by EU Commission Representatives	Inclusivity in mobility: overview of EU policies and funded research	Anca Pasca - EU Commission, TInnGO & DIAMOND Project Officer (to be confirmed)
08.45-09.15 / 09.45-10.15	Keynote	Are we blind? Seeing beyond white male privilege in the transport sector	Glenn Lyons - UWE Bristol and Mott MacDonald
09.15-09.30 / 10.15-10.30	Overview of need and conceptual approaches to drive transformative change	TInnGO's representation of European gender transport poverty as a wicked problem	Andree Woodcock - Coventry University - TInnGO
09.30-09.45 / 10.30-10.45		Fairness and Inclusivity for transport operators. Moving towards a Maturity Model for evaluating services against user needs	Maria Chiara Leva - TU Dublin - DIAMOND Francisco Santarremigia - AITEC - DIAMOND
09.45-10.00 / 10.45-11.00	**Coffee break**		
10.00-11.00 / 11.00-12.00	**Session I: Discussing users attitudes and mode choices towards transport**		
CHAIR: Glenn Lyons - UWE Bristol and Mott MacDonald			
10.00-10.15 / 11.00-11.15	Discussing users attitudes and mode choices towards transport	Factors that change attitude to public transport during major transport system changes	Wojciech Szymalski - Institute for sustainable Development Foundation
10.15-10.30 / 11.15-11.30		Statistical modeling of mode choice for shopping trips in the central business district of Paynesville, Liberia	Amara Ballack Massaquoi - Transport Research and Education Centre Kumasi, Kwame Nkrumah University of Science and Technology, Liberia
10.30-10.45 / 11.30-11.45		Mode choice among public university students in Freetown, Sierra Leone	Simeon Stevenson Turay - Kwame Nkrumah University of Science and Technology
10.45-11.00 / 11.45-12.00		Q&A and panel discussion	

11.00-12:15 / 12.00-13.15 Session II: Covid-19 Impact on travel demand

CHAIR: Grigorios Fountas

11.00-11.15 / 12.00-12.15	Considerations on the impact of Covid-19 on travel demand	Residential relocation after Covid-19	Ajay Saxena - Transport Research Institute, ENU - TDM
11.15-11.30 / 12.15-12.30		Impact of Covid-19 on Commercial Drivers and Public Transport in Freetown, Sierra Leone	Fidelma Ibili - TRECK - Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
11.30-11.45 / 12.30-12.45		An empirical analysis of the factors influencing scottish residents' compliance with Covid-19 travel restrictions	Mostafa Ayman Ilham - Edinburgh Napier University
11.45-12.00 / 12.45-13.00		The health impact of remote work during the Covid-19 pandemic: a snapshot on commuting and other aspects from a holistic approach	Suzanne Kelly - Ireland´s Health and Safety Authority
12.00-12.15 / 13.00-13.15		Q&A and panel discussion	

12.15-12.45 / 13.15-13.45 Lunch

12.45-13.15 / 13.45-14.15 Keynote: Chandra Bhat

12.45-13.15 / 13.45-14.15	Keynote	Racial equity considerations in transportation provision and road user safety	Chandra Bhat

IN PARALLEL WITH SESSION IV

13.15-14:45 / 14.15-15.30 Session III: Autonomous vehicles (in parallel with session IV)

CHAIR: Ricard Barberà (IBV)

13.15-13.30 / 14.15-14.30	Inclusivity in automated mobility	Automated mobility and inclusion of mobility impaired persons - Current situation and perspectives of inclusion, requirements of mobility - Impaired persons (PART 1)	Gerd Sammer Christopher Schlembach - University of Vienna
13.30-13.45 / 14.30-14.45		Automated mobility and inclusion of mobility impaired persons – Components of an inclusive automated mobility system and recommendations (PART 2)	Bente Knoll - B-NK GmbH Büro für nachhaltige Kompetenz Georg Hauger - TU Wien
13.45-14.00 / 14.45-15.00		The impact of autonomous vehicles on traffic flow	Akito Higatani - Hanshin Expressway Co. ltd.
14.00-14.15 / 15.00-15.15		From driver and occupants to passengers. Safe and comfortable autonomous vehicles for all	José Solaz - IBV
14.15-14.30 / 15.15-15.30		Q&A and panel discussion	

IN PARALLEL WITH SESSION III

13.15-14.45 / 14.15-15.30 Session IV: Safety and security in different aspects of mobility (in parallel with session III)

CHAIR: Chandra Bhat

13.15-13.30 / 14.15-14.30	Safety and security in different aspects of mobility	Assessment of the perceived security among public transport users in Europe	Ana Rita Lynce - VTM Global - TInnGO
13.30-13.45 / 14.30-14.45		Quantifying the effectiveness of 20mph speed limits in rural areas: empirical evidence from the scottish borders area	Grigorios Fountas - Edinburgh Napier University - Transport Research Institute
13.45-14.00 / 14.45-15.00		Understanding safety perceptions for women as users of surface transport combined with a snapshot of barriers and facilitators in the Covid pandemic	Ajeni Ari Thimnu - Technological University Dublin - DIAMOND
14.00-14.15 / 15.00-15.15		E-Scooters Dublin - An observational study on their users and key road safety behaviours	Eugene Chia Nasali - TU Dublin
14.15-14.30 / 15.15-15.30		Q&A and panel discussion	

14.30-14.45 / 15.30-15.45 CLOSURE OF THE FIRST DAY: WAFAA SALEH, CHAIR OF THE TDM SYMPOSIUM

Thursday, November 18th

GMT Time / CET Time

08.15-09.00 / 09.15-10.10	**Welcome II: Opening Keynotes**	**Thursday, 18th November 2021**	
08.15-08.30 / 09.15-09.30	Opening of Second Day		Lali Soler, Directora de la Unidad de Big Data & Data Science, Centro Tecnológico Eurecat Javier Zabaleta - CEO of ITENE Pedro Ballester - President of ITENE Mónica Oltra - Vice-President and Regional Minister for Equality and Inclusive Policies of the Valencian Regional Government (TBC)
08.30-09.00 / 09.30-10.00	Keynote by EU Commission Representative	Inclusivity in mobility: overview of EU policies and funded research	Anca Pasca - EU Commission, TInnGO and DIAMOND Project Officer (TBC)
09.00-10.30 / 10.00-11.30	**Session V: Influencing policy**		
CHAIR: Patricia Castillo - EURECAT - DIAMOND			
09.00-09.15 / 10.00-10.15	Influencing policy	The concept of fairness in relation to women transport users: a review of the state of the art in the DIAMOND project	Yvonne Hail- University of Stirling - DIAMOND
09.15-09.30 / 10.15-10.30		How to advance theories of gender and intersectionality into practice for transport planning	Lena Levin - VTI - TInnGO
09.30-09.45 / 10.30-10.45		Gender-equitable transport planning policies: An impact assessment framework	Augustus Ababio-Donkor - Edinburgh Napier University - DIAMOND
09.45-10.00 / 10.45-11.00		How can Gender Smart Mobility become a more intersectional form of mobility justice?	Jacquie Bridgman - University of Northamptom - TInnGO
10.00-10.15 / 11.00-11.15		Gender in sustainable urban mobility plans: an Italian analysis	Angela Carboni - Politecnico di Torino - TInnGO
10.15-10.30 / 11.15-11.30		Q&A and panel discussion	
10.30-10.45 / 11.30-11.45	**Coffee break**		
10.45-12.30 / 11.45-13.30	**Session VI: Data and intersectionality new methods and approaches**		
CHAIR: Francisco Santarremigia - AITEC - DIAMOND			
10.45-11.00 / 11.45-12.00	Data and intersectionality: new methods and approaches	Gendered perceptions of new mobility services	Sofia Kalakou - ISCTEO
11.00-11.15 / 12.00-12.15		Analysing the mobility patterns of urban transport users in five European cities	Cristian Adorean and Juan Arguello - VTM Global - TInnGO
11.15-11.30 / 12.15-12.30		A methodological approach to reveal fair and actionable knowledge from data to support women's inclusion in transport systems: the DIAMOND approach	Francisco Santarremigia - AITEC - DIAMOND
11.30-11.45 / 12.30-12.45	New methods and approaches for looking at smart cars and autonomous vehicles	Location-based data and gis analysis for the study of the women's needs as users of public transport: The H2020 DIAMOND Project	Andrea Gorrini - Systematica - DIAMOND
11.45-12.00 / 12.45-13.00		The lure of smart cars. How to analyze gender and diversity in visual car branding	Hilda Rømer Christensen - UCPH - TInnGO
12.00-12.15 / 13.00-13.15		Autonomous vehicles, a new opportunity to gain women fairness. Main results of the DIAMOND Project	Ricard Barberá - IBV - DIAMOND
12.15-12.30 / 13.15-13.30		Q&A and panel discussion	
12.30-13.00 / 13.30-14.00	**Lunch break**		
13.00-13.30 / 14.00-14.30	**Keynote**		
13.00-13.30 / 14.00-14.30	Keynote	Inclusive Mobility: An intersectional perspective	Eleanor Lisney
13.30-14.45 / 14.30-15.45	**Sesion VII: Inclusivity for transport planning and design**		
CHAIR: Andree Woodcock - Coventry University - TInnGO			
13.30-13.45 / 14.30-14.45		Gender- and diversity- oriented design of social media for participation in public transport: extended case study of German transport companies	Cathleen Schöne - Technische Universität Ilmenau - TInnGO

13.45-14.00 / 14.45-15.00	Inclusivity for transport planning and design	Railway station accessibility: an assessement tool	Amanda Fernandes Ferreira - National Taiwan University - Taiwan
14.00-14.15 / 15.00-15.15		Bigger than transport design: beneficial undergraduate experience of gender and diversity sensitive smart and sustainable mobility innovations	Paul Magee - Coventry University - TInnGO
14.15-14.30 / 15.15-15.30		Observation checklist for evaluation of inclusive railway infrastructures and transport services: the H2020 DIAMOND project	Lukasz Filipczak - ZTM - DIAMOND
14.30-14.45 / 15.30-15.45		Q&A and panel discussion	

14.45-15.00 / 15.15-16.00 **Coffee break**

IN PARALLEL WITH SESSION IX

15.00-16.00 / 16.00-17.00 **Session VIII: Women and diversity in cycling** (in parallel with session IX)

CHAIR: Giulia Grigolli

15.00-15.15 / 16.00-16.15	Women and diversity in cycling	For who does the transport system care for? – Mobilities of care in cycling	Michala Hvidt Breengaard - University of Copenhagen - TInnGO
15.15-15.30 / 16.15-16.30		Female-only cycling initiatives: An avenue for gender equal mobility?	Isobel Duxfield - POLIS Network
15.30-15.45 / 16.30-16.45		Opportunities and challenges for women using bike sharing services: DIAMOND data collection results	Wafaa Saleh - Edinburgh Napier University - DIAMOND
15.45-16.00 / 16.45-17.00		Q&A and panel discussion	

IN PARALLEL WITH SESSION VIII

15.00-16.00 / 16.00-17.00 **Session IX: Users of public transport: New approaches looking at gender related issues** (in parallel with session VIII)

CHAIR: Achille Fonzone

15.00-15.15 / 16.00-16.15	Users of public transport: new approaches looking at gender related issues	"EAASI" A Gender- and diversity- sensitive usability evaluation tool	Janet Saunders - Coventry University - TInnGO
15.15-15.30 / 16.15-16.30		Factors effecting the mobility of breastfeeding mums in public spaces	Kat Gut - Coventry University - TInnGO
15.30-15.45 / 16.30-16.45		Issues raised and challenges faced by women in surface transport from DIAMOND data and the DIAMOND idea of maturity model for Service provision evaluation	Maria Chiara Leva - Technological University Dublin - DIAMOND
15.45-16.00 / 16.45-17.00		Q&A and panel discussion	

16.00-16.15 / 17.00-17.15 **COMMON CLOSURE OF THE SECOND DAY**

Friday, November 19th

GMT Time / CET Time

08.15-09.40 / 09.15-10.30 **Welcome II: Opening keynote and interactive workshop**

CHAIR: Hilda Rømer Christensen - UCPH - TInnGO

08.15-08.45 / 09.15-09.45	Keynote	Women truck drivers and (future) mobile work: Towards gender equal transport futures?	Dag Balkmar - Örebro University
08.45-09.30 / 09.45-10.30	Interactive workshop	Gender smart mobility: Living lab using gender smart indicators in the creation of GaDAP plans	Hilda Rømer Christensen and Michala Hvidt Breengaard - UCPH Lena Levin and Malin Henriksson - VTI

09.30-09.40 / 10.30-10.40 **Coffee break**

09.40-12.30 / 10.40-13.30 **Session X: Bringing the community together**

CHAIR: Hilda Rømer Christensen - UCPH - TInnGO

09.40-10.00 / 10.40-11.00		The TInnGO Observatory and the DIAMOND toolbox: self assessment for service operators on fairness and inclusivity	Clea Prieto - LGI - TInnGO Luca Piras - EURECAT - DIAMOND
10.00-10.20 / 11.00-11.20		Hubs as beacons of engagement in TInnGO and DIAMOND "Corporate Social Responsibility protocols and White paper"	Cathleen Schöne - Technische Universität Ilmenau - TInnGO Francisco Santarremigia - AITEC - DIAMOND

10.20-10.40 / 11.20-11.40	Bringing the community together	Open data collection and repository (TInnGO and DIAMOND)	Fotis Liotopoulos - SBOING - TInnGO Andrea Gorrini - Systematica - DIAMOND
10.40-11.00 / 11.40-12.00		Q&A and panel discussion	
11.00-11.10 / 12.00-12.10	**Coffee break**		
11.10-11.30 / 12.10-12.30		Educational guidelines (TInnGO and DIAMOND)	Lazaros Tzampazis - LEVER - TInnGO Wafaa Saleh - Edinburgh Napier University - DIAMOND
11.30-11.50 / 12.30-12.50		Citizen science	Sinead Ouillon - Coventry University - TInnGO
11.50-12.10 / 12.50-13.10		Co design for empathy and reducing barriers to inclusion	Andree Woodcock - Coventry University - TInnGO
12.10-12.30 / 13.10-13.30		Q&A and panel discussion	
12.30-13.00 / 13.30-14.00	**Lunch break**		

IN PARALLEL WITH SESSION XII

13.00-14.15 / 14.00-15.15	**Session XI: Inclusion for employability & entrepreneurship in transport** (in parallel with session XII)		
CHAIR: Mary Kinahan - TU Dublin - DIAMOND			
13.00-13.15 / 14.00-14.15	Inclusion for employability & entrepreneurship in transport	Implementing organisational change for workplace diversity in transport organisations	Ann-Marie Nienaber - Coventry University - TInnGO
13.15-13.30 / 14.15-14.30		Career and Women Entrepreneurship in the Transport Industry Across Europe	Stefan Roseanu - Integral Consulting R&D - TInnGO
13.30-13.45 / 14.30-14.45		Fostering gender balance inclusion from the transport employment perspective	Mireia Calvo - ITENE Research Centre - TInnGO
13.45-14.00 / 14.45-15.00		Challenges and issues for women as employees in surface transport: a snapshot from the DIAMOND project findings	Mary Kinahan - Technological University Dublin
14.00-14.15 / 15.00-15.15		Q&A and panel discussion	

IN PARALLEL WITH SESSION XI

13.00-14.15 / 14.00-15.15	**Session XII: Gender equity in education and research for transport** (in parallel with session XI)		
CHAIR: Lena Levin - VTI - TInnGO			
13.00-13.15 / 14.00-14.15	Gender equity in education and research in transport	Gender and diversity in transport research in Europe	Andree Woodcock - Coventry University - TInnGO
13.15-13.30 / 14.15-14.30		Experiences of gender and diversity in research teams working on transport related projects funded by EU diversity in transport related projects funded by EU	Kat Gut - Coventry University - TInnGO
13.30-13.45 / 14.30-14.45		Gender and equality aspects through the process of education and its impact on transport sector in Baltic States	Egle Kalasnikovaite - Smart Continent - TInnGO
13.45-14.00 / 14.45-15.00		Building capacities on how to integrate a gender dimension in the content of scientific research and innovation: the GE Academy project experience	Natasha Sega - Smart Venice - GE Academy
14.00-14.15 / 15.00-15.15		Q&A and panel discussion	

14.15-14.45 / 15.15-15.45 **COMMON CLOSURE OF THE THIRD DAY**

Wednesday, 17th November 2021

Keynote

8.45-9.15/ 9.45-10.15: **International** keynote **speaker**

Are we blind? Seeing beyond white male privilege in the transport sector

Professor Glenn Lyons
The Faculty of Environment and Technology (FET) University of the West of England

Take a look around at the transport system where you live and ask yourself, 'who designed this?'. The chances are that the answer will not be 'mostly women'. In fact, in my case I live in a country in which the transport system has been designed predominantly by white men, to serve a population the majority of whom are not white and male. The last census for England and Wales for which we have the results revealed that, in 2011, 51% of the population were female; and 14% of the population (nearly 8 million people) were not white. I have only recently come to properly appreciate the significance of my white male privilege both in terms of my experience of using the transport system and my experience as a transport professional. Caroline Criado Perez in 2019 wrote a book that brilliantly problematised 'invisible women' in society and with transport a prime example of where we are blind - with our data and in turn our planning - to gender difference, let alone intersectionality such as gender combined with ethnicity, or with disability or with other (protected) characteristics. I have been very taken by some important advice when it comes to the issue of diversity and inclusion: be an upstander not a bystander. In this paper I aim to draw upon the wisdom and experience of others to articulate important insights from the learning journey I am on in moving from unconscious incompetence (ignorance of the nature and significance of gender inequality in transport) towards unconscious competence (automatically behaving in ways that help progress greater gender equality in transport). I hope this will help others progress on their own learning journeys.

Professor Glenn Lyons

The Faculty of Environment and Technology (FET)

University of the West of England (UWE) Bristol, UK.

Email: Glenn.Lyons@uwe.ac.uk

Overview of need and conceptual approaches to drive transformative change

9.15-9.30/10.15-10.30 Presentation 1: Wednesday, 17th November 2021

TInnGO's representation of European gender transport poverty as a wicked problem

Woodcock, A.
Institute for Creative Cultures, Coventry University, UK

Abstract

Globally, transport poverty is acknowledged as a wicked problem. Transport is an enabler to education, health care, employment, and leisure activities. Therefore, reducing transport poverty is key for the EU to building an inclusive and equal society. However, many citizens are denied access to effective and efficient forms of transport. They may lack agency/freedom to travel, the transport they need unaffordable or unavailable. Certain groups are designed out of transport systems, and therefore out of the life of the city. Not all these reasons are to do with transport per se, but they are exacerbated by inequalities in the transport system. The term 'gender transport poverty' has been used to emphasize the added problems faced by women because of their gender.

The H2020 TInnGO project was designed to create a paradigm shift in the European transport (usage, employment, and education) sector, in the emerging field of smart mobility with respect to gender. This paper articulates some of the work conducted by the project to show the gains which can be made through recognizing and naming gender transport poverty as a wicked problem.

Introduction

The H2020 TInnGO project aimed to create a paradigm shift in Europe in the transport sector to lead to greater equality in the sector, and to understand and remove barriers to mobility for women, thereby creating a more inclusive society.

The starting point was the recognition that

- previous approaches such as gender mainstreaming, although proven to be effective have not been widely adopted,
- survey results repeatedly point to the same problems (such as safety and security, lack of support for trip chaining, greater vulnerability in traffic accidents, gender biases in employment). This illustrates that these have not be addressed and potential solutions for increasing inclusivity not implemented (e.g., better lighting, security cameras, driver training),
- ethnographic studies of the lived experience of female transport users, such as harassment on transport and public spaces have not translated into significant levels of empathy and championing of the needs of vulnerable groups in transport design, implementation, and operation.

Smart mobility may provide an opportunity to create fairer transport services and hence a more equitable society - with new service offerings providing on demand, greener, safer, and more flexible transport. It will also provide accurate, potentially disaggregatable, open data which will provide a better, and potentially more convincing evidence base to build fairer transport.

The key question is how can the Transport Business Ecosystem, and the smart mobility sector in particular be more engaged in debates and actions to reduce (gender) transport poverty?

Transport poverty

Firstly, one has to confront and accept the reality of transport poverty as a wicked problem (Rittel and Webber, 1973). Transport poverty has four key elements, namely

- Mobility poverty; Non-availability or poor design of motorized transport appropriate to the needs of an individual.
- Accessibility poverty; The inability of transport to reach destinations which ensure a decent quality of life.
- Transport affordability; not being able to afford the cost of transport.
- Exposure to transport externalities; including the harmful effects of exposure to the transport system itself, such as traffic congestion, pollution, or accidents.

However, these are systemically linked to socio-political and cultural problems (Lucas, et al, 2016), creating further cycles of poverty and deprivation. For example, poor access to transport, means limited access to employment opportunities, health care and recreational facilities. Poor transportation is a challenge for everyone, but it is more of a problem for women and 'traditionally disadvantaged' groups where interrelated factors create downward spirals of poverty and social exclusion. This is exemplified in figure 1 in relation to the gender and diversity sensitive evaluation tool.

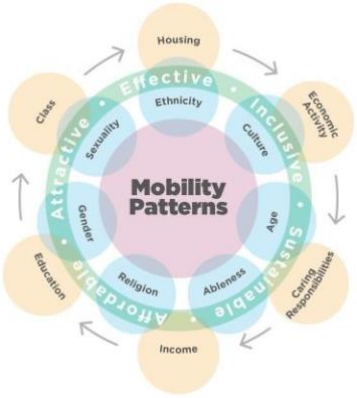

Figure 1 TInnGO Intersectional Design Wheel (Saunders et al, 2021)

Within the EU, as elsewhere, gender transport poverty has not received much attention (Lucas, 2012). This is an important concept as it acknowledges the disproportionate, societal burdens on women. Women take on multiple roles as mothers, employers, carers, and housekeepers. Their journeys are prescribed by others, so they are more complicated and serve multiple purposes. For example, they may travel with people who need special assistance, they have less time, and may have less money as a consequence of gender pay gaps, they need to take lower paid/part time work to fit around their families' requirements. On top of this societal, cultural, and religious norms prevalent in some societies, may affect a women's agency (i.e., their freedom to travel how, when and where they like), the level of respect, safety, and security they experience on transport and in the public domain. Hence, socioeconomic status, marital status, gender, and age can also contribute to social disadvantage. These factors feed into reduced mobility and marginalisation of groups (Uteng and Lucas 2018)

Gender transport poverty and the stress on women is exacerbated by poor quality of transport services, especially in low -income areas or households where women are more dependent on public transport, and on routes which have been designed to minimise the cost of providing access to the greatest number of passengers. Journey times and routes have not been designed for non-commuters or those having to trip chain. Smart mobility services may plug this gap – but some local authorities

(Spundflasch et al, 2019) have expressed concerns that they may not be as inclusive as current transport provision and will reduce the revenue used to fund concessionary or non-profitable services. Lack of affordable, reliable transport leads to increased poverty and social exclusion, greater anxiety, and the need for more careful planning and budgeting.

The basis of a paradigm shift

A key question is should transport consider issues related to transport poverty and social exclusion? Creating a paradigm shift in the sector requires a holistic approach. The conservative, male dominated and heavily engineering led transport fields have not specialised in focusing on the needs of real-world users. As a result, travellers have been left to manage with the systems with which they are presented. Personal examples include the scheduling of flights for maximum efficiency, which does not leave any margin for error for those making connecting flights (whether this error is caused by late running flights, gate management or simply getting lost/not able to walk at the speed of the presumably able bodied, time and motion expert who set the parameters), lack of pedestrian /cycling infrastructure.

Changing the sector means feeding it with people who can make a difference once they graduate. However, looking at three examples in the **educational** domain:

- Engineering graduates have admitted they have not been taught to consider the human as part of the system.
- Young students are attracted to transport design because they are interested in aesthetics, concept vehicles and speed rather than taking a more systems and user-oriented approach, to the needs of real transport users. We are in a transitional society in which designing for early adopters in the hope that 'late adopters and laggards will catch up, is no longer appropriate (Woodcock, 2014). It takes too long, especially when one considers that this group represents 50% of the population. This is a mindset which is difficult to change, exacerbated by male dominated cohorts and teaching staff (Gut et al, 2021a). User needs may be reduced to package drawings which show that vehicle interiors can accommodate 2.5 percentile Chinese females and 97.5 percentile Dutch males.
- The lack of gender and cultural/ethnic diversity in transport research teams (and across the HEI) is a real barrier to the development of female leaders.

Current educational systems, and curricular need to change, as they perpetuate old ways of thinking and skill sets. These are out of alignment with pressing societal and industrial needs. Analysis of funding and research outcomes shows that fewer females win substantial research contracts, their work is not so highly regarded, and they have less powerful networks (Gut et al, 2021).

TInnGO has tried to address the shortcomings in design education

- by introducing user centred design and empathy to undergraduate students; giving them space and time to work on design provocations – as a means of developing deeper conversations with proxy users and the need to base the design of smart mobility products on an understanding of user requirements – not just from their imaginations or market reviews (Woodcock et al, 2020).
- development of the EAASI tool (Saunders et al 2021) to evaluate smart mobility design concepts in terms of their Effectiveness, Attractiveness; Affordability; Sustainability and Inclusivity

The lack of gender, ethical and cultural diversity permeates the whole transport **employment** sector in all countries in the TInnGO project (Roseanu et al, 2021, with women found in less senior roles and occupying different jobs e.g., clerical, cleaning and hosting. Successful women, regardless of transport sector reported the same challenges and barriers (e.g., misogynism, gender pay gaps, managing the work life balance, glass ceilings) and the resilience and fortitude they needed to succeed. Other sectors have benefitted from recognising the importance of work force diversity in effectiveness, creativity and developing a tacit understanding of the needs of different sectors of the society – creating opportunities to develop products for new market sectors. Not having gender equality in employment is a key problem as male dominated industries may have little understanding of the needs of those unlike themselves.

To address this, we have provided training material to raise the importance of gender related issues, gender and diversity action planning tools and provided inspirational stories, a mentorship network on Facebook and guides to finding the correct mentor. Networking and mentorship are important for women to increase their profile and access to opportunities, but many have been criticised in terms of their effectiveness. Gender and diversity action planning tools can be used by organisations to increase workforce diversity, promote gender mainstreaming, and evaluate the sender and diversity sensitivity of smart mobility products,

> In 2000, Turner and Grieco, using the example of centralised urban and welfare services, were heavily critical of **transport planners** who had *'failed to produce systematic methodologies which incorporate gender analysis for the purpose of urban development and planning. At present it would be fair to argue that there are no systematic gender - inclusion procedures for transport, in terms of the training of professionals, in terms of the participation of users or in terms of the design and planning of transport systems, transport services and equipment'*, p132.

Gender analysis, social and environmental impact assessment tools do exist, but may not be used effectively to evaluate the distributed and wider effects of proposed transport systems. Here we have advocated the use of the TInnGO roadmap and GaDAP tools to support planning process. TInnGO's German hub has particularly addressed this issue. Surprisingly, across the organisations we have worked with, we have found it very difficult to persuade organisations within the Transport Business Ecosystem to look at gender related issues within their organisations and clientele.

The difficulties in **engaging citizens** in transport planning activities are well known, we have experimented with codesign and citizen science as more interactive and 'fun' ways to understand the user experience (e.g., through the design provocations and Open Innovation Platform and neighbourhood walks, and a street harassment reporting tool). These activities can lead to deeper understanding by design and implementation teams, awareness razing and build up competence and knowledge within local communities.

Transport planners are now able to **acquire real time mobility data** to inform their actions, from a number of sources (e.g., in vehicle, roadside, from transport apps and service providers. It is still the case that data is not routinely collected or analysed in relation to the socio demographic profile of users, even though trip information is collected. So, service providers may not know who is using their vehicles, how different groups of people travel to work or why they are using their vehicles. This crucial intersectional data is of vital interest to both service providers and local authorities.

To address, this we have performed intersectional analysis of mobility data from the TInnGO hubs, to illustrate how data can be used and what can be revealed (Arguello et al, 2021) from intersectional analysis. Data was collected during the covid lockdown, revealing a shift in gender related mobility patterns in some countries, but also the same issues arising in terms of safety and security for women

travellers. Additionally, we have developed an open data repository for secure storage and access of data by the wider community. However, there is extreme reluctance on the part of data gatherers and owners to share data for the benefit of the wider research community. Such issues are unfortunately outside the scope of the community.

Conclusions

Creating a paradigm shift towards greater equality in transport design, usage and operation requires a holistic approach which goes beyond the mere reporting of problems and piecemeal solutions. Intersectional approaches reveal how multiple levels of deprivation and inequality contribute to gender transport poverty. This means efforts should focus on addressing the wider issues as well Transport does not exist in a vacuum; it is influenced by the context in which it is designed and takes place. Uncovering and discussing these wider issues and how they affect mobility is key to increasing inclusivity and equality both in transport and in wider society.

H2020 TInnGO has over the course of its lifetime discovered some of the barriers to progress within the sector. This paper has looked in particular at biases in education and employment practices which impede the progress of women to leadership and influential positions and may actually result in them leaving the sector; the lack of recognition of the need for greater workplace diversity.

There is a growing body of data which evidences women's mobility patterns, the social, cultural, and economic case for supporting their journeys. TInnGO as a project has contributed to this and provided a means by which data can be stored and shared between projects. More data is undoubtedly needed, but more importantly there needs to be an appetite to use this data to create more equitable transport systems which reduce gender transport poverty.

Acknowledgements

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9.30-9.45 /10.30-10.45 Presentation 2: Wednesday, 17th November 2021

Fairness and Inclusivity for Transport operators. Moving towards a Maturity Model for evaluating services against user needs

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Abstract
The Diamond project initially set out a first set of fairness characteristics for four specific area of applications in transport: (1) users of urban rail surface transport, (2) User acceptance for autonomous vehicles, (3) users of share bike services, (4) employees in the rail sector. This was then supplemented by the initial analysis of primary data collection and a further scoping review, which looked to explore best practice and provide suggestions on how to improve each area of fairness to achieve a better level of maturity in the inclusiveness of the service and or employment provision. This led to the formulation of a self-assessment tool for organization in rating their level of fairness and inclusivity using the concept of a fairness maturity Model. This short paper presents the key underpinning concepts used.

Introduction

The DIAMOND project has adopted and formulated an approach to help transport organizations evaluate how fair and inclusive their services and employment conditions are based on the academic literature and the data collected from across eight European countries for the project. The DIAMOND model is based on the Safety Culture Maturity Model which was first developed in 2000 in an offshore technology report issued by the UK HSE (Fleming 2000). The model concept was developed on the basis of a five-level process issued by the Software Engineering Institute (SEI) as a mechanism to assist organizations in developing better software engineering practices (Paulk et al. 1993). The maturity model framework has been further adapted to be used in other domains and to address issues, such as project management (Fincher and Levin1997), human resources (Helfey et al. 19195), usability (Earthy 1998) etc. The capability maturity model concept is particularly useful in the context of the DIAMOND project because it can be used as a diagnostic tool, to enable transport organisations to establish their current level of maturity and the actions required to reach the next level.

The core elements that form the safety culture maturity model have been adapted from the safety culture components listed by the UK HSE in a guidance document called HSG48 (HSE 1999). The DIAMOND maturity model is based on the characteristics identified for each Use Case on the basis of the literature review (WP3) and the initial focus groups and revised on the basis of the Fairness characteristics identified from the literature review and further revised through the datasets collected through the activities of 'Work Package 3 – Data collection' focusing on each Use Case of DIAMOND.

In summary the Fairness and inclusiveness dimensions considered are those aspects that different and diverse female users find important for a *comfortable, safe, and useful service* or for *inclusive and fair* employment in transport. In this sense they could differ from one Use Case to another as summarised above in the present document.

Examples of Fairness Maturity Model applied

The key characteristics identifying different levels of maturity will be customised for each Use Case, however they fundamentally subdivide into considering fairness in employment and in usage of a transport service. This builds on the literature review and analysis carried out in relation to Socio-economic, demographic, and psychological choices for women in transport. It describes the identification of related specific issues (based on importance, or major research gaps, identified in the scoping review and the quantitative and qualitative data analysis) concerning fairness for women as users of transport, and as employees in transport. This was done through a systematic-type scoping review and data analysis to provide a basis for describing and analysing a) the association between key women characteristics and transport modalities features, and b) women preferences and job characteristics of different work activities in the sector. (see Leva et al. 2021)

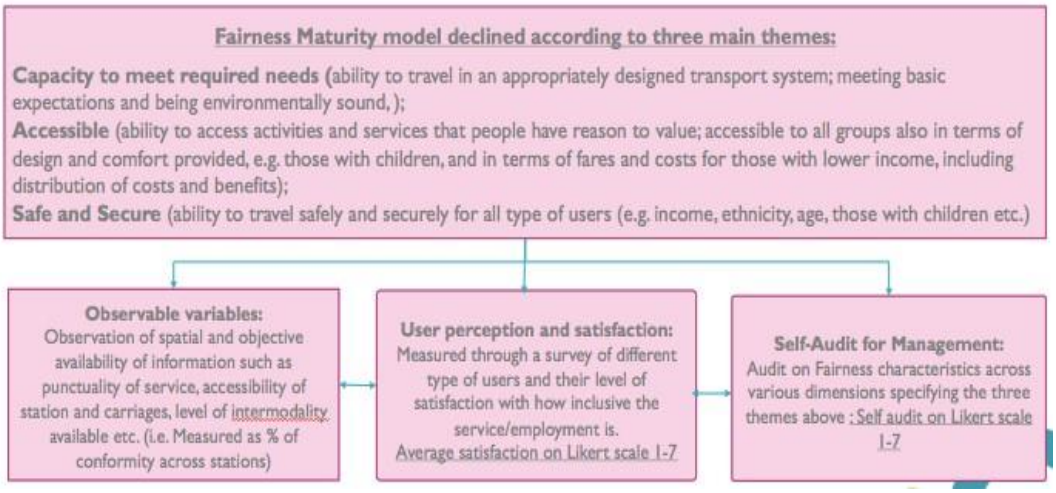

Figure 1: DIAMOND Fairness Maturity Model, based on Cooper M.D. (2000)

The maturity model defined for this application has four levels as reported in Figure 2. The four level are described below.

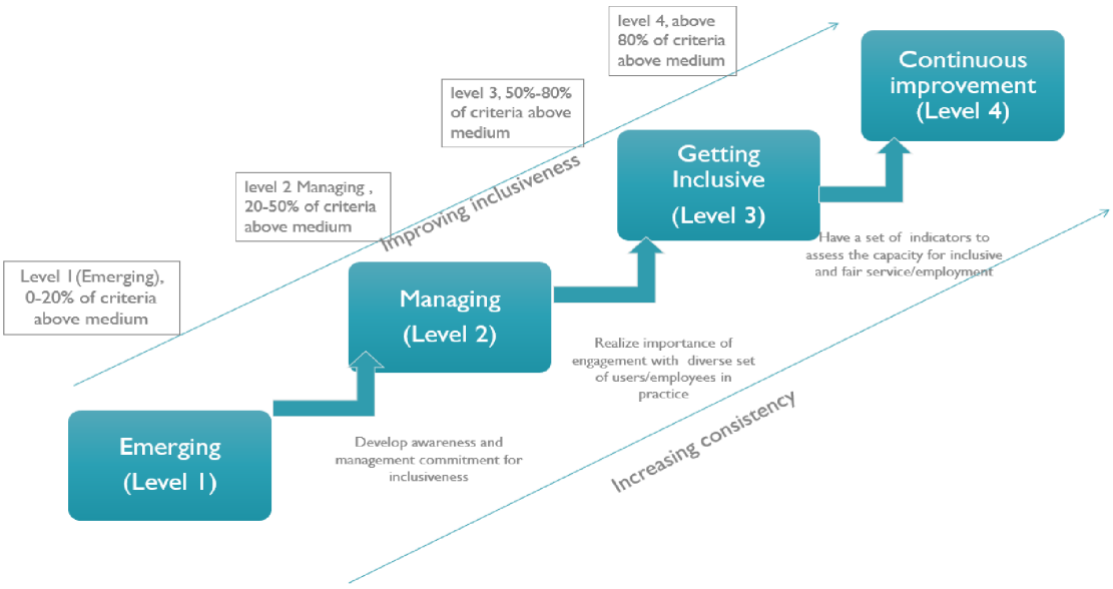

Figure 2. DIAMOND Fairness Maturity Model

Emerging (Level 1)

It is characteristic of processes at this level to be typically undocumented and are usually driven in an ad hoc manner by users or events. This provides an unstable or chaotic environment for the processes. Fairness is not seen as a key business risk. Most frontline staff may only use fairness as the basis for other arguments, such as changes in shift systems.

Managing (Level 2)

The organisation's understanding and provisions for fairness and inclusivity is average for its sector but they tend to have an initial awareness of the relevance of it, even if their performance in this sense is not being monitored. Fairness and inclusivity are seen as part of the company objectives but limited management time and effort is put into achieving them. Fairness is solely defined in terms of adherence to rules and procedures. Fairness and inclusivity are measured in terms of lagging indicators only.

Getting Inclusive (Level 3)

Accident rates are relatively low, but they have reached a plateau. The organisation is convinced that the involvement of the frontline employee in fairness and inclusivity is critical, if future improvements are going to be achieved. Managers recognise that a wide range of factors lead to fairness being upheld and some of these factors originate from management decisions. A significant proportion of frontline employees are willing to work with management to improve fairness and inclusivity. The performance is actively monitored and the data is used effectively.

Continuous Improvement (Level 4)

The majority of staff in the organisation are convinced that fairness and inclusivity are important from both a moral and economic point of view for the service being offered and for employment conditions. Managers and frontline staff recognise that a wide range of factors are contributing to fairness being upheld and some of them come back to management decisions. Frontline staff accept personal responsibility for their own role in fairness and inclusion. The importance of all employees feeling valued and treated fairly is recognised. The organisation puts significant effort into proactive measures to improve their level of fairness and inclusivity in the services and in the organizational conditions for their employee. The performance is actively monitored using all data available.

Based on the concept of Fairness applied to the four use cases addressed by Diamond published in Hail, Y., & McQuaid, R. (2021) and taking into account all the results and learnt lessons detailed in the section 2 of this Deliverable a Fairness Maturity model has been created.

This Fairness Maturity Model (FMM) starts with a self-evaluation of the transport service provider or the employer (15 minutes effort) which provides a score about the level of fairness. A FMM table was therefore provided and customised for each use case. The table below report the example formulated for the use case about fairness for women using light rail surface transports.

The score about the level of fairness is calculated considering some "high", "medium" or "low" standards defined by:

- The interdisciplinary Diamond's team, and
- External experts belonging to the WAVE association. (These standards were collected through on-line templates).
- Feed-back collected from workshops

After getting this score about fairness, the FMM provides some recommendations to the transport service provider or employer for managing and getting inclusion, and finally some simulations can be managed by this service provider and employer with the aim to appropriately address a continuous improvement by being aware of what points must be more priorly addressed.

All this process can be customized per different socio-demographic profiles by the transport service provider and employer.

	SCORING KEY			Score
	Poor-1	2	Good-3	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 1) Reliability and efficiency	Service scheduled travel/transit time is always exceeded.	Good travel time for journey with some delays	Evidence of reliable transit/service operational times that allows on-time arrival at destinations	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 2) Service and efficiency for commuting	Commuter isolated due to lack of service e.g. rural commuters, night, or last service options etc	Service allocation for city areas but lacking or scarce in suburban and rural zones	Good frequency and availability of service for different areas i.e. rural, urban areas irrespective of day of the week	

	SCORING KEY			Score
	Poor - 1	2	Good - 3	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 3) Service and efficiency access to point of interest for all users	Lack of significant service to point of interest suited to the needs of diverse users	Good number of services allocated to some point of interest around stations vicinity and distant locations.	Level of service that allows physical access to points/facilities/service/areas within stations proximity are good for all users (e.g. including people with disabilities, parents with toddlers, elderly, carers)	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 4) Integration with other modes of public transport including bus, train, etc	Poor local and inter-city mode links to many locations.	Some connection service to travel destinations	Well-connected service to communities and/or destination that suits travel purpose of users	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 5) Wayfaring information	No presence of visible and/or clear real-time information available at stations and/or stops.	Operational service structure with displayed service information visible and understandable for most users but incomprehensible for some.	Presence of operative and efficient boarding system, legible and clear information for scheduled route that aids the understanding for options of transit/destination journey for all users.	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 6) Service and efficiency	Absence of substantial and dependable rail, bus, light rail/metro service allocated at all hours of the day	Frequency of operational hours of service mode fits some user travel requirements/daily travel	Reliable service modes available at all operational hours and well managed flow of waiting time to service entrée/access	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 7) Service and efficiency	Trip chain travel, carers and disabled commuters have limited options to routes and stops	Some areas overserved with modal service and others lacking	Option to use different types of transport and multimodal transfer are dependable and readily available	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 8)Service reliability	Waiting times are significantly longer in comparison to travel times. Presence of Inaccessible public transport transit lanes that could provide efficient flow to destination routes.	Minor sources of delay while using public transport e.g. poor transport operation and/or layout. Minimal waiting time for transit mode during travel	Selections of public transport modes and transit design allows for reliable journey travel times that suits daily travel needs of all users.	

	SCORING KEY			Score
	Poor - 1	2	Good - 3	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 9) Service and efficiency	Measured and inconsistent service available for leisure and work purpose.	Good quality of service for various daily interconnected travels with room for improvement	Availability of fast and consistent service between/or for single or multiple trips (chained trips) carried out through the day by women, carers etc. both for work and non-work purpose.	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 10) wayfaring information and integration with other modes of public transport	Poor corresponding information on connecting modes of transport and train/service times and errors while booking on public transport platforms.	Good functioning technological system that allows for real-time travel information during journeys, adequate payment and reserve process but not understood by all users e.g. user less tech savvy	Highly efficient telematic system that allows inclusive and reliable travel and payment plan along with incorporated information throughout passenger journey.	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 11) Integration with other modes of public transport including	Lack of modal option or service to usual travel destinations from the station.	Service mode appropriate for travel purpose but lacks sufficient inter-modal network connections	Location of station allows for good mode of intersection with intermodal and multiple trips suitable for travel purpose and journeys.	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 12) Integration with other modes of public transport including	Location of station allows for deprived interconnection, route selection and mode options for persons travelling with dependants.	Station transport network is well connected and supports convenient travel journeys for women with children, carers, and all abilities to different places	Excellently Seamless (obstacle free routes etc) and user-friendly service operations derived from station while using various modes of transit in travel journey for women with children, carers, and individuals with reduced mobility.	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 13) Integration with other modes of public transport including	Poor integration of existing or reachable alternate to shared and on demand mobility service for last mile connections.	Proximity of accessibly service modes (public transport) are passable for all user demand but not always suitable for last mile travel.	Physical access to mode points/service within stations proximity is suitable for all users (e.g. including people with disabilities) and alternative shared mobility services for last mile connections are available (e.g. bike, scooter and car, taxies etc.)	

	SCORING KEY			Score
	Poor - 1	2	Good - 3	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 14) Integration with other modes of public transport including	Poor merge of provided modes of transport for all e.g. distanced platforms with no room for speedy/impromptu self-emergency boarding/departing of mobile vehicles, women with children or as carers.	Available interconnected modes of transport but lack accessible platforms for carers, the disabled, women with children that enables convenient boarding. e.g. self-service or service provided ramps/facility available if needed by passengers.	Incorporation of near-level platforms, level boarding and readily allocated provision/service that permits quicker passenger and/or their transit vehicles boarding and existing while using different modes public transport.	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 15)Design	Minimal presence of well-rounded seating layout for all users.	Available public seating but few visible priorities given to parents with children, disabled, elderly etc	Good seating design that fulfils the need and/or with appropriation given to pregnant women, persons/carers with toddlers, disabled persons, elderly etc.	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 16) directions in stations	Absence of easily navigated directions, accessible interphone communications with control-centre, present help desk attendee and clearly audible or visible service operation information.	Poorly visible vertical and horizontal signposting on platform levels. Accessible wayfinding and online planning tools evident but not user friendly for all user.	Clearly marked signage for easy wayfinding, relatable/comprehensible video, or audible announcement on travel updates for concourse and platform level suitable for all, i.e. hearing and sight disabilities.	
CAPACITY TO MEET REQUIRED NEEDS (for all users) 17) Improved ventilation and air-conditioning	Inconducive temperature and poor ventilation in stations and on public transport	Good airing and temperature on some services (bus, trains, trams) and stations but lacking in others.	Adequate cross-ventilation and air-conditioned environments and travel modes suitable for different seasons and meet the needs of women with children, elderly etc.	
ACCESSIBILITY: (for all users) 18) Location of station	Maximum walkable access and distance to the railway station – 50% of access travels longer than 1.5 km.	Varying walking time/distance from points of interest to stations and vice versa.	Physical access to the station walkability and access. Maximum access distance to the railway station – 50% of access travels less than 1.5 km.	
ACCESSIBILITY: (for all users) 19) Location of station	Long distance (Above 400m) and unfavourable physical, symbolic, and psychological barriers that hinders or lessens the choice to walk to and from station to points of interest	Accessible walk commute provision from station to point of interest that suits the need of individuals with children during transit but lacking in proximity.	Within 400m convenient, pleasant safe walking conditions with good foot path conditions without dark/isolated corridors suitable for lone parents etc.	

	SCORING KEY			Score
	Poor - 1	2	Good - 3	
	parents with toddlers, single parents etc.			
ACCESSIBILITY: (for all users) 20) Location of station	Long distance and unfavourable walks/paths to stops/stations for connecting travels.	Accessible walks to stops/stations during transit for all users.	Less/fewer walk distance/times between locations while carrying out single or multiple trips for women with children, carers, disabled etc.	
ACCESSIBILITY: (for all users) 21) Reliability and efficiency	Unreliable service, low frequency, inefficient connections between transport modes and services, lack of feeder public transport, bike and car sharing services. Without alignment to the needs of minority passenger segments.	Reliable service, high frequency, good integration with other modes of transport. Induction loops, fixed ramps, help points, handrails, mobile customer assistance points.	Efficient and accessible multimodal transfers, integrating ticketing systems, presence of feeder public transport, presence of bike sharing and car sharing service. Services are in line with the need of minority segments of passengers.	
SAFETY AND SECURITY: (for all users) 22) harassment and pickpocketing	Presence of complaint information points, but mostly lack surveillance personnel when cases needed.	Presence of complaint information point but security or transport personnel sometimes lacking a gender sensitive approach to users of service but not available for all service.	Proportioned and readily available complaint information points on transit mode or at station/stops for single travellers, women with children etc available at urban, rural or sub-urban areas in the case of safety violation and presence security measures and accessible security staffs.	
SAFETY AND SECURITY: (for all users) 23) harassment and pickpocketing	Facilities and trains are not equipped with modern tools for monitoring/reporting of violence	Available platforms and information on personal safety violation with slow response/follow up.	Easy to understand platforms and information on the process to report cases of personal safety violations openly or privately.	
SAFETY AND SECURITY: (for all users) 24) harassment and pickpocketing	Poor lighting for the close areas of the station.	Surrounding of station equipped with visible but poor lighting in some areas.	High visibility and improved lighting for the surrounding area of the station.	

	SCORING KEY			Score
	Poor - 1	2	Good - 3	
SAFETY AND SECURITY: (for all users) 25)harassment and pickpocketing	Stations surrounding layout prohibits visibility of amenities and approaching service or modes that fits all users	Forthcoming modes of travel are impartially visible and appropriate for most users nonetheless lacking in some locations.	Clear visibility of approaching and departing vehicles, amenities, and safety guidelines present/suitable regardless of living environment, gender, responsibilities (parent or carer), age or disability.	
SAFETY AND SECURITY: (for all users) **26)** Design	Station design allows poor/closed environments that are not within view sub-areas or persons	Some occluded areas in station surroundings but passengers within view of other passenger and staff	Good environment visibility and open areas within view of other area, other passengers, staff, and security personnel.	
SAFETY AND SECURITY: (for all users) **27)** Harassment and pickpocketing	Entrance and exist not within sight or easily located by all users	Station surrounding directions not effectively linked to entrance and exit but within view	All entrances and exit are within view with directions of surroundings well marked and obvious	
SAFETY AND SECURITY: (for all users) 28) Harassment and pickpocketing	No obvious or clearly marked automated or natural surveillance and security points at the surrounding areas of the station	Some station surveillance visible and absent in some areas	Presence of visible CCTV, security aids (Police/transport staff), automated platforms (Emergency alarms, panic buttons, phone, strips) clearly visible in the vicinity around station.	
SAFETY AND SECURITY: (for all users) **29)** Display advertisements for public awareness campaigns and for publicizing helpline numbers	No visible display advertisements for public awareness campaigns and for publicizing helpline numbers.	Presence of helpline number but no clearly publicised guidelines or advertisements or movements for public awareness campaigns	Evidence of well-informed advertised public awareness movements along with information and/or helpline contacts.	
SAFETY AND SECURITY: (for all users) **30)** Overcrowding and emergency management	Poor allocation, structure, or design that does not give room for personal space or crowd control.	Public transport allows for personal space while travelling but low allocation for multiple users e.g. mothers with children, disabled, careers etc when needed.	Redesigned space within the trains that allows adequate personal space, conducive travel experience and the regulation of crowds for users of public transport whom are mothers with children, elderly, careers, disabled etc.	

	SCORING KEY			Score
	Poor - 1	2	Good - 3	
SAFETY AND SECURITY: (for all users) 31) Overcrowding and emergency management	Stations and trains are not empowered with hardware and software measures for handling overcrowding. .	Supporting tariff measures for reducing the overcrowding (shifting the flows out of the peak hours).	System for real-time train crowding information provision - Apps and websites highlighting less crowded carriages; Advanced solutions for platform overcrowding (wide and long platform area, improved design of tunnels, enough number of stairs, enough check-in and check-out posts), crowd controller system.	
SAFETY AND SECURITY: (for all users) 32) Overcrowding and emergency management	Traditional emergency management without advanced procedures and tools for acting in case of emergency	Developed emergency plan with several emergency call points; Clear emergency procedures; Passenger information and security systems.	Emergency call points established and for passengers available (on a number of points) emergency procedures in trains and at stations with detailed evacuation plans; enough number of emergency exits for evacuation.	
SAFETY AND SECURITY: (for all users) 33) Overcrowding and emergency management	Cramped and insecure stop/station/transit links/locations while travelling.	Good universal design in stop/station/transit that allows a decent flow for carers, women with children, elderly and with disabilities.	Access to well-structured and safer transit network for better travel experience e.g. public space (congestion avoided etc), walk pathways (road crossings etc), stops and station.	
SAFETY AND SECURITY: (for all users) 34) Overcrowding and emergency management	Available seat without standard that accommodate the disabled, carers, women with children.	Seating outline gives options for more/less social interactions with some room for efficient exits for women with children, carers etc.	Improved seating layout that accommodates emergency exits for all users and with less dealings with other public transport users if needed.	
			Raw Score 1- (34*3)	
			Divide by 34	

The maturity model criteria were evaluated with experts in the course of different workshops and then the resulting self-diagnosis questions were used as a foundation of a Web-based toolbox, which will be available online at the end of the project for other organisation to use as a benchmark of the level of fairness and inclusivity they offer in their mobility services or as part of their employment conditions.

Acknowledgements
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Session I: Discussing users' attitudes and mode choices towards transport

10.00-10.15/11.00-11.15 Presentation 3: Wednesday, 17th November 2021

Factors that change attitude to public transport during mayor transport system changes

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Abstract

In the paper author analyses the question how car users may radicalize their opinions about public transport quality? Analyzed city is Warsaw in Poland. The time of analysis are years 2018 and 2019. This time is representative for a substantial new part of Warsaw 2nd metro line opening, as well as new road arrangements made for construction of the further part of the 2nd line. Both changes were upgrading public transport quality.

To analyze the issue author used existing results of Warsaw Barometer survey made on the representative sample of 1100 Warsaw inhabitants. Autor took the results of Warsaw Barometer and divided its respondents into 6 groups that declare different intensity of use of car and public transport. Results are shown as changes in attitude of these 6 groups towards various aspects of public transport before and after the changes in the transport system. Results shows clear difference in opinion changes between frequent users of car and public transport. Car users end up generally more negative in their

attitudes to public transport – their opinions radicalize in a descriptive meaning from the beginning to the end of the analyzed period (eg. McCauley and Moskalenko, 2008). Reasons for these changes are seek in the real changes of people daily travel routines.

Introduction

Warsaw city is probably not the only one, where temperature of discussion between car users and proponents for car use restrictions is high. Internet fora is full of negative opinions about public transport stated by declared car users, starting from the precondition, that public transport is mostly for the poor. Many times, public transport also share their negative views about car users, who are blamed for congestion, air pollution, noise, and general deterioration of the quality of city life. These excessive opinions do not help in changing city transport systems, towards more environmentally friendly.

Public transport quality research focusses on the opinion of public transport users only, what can be found in many national handbooks about that issue (SITK, 2002) and research results (Starowicz, Bryniarska, 2010; Park et all, 2003; Alpert, Golden, 1978; Morton, Caufield, Anable, 2016). There are many various types of research (de Ona, de Ona, 2014), that allow for assessment of public transport quality, but base on the samples mostly made among public transport users. Sometimes fruitful experiments led into exchange of travel behaviour of car users towards more frequent use of public transport and therefore rising attitude towards this means of transport (Forward, 2019). It is not easy to find fruitful studies, that explore car users' opinions on public transport just as the studies made by Steg (2003), Beirao and Cabral (2007) or Grdzelishvili and Sathre (2011). Therefore, it is important to make such studies and find out more about the mechanisms of opinions changes in the car users.

To guide the discussion about transport system changes in a local context it is equally important to understand how and why different transport users' groups change their opinions and how radical groups can form. This can be made mostly by studying changes in transport behaviour and changes of the attitudes with the time. This article tries to show one of the causes of such radicalisation.

Method

We used a simple strategy of evaluation research, to find out, how the opinions of different transport users change. The opportunity for the research was created by the fact, that since 2003 Warsaw hold a regular opinion survey among its citizens - Warsaw Barometer (Warsaw City Hall, 2003-2019). Warsaw Barometer is a survey among city inhabitants that consists of many questions about the perception of quality of public services in the city. The survey is done twice a year. For the transport it covers various aspects like frequency, punctuality, range, crowdedness. It also allows for division of respondents according to the type of transport they use. Warsaw Barometer is made on the representative sample of 1100 Warsaw inhabitants.

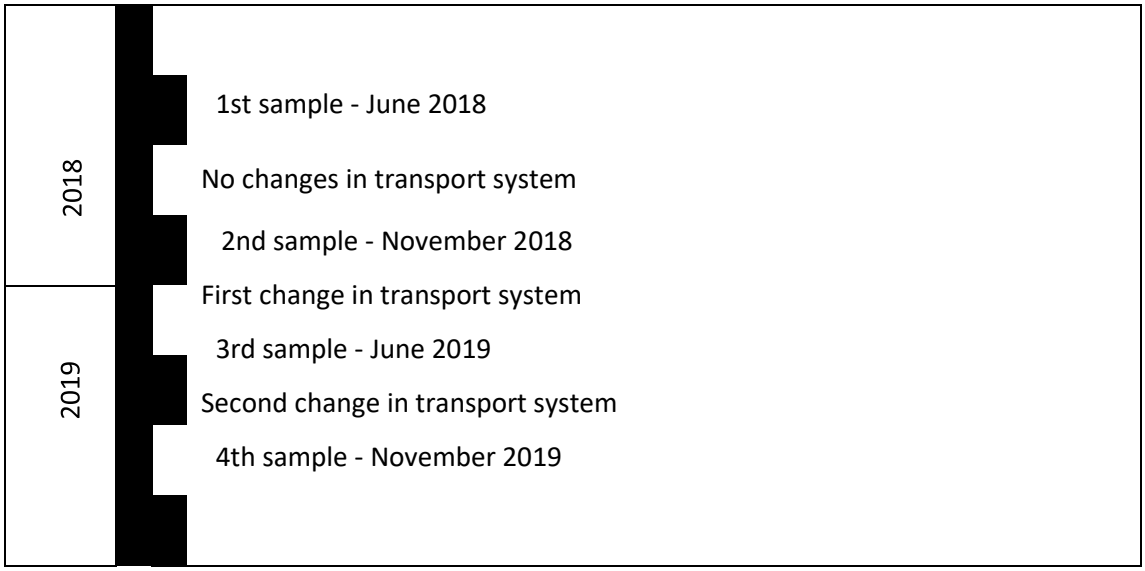
For the sake of this article, the results of questions about the quality of travel either by car or by public transport are shown. These are two separate questions in the Warsaw Barometer, that measure the quality of travel by a rating scale. The scale has 10 points from 1, being the worst opinion, to 10, being the best opinion. We measure the overall opinion of the respondents by a weighted mean of the opinions shown by a specified group of respondents.

The evaluation study was created by picking up results of the Warsaw Barometer from 4 subsequent samples done in the time of important changes in Warsaw public transport system and checking the changes of opinions between the samples. The overed period was 2018-2019 when the samples of the survey were realised both years in June and November. Those years were the time when only two important changes occurred in Warsaw transport system, and they took place exactly between three of the analysed samples.

First change took place at the beginning of March 2019, when Saint Vincet Street was closed for the use of private cars and left open only for public busses. This street is one of the important road axles connecting North-East districts of the city with the centre. At the same time important district road Kondratowicza Street was also fully closed, and few local streets were rearranged to give public busses a priority. All those changes were caused by the extension of Warsaw Second Metro Line construction site.

Second change took place in September 2019. Second Warsaw Metro Line was extended for three new stations North-East. It allowed to connect one of the biggest Warsaw housing districts Targówek with the city centre with fast and direct public transport connection. At the same time additional rearrangements were made to upgrade bus connections of temporarily last station of the Second Metro Line with remaining North-East districts of the city where the extension of the metro is built. The table shows timeline of the Warsaw Barometer samples and transport system changes in the analysed period.

Table 1. Timeline of the samples and changes in transport system analyzed in the research



Second important method used was a division of the survey respondents into 6 groups that declare different intensity of use of car and public transport. In the sociological literature it is called a subgroup (or cluster) analysis (Babbie, 2003; de Ona, Lopez, de los Rios, de Ona, 2014). Based on the answers to the Warsaw Barometer questions about the frequency of using the car as a driver or passenger and using public transport, 6 groups of respondents were distinguished:

- Only drivers - people who use the car as a driver and do not use any other forms of transport.
- Car users - a group of drivers and car passengers who do not use public transport at all. - Car-preferring group - a group of those who everyday use the car as a driver or passenger and can also use public transport at various frequencies.
- Those who prefer public transport - a group of those who everyday use public transport and can also use a car in various forms and frequency.
- Passengers of public transport and cars - those who use public transport every day and never use the car as a driver.
- Public transport users - a group of public transport users, excluding all those who use a car in any form.

It is worth noting that not all these groups are separate, but in the presented structure, there is a strong gradation of respondents due to their preferences to use either a car or public transport. It is

sure, that only drivers and car users do not use public transport at all. The difference from car-preferring group to passengers of public transport and cars is in the lowering intensity of car use. On the other side public transport users do not use cars at all.

Results

The sizes and shares of each of the groups distinguished in the analysed samples of the survey are presented in the table.

To begin with, let us note that in the analysed period, the group of drivers, and even the group of car users (9.8-5.8%), was always at least twice smaller in the entire analysed population than the group of transport users (15-20.4%). The group of people preferring a car was always smaller (49% -61%) than the group preferring public transport (88-92%). It is worth remembering this relationship, as it underlies how the answers to many different questions about transport should be interpreted in the entire Warsaw Barometer study.

Assessment of the quality of traveling in Warsaw by public transport

Changes in the opinions of analysed groups about the quality of traveling by public transport in Warsaw among the samples are shown in the table and on the graph. Below we describe only the most important results that allow us to verify the research questions, whereas many more results could be derived from the numbers shown.

Table 2. Results of the assessment of the quality of travel in Warsaw by public transport among various transport users groups in 2018 and 2019 according to Warsaw Barometer samples. Own study.

Quality of travel with public transport	2018_1		2018_2		2019_1		2019_2	
	%	n	%	n	%	n	%	n
Only drivers	7,14	81	6,52	50	5,24	41	5,39	33
Car users	7,21	122	6,59	68	5,77	57	6,45	60
Car-preferring	7,70	628	7,37	527	7,68	597	7,49	721
Who prefer public transport	8,00	956	7,92	959	8,11	1005	7,91	1011
Passengers of public transport and cars	8,19	449	8,32	497	8,37	465	8,51	350
Public transport users	8,08	203	8,30	230	8,66	192	8,58	131
Mean opinion	7,98		7,81		7,93		7,79	

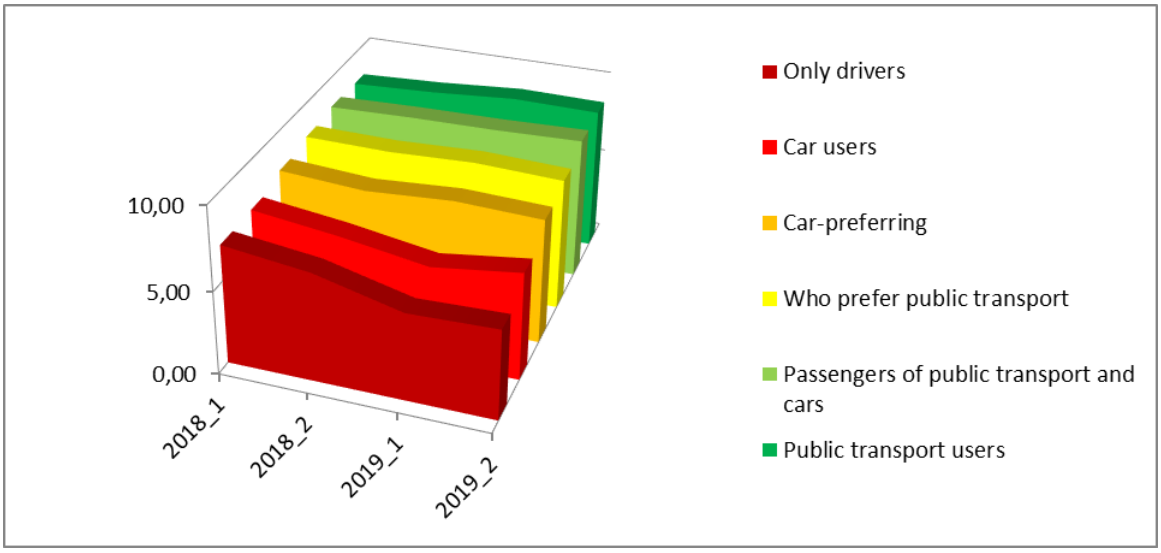


Figure 1 Change in opinions about the quality of travel with public transport among various transport users' groups in 2018 and 2019 according to Warsaw Barometer samples. Own study.

Throughout the analysed period, the results of the Warsaw Barometer show a clear tendency towards a worse assessment of the quality of traveling by public transport by people who use a car more intensively than by people who use public transport more intensively. This is a very clear difference. Between people who prefer a car and who prefer public transport there is always a difference of at least 0.3 (2018_1) and at most 0.5 points (2018_2). The overall assessment of public transport quality of travel in the whole population diminished from 7,98 to 7,79 but was waving between the periods and did not change as significantly as in the analysed subgroups.

The quality of public transport travel in the analysed period is assessed increasingly better by the groups that use more frequently public transport: the group of passengers - a jump in opinion from 8.19 to 8.51; and public transport users - jump in opinion from 8.08 to 8.5, with the highest opinion in June 2019 – 8,66. In groups of car-preferring people and those who prefer public transport the opinion was falling and rising from sample to sample with higher grades in June 2018 and 2019 and lover grades in November 2018 and 2019. The only groups that deteriorate their opinions about public transport are those using more frequently a car: only drivers – drop in opinion from 7.14 to 5.24-5.39 and car users - drop from 7.21 to 6.45 with the worst assessment in June 2019 - 5.77.

As a result of the changes described in the previous paragraph, the ratings of only drivers and users of public transport started to differ much more from each other. The difference between those groups rose from 0.94 points to 3.19 points. In the first half of 2019, the difference was the highest and amounted to 3.42 points.

From the first to the last analysed sample the number of only drivers asked in the survey dropped significantly from the number of 81 (7,3%) to 33 (3%). At the same time the number of public transport users also dropped from 203 (18,4%) to 131 (11,9%), but the highest number of this group representatives was asked in November 2018 – 230 (20,9%). Both most mixed groups: car-preferring and those who prefer public transport has increased their number of respondents. The group of those who prefer public transport was rising through all the period from 956 to 1011. Car-preferring group rose from 628 to 721, but its number of respondents was lower in November 2018 and June 2019 samples.

Interpretation

It can be seen from the presented numbers, that the only groups that deteriorated their opinion towards quality of travel with public transport were those, that did not use public transport at all. Their opinion was the most critical after introduction of first transport system changes, we analyse, in June 2019. We may say that this opinion seriously radicalised in descriptive meaning. Objectively there were no causes at that time to change this opinion this way. Firstly, those groups do not use public transport, so could not build their opinions upon their own experience. Secondly, any other group that was using public transport rather than car increased their overall opinion after that change. Then what might have been the cause of this change?

This could have been caused by the fact that the number of people in groups only drivers and car-users decreased from one study to another. It seems that people who were in this groups but had fewer radical views on public transport quality decided, because of the transport system changes, to change their daily travel plans and use other means of transport than before. They ended up in mixed groups. This created a situation, when people in car-using groups ended with more radical opinions about the quality of traveling by public transport. The occurrence of such a process is supported by a clear change in the contrast in the assessment between two groups car-preferring and those who prefer public transport. At the beginning of 2018, those who carpreferring group assessed travel with public transport worse by only 0.08 points than those who preferred public transport. At the end of the period, those who prefer public transport assessed it better by as much as 0.67 points than those who prefer cars.

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10.15-10.30/ 11.15-11.30 Presentation 4: Wednesday, 17th November 2021

Statistical modeling of mode choice for shopping trips in the central business district of Paynesville, Liberia.

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Transport Research Institute-Edinburgh Napier University, United Kingdom[2]

Abstract

Existing literature reveals that choice modeling techniques have been widely used to investigate and understand the factors that influence travel behavior among trip makers in the field of transport and sustainable planning. Most of these studies focused on work and education modeling, but there is limited literature on shopping travel behavior modeling in developing countries; especially in Liberia. The present research aims to investigate the behavioral factors of an individual traveler and develop a model that predicts the shopping travel mode choice of travelers within the Central Business District (CBD) of Paynesville, Liberia. A simple random sampling technique was adopted with a well-structured revealed preference questionnaire for the data collection of this study. A total of 751 samples was collected through a pen-and-paper-based survey in CBD. The collected data was analyzed using the Multinomial Logit Model (MNL) approach; two separate models were developed, shopping and general (all trips). Age, travel cost and time, travel distance, vehicle ownership, education, gender, income, and income, and trip purpose were identified in existing literature as the common factors influencing travel mode choice for shopping. In this present research, it was found that socioeconomic and demographic characteristics such as education, income, household location, and age had significant influence on commuters' travel choices. In addition, trip-related attributes (travel cost and time, trip purpose, and travel distance) were also identified as determinants influencing the travel choice of the study population. Therefore, improvement in the public transport service quality, might enhance user perception and attract more commuters toward the use of PT utility.

Keywords: Travel behavior analysis, CBD of Paynesville, Shopping trips, Discrete choice modeling

1. Introduction

Travel mode choice analysis plays an integral part in investigating some challenges faced by the transport infrastructures due to commuter's mode decisions; and it enables appropriate transport planning decision making for both motorized and non-motorized modes (Ben-Akiva, Moshe and Lerman, 1985; Thomas and Daniel, 1975). In particular, the prediction of the proportion of trips in terms of the mode share among travelers is better presented using discrete choice mode models rather than aggregate models (Ben-Akiva, Moshe and Lerman, 1985; Profillidis and Botzoris, 2006; Thomas and Daniel, 1975). In recent years, several studies have been carried out by transport planners, economists among others, and these researches aims were to understand how a group of people or individual travel behavior are influenced by their socioeconomic, trip-related, and level of service attributes (Bhat, 1996; Ding *et al.*, 2014; Manski and Manski, 2001; McFadden, 1974).

However, these studies were mainly centered around work trips using different types of data from urbanized travel surveys. Also, they developed comprehensive models based on specifications and tested the accuracy of predicting changes in the behavior as mentioned earlier. Based on these findings, the study suspects that due to of lack understanding about traveler behavioral choice in CBD of Paynesville, the transport network and individual traveler faced many problems as mentioned. Furthermore, the CBD of Paynesville has experienced exponential growth in the number of trips as mentioned in a report by Plan *et al.* (2008). This is due to the increased in activities such as shopping, work, education among others. As it stands, the CBD is considered one of the busiest urban locations when it comes to various trips and activities in Montserrado county (MPW *et al.*, 2019). For some time now, it is observed that there is a significant increase in the number of shopping stores and supermarkets (Plan *et al.*, 2008). From this evidence and existing research gap, the purpose of this current research is to identify and investigate the factors that influence travel mode choice for shopping trips and develop a model that explains and predicts the current travel behavior in the context of CBD of Paynesville, Liberia.

2. Literature review

Richards and Ben-Akiva (1974) examined mode choice for shopping trips in Eindhoven, the Netherland using multinomial logit models. They studied car ownership and trip-related variables such as travel time, travel distance, and out-of-pocket cost comparing these findings with developed work trip models using similar datasets. The study found that waiting and final destination time of public transport was insignificant. Furthermore, it was seen to influence travel mode in terms of transfer and waiting time in the work trip models for public transport which was attributed to limited variability in the data set used. In addition to this study, Marjanen (1995) and Bhat (1996) investigated shopping trips from a different perspective. For instance, Marjanen (1995) studied shopping travel behavior considering different activities areas and the changes in choice frequencies of different types of store locations (city-center shopping mall, edge-of-town retail park, and local stores) in Finland. While Bhat (1996), studied shopping travel behavior for both joint mode and departure time from existing travel survey data in United States of America. The essence of this study was to establish the statistical relationship between travel mode choice for shopping and identified independent variables (travel cost and time, employment status, and age). Multinomial Logiit Model approach was used to developed various models and it was identified that age, occupation, travel cost, and time had a significant influence on commuters' mode choice and departure time. Again, recent studies conducted in China by Ding *et al.* (2018) and Du *et al.* (2021) and in India by Meena *et al.* (2019) identified factors such as monthly income, number of people residing in a house, age, job status, car ownership, gender, driving license ownership as trip maker's characteristics that are common and influenced the travel mode choice. In addition, trip frequency and preferred time of the day to visit were also considered.

Despite numerous research contributions on mode choice for shopping, Su *et al.* (2009) argued that understanding shopping trip goes beyond just investigating the mode choice chosen before shopping. They suggested that combined mode travel decisions should be considered. In that, before and after shopping mode choice must be investigated because it is most likely that the mode selected by an individual before shopping might be different from the mode, he/she will pick after shopping due to additional loads to be carried. Henceforth, their study investigated the combined travel mode of only older people for shopping in this context. The study found that for the older commuters, the combined mode choice like using public transport and walking after shopping were based on the quality of services, the number of bus stops density, and public transport access time; these aformetioned factors influenced the elderly commuters to choose this mode. Based on findings from all the studies, the research considered these identified factors (variables) as the most common factors influencing the traveler's behavior for shopping purposes in both developed and developing countries. Most of the studies on shopping trips focused on considering shopping malls; however, evidence showed that shopping activities in developing cities include: malls, supermarkets, local commercial stores among others. The present study tries to fill the gap in the literature by collecting data randomly from commuters and develop model that predicts the travel behavior in the CBD of Paynesville.

3. Methodology

The research design adopted for the present study was a quantitative research approach to make inferences on the collected sample data. A well-structured survey questionnaire was used to gather information from commuters traveling within the CBD of Paynesville through an intercept survey using a simple random sampling technique. The survey questionnaire captured the following information of every commuter: trip-related attributes (such as the journey purpose, travel distance, time of day, among others), transport facility attributes (such as travel time, travel cost, walking time, etc.) and commuters' demography and socioeconomic attributes such as income, age, household location, gender, vehicle ownership among others were collected. The journey purpose refers to the trip purpose namely; shopping, working, education, and religious trips respectively. A traditional pencil and paper-based survey method were adopted for questionnaire distribution (Adjei 2020; Meena *et al.*, 2019) through a simple random sampling technique as mentioned. A sample size of 751 was collected in two phases: 631 respondents were surveyed for the model calibration and 120 responses were collected for model validation. The collected sample six days of the week excluding Sundays. In addition to the main survey explained above, a pilot survey was also conducted for the developed questionnaire for a sample size of 100 people. The collected data were analyzed using both descriptive statistics and Multinomial Logistic Regression (MNL). Descriptive statistics were performed to present respondents' profiles in terms of the various characteristics: commuter's characteristics, trip characteristics, and transport system characteristics. For model calibration and validation, the MNL approach was used and this has been recognized as widely used and most robust (Daisy *et al.*, 2018; El-Esawey and Gharieb, 2009; Liu *et al.*, 2020; Meena *et al.*, 2019).

4. Results and Discussions

As discussed in previous sections, the essence of the study is to identify factors that influence mode choice behavior among commuters in the CBD of Paynesville, Liberia. Evidence from Table 2 indicates that a very high number of trips are for shopping purposes. In other words, shopping trips reported the highest value and the preferred mode of travel among commuters for shopping activities are motorcycle and mini-bus (public transport). For work trips, commuters prefer to use a privately-owned vehicle or motorcycle. These results imply that there has been a shift in the use of public transport as compared to previous statistics. This could be attributed to the fact motorcycle has less rate of fuel consumption efficiency and easily maneuver in traffic-congested locations. However, during the survey, it was realized despite the high usage of motorcycle, respondents expressed willingness to

shift from motorcycle to public transport in terms of safety and risks associated. The age of the respondents between 18 and 25 years of age revealed that their most preferred mode of travel is motorcycle, followed by taxi. The older group of commuters between the age of 35-45 and more than 45 years of age preferred to use safe and convenient transport services in order to make their trips to the CBD. Therefore, private cars and large buses are common within these age groups. Precisely, commuters within the age band of 35yrs-45yrs prefer private car mode than any other alternatives available. This suggests (all things been equal) older travelers are more sensitive to safety and convenience service in choosing their travel mode to various shopping centers.

In addition, summary statistics of travel cost among respondents indicate 75% of the commuters spent LRD200 and above on transport fare to and from the CBD. This could be due to the high use of motorcycle by an average number of commuters and also the income factor. An average number of the respondents have no monthly income or income less than LRD10,000. The study suspects that average commuter preferred cheaper mode of transport, this can be attributed to their income levels; however, most of the respondents tend to choose motorcycle for both low- and high-income individuals, this might be associated with the issue of accessibility and while respondents who have income more than LRD36,0003 tend to choose a private car. This result implies that most of the commuters surveyed had no income level or employment status which further confirmed the study by Adjei (2020). The most attractive mode of travel among respondents within 0-1km and 1.5km-3.5km is motorcycle, followed by kekeh (tricycle), mini-bus, and taxi. Also, commuters who are located within the City of Paynesville choose motorcycle as their primary mode of transport as compared to other alternatives available. This can be true for a traveler who lives in close proximity to the study location. In addition, few of the travelers who live within the study location choose taxi and kekeh as their second alternatives. From the data observation, it is obvious that as the travel distance increases, motorcycle might become unpopular due to the risks involved.

4.1 Model Development

As mentioned, the calibration and validation of the model were conducted using Multinomial Logit Model approach which is based on the principles of utility maximization and has the advantage of simplicity and ease of estimation. The minimum acceptance model fitting criteria (t-value, loglikelihood, test of significance, among other) were used to develop the study model. The commonly used transport mode for study locations are seven, and all the seven (7) available alternatives were considered for this research. These include “MOTORCYCLE, PRIVATE CAR, TAXI, KEKEH (Tricycle), MINI-BUS, LARGE BUS, and WALKING”. Based on the responses from respondents, these alternatives were classified as follows: MOTORCYCLE, DRIVE ALONE (Private car), PUBLIC TRANSPORT (min-bus, large bus, and kekeh), and SHARE RIDE (taxi). In addition to what is explained, Table 1 presents defined codes assigned to these alternatives used in the model.

Table 1. Assigned codes and descriptions of the travel mode used in the model

Code	Abbreviation	Description
1	Mcycle	Motorcycle
2	Public Transport (PT)	Mini bus, large bus, and kekeh
3.	Drive Alone	Private car
4	Shared Ride	Taxi

As indicated in Table 3, the alternative specific constants for all utilities are statistically significant at 99% and 95%. The coefficient estimates of travelers choosing motorcycle, public transport, and shared ride are 20.062, 16.566, and 12.793 respectively. This suggests that trip makers prefer to use motorcycle when making trips for shopping, followed by public transport and shared ride. Since drive alone served as the reference category in this model, it suggests that at the disutility of motorcycle, shared ride, and public transport, this mode is the most preferred by travelers. The estimated parameters results shown in Table 3 presents the contributing factors that influence travel mode decisions in the context of CBD. This research identifies factors such as income, travel distance, household location, and education to have a negative effect on the utility of public transport and is statistically significant at 95% confidence level. Income was also identified to have a significant influence on the travel utility of public transport. There exists a negative relationship between PT and income; which implies that Individuals earning a monthly less than LRD10,000 are most likely to use PT. Again, household location has a negative relationship with PT, significant at 95% confidence level. This suggests that people who live far distance are most likely to use PT, while those who reside in close proximity are less likely to use PT. Similar findings were reported in existing literature (Abuhamoud et al., 2011; Elesawey, 2017; Zhang et al., 2021). This implies that individual trip makers with higher education status are less likely to use PT. This could be true for an individual with higher education status who might prefer DA or other transport alternatives far better than PT. In short, trip makers with less education status are most likely to use PT service. The current research findings are similar to Wei-Shiue (2014) report. The utility of motorcycle, travel distance (TD) and travel cost (TC) were found to be significant at 99% and reported negative coefficients as expected. This implies that travelers making trips to the CBD within 0km-1km and 1.5km-3.5km are most likely to use motorcycle as their preferred mode of transport. This can be attributed to commuters living within the city of Paynesville. This claim can be supported by Table 2, where more than 70% of the commuters residing in Paynesville and about 42% of the trip makers travel less than 3.5km. Suggesting that traveler's utility to choose motorcycle decreases when the travel fare increases. This is obvious since travelers are more sensitive to the amount spent on their travel, especially for low-income earners.

Age and travel cost were identified as factors that influence mode choice and age has an impact on the utility of drive alone on the travel mode choice relative to the income. In this regard, aging trip makers considered the problem of safety, comfort, and convenience when choosing the preferred mode of travel regardless of the cost associated with the trip. Travel cost for the drive alone has an opposite sign than expected. However, this seems true, because once the cost of transport increases for other modes (motorcycle, shared taxi, and PT), this might result in commuter disutility for this mode, therefore, allowing the users to consider drive alone as their preferred mode of travel and it is driven by income. All predictors presented in the utility are significant at 95% confidence levels. A similar explanation for motorcycle and PT applied to shared ride utility. In short, when the travel cost of this utility decreases, it leads to the disutility of the other mode available. As the travel distance increases, based on the household location, it is obvious that shared ride might be preferred by more trip makers. This could be true for individuals living outside Paynesville such as Monrovia and other locations as shown in Table 2. As mentioned earlier, relating the factors associated with bus stations density for PT and the risks involved with the utility of motorcycle for long distances, shared ride might be preferred all things being equal. The prediction success rate of 88.7% and adjusted Rho squared of 0.61, while the final model overall prediction rate is 75% with an adjusted rho squared of 0.51. The adjusted rho-squared of 0.61 indicates a satisfactory fit of the model (Meena *et al.*, 2019) and the result suggests that the dataset used in this study predicted the modal split of travel behavior despite the sample size.

5. Conclusions

The study findings revealed that trip-related attributes such as travel time, trip purpose, travel fare, comfort, convenience among others were identified; and traveler's attributes such as income (INC), household location (HL), and education were identified as factors influencing travel mode choice of commuters for shopping purposes. Age (AGE) of respondent is found to have positive effect on drive alone and HL was found to positively influence shared ride. Triprelated and transport facility attributes such as travel time (TT), travel cost (TC), and travel distance (TD) were identified as factors influencing traveler's shopping behavior in terms of mode share. Out-of-vehicle time was identified to negatively impact public transport and shared ride. Travel distance was found to positively influence drive alone and shared ride, while negatively influence motorcycle. Travel cost was found to negatively influence shared ride, motorcycle, and public transport. Model calibration and validation was based on MNL modeling approach and the developed model is described as appropriate and accurate based on the minimum acceptance model fitting criteria as discussed. The city corporation should introduce and institutionalize off-street parking facilities alternatives to minimize random parking on streets and other locations to minimize traffic flow disturbance. In the future, if the service quality is improved and strategy policies are implemented, eventually more commuters will express willingness to use public transport services which minimizes the transport-related problems faced by both trip makers and the infrastructure.

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Appendix

Table 2.: Selected socioeconomic and trip-related variables frequency distribution.

Characteristics	Statistics
Gender	Male: 45.2% (276); Female: 54.8% (334)
Age (in years)	18 – 25: 33.4% (204); 26 – 34: 46.7% (285); 35 – 45: 16.6% (101); > 45: 3.3 (20)
Household size	One: 11.1% (68); 2-4: 39.8% (243); 5-7: 31.6% (193); More than 7: 17.0% (104)
Education Level	None: 23.6% (144); High school students: 8.9% (54); High school graduates: 36.4% (222); University students: 21.8% (133); Bachelor/Master/Ph.D.: 9.3% (57)
Occupation	Student: 30.2% (184); Entrepreneur: 29.8% (182); Civil Servant: 3.0% (18); Private sector worker: 12.0% (73); Other: 25.1% (153)
Income level	None: 31.8% (194); Less than LRD10,000: 25.4% (155); LRD11,000 - LRD25,000: 7.4% (45); LRD26,000 - LRD35,000: 7.2% (44); LRD36,000 - LRD45,000: 7.9% (48); Above LRD45,000: 20.3% (124)
Travel distance	0 – 1km: 30.8% (188); 1.5km – 3.5km: 42.3% (258); 4.0km – 5.5km: 12.0% (73); More than 6.0km: 14.9% (91)
Household location	Paynesville: 73.4% (448); Monrovia: 5.4% (33); Other: 21.1% (129)

Table 3. Estimation Result for Shopping

VARIABLE	SHOPPING		
	COEFFICIENT	T-STATISTIC	SIG-VALUE
$ASC_{Drive\ Alone}$ (base)	0.000	0.000	0.000
ASC_{Mcycle}	20.062***	3.806	0.000
ASC_{PT}	16.566***	3.163	0.002
$ASC_{Shared\ ride}$	12.793**	2.440	0.015
U_Motorcycle			
β_{TD_Mcycle}	-0.848***	-3.721	0.000
U_Drive Alone			
$\beta_{TC\_Drive\_Alone}$	0.019***	3.685	0.000
U_PT			
β_{TC_PT}	-0.009***	-3.645	0.000
$\beta_{H.Location\_PT}$	0.754***	7.057	0.000
$\beta_{EDUCATION\_PT}$	-0.283**	-2.125	0.034
U_Shared Ride			

$\beta_{TD\_Shared\_ride}$	0.412*	1.958	0.050
$\beta_{H.Location\_Shared\ ride}$	1.555***	6.716	0.000
Summary statistics Sample size:			
Log Likelihood (0)	-485.203		
Log Likelihood (β)	-222.295		
Log Likelihood (Final)	525.815		
Rho-square (ρ^2)	0.542		
Rho-square-bar (ρ^2)	0.513		

10.30-10.45 /11.30-11.45 Presentation 5: Wednesday, 17th November 2021

Mode Choice Among Public University Students in Freetown, Sierra Leone

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Abstract
The University of Sierra Leone (USL) constitutes of three colleges; each attracts thousands of students from different regions of the country. Over the years, there has been an increase in traffic congestion and air pollution in Freetown, where the university is located. This congestion may have been caused by the decisions relating to transport mode choice, choice of departure times and destinations, and road infrastructure. However, the travel behaviour of USL students has not been understood for years. This study therefore investigates the most common transportation modes used by students, the factors responsible for their choice decision, and their attitudes towards transportation facilities and the environment in the context of a developing nation. Simple random sampling method was used with Revealed Preference questionnaire. Primary data were collected using paper and pencil survey method, supplemented by internet questionnaire survey via Google Forms using smart phone assisted self-interviewing technique. The survey revealed that; out of nine categories of transportation modes, only five were most commonly used by students. More than one-third of students' chose the services of paratransit mode; "Podapoda", making it by far the dominant mode of transport, followed by Motorbike, Taxi, Keke and Non-Motorized Transport (NMT) in that order. The model results and exploratory analysis also revealed that sociodemographic, trip characteristics and characteristics of the built environment are the significant factors that influence students' travel decision. These findings present university authorities and transportation officials with the need to implementing a sustainable transport system through the procurement of suitable travel modes for each campus, establish cycling and pedestrian pathways to encourage active travel and create a more "related society" by building student flats with reduced commute distances for improved mobility.

Keywords
Travel Behaviour, Mode Choice, Multinomial Logit, Podapoda, Keke, Freetown

1. Introduction

Mode choice modelling is perhaps one of the most critical elements in transportation planning since it affects overall travel performance and resource allocation (Ortúzar and Willumsen, 2002). Using a discrete modelling approach, mode choice models help to analyze and predict the likelihood of a person choosing a specific mode of transportation for a trip; based on trip characteristics, individual characteristics, and available modes. According to Ben-Aakiva and Lerman, (1985), mode choice models reflect customer decisions when confronted with alternative modal options, i.e., a person is visualized as choosing a mode that maximizes his or her utility. Discrete choice models have proven to be particularly useful in offering detailed representation of the diverse aspects of transportation demand that is focused on sound theoretical foundations. When individuals are presented with a variety of travel options from which to choose, these models appear to reflect their travel behaviour. During some specific hours, university campuses attract high concentration of trips since they are often among the largest employers in most developing countries. When compared to the general population, university students are more likely to use public transportation and non-motorized forms of transportation (Bonham and Koth, 2010). In contrast to private automobiles, cities with a larger student population use more public transportation and other alternative modes such as walking, biking, and motorcycles (Santos et al., 2013). In particular, there is not much research in the country, among others, on mode preference modelling and for large trip generators and attractors such as schools, colleges, shopping malls, and work trips.

This research therefore, investigates the most common choice of transportation modes adopted by students of the University of Sierra Leone and the factors responsible for their choice. It also investigated students' attitudes towards transportation facilities and the environment. The study greatly expands the research field's knowledge boundaries, and to the best of the researchers' knowledge, it is the first study to explore into the mode choice travel behaviour of University of Sierra Leone students in the context of a developing country where Podapoda and Motorbikes have been dominating traffic systems.

2. Methodology

2.1 Survey Design and Sampling

The survey required students to complete a Revealed Preference (RP) questionnaire built from three sections. The first section focused on real trip characteristics of the students. The second section focused on opinion questions on travel preferences and attitudes where the respondents were asked to indicate their perception on the importance of ten factors that affect the choice of transportation mode, the environment and satisfaction with service. To achieve this, a five-point Likert scale was used, ranging from strongly disagree to strongly agree (Malhotra and Dash, 2007). The third part includes the socio-demographic information of the respondents such as (gender, age, education level, monthly income, family size, etc.). A more reliable estimate of the sample size was computed using a relationship formulated by Cochran, (1977). A minimum sample size of 384 was estimated. However, to allow for model calibration and validation, the researchers employed a sample size of 632. With this sample size, simple random sampling, a form of probability sampling in which students were randomly selected from the three campus was used. The survey which constitutes of paper and pencil-based questionnaire supplemented by online survey, using smart phone assisted self-interviewing technique was administered to a sample of respondents who were registered fulltime students at the three campuses of the University of Sierra Leone for 2020/2021 academic year. A total of, 183 (29%) online and 449 (71%) paper-based responses were received.

2.2 Calibration and Estimation of Revealed Model

The magnitudes of the impact of various variables were investigated in this analysis using a quantitative approach called Multinomial Logistic Regression. This analysis was performed for the

estimation of parameters using the method of maximum likelihood which is a classification approach that extends logistic regression to multi-class problems with more than two possible discrete outcomes (Greene, 2003). Based on descriptive data analysis, there are five modes to examine for modelling the mode choice of University of Sierra Leone students; Podapoda, Motorbike, Taxi, Keke/Tricycle, and NMT (walking and cycling). The model structure omitted private car, Serena and student bus since these modes were not considered viable by the students. Different specifications were tested using Podapoda as the reference alternative, to see which one would best replicate the data for campus trips. Under a trial-and-error approach, the inclusion of potential variables was tested, and the parameters of the utility functions were compared. The basic functions were tweaked until an optimum fit was achieved. Table 1 lists the variables that were used in model calibration along with their acronyms.

Table 1. Description of the Variables Considered in Model Calibration

Variable	Description	Variable Indication
ASC_{MBike}	Alternative Specific Constant for Student Bus	Mode Specific
ASC_{Taxi}	Alternative Specific Constant for Motorbike	Mode Specific
ASC_{Keke}	Alternative Specific Constant for Taxi	Mode Specific
ASC_{NMT}	Alternative Specific Constant for Keke	Mode Specific
TT	Total Travel Time in minutes	Mode Specific
TC	Total Travel Cost in SLL	Mode Specific
WT	Bus stop Waiting Time in minutes	Mode Specific and Generic
TD	Total Travel Distance in kilometres	Mode Specific
CO	Level of Comfort	Mode Specific
TF	Trip Frequency	Mode Specific
GEN	Gender of Respondents	Mode Specific
AGE	Age of Respondent in years	Mode Specific and Generic
TH	Trip Hour	Mode Specific
DEG	Education Status	Mode Specific

3. Results and Discussion

3.1 Descriptive Analysis

The students' population of the University of Sierra Leone are young people with ages between 1830 years (Table 2). They commenced college education soon after graduating from high school, putting them in a competitive category. There were 343 males (54%) and 289 females (46%). The majority of the participants were local off-campus college students. On average, students live 5km or more from the three campuses, spend more than 40 minutes traveling to campus via various modes, spend at least 50,000 SLL per week and 200,000 SLL per month on transportation. Given that these students' average monthly household income is around 750,000 SLL, this means that if they do not earn money on their own, transportation consumes roughly 27% of their family's monthly revenue.

Table 2. Characteristics of Survey Sample

General Information	Frequency	Percentage
Gender of Respondent		45.7
Male	343	54.3
Age of Respondent		
18 – 25	436	69
26 – 35	157	24.8
36 - 45	25	4.0
Above 45	6	0.9
Average Monthly Household Income		
500,000 – 1,000,000 SLL	197	31.2
1,000,000 – 5,000,000 SLL	130	20.6
≥5,000,000 SLL	56	8.9
University Campus		
Institute of Public Administration and Management (IPAM)	214	33.9
College of Medicine and Allied Health Sciences (COMAHS)	198	31.3
Degree of Study		
Certificate	18	2.8
Bachelors	433	68.5
Masters	4	0.6
Other	3	0.5
Driver's License		
No	564	89.2
Travel Distance		
1 – 5km	199	31.5
> 5km	406	64.2

Clearly, 46% of university students travel to campus by Podapoda, 20% by Motorbike, 12% by Taxi and around 10% using Keke. Walking and biking were the least common modes of transportation among university students, accounting for only 5.6% of all trips. These modes were amalgamated into one transport mode, Non-Motorized Transport (NMT). Figure 1 provides graphical representation of the various transport modes.

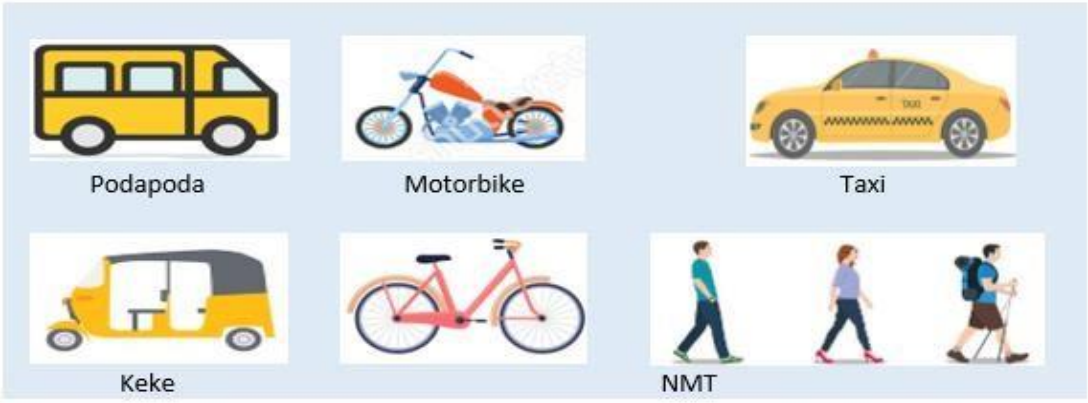

Figure 1. Graphical Representation of Transport Modes

By modal share per campus, FBC students were accustomed to using Taxi (55.3%), Serena (71.4%), Student bus (90.9%), and Motorbike (43.2%), given that the college is situated on a mountainous environment easily accessible by Motorbikes, Taxis, and Serena (Figure 2). COMAHS students make up the bulk of those who use Non-Motorized Transportation to get to campus. This is because, this school has the highest percentage of students who live within a 1km radius.

In terms of travel costs, approximately 77.8% of students who drive their own cars to college spend more than 50000 SLL per week, whereas only about 47% of students who use public transportation do so. Notably, 44.4% of those who use the new mode of transportation, Keke/Tricycle, spend more than 50000 SLL per week, almost the same as a Taxi, while 56.8% of those who use Motorbike do spend this same amount. These are the relatively most expensive modes of transportation in the country, especially for long distance trips. Across the three campuses, about 48.1% of FBC students were from high-income families (at least 5,000,000 SLL monthly). This could be due to the Law and Engineering degree programs offered by this college, two of the most popular and prestigious majors among students. Regarding their attitude towards the potential influence of mode choice on the environment and their travel decisions, it was revealed that university students in Sierra Leone are quite heterogeneous in behaviour.

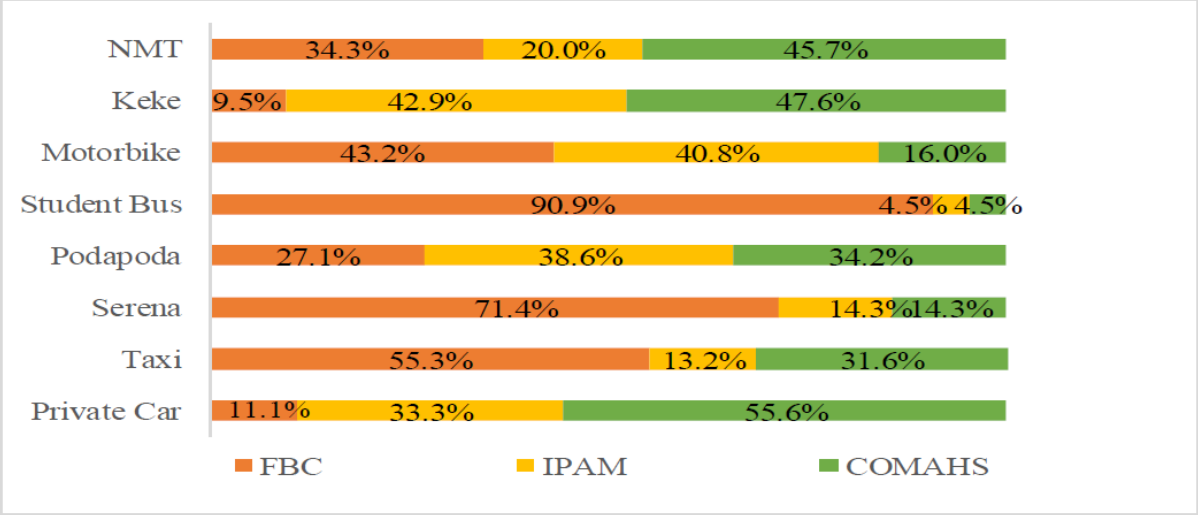

Figure 2. Distribution Between University Campus and Preferred Mode

3.2 Model Results

Under a trial-and-error approach, eight models were generated and the model with the highest goodness-of-fit was chosen for further interpretation. After numerous iterations, model 8 was chosen as the minimal acceptable model based on model fitting parameters such as the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Likelihood Ratio Tests and asymptotic Rho-Squared. This model clearly exhibits the lowest AIC and BIC values, as well as reasonable asymptotic Rho-Squared and Likelihood Ratio values of all the models after a sequence of trials. For each predictor, the logistic coefficient, standard error, t-statistics, and p-values are reported in Table 3.

Table 3. Estimation Results of the Minimum Acceptable Model - MODEL 8

Parameter	Mode	Estimated	Standard	$t-test$	$p-value$
ASC_{MBike}	Motorbike	4.67	0.795	5.878	0.000
ASC_{Taxi}	Taxi	4.38	0.834	5.252	0.000
ASC_{Keke}	Keke	3.50	0.884	3.952	0.000

Parameter	Mode	Estimated	Standard	$t-test$	$p-value$
ASC$_{NMT}$	NMT	2.91	2.042	1.427	0.154
TCp	Podapoda	-1.45	0.283	-5.100	0.000
TDp	Podapoda	1.55	0.262	5.911	0.000
COp	Podapoda	0.29	0.092	3.156	0.002
TTm	Motorbike	-0.96	0.217	-4.413	0.000
TCm	Motorbike	-1.02	0.278	-3.683	0.000
COm	Motorbike	-0.24	0.109	-2.229	0.026
TTT	Taxi	-1.15	0.228	-5.070	0.000
TCT	Taxi	-1.19	0.281	-4.252	0.000
THT	Taxi	-1.50	0.448	-3.342	0.001
COT	Taxi	0.26	0.095	2.740	0.006
TTk	Keke	-0.69	0.241	-2.854	0.004
TCk	Keke	-1.42	0.288	-4.916	0.000
$AGEk$	Keke	0.73	0.201	3.614	0.000
$GENk$	Keke	-0.70	0.331	-2.102	0.036
TTn	NMT	-2.15	0.456	-4.725	0.000
TDn	NMT	-1.62	0.459	-3.543	0.000
$AGEn$	NMT	-1.90	0.663	-2.870	0.004
$GENn$	NMT	1.76	0.672	2.621	0.009
$DEGn$	NMT	1.18	0.432	2.740	0.006
TFn	NMT	-0.54	0.278	-1.928	0.054
WT	Motorbike &	-0.30	0.107	-2.808	0.005
	Model Statistics				
	Initial Log Likelihood	-770.921			
	Final Log Likelihood	-462.559			
	Likelihood Ratio Test	616.723			
	Rho Square	0.400			
	Akaike Information	969.656			
	Bayesian Information	1090.635			

$$U_{Poda} = -1.45(TC_p) + 1.55(TD_p) + 0.29(CO_p) \quad \text{1}$$

$$U_{MBike} = 4.67 - 0.96(TT_m) - 1.02(TC_m) - 0.24(CO_m) - 0.30(WT) \quad \text{2}$$

$$U_{Taxi} = 4.38 - 1.15(TT_T) - 1.19(TC_T) - 1.50(TH_T) + 0.26(CO_T) - 0.30(WT) \quad \text{3}$$

$$U_{Keke} = 3.50 - 0.69(TT_k) - 1.42(TC_k) + 0.73(AGE_k) - 0.70(GEN_k) \quad \text{4}$$

$$U_{NMT} = 2.91 - 2.15(TT_n) - 1.90(AGE_n) + 1.76(GEN_n) - 1.62(TD_n) + 1.18(DEG_n) - 0.54(TF_n) \quad \text{5}$$

The estimated coefficient of travel cost for Podapoda, Motorbike, Taxi, and Keke modes is negative as expected in hypothetical modelling (eqns. 2, 3 and 4). This suggests that when travel costs grow, students' utility for these modes decreases. They may therefore make less long-distance journeys to college with these modes. With an estimated coefficient of -1.02, Motorbike will become less appealing if travel costs rise in a linear relationship with distance travelled. This is due to poor safety,

air pollution, and hot and humid weather, which are particularly uncomfortable for long distance travel. (Bray and Holyoak, 2015).

In terms of cross elasticity, the demand for Keke is quite inelastic, with a cross fare elasticity of 0.77, implying that for a 1% increase in Motorbike travel fare, Keke market shares will increase by 0.77%. When this situation arises, more students will tend to patronize the services of Keke than the reference mode, Motorbike (Table 4).

Table 4. Aggregate Elasticities

Percentage Change in Probability of Choosing									
Mode	Podapoda		Taxi		Keke		Motorbike		NMT
Due to a 1% change in	Travel Cost	Travel Time	Travel Cost	Travel Time	Travel Cost	Travel Time	Travel Cost	Travel Time	Trip Length
Cross Elasticity	1.24	-	0.81	0.21	0.77		0.16	0.41	0.08
Direct Elasticity	-4.86	-	-4.33	-1.56	-5.61	-0.84	-3.56	-1.23	-7.05

Trip distance and journey time are the most widely studied trip variables. These attributes are highly connected and are frequently considered to be equivalent (Ton et al., 2019). In this study, the estimated coefficient of trip distance for the paratransit mode - Podapoda implies that, students are more likely to use this mode as their journey distance to campus increases. For active modes, the travel distance parameter yielded a negative sign. This suggests that students who travel longer distances are less likely than those who travel shorter distances to employ these modes in comparison to Podapoda which is consistent with the findings of McMillan, (2002). According to the elasticity results, active travelling is negatively influenced by trip distance, implying that students are likely to walk for shorter distances. Motorized modes of transportation become their most popular mode of transit as distance exceeds the permissible threshold of 5km.

The estimated coefficient of travel time for Motorbike, Taxi, Keke and NMT is negative, as expected in the hypothetical model. This negative indicator suggests that when travel time grows, students' utility decreases. With the exception of Keke, whose users are more sensitive to travel cost, the computed coefficients of travel time for Motorbike, Taxi and NMT, indicates that students are more sensitive to travel time than cost. Also, the larger t – values for travel time of these modes explain why they are faster than Keke/Tricycle and the reference mode, Podapoda. Motorbike in particular provides flexibility in getting students to their desired location regardless of the exorbitant expense associated with this mode (up to twice the cost of a taxi or a student bus). In terms of bus stop waiting time, students who use Taxi and Motorbike have less waiting time at the stops compared to users of Podapoda.

The age variable for Keke has a positive coefficient (3.61) and it is statistically significant at a significance level greater than 0.05. This suggests that because older students are less inclined to walk, they are more likely to use this new mode of transportation. On the other hand, gender variable appeared in the utility function for this mode with a negative sign, indicating that unlike females, male students are more inclined to the use of this mode. Since Keke is the most recent travel mode in the country, this finding can be better understood if all categories of Keke users in the country are sampled. Older students are less likely to walk or cycle to campus for lectures, comparable to the findings of (Mackett and Ahern, 2000). It is worth noting that the Gender appeared in the utility function of NMT with a positive sign, indicating that females are more likely to choose active modes than Podapoda. This is because, most of them come from low income households. However, this finding is not consistent with that reported by McMillan *et al.*, (2006) and is incompatible with the

Sierra Leonean culture especially when majority (64.2%) of them are not in close proximity to the campuses.

The students program of study at the university was observed to have a substantial influence on mode selection. Students pursuing higher degree programs were found to use active modes more frequently, which is consistent with the conclusion of (Atasoy et al., 2013).

Conclusion

We have examined students' transportation mode choice for three public colleges. The results revealed that; out of nine categories of transportation modes, only five were most commonly used by students and that their choices vary according to their sociodemographic, trip characteristics and characteristics of the built environment. It is obvious from this study that; travel time is of great importance to students than cost. The supremacy of time was only undermined in the Podapoda and Keke modes, where respectively travel distance and travel cost were significantly considered by students. The performance of the multinomial logit models estimation suggests that the survey dataset is appropriate for this travel pattern, and that similar survey datasets designed, conducted, and enhanced for other regions of the country, if available, may be appropriate for similar models.

The identification of determinants and quantification of their influence on mode choice for students traveling to the several university campuses in Freetown are among the contributions of this research. The findings present university authorities and transportation officials with the need to implementing a sustainable transport system through the procurement of suitable travel modes for each campus, establish cycling and pedestrian pathways to encourage active travel and create a more "related society" by building student flats with reduced commute distances.

The findings in this paper are limited to trips made by public university students in the Western area of Freetown. Moreover, students found it difficult to recollect their families average monthly income. As a result, there may be inconsistencies between the information they provided and the genuine financial status of their household. This may have rendered this variable statistically inconsequential in students' mode selection decisions.

Acknowledgement

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Statement of Disclosure The authors declare no potential conflict of interest

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Session II: Considerations on the impact of Covid-19 on travel demand

11.00-11.15 /12.00-12.15 Presentation 6: Wednesday, 17th November 2021

Residential relocation after Covid-19

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Abstract

COVID-19 forced authorities to restrict gathering and movement of individuals. Many businesses and schools switched to virtual operations, which resulted in the wide emergence of telecommuting patterns, especially during the lockdown periods. Some of these patterns may remain even after the end of the pandemic, thus weakening the influence of commuting on people's future residential choices. This study aims to identify factors affecting the intentions of Scottish residents to relocate in the short term (within 5 years), long term (after 5 years), or not to relocate at all. In this context, data was collected through an online survey administered during Scotland's second COVID-19 lockdown, focusing on changes, perceptions, and attitudes regarding lifestyle changes, travel behavior, and relocation preferences. Data on individuals' perceptions of COVID-19 about infection risk; changes in lifestyle and travel behavior; relocation preferences in terms of preferred location, expected timeline, possible reasons and circumstances; and sociodemographic characteristics like age, income, education, household composition, and home ownership was used to conduct the analysis. Intentions for future relocation were statistically modelled using a nested logit framework. Random parameter binary choice models were also estimated to understand the factors that affect relocation intentions to urban and non-urban areas.

Overall, the results show that people who contracted COVID-19 were more likely to relocate. People whose life completely changed due to COVID-19 intend to relocate in the short term. Higher trust in employers' communication regarding COVID-19, younger people (aged 18 to 34), and pre-pandemic life satisfaction are found to be associated with plans for relocation. Individuals with higher education intend to relocate in the short term while high-income earners (above £50,000 annually) and

households with school-going children have longer-term relocation plans. People intending to relocate in the short term want a different lifestyle and have experienced a recent change in their employment situation or family circumstances. Those who intend to relocate in the long term want proximity to good transport. People aged above 54, family oriented, and low-income earners are more likely not to relocate at all.

Non-urban to non-urban movements are associated with a relocation distance of under 20km, urban to non-urban with 40-60km, and non-urban to urban with 80- 100km. Urban dwellers with high household income are willing to relocate to non-urban areas to enjoy larger properties (more rooms, off-street parking). Non-urban dwellers earning £30,001 to £40,000 annually wish to relocate to urban destinations for better transport and to get closer to work. Those relocating from non-urban to non-urban regions cite crowdedness as a reason for reduced public transport use in the future.

The analysis highlights potential structural changes post-pandemic in commuting distances and residential location choices in Scotland. It warns of the potential gentrification in settlements commutable from large urban centers. The findings of this study can help explain the sudden increase of demand for rural housing noted amidst the pandemic. Overall, this study emphasizes the challenge for optimal provision of transport, education, health services in urban and non-urban areas post-pandemic.

11.15-11.30 / 12.15-12.30 Presentation 7: Wednesday, 17th November 2021

Impact of COVID – 19 on Commercial Drivers and Public Transport in Freetown, Sierra Leone

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Abstract

Since its inception in 2019, the COVID19 pandemic has caused major shifts in activity patterns and travel behaviour around the world. Some of these changes in behaviour are the result of restrictions or policy guidelines imposed by governments (curfew, complete or partial lockdowns). This paper analyses the impact of COVID-19 on urban mobility and the economic well-being of commercial drivers in the Western area of Freetown, Sierra Leone. An online survey through phone calls was carried out during the period from May to June, 2020 within the study area. Data were collected from 250 drivers and commuters from 21 vehicle terminals within three zones. Gender, age, income before and during COVID-19, number of passengers per trip both before and during lockdown, traffic congestion level during lockdown, availability of transport mode before and during lockdown, and terminal waiting time were all variables in the survey. Descriptive and quantitative comparative analysis were used in the statistical study. The researchers utilized the Non-parametric Wilcoxon signed Rank Test to compare factors impacting mode choice prior to and during COVID-19 to see if there was a shift in transportation and economic welfare of drivers as a result of COVID-19. The findings revealed that

COVID-19 had a significant impact on public transportation, including an increase in vehicle terminal waiting time, a hike in transportation fares, social distancing, and a decrease in traffic congestion, as well as a significant difference in driver daily turnover before and during the pandemic. The use of paratransit services with high occupancy, such as "Podapoda," has decreased dramatically in favour of motorbikes. These findings will help policymakers determine what measures are needed to strengthen the country's transportation sector, as well as how to design a scheme that will increase the economic well-being of commercial drivers during emergencies. This could be accomplished by lowering the tax on spare parts, lowering insurance premiums, and, if possible, subsiding the cost of fuel during emergency of similar nature and magnitude. To deal with the problems that public transportation systems face, planners should create new cycling lanes and urban space adaptations that can give an alternative to driving and land transportation.

Keywords: COVID-19, Lockdown, Pedestrians, Drivers, Urban Transportation,

1. Introduction

Since the emergence of COVID-19 late in 2019 Keni et al., (2020), the idea of social distancing in automobiles has been viewed as one of the strategies to slow the transmission of the pandemic. Most countries especially Africa cities are still struggling to adapt to COVID-19 restrictions as a result of obvious challenges in the transport sector (few commercial vehicles, smaller sized and capacity vehicles, less alternative routes, economy, attitude of commercial drivers etc.). However, various governments instituted policy guidelines as to the number of passengers per any available public transportation mode, working hours, among others (Dzisi and Dei, 2020). According to Béland et al., (2020), some national governments responded by ordering lockdowns to prevent the spread of infection and probable deaths, but this had significant economic and social consequences (unemployment, business bankruptcies, etc.). Because air and land movement were two of the key vectors for the spread of COVID-19, one of the restrictions imposed limited human mobility (Kraemer et al., 2020). This was seen to have an impact on public transportation users and drivers in terms of fuel consumption, cost, journey time, delay, daily, weekly, or monthly turnover, among other considerations. One of the positive effects of the COVID-19 control measures was the reduction of traffic accidents on both urban and interurban roads (Aloi et al., 2020). These reforms, however, have only provided immediate and short-term gains. Once normal operations resume, old issues are likely to re-emerge. Exploring the COVID-19 pandemic's effect on mobility behaviours hence demands a really interdisciplinary, multifaceted, and comprehensive approach (Linka et al., 2020).

Sierra Leone, a prominent regional actor in West Africa with a population of just over 7 million people Census, (2015), reported the first case of COVID-19 in Freetown on March 31, 2020 (MoHS, 2021). As at the 19th of September 2021, the country has recorded 6,392 confirmed cases with a greater percentage coming from Freetown (MoHS, 2021). Freetown's setting is particularly important in this study for a variety of reasons, including the circumstance that it is the country's major commercial centre with growing urbanisation, with an estimated population of 1.5 million people on 82km2 of land (Census, 2015). Second, the growing population, along with insufficient transportation infrastructure and an increasing number of cars on Freetown's roadways has resulted in severe traffic congestion over time. Third, the city has an effective commercial transportation system with functional leadership, the availability of vehicle terminals, significant public transportation utilization, various trip generation and distribution centres, among others. Unlike other towns in the country, where motorbike is the only motorised mode for internal transportation, Freetown is the only city

with an intra-urban transportation system that includes a variety of modes ranging from motorbikes to cars. It is a densely populated city with a long history of epidemics, the most recent being COVID-19 and Ebola Virus Disease (EVD) (Richards, 2020). During the partial and entire lockdown periods, the country's fragile transportation system, along with high rate of unemployment, was considered as a severe threat. The government of Sierra Leone declared a state of emergency, which impacted the economic, social, and religious activities of drivers and road users. This study assesses the impact of the COVID-19 on urban mobility and its relative influence on the economic wellbeing of commercial drivers in Sierra Leone. This paper offers policymakers in the public and private sectors realistic recommendations on how to enhance the country's transportation system, as well as a feasible scheme for commercial drivers, particularly during emergencies.

2. Methodology

2.1. Questionnaires Design and Sampling

A focus group discussion with representative drivers, terminal heads and passengers from all 21 terminals was held in order to gather preliminary information and create an understanding of the survey instrument's design. Prior to the design of the questionnaire, basic information (such as station name and coordinates, names, age, gender, cell phone numbers, designation, origin, destination, and mode of transportation for each station driver) was collected. A research instrument was developed based on the requirement for the study and the information gathered from the focus group discussion. This survey instrument includes socioeconomic questions as well as attitudinal questions. Respondents were asked about their usual mode of travel before and their preferred travel mode during COVID-19, the impact of COVID-19 on public transport, the effect of COVID-19 on drivers daily turnover, factors that influence public transport mode choice prior to and during the pandemic among others.

Before the emergence of COVID-19 in Sierra Leone, the government put in place a number of measures in preparedness to address the pandemic. Despite these strict measures, the country recorded its first COVID – 19 case on March 31, 2020, prompting a three-day partial lockdown (MoHS, 2021). During this time, no movement between districts or inside the city was permitted. Commercial vehicle operators were only allowed to operate on their regular routes within the city for a limited time each day. During this period, the survey questionnaire was pretested with 70 individuals from the 21 vehicle terminals who were part of the selected stations for the main survey. The sample size was selected based on an extensive simulation study at a high level of confidence performed by Teare et al., (2014). From the feedback collected from the target respondents, the survey instrument was revised.

As the number of confirmed cases soars, the country was placed on complete lockdown for two weeks, during which no commercial vehicles were allowed to operate except for necessary cargo vehicles. During this period, a detailed survey was conducted via mobile phone calls. This survey approach was deemed the best realistic choice in light of the countrywide lockdown, which rendered the face-to-face survey option infeasible. By allowing us to meet the specified target population based on sociodemographic information, this method, a nonrandomized convenience sampling approach, helped us collect a more diversified sample across the city. A total of 250 people answered to our survey out of a total of 270, indicating a response rate of 93%. This sample size was adopted as a result of time, money, and constraint related to participant’s compliance especially during the state of emergency.

2.2. Statistical Analysis

IBM Statistical Package for Social Sciences version 26 was used to analyse the survey results. Descriptive and quantitative comparison analysis were used in the statistical study. Inferential statistical analysis was performed using non-parametric tests. The Wilcoxon signed-ranked test was used to compare commercial transportation modes before and during COVID-19 in order to see if there were any changes in mode preference. Prior to and during COVID-19, the Wilcoxon signed-ranked test was utilized to examine the factors that impact public transit mode choice. This test is particularly applicable to repetitive measure designs, in which the same subjects are examined twice under different conditions (Scheff, 2016). It is a non-parametric substitute to the paired Student's t-test for analysing matched-pair data (e.g., pre- and post-treatment measures), or for a single sample (Woolson, 2005).

3. Results and Discussion

3.1. Descriptive Statistics

Out of the 250 respondents, 60% are commercial drivers whilst the remaining 40% are passengers. The majority of respondents were males (about 94%) between the ages of 18-45 years. This reflects the culture of the country as there are more male commercial drivers. In terms of public transport modes, about 34.8% of paratransit mode “Podapoda” was used by both drivers and passengers before COVID-19, making it by far the most predominant mode. However, during COVID-19, a decline in usage of this mode was observed by one-third. This was supplemented by 33.6% of commercial Motorbike, making it the most popular mode among drivers and passengers during the pandemic (Figure 1). Wilcoxon signed rank test revealed a statistically significant change in modal share ($Z = -2.777$, $p = .005$), indicating a substantial increase in share of transport modes during the pandemic. Prior to and throughout the epidemic, an equal percentage of Keke/Tricycle, the country's most recent mode of transportation, was used by both drivers and commuters. This mode is limited to only two passengers, which is unlike the other modes.

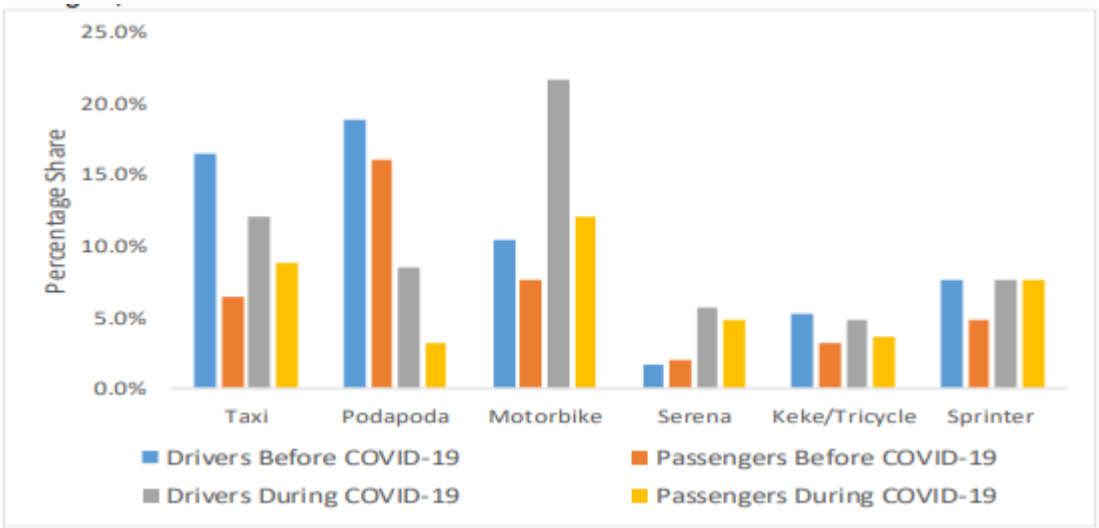

Figure 1. Modal Share of Commercial Transport Before and During the Pandemic

During the pandemic, approximately, 76% of the respondents revealed that the roads they ply were free of traffic congestion and 77.6% acknowledged that transportation fares for all available mode classes had increased. This increase in transportation fare has a number of societal consequences, including an increase in financial burden on most travellers and employed people. It may also

contribute to social exclusion; as low-income families may not be able to afford to fully engage in society. About 73.2% revealed that they spend more time waiting at the bus station than usual. Of the 60% drivers, majority (about 24.8%) are experienced drivers who have been operating commercial transport for 6-10 years. The demographic characteristics of respondents are shown in Table 1.

Table 1. Demographics of Respondents

General Information	Frequency	Percentage (%)
Gender of Respondent		
Male	235	94.0
Female	15	6.0
Age of Respondent		
18 – 25	80	32.0
26 – 35	75	30.0
36 - 45	60	24.0
Above 45	35	14.0
Designation of Respondent		
Driver	150	60.0
Passenger	100	40.0
Driving License		
Yes	178	71.1
No	72	28.8
Years of Driving Experience		
1-5	48	19.2
6-10	62	24.8
More than 10	40	16.0
Not Applicable	100	40.0
Commercial Vehicle Ownership		
Yes	64	25.6
No	186	74.4

3.2. Effect of COVID-19 on Commercial Transport

According to survey-based studies, COVID-19 pandemic had a substantial impact on urban travel habits (Gajendran, 2020). During the pandemic, travel patterns all across the world were interrupted, having a severe impact on commercial transportation. It can be seen from Figure 2 that the major impacts of COVID-19 on public transportation in Sierra Leone are increase in terminal waiting time, requirement for social distancing, and increase in transportation fare. About 40% of respondents are concerned about being infected when they go out, therefore they take fewer public transportation trips per day than usual, resulting in more car idle time at the terminal. This conformed to the findings of Pawar et al., (2020), who found that road users regarded public transportation as risky due to the possibility of virus infection. The majority of commuters choose active modes of transportation, particularly walking, which may have contributed to the long vehicle queues at the various terminals. Because of the close seats and culture of overloading passengers on public transportation, 27.2% are concerned that they will be infected with the virus if social distancing is not practised. The findings support earlier study by Dzisi and Dei, (2020) which suggests that public transportation remains a high-risk area in the fight against COVID-19, and that the majority (98.0%) of buses adhere to the Ministry of Transportation's social distancing requirements. The requirement of social separation in public transportation has become a "new normal" in the country and is still a growing challenge. This was

also reinforced by the study of Sogbe, (2021), in which the researcher found growing influence of the coronavirus pandemic on public transportation in Ghana, especially in terms of social distancing requirement. The risk of getting the virus as a result of the close proximity of seats in a "Podapoda" was a major cause of worry and concern for the majority of commercial transportation commuters. As a result of this influence, public transportation has shifted from the paratransit mode, “Podapoda” to Motorbike, which typically transports one passenger as well as active modes. The social concern of being infected when using crowded public transit, such as "Podapoda," prompted this change. This is probably why most commuters tend to avoid public transport during pandemics (Kwok et al., 2020). This shift could affect the environment in terms of pollution and accidents, as well as an adverse influence on the rider or commuter.

Increase in the cost of transportation is another major consequence of the epidemic on transportation, as acknowledged by 21.6% of the respondents. According to the Wilcoxon signed rank test, transportation fares increased statistically significantly during COVID-19 compared to before the pandemic (Z = -11.176, p = 0.000). The study supports previous research by Mogaji, (2020) that COVID-19 has had a significant impact on transportation in Lagos, Nigeria. Ridership dropped as a result of the pandemic's effects on transportation, both because of the directive in place during the partial lockdown and because of the panic of getting the virus during the post-lockdown period.

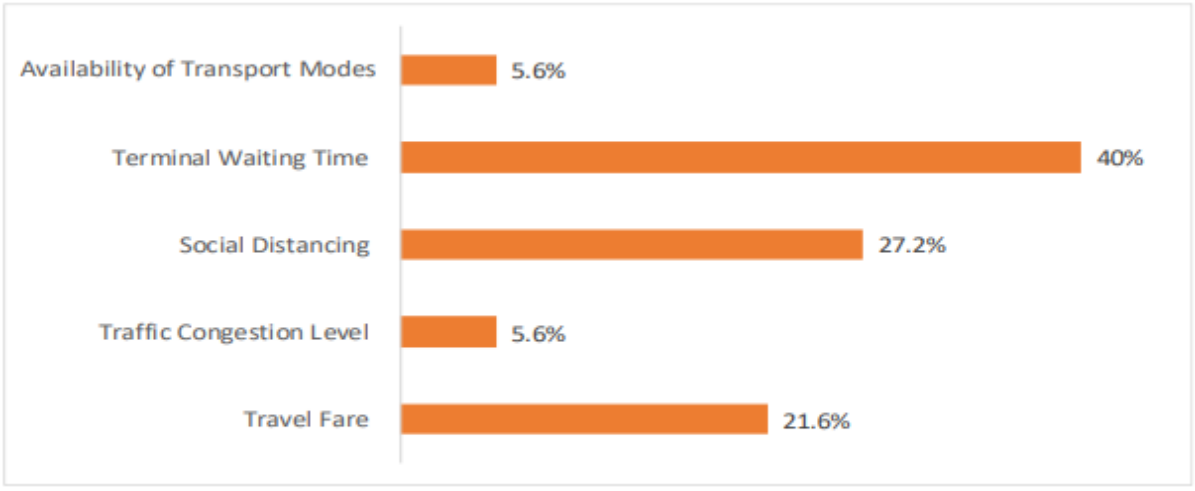

Figure 2. Effect of COVID-19 on Commercial Transport

3.3. Effect of COVID-19 On The Economic Wellbeing of Commercial Drivers

The effects of COVID-19 on commercial drivers' economic well-being and its impact on public transportation were assessed using Wilcoxon signed Rank Test. The null hypothesis is: COVI-19 has no impact on the economic welfare of commercial drivers and public transportation. This hypothesis was evaluated by comparing the p-value to the significance level (0.05). All of the factors investigated are statistically significant at the 95% confidence level, according to the data shown in Table 2. As a result of COVID-19's detrimental impact on commercial drivers' and public transportation, the null hypothesis was rejected. The precautions put in place to curtail the spread of the pandemic had different influence on commercial drivers' economic welfare and public transportation since they were unable to work as usual due to government restrictions (z = -12.030, p = 0.000) with large effect size (r = 0.54) (Gignac and Szodorai, 2016). Majority of the commercial drivers (74.4%) who rely on vehicle owners, as well as co-workers, were unable to complete their daily commutes. Some of these drivers are self-employed vehicle owners (25.6%) who rely on daily income and must leave the house every day to make ends meet. Passengers were discovered not actively moving in their vehicles, posing

a threat to the state's economy. The major impacts of COVID-19 on transportation in Freetown were reported as increased in terminal waiting time, increase in transportation costs, decrease in traffic congestion and the need for social distancing in vehicles. During the epidemic, commercial drivers on several routes throughout the city are reported to have raised their passenger transportation fares (z = -11.176, p = 0.00) with relatively large effect size (r = 0.5). This suggests that, the increase in transportation fare during the pandemic is quite large. However, it is not significant enough to have a meaningful impact on daily driver's turnover. There are only a few public transit fleets in Sierra Leone. However, during the epidemic, practically all modes of transportation for moving people within the city were available. Because there are so many people at some point of the pandemic who want to travel in vehicles despite social distancing, the use of facemasks among other measures, the transporters have raised their fees. During this time, the high cost of transportation has increased the overall cost of living in the city. Similarly, since western area urban Freetown is not a food-producing area, the cost of food has soared. Food is transported in from other cities and Western area rural, making the travel to the city more expensive. Despite the increase, drivers were unable to meet their daily financial obligations. The findings suggest that measures adopted to fight the pandemic's spread on public transit have had a negative impact on commercial drivers' daily income turnover, as well as traveller's income.

Table 2. Wilcoxon signed Rank Test on Factors that Impact Public Transport and Commercial Drivers

Variable	Mean		Mean Rank		*Z*	*P – value*
	Before COVID	During COVID	Negative	Positive		
Drivers Daily Turnover	1.00	0.13	94.00	111.97	-12.030	0.000*
Availability of Transport Mode	1.77	2.20	108.76	105.90	-2.777	0.005*
Transportation Fare	0.16	0.91	111.50	120.17	-11.176	0.000*
Level of Traffic Congestion	0.93	0.25	102.50	110.04	-10.609	0.000*
Terminal Waiting Time	0.16	1.01	99.00	116.87	-11.723	0.000*

*Significant at the 0.05 level

Conclusion

This paper has investigated the influence of COVID-19 on public transport and its relative effect on the economy of commercial drivers in Freetown, Sierra Leone. COVID-19 first appeared in Sierra Leone in late 2019, and the first case was recorded on March 31, 2020. There have been a total of 6,392 confirmed cases thus far, including 121 deaths (MoHS, 2021). Home lockdowns, social isolation, and other measures are among the government's most essential prevention efforts. During the lockdown, the cost of transportation has skyrocketed. Movement restrictions put people's lives and livelihoods in jeopardy. However, this creates an issue that must be handled in order to prevent the disease from spreading and the related financial implications (Mogaji, 2020). It is astounding to observe a 76% reduction in traffic congestion in a city known for long in-vehicle travel times, particularly during rush hour. 73.2% of the respondents revealed that they spend more time than normal waiting at the bus terminal. This was seen to have impacted driver's productivity and travellers wellbeing. Because fewer people will arrive at a bus terminal as a result of the lockdown, this result indicates the impact of the lockdown on travel behaviour.

Many travellers substantially altered their mode of transportation by foregoing their customary travel mode. The increased use of Motorbike, despite the risk, demonstrates this. This change was made in

response to government social distancing standards, as motorbike riders were only permitted to transport one passenger. This outflow is consistent with existing evidence (Molloy et al., 2020). The question of whether this trend is temporary or indicates a shift in the long-term equilibrium has to be followed up on. The Sierra Leone government, like many other countries, opted for mandatory curfews or lockdowns. Citizens were encouraged to stay at home, work from home, and only utilize public transportation when absolutely required, with public transportation services maintained at or near minimum levels to reduce crowding and transmission risks. This paper thus analyses COVID-19's consequences and assists decision-makers in reducing the pandemic's negative effects on the economy and individuals. We suggest that the government could lower the tax on vehicle spare parts, lower insurance premiums, and, if possible, subsidise the cost of fuel for commercial public transport operators. This will reduce the likelihood or quantum of fare increment during an emergency of similar nature and magnitude to mitigate the impact of such epidemic on the poor and vulnerable. To deal with the problems that public transportation systems face, planners should create new cycling lanes and urban space adaptations that can give an alternative to driving. Construction of new and improvement of existing walking facilities could also provide ease and flexibility to those that prefer walking.

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11:30-11:50 Presentation 8: Wednesday, 17th November 2021

An empirical analysis of the factors influencing Scottish residents' compliance with Covid-19 travel restrictions

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Introduction

The Scottish Government have introduced various travel restrictions to curb the spread of COVID-19. These restrictions include reduced capacity on public transport modes, mask wearing and social distancing in public spaces, and prohibiting travel abroad and across different regions of the country. In this paper we investigate Scottish residents' compliance with COVID-19 travel restrictions, via analysis of survey data (n=819) collected during February 2021.

Data & Methodology

The key survey question, which corresponds to our dependent variable, gauged compliance with the Scottish Government's COVID-19 travel restrictions. The distribution of respondents' compliance was as follows: 61 (7.45%) were non-compliant or had low levels of compliance, 288 (35.17%) were mostly compliant and 470 (57.39%) were fully compliant with all measures. Given the discrete, ordered nature of the dependent variable the ordered probit modelling framework was deemed appropriate for the statistical analysis. The framework was extended to include random parameters, which allows

unobserved heterogeneity within independent variables to be captured, and heterogeneity in the means of random parameters (Washington, et al., 2020), hence, the complete modelling framework will be referred to as the Random Parameters Ordered Probit with Heterogeneity in the Means of random parameters (RPOPHM).

Results & Discussion

Table 1 displays the RPOPHM model estimation results and marginal effects for the independent variables that were found to significantly affect Scottish residents' compliance with COVID-19 travel restrictions (t-stats >1.65 are significant at >90% level of confidence (l.o.c.), t-stats >1.96 are significant at >95% l.o.c.). One instance of heterogeneity in the mean of a random parameter variable was found, such that the "COVID-19 information channels (online sources)" variable was affected by an exogenous variable gauging highest education level. Table 3 is succeeded by "LRT (I)" and "LRT (II)", the results of which justify the inclusion of random parameters and allowances made for heterogeneity in the means of random parameters, respectively.

Table 1 RPOPHM model estimation results: Compliance with COVID-19 travel restrictions in Scotland[1]

Variable Description	**RPOPHM**		**Marginal Effects**		
	Coeff.	***t*-stat**	**Level 1 – Non-Compliant or Low Compliance**	**Level 2 – Mostly Compliant**	**Level 3 – Fully Compliant**
Constant	0.749	12.63	–	–	–
Gender (1 if female, 0 otherwise)	0.214	2.083	-0.0504	-0.0171	0.0675
Age indicator (1 if 18-24, 0 otherwise)	-0.448	-2.95	0.1199	0.0109	-0.1308
Age indicator (1 if over 65, 0 otherwise)	0.446	3.30	-0.0944	-0.0544	0.1488
Household income (1 if more than £50,000/year, 0 otherwise)	-0.270	-2.33	0.0677	0.0151	-0.0828
Car ownership (1 if no household car, 0 otherwise)	-0.017	-0.12	0.0051	-0.0013	-0.0038
Standard deviation of parameter density function	*0.625*	*2.08*	–	–	–
Public trust (1 if Scottish Government is a trustworthy source of COVID-19 information, 0 otherwise)	0.242	2.49	-0.0577	-0.0189	0.0766

1 **Abbreviations:** FPOP = fixed parameters ordered probit, RPOP = random parameters ordered probit, RPOPHM = random parameters ordered probit with allowances for heterogeneity in the means of random parameters

COVID-19 information channels (1 if frequently uses television or radio, 0 otherwise)	0.321	2.95	-0.0805	-0.0188	0.0992
COVID-19 mode of travel (1 if personal vehicle used at least 3 days per week, 0 otherwise)	-0.304	-2.84	0.0759	0.0178	-0.0936
Perceived danger of COVID-19 (1 if very dangerous, 0 otherwise)	0.254	2.53	-0.0603	-0.0209	0.0811
Perceived likelihood of spreading COVID-19 (1 if very likely to pass on to others, 0 otherwise)	0.178	1.85	-0.0424	-0.0140	0.0564
Perceived importance of protecting the environment (1 if very important, 0 otherwise)	0.431	4.27	-0.1079	-0.0260	0.1339
COVID-19 information channels (1 if frequently uses online sources, 0 otherwise) *Standard deviation of parameter density function*	0.345 *0.474*	2.79 *1.68*	-0.0691 –	-0.0279 –	0.0970 –
Heterogeneity in the mean of random parameter COVID-19 information channels (online sources: Highest education level postgraduate qualification, e.g., MSc or PhD)	-0.332	-1.95	0.0435	0.0164	-0.0599
Threshold 1	1.528	12.63	–	–	–
Number of observations	819		–	–	–

$LL_{CONSTANT}$ / $LL(\beta_{FPOP})$ / $LL((\beta_{RPOP})$	-720.42 / -666.22 / -665.06	–	–	–
$LL(\beta_{RPOPHM})$	-663.14	–	–	–

LRT (I): RPOPHM > FPOP with > 90.0% l.o.c.; LRT (II): RPOPHM > RPOP with > 95.0% l.o.c

A variety of sociodemographic, perceptual and behavioural factors were found to significantly affect Scottish residents' compliance with COVID-19 travel restrictions. Some of the findings in Table 3 have been observed in other recent studies, particularly those related to age, gender and COVID-19 risk perceptions (Asnakew, et al., 2020; Griffith, et al., 2020). However, some findings were in disagreement with previous studies, for example, the finding that high income households were significantly more likely than lower income households to be non-compliant. Some other interesting findings include those related to COVID-19 information channels, as those who frequently use television, radio or online sources for COVID-19-related information were significantly more likely to comply with restrictions.

Conclusion

The vast majority of Scottish residents (~92%) complied mostly or fully with COVID-19 travel restrictions. The RPOPHM model estimation results showed that a variety of factors significantly influenced levels of compliance. Given that the relationship between gender, risk perception and compliance with government health interventions is well established, the Scottish Government may consider tailoring public health information to males. In addition, we also suggest that the Scottish Government continues to disseminate public health advice through online information channels.

Acknowledgments

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11.45-12.00 / 12.45 -13.00 Presentation 9: Wednesday, 17th November 2021

The health impact of remote work during the Covid-19 pandemic: a snapshot on commuting and other aspects from a holistic approach

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Abstract

Introduction: The emergence of the Covid-19 pandemic in 2020 resulted in immediate remote work orders for millions of workers globally. Although some recent research has been published regarding the impact of Covid-19 on the health of remote workers, most of the existing research into remote work was conducted before remote working was implemented at such an unprecedented scale. This coupled with the unique demands of the pandemic mean the existing research on remote working might lack validity and relevance when considering the Covid-19 crisis (Wang et al., 2021). In addition, much of this research on remote work does not consider the impact on human health from a holistic viewpoint. The objective of this study was to determine the impact of remote work during the Covid-19 pandemic on worker health.

Methods: This study utilised qualitative and quantitative research methods, combining existing validated tools to holistically assess worker health using remote methods. Eight self-reported health measures were selected: physical activity, sedentary behaviour, pain, stress, job satisfaction, performance and isolation, mental workload, overall satisfaction and ergonomic resources.

Results: 103 participants (68 females, 35 males) from twelve countries (Ireland n=62; United Kingdom n=17; Australia n=11) completed the online survey. Eight of these further volunteered to participate in a remote workstation assessment. Half of the participants travelled to work via car, van or minibus prior to remote working (n=52), followed by bus, coach, private bus (n=18), train (n=14) and underground train, light rail, tram (6). Ten participants used active methods of walking (n=7) or cycling (n=3) to commute to the workplace. The mean reported commute time was forty minutes (SD 35.7). The elimination of a daily commute to a workplace was mentioned as a positive of remote work by 41% of respondents. Remote workers with a historical commute time of over 90 minutes reported the highest overall satisfaction, active behaviours and lowest stress scores of all workers. Historically active commuters reported weekly exercise lower than the rest of the sample by over 800 MET-minutes / week. The longest reported commute time of a previously active commuter was 40 minutes.
Discussion: The research suggests elimination of a lengthy daily commute positively impacts health, fitness and wellbeing measures. It could be possible that the time saved from commuting was redirected into daily exercise and personal enrichment activities, increasing health and wellbeing (Lachapelle et al., 2018). The method used to previously travel to work may influence this with individuals who previously used passive commuting methods more likely to redirect the time saved into physical activity and those who used active methods displaying a tendency towards decreased exercise, which may have a major impact on health. Living close to work commuter hubs may also be an important factor to facilitate public health improvements by increasing the active commuting population.

Table 1. Overall Satisfaction, Perceived Stress and IPAQ Scores by Commute Times

Variable	Code	Commute Time	Mean	SD	Conditions	Results
N/A	N/A	Total Sample	47	35.7	N/A	N/A
Overall Satisfaction*	1	30 minutes or less	6.8	2	Array 1, array 2	0.92
					Array 1, array 3	0.75
					Array 1, array 4	**0.01***
	2	Between 31 - 60 minutes	6.9	2.2	Array 2, array 3	0.72
	3	61 - 89 minutes	6.5	1.7	Array 3, array 4	0.13
	4	90+ minutes	8.3	1.5	Array 2, array 4	**0.02***
IPAQ - Sitting Hours*	1	30 minutes or less	8.2	2.7	Array 1, array 2	**0.008***
					Array 1, array 3	0.94
					Array 1, array 4	0.17
	2	Between 31 - 60 minutes	10.3	4.3	Array 2, array 3	0.17

	3	61 - 89 minutes	8.1	2.5	Array 3, array 4	0.41
	4	45 - 54	9.4	2.5	Array 2, array 4	0.33
IPAQ - MET Minutes	1	30 minutes or less	2074	2972	Array 1, array 2	0.84
					Array 1, array 3	0.27
					Array 1, array 4	0.27
	2	Between 31 - 60 minutes	1963	2228	Array 2, array 3	0.26
	3	61 - 89 minutes	1491	227	Array 3, array 4	0.12
	4	90+ minutes	3602	4316	Array 2, array 4	0.23
Perceived Stress Scale*	1	30 minutes or less	7.4	2.9	Array 1, array 2	**0.02***
					Array 1, array 3	0.56
					Array 1, array 4	**0.05***
	2	Between 31 - 60 minutes	5.8	3.1	Array 2, array 3	0.07
	3	61 - 89 minutes	8	2	Array 3, array 4	0.07
	4	90+ minutes	5.7	1.9	Array 2, array 4	0.87

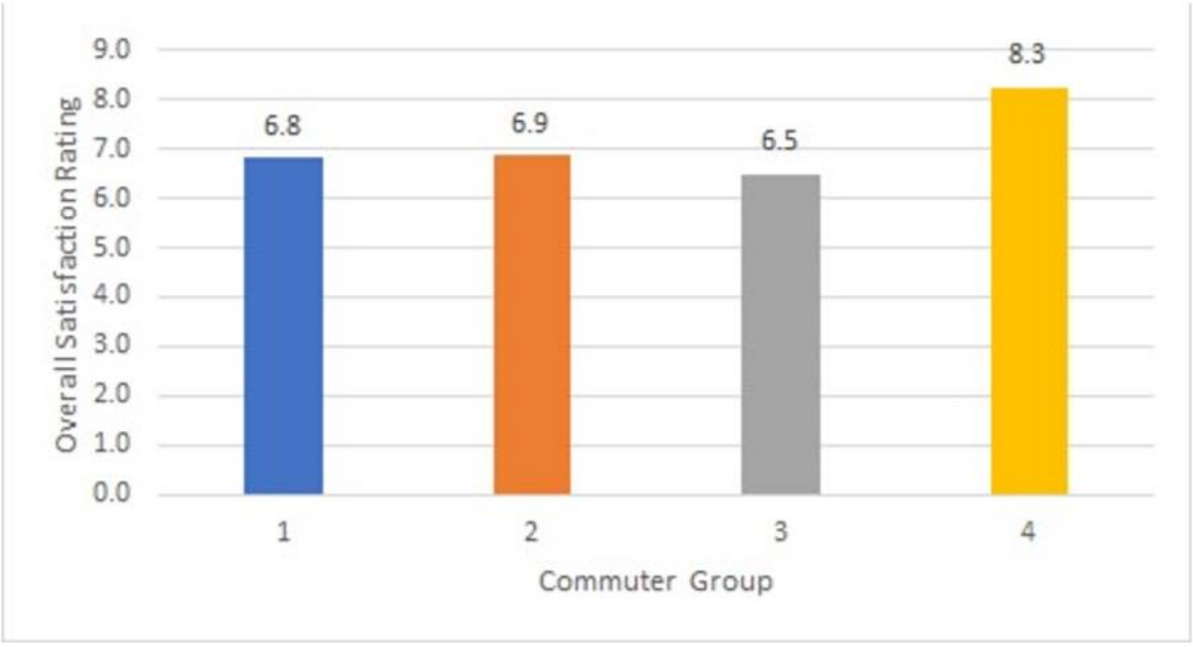

Figure 1. Historical Commute Times and Overall Satisfaction Levels

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Keynote

12.45-13.15 / 13.45-14.15 Presentation 10: Wednesday, 17th November 2021

Racial equity considerations in transportation provision and road user safety

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Abstract

This keynote address will examine the nature of our transportation planning and design process, how it may be contributing to racial equity issues in transportation provision, and how user behaviour itself is intensifying (in) equity in travel. For instance, ethnic/racial minorities are disproportionately represented in pedestrian-related serious injuries and fatalities, and neighbourhoods with higher minority populations experience more frequent pedestrian crashes and related mortality rates, even after controlling for exposure. Is this partly because of disparity in transportation infrastructure conditions? Is this partly because of differences in how drivers react when seeing pedestrians of colour? Is this partly because of pedestrian behaviour itself? The address will also provide some thoughts on how racial justice can be incorporated as a process to better attain the outcome of equity, including considerations of how to self-empower individuals and repair the harms caused by wrongful behaviour (restorative justice) through collaborative community activities.

Session III: Autonomous vehicles

13.15-13.30 / 14.15-14.30 Presentation 11: Wednesday, 17th November 2021

Automated mobility and inclusion of mobility impaired persons - current situation and perspectives of inclusion, requirements of mobility-impaired persons (PART 1)

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Baseline

In the past, inclusion, that is, equal and barrier-free participation in the traffic system, addressed primarily physically and sensory impaired persons and the removal of barriers mainly to public and pedestrian transportation. The UN Convention on the Rights of Persons with Disability, however, demands inclusion in terms of offering accessibility for all mobility needs and all types of mobility impairment, not just physical or sensory disabilities. This also includes, for example, single parents, sick and low-income persons. While the percentage of the group of physically and sensory disabled persons in Austria is 22%, all persons who subjectively feel to be mobility impaired comprise 38%, of which 13% are severely and moderately disabled. These are non-negligible proportions of the population who are more or less excluded from and discriminated against mobility that is necessary for everyday life. These mobility disabled persons can be divided into very different groups of mobility disability with very different demands of inclusion.

Automated and digitized mobility options from the perspective of inclusion

New technologies, such as automated driving and digitization of mobility, raise new questions about the extent to which they promote or hinder inclusion. Studies show that both potentials and risks exist, which require scientific analysis as well as a need for transport policy action to exploit the existing potentials and to avoid the risks in the best possible way. This analysis is not limited to the automation of the means of transport and vehicles themselves, but to all the necessary steps for the implementation of an origin-destination journey, pre-trip, on-trip and post-trip phases.

These offerings were classified and analysed according to the demands of inclusion into short-term and long-term time horizons, as well as into automation-relevant groups of public rail and road transport, demand-responsive shuttle, cab, and sharing forms, automated passenger vehicles and pedestrian transportation, registration, ordering, payment, and information systems. Automated city public transport, micro-public transport, and car-sharing systems currently under application testing were included in the analysis to incorporate concrete experiences from ongoing application testing into the inclusion perspective.

SWOT analysis of automated mobility from an inclusion perspective

A SWOT analysis shows that inclusion will come about automatically. Increased traffic safety (for vulnerable groups), improved opportunities for participation, time and cost optimization, infrastructure development in structurally weak regions, and the closing of gaps in route chains support inclusion. However, people with disabilities are insufficiently included in the development and testing of automated vehicles. New accident risks emerge while traffic participants lack of human assistance in automated situations. Legal issues surrounding the use of automated vehicles are unclear. The lack of knowledge required for inclusion in the design of automated mobility options, as well as uncertainty regarding technology acceptance, represent further risks of exclusion. Table: Inclusion opportunities and exclusion risks for people with disabilities with respect to the development of automated mobility systems

Opportunities	Risks
Increased traffic safety	User requirements for vehicles and operating points are not considered
Participation opportunities in social life	New Barriers to accessing information
Opportunities for participation in work, education, health care, etc	Higher traffic volume, especially due to increase in automated private motorized transport
Increasing technology acceptance	Technology scepticism, partly induced by job losses
Cost reduction and efficiency increase of municipal services	Selection of suitable first (test-)users important for implementation process
Development of fields of activity and business models which improve inclusion	Situation-induced fears and stress in the use of new automated mobility services
Expansion of good practices of inclusion to other fields of activity	Financially overburdening

Conclusions and Note

The empirical data indicate that the automation and digitization of the transport system has great potential in terms of inclusion, but this will not develop automatically. Only through knowledge building and the political enforcement of clear legal frameworks in the standardization of behavior, vehicles and infrastructure.

This paper contains the first self-contained part of the results of the R&D service "Automated Mobility Inclusive!" (Knoll et al. 2021). The second part is in the submitted extended abstract "Automated mobility and inclusion of mobility impaired persons - Components of an inclusive automated mobility system and recommendations" by Hauger and Knoll.

Acknowledgements

This R&D service was commissioned by the Austrian Ministry for Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (project number 873392).

Reference

Knoll, B., Hofleitner, B., Feßler, A., Hauger, G., Fian, T., Adensam, N., Hohenecker, N., Schlembach, Chr., Lehmann, T., Sammer, G., Neuhold, R., Benesch, E., 2021, Automated Mobility included! - AM included!, R&D service as part of the "Mobility of the Future" program of the Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology.

13.30-13.45 / 14.30-14.45 Presentation 12: Wednesday, 17th November 2021

Automated mobility and inclusion of mobility impaired persons – components of an inclusive automated mobility system and recommendations (PART 2)

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Baseline

With increasing automation, digitalisation and networking, there is the opportunity that the four exemplary use cases for Automated Mobility after 2030 (automated city public transport, automated micro-public transport, automated car-sharing or automated private cars) will form an innovative, automated, networked and inclusive mobility. In order to establish an inclusive mobility system that enables self-determined mobility for all people, it is necessary to guarantee a seamless, inclusive mobility chain from door to door. In reality, many different mobility barriers occur – all variations need to be considered and planned for all forms of disability to be inclusive. The involvement of people with disabilities is therefore essential in the planning and implementation process.

Requirements and potential analysis

Automated mobility has potential for independent mobility of people with disabilities, provided that its various offers address the concrete and diverse needs of people with disabilities – pre-, on- and post-trip:

- It is essential that the pre-trip activities, e.g., obtaining information about the automated mobility services, the ordering, booking and payment process, the reservation of any necessary assistance services, can be managed by people with disabilities as independently as possible. The consistent implementation of the multi-sense principle is mandatory.
- Barrier-free access for people with disability has to be ensured that all stages of the journey (on-trip). Starting with leaving the front door, this refers to access to the automated mobility services, the (possible) stop, transfer, equipment, information on and around the route, stage or vehicle, the stay in the means of transport itself (quality of stay and equipment) and ends when getting off near the destination as well as when leaving for the destination address up to the front door. This also includes socially adequate financing of automated mobility services. However, the appropriate provision of the necessary information, applying the multi-sense principle, during the journey, has to be considered due to risk and challenges, such as unplanned stops, technical breakdowns, may occur while using the automated mobility system.
- In the post-trip phase, people with disabilities' experiences of using the automated mobility system must be reflected, as well as any complaints to the operating company or, if necessary, parking the vehicle and providing services for the vehicle (e.g., charging the battery, collecting luggage, etc.) have to be considered.
- Ideally, inclusive planning and implementation reaches a broad variety of user groups (Design for All). It can be calculated and financed similarly to conventional systems through economies of scale if widely rolled out and standardised. However, suppose particular technologies and requirements result in significantly higher costs for an inclusive mobility offer. In that case, funding from the public sector should be discussed to allocate funding in a socially and fairly balanced way.

Components of an automated inclusive mobility system

In order to systematically consider the individual building blocks required for the implementation of an inclusive automated system in future research and technological developments, components for an inclusive automated mobility system were developed (Fig. 1)

Figure 1: Components of an ideal inclusive connected and automated mobility system

Recommendations

Based on the results of the F&D service "Automated Mobility Inclusive!" (Knoll et al. 2021), recommendations were developed. They can be considered as essential for the design and implementation of a connected, automated and inclusive mobility system. This paper contains the second self-contained part of the results of the R&D service "Automated Mobility Inclusive!" (Knoll et al. 2021). The first part is in the submitted extended abstract "Automated mobility and inclusion of mobility impaired persons - Current situation and perspectives of inclusion, requirements of mobility-impaired persons" by Sammer and Schlembach.

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The Austrian Ministry commissioned this R&D service for Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (project number 873392).

Reference

Knoll, B., Hofleitner, B., Feßler, A., Hauger, G., Fian, T., Adensam, N., Hohenecker, N., Schlembach, C., Lehmann, T., Sammer, G., Neuhold, R., Benesch, E., 2021, Automatisierte Mobilität inklusive! AM inklusive!, F&E-Dienstleistung im Rahmen des Programms „Mobilität der Zukunft“ des Bundesministeriums für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie.

13.45-14:00 / 14.45-15.00 Presentation 13: Wednesday, 17th November 2021

The impact of autonomous vehicles on traffic flow

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Abstract

In recent years, the dramatic progress of ITS makes auto driving technology highlighted. Society with autonomous vehicles is not a dream. Then what impact on traffic flow do the autonomous vehicles have? Will congestion be increased or decreased by autonomous vehicles? The impact of autonomous vehicles on congestion has not been concluded yet. In this study, we investigated the impact of autonomous vehicles on traffic flow using microsimulation model.

Introduction

In recent years, the dramatic progress of ITS makes auto driving technology highlighted. It can be said that people are enthusiastic about the term 'Autonomous Vehicle'. People will become free from driving and do meetings, shopping or reading books in their vehicles, which is like a second house. Such a situation like a dream will be achieved.

Then what impact on traffic flow do the autonomous vehicles have? Specifically speaking, will congestion be increased or decreased by autonomous vehicles? The impact of autonomous vehicles on traffic congestion has not been concluded yet. Some researchers say there will be no congestion in the future (e.g. Martin and Dirk, 2001) but others say it's not always so (e.g. Bart et al., 2006). In this study, we focused on the acceleration and the desired time gap of autonomous vehicles and investigated the impact of autonomous vehicles on traffic flow using microsimulation model.

Method

Network

In order to investigate the impact of autonomous vehicles on the traffic flow, the microsimulation tool was used in this study. The microsimulation network was created using VISSIM. The length of the network is 5.5km which reproduces a part of the Hanshin expressway network, Route 11: Ikeda line. Route 11 runs from north to south to connect to the loop route in central Osaka city and has three merging sections. This route to Osaka area has one of the severest congestion in the Hanshin expressway network. Ikeda line is basically a two-lane road and the regulation speed is 60km/h. Massive traffic volume comes into this line from two interurban expressways in order to get into the centre of Osaka. The maximum traffic volume on this line reaches over 46,000 vehicles per day.

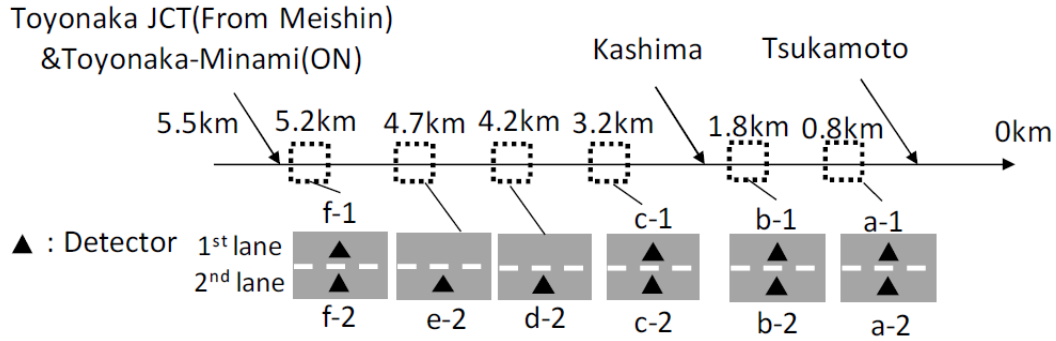

Figure 1. Simulation network (Route11)

Car following model

VISSIM has the original car following model. However, the detail of the original car following model isn't open to the public. Therefore, the add-on was used in this study. As the car following model to control non-autonomous vehicles' following behaviour, IDM+ (e.g. Martin et al., 2000) was used. IDM+ is represented as follows:

$$\frac{dv_i(t)}{dt} = a * min\left(1 - \left(\frac{v_i(t)}{v_0}\right)^4, 1 - \left(\frac{s^*(v_i(t), \Delta v_i(t))}{\Delta x_i(t)}\right)^2\right)$$

$$s^*(v_i(t), \Delta v_i(t)) = s_0 + v_i(t)T + \frac{v_i(t)\Delta v_i(t)}{2\sqrt{ab}}$$

Where, a is 1.4, b is 2.1 and T is 1.55s. The values of the parameters, a and b, were the same values as those suggested by Bernat Goñi-Ros (e.g. Bernat et al., 2016). And the value of T, desired time gap, was obtained from real traffic time gap distribution. Figure 2 shows the histogram of the time gap that is composed of values under 3s. 1.55s is the mean value of the distribution. The time gap distribution came from vehicle trajectory data which was created using video image data around the merging section of the network. The detail of the vehicle trajectory data can be seen on ZTD (Zen Traffic Data) website (https://zen-trafficdata.net/english/).

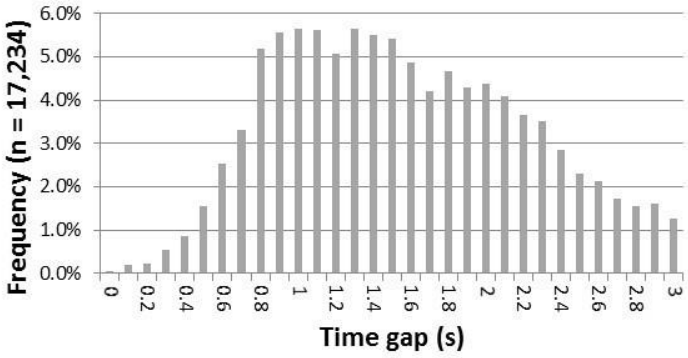

Figure 2. Distribution of the time gap for 15 minutes

As the car following model to control autonomous vehicles' following behaviour, updated Helly model was used in this simulation. Helly model (e.g. Helly, 1959) is a simple controller. In Helly model, the vehicle acceleration is controlled by the distance gap and speed difference. In this study, we gave a little update to Helly model. The updated model is called Helly (FACC) model in this paper. FACC means Full-ranged Auto Cruise Control. The concept of sensor detection range, the constraints of speed and acceleration and enhancing brake function was introduced in this model. Helly (FACC) model is formulated as follows:

$$\frac{dv_i(t)}{dt} = \begin{cases} \delta\left(\alpha\Delta v_i(t) + \beta(\Delta x_i(t) - (s_0 + v_i(t)T(t)))\right) & if\ \Delta x_i(t) \leq s_i^{ACC} \\ \gamma(v_0 - v_i(t)) & if\ \Delta x_i(t) > s_i^{ACC} \end{cases}$$

$$T(t) = \min(k_{1,setting} + k_{2,setting}/v_i(t), k_{3,setting})$$

$$\delta = \begin{cases} max\left(max\left(\frac{v_i^2}{2\Delta x_i b_i} - \frac{v_{i-1}^2}{2\Delta x_i b_{i-1}}, 0\right) + \frac{c}{\Delta x_i}, 1\right) & if\ a < 0 \\ 1 & if\ a \geq 0 \end{cases}$$

$$with$$

$$0 \leq v_i(t) \leq v_{max} \qquad a_{min} \leq \frac{dv_i(t)}{dt} \leq a_{max}$$

Here, α is 0.5, β is 0.125, γ is 0.2, s_i^{ACC} is 120m, a_{min} is -8m/s^2 and a_{max} is 0.6m/s^2. The first equation of the model controls the acceleration of the vehicle. The second equation of the model represents the time gap control strategy. The third equation of the model is for enhancing brake function. The parameters which related to the time gap control strategy, $k_{1,setting}$, $k_{2,setting}$ and $k_{3,setting}$ are shown in Table 1.

Table 1. Values of $k_{1,setting}$, $k_{2,setting}$ and $k_{3,setting}$

setting	k 1, setting	k 2, setting	k 3, setting
Very short	1.8	8	2.52
Short	1.5	6.3	2.07
Middle	1.2	4.7	1.62
Long	0.9	3	1.17

Additionally, δ that is defined as the safety risk was introduced in this model. The concept of the safety risk is based on the Mazda algorithm (e.g. Oncil et al., 2006). Figure 2 shows the concept of the safety risk. In Figure 2, b_i and b_{i-1} is 0.3G (2.97m/s^2) and c is 4m. This function works especially when a vehicle is in dangerous situation, (e.g. emergency stop). On the contrary, it doesn't work when a vehicle cuts into the short gap in front of the controlled vehicle, for example.

In this microsimulation model, traffic flow during two hours from 2 pm to 4 pm on the 14th of December in 2016 was reproduced. Traffic congestion started from Tsukamoto merging section at around 3 pm. Then the congestion spread over toward Toyonaka junction.

Table 2 summarises the microsimulation case studies in this study. In order to create the composition of autonomous vehicles' time gap setting in the case of from No.2 to No.7, it was assumed that drivers' preference of time gap would not vary in the future. Then the values of the proportion was calculated from the distribution of Figure 2.

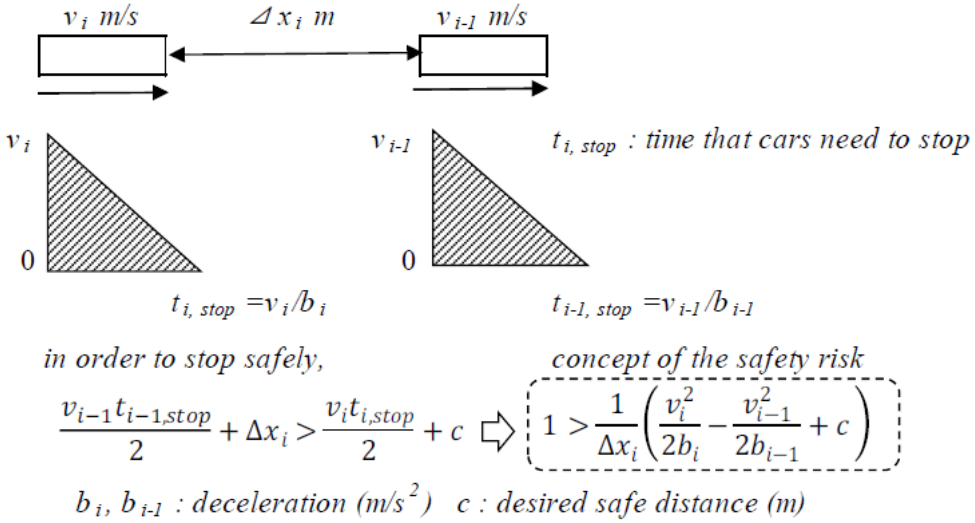

Figure 3. The concept of the safety risk

Table 2. Summary of case studies

Case	Non-AV with IDM+	AV with Helly (FACC) model	Note
No.1	100%	0%	No AV
No.2	95%	5%	$a_{max} = 0.6m/s^2$ Compositon of AVs' time gap setting Very short 33% Short 29% Middle 24% Long 14%
No.3	90%	10%	
No.4	85%	15%	
No.5	75%	25%	
No.6	50%	50%	
No.7	0%	100%	
No.8	75%	25%	$a_{max} = 1.4m/s^2$ Compositon of AVs' time gap setting is same as No.2 to No.7
No.9	0%	100%	
No.10	0%	100%	$a_{max} = 0.6m/s^2$ Very short 100%

Results

Figure 4 summarises the total loss time results of case No. 2 to No. 10. Loss time is the indicator of traffic congestion volume and calculated every 5 minutes as follows:

$$Loss\ time = Q * \left(\frac{L}{V} - \frac{L}{V_r}\right) * 60$$

Here, Q is traffic volume, V is traffic velocity, V_r is regulation speed and L is the length of the section. According to the results of case No.2 to No.7, the more autonomous vehicles increase, the larger loss time becomes. That's because the average desired time gap of autonomous vehicles was around 1.7s in this simulation, which was longer than the value of the nonautonomous vehicles' desired time gap, 1.55s. Moreover, autonomous vehicle's speed recovery after the speed reduction happens was slower than non-autonomous vehicle's speed recovery because the maximum acceleration of autonomous vehicles was set to 0.6m/s^2. These two settings seem to be the cause of increasing congestion.

Comparing the results of case No.5 with the results of case No.8, although the percentage of autonomous vehicles is the same value, 25%, loss time of case No.8 was lower than that of case No.5 apparently and similar to the result of case No.1. In case No.8, the maximum acceleration was changed to 1.4m/s^2 from 0.6m/s^2. 1.4m/s^2 is the same value as the parameter 'a' of IDM+. Moreover, the acceleration ability of Helly (FACC) model is superior to that of IDM+ because of the structure of the car following model. Hence, autonomous vehicles' speed recovery is faster than non-autonomous vehicles in case No.8. That's the reason for lowering the loss time of case No.8. On the other hand, because 75% of all the vehicles are non-autonomous vehicles in case No.8, if the leading vehicle is non-autonomous vehicle, the autonomous vehicle has no choice but to follow that non-autonomous car. Therefore, the effect of increasing the maximum acceleration didn't overcome the influence of the difference of the desired time gap.

Comparing the results of case No.8 with the result of case No.9, the loss time of case No.9 was smaller than that of case No.8. Moreover, the loss time of case No.9 is smaller than even that of case No.1. That's because all the vehicles are autonomous vehicles in case No.9. In other words, under the circumstance in which enough autonomous vehicles are in the network, increasing maximum

acceleration make a significant contribution and can overcome the influence of the difference of the desired time gap.

Finally, traffic congestion didn't occur in case No.10. The reason is that the desired time gap setting of all the vehicles was set to be very short. That means they follow their leading vehicles with the desired time gap from 1s to 1.2s. Autonomous vehicles accelerate slower than nonautonomous vehicles because of the maximum acceleration, 0.6m/s^2, in case No.10. Nevertheless, reducing average time gap seems to have more powerful impact on traffic congestion than increasing maximum acceleration.

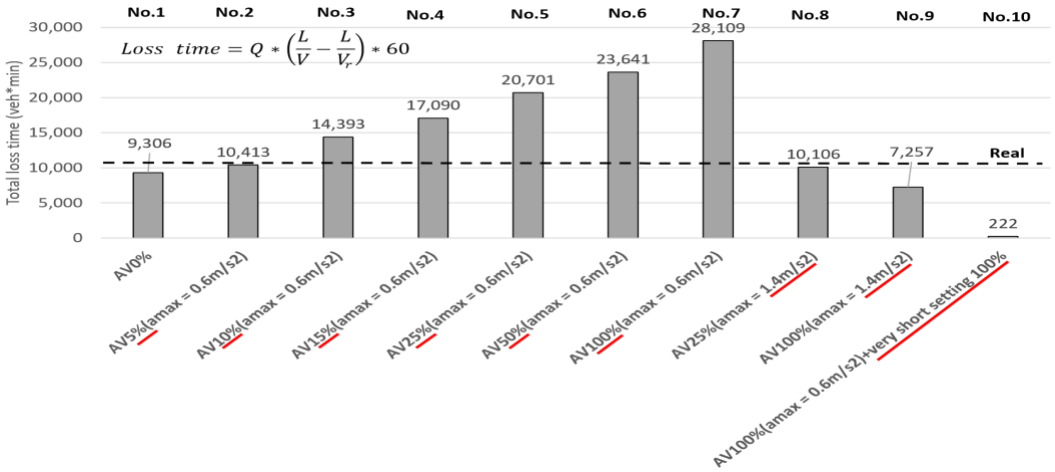

Figure 4. Comparing loss time (No.1 to No.10)

Discussion and Conclusion

In this study, the impact of autonomous vehicles on traffic congestion was observed using microsimulation model. According to the result, it seems that increasing autonomous vehicles makes traffic congestion worse so far. There are two causes of increasing traffic congestion. One is the maximum acceleration of autonomous vehicles. The other thing is the longer average desired time gap of autonomous vehicles.

There are three ways to reduce traffic congestion using autonomous vehicles. First, the maximum acceleration should be raised to the same level of human behaviour. On the contrary, increasing maximum acceleration can result in losing comfortability of autonomous vehicles. Hence, it has to be discussed with car manufactures who want to sell more vehicles by improving comfortability.

Secondly, another way is reducing time gap. It was clarified that the effect of decreasing desired time gap is enormous on reducing traffic congestion in this study. On the other hand, selecting shorter desired time gap setting is nothing but taking more safety risk for drivers under the present circumstance. Thus, it is quite unlikely to think that drivers will proactively select the shorter time gap setting than they want.

Finally, the last way to reduce traffic congestion is connecting technology. CACC (Connected Auto Cruising Control) was not taken into account in this study. On the other hand, there is a problem of the penetration rate of connected vehicles. Under the circumstance of low penetration, connected vehicles are forced to rely on the information from the outside because the accuracy of understanding circumstance is not sufficient. Consequently, they can't perform that function sufficiently. Thus, improving penetration rate is essential.

Auto driving technology should be improved in the future so that autonomous vehicles become the effective way on both lighting the burden of drivers and improving social environment.

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14:00-14:15 / 15.00-15.15 Presentation 14: Wednesday, 17th November 2021

From driver and occupants to passengers. Safe and comfortable autonomous vehicles for all

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Abstract

The increase of automation in vehicles is a reality, embedded in other social, economic and technological trends. And, although fully automated vehicles, still under development, will be a near future reality. The detail of their design, configuration and functionalities remains open. What we know so far is that technology push and design for an "average man" has raised serious safety issues for some collectives, notoriously women. Considering what we have learnt without forgetting a high degree of uncertainty we should be able to produce AVs safe and comfortable for all.

Introduction and background

In 1908 Ford begun to produce in USA the model Ford-T, first affordable car in the history thanks to the introduction of assembly line in production. Lots of things have happened since then in the automotive sector. One of them has been the introduction over time of different levels of driver assistance, ranging from driver-assist technologies (e.g., lane keeping, parking assist, etc.) to full vehicle automation, in which the vehicle will be responsible for all safety -critical functions.

Fully automated vehicles, still under development, will be a near future reality. But the detail of their design, configuration and functionalities remains open. While automotive sector is dealing with partial and conditional automation, following the SAE classification of automation levels (SAE, 2021), what is clear is that full automation of the car will signify a breakthrough of what we understand so far by

"car". Table 1 shows four different use cases, identifying four different scenarios with their correspondent users.

To complete them we should add the type of activities the passengers would like to perform, such as sleep, eat, socialize or enjoy an intimate and relaxed space, without forgetting that in the case of a shared vehicle the desired activities may be different among the present passengers.

Table 1. For different use cases in autonomous vehicles

Main concept	Description of users
A family	Parents, a teenager, a 10 years old kid and a pet
Rent-a-car	Four work colleagues in a trip to a company in a foreign country
Cargo delivery truck	Two/three hard workers
Shared car	Four perfect strangers

Source: Solaz. J. (20219). Remain up-to-date with the ad seats advancements: safety, activities and comfort. 14th International Conference. Innovative Seating.

The vehicle's automation is embedded with overall social, economic and technological trends from ageing and more connected populations, having vs sharing dilemma to advanced robotics or AI systems. While uncertain where this lead us, it is clear that innovation into the automotive sector has mostly been technology-push. And, when people have been put into the equation, it has been an "average man". One consequence of this is that women run a higher risk of getting injured in traffic than men. Of course, there are notable exceptions, such as the EVA Initiative (VOLVO, 2019).

We also know that men and women have different mobility patterns, that women are more likely to suffer harassment situations in mobility and that women and men are different, from a physical and physiological point of view (Criado-Pérez, 2019). The latter should promote research for basic ergonomics, we face with problems from the past that are still unresolved, but also for advanced interaction modes with the autonomous vehicle or definition of new functionalities or layouts.

Conclusion

Whatever the final configuration of autonomous vehicles may end up in the following decades, the least we should ask to an AV is to meet the required needs, to be accessible and to be safe. Of course, not only for an "average man".

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Session IV: Safety and Security in different aspects of mobility

13.15-13.30 / 14.15-14.30 Presentation 15: Wednesday, 17th November 2021

Assessment of the perceived security among public transport users in Europe

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Abstract

Passenger experiences with public transport are expected to be safe, secure, comfortable, convenient and pleasant. However, this experience is often disrupted by harassment incidents, such as sexual, theft and verbal harassment that may affect passengers' perspective towards public transport services. Security perceptions and harassment experiences may vary according to gender and age. This study analyses the perceptions of 2413 citizens in six European cities over security aspects of public transport and potential measures that can improve these perceptions. Harassment experiences are also illustrated, and their patterns are discussed. The paper concludes with some recommendations to operators of public transport over enhancing the feeling of security and ameliorating negative experiences related to harassment.

Introduction

Travellers' security perceptions have consistently been among the most critical aspects that determine travel satisfaction. Security concerns the incidents "the actual degree of safety from crime or accidents and the feeling of security resulting from that and other psychological factors" (Joewono and Kubota, 2006). Ensuring security in door-to-door public transport trips is a fundamental challenge for service providers. There is a strong link between travellers' security perceptions and overall travel satisfaction, affecting public transport customer retention and recommendation (Abenoza et al., 2018). In this context, harassment incidents are common occurrences on public transport. This study aims to analyse the security aspects of public transport users in six European metropolitan areas. Additionally, it analyses incidents of harassment and their reporting to Authorities. Passenger data was collected through an online survey disseminated in social media channels, platforms, and networks. At the same time, data handling, analysis and processing were carried out through GIS software, Python codes and SPSS. The data from Paris (279 answers), Torino (420 answers), Thessaloniki (231 answers), Valencia (442 answers), and Malmo (210 answers) was collected from November 2020 until March 2021. In Lisbon, the 373 responses were collected in April and August 2021.

Theoretical background or state of the art

In general, women of all ages and backgrounds are more concerned about safety and personal security because they face higher levels of violence as transport users: this affects the selection of transport mode when there are different options and their possibility of choice. They may seek a less efficient or more costly alternative when there is a perceived threat (Singh, 2020). According to reality and

documented research, more than 80% of women and girls have experienced harassment in public, and 80% are afraid of being harassed in public transport. However, a high level of underreporting is found (ITF, 2018). Women are more frequent transit users, and thus, they should be allowed to get off the vehicles closer to their final destination, even if outside the approved bus stops, especially in the evening and at night. Providing adequate lighting is also essential in this respect: bus stops outside residential areas, in bad or remote neighbourhoods, or inside empty parking lots affect a woman's decision about how and when to use the public transportation system (Hasson and Polevoy, 2011).

The findings of Yavuz and Welch (2010) indicate that 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. Factors that may help to alleviate safety concerns are stated as the following: increasing periodic random police or security personnel presence, employing greater enforcement of the rules on the train or inside the stations (or in both), 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. Focusing on railway services, women feel both carriages and train stations as vulnerable spaces (Pirra et al., 2021). On one side, they could be crowded spaces where harassment could occur; on the other, they could have isolated areas where there is no one available to intervene and help in case of an emergency. Also, bus stops and the paths leading to bus stops must consider women's needs, particularly accessibility to vehicles and safety (European Parliament, 2012). Gender influences the perception of crowding, too. Women's lower satisfaction and higher importance might result from a more negative crowding experience due to a lack of security, as the risk of harassment and unwanted touching might increase. Moreover, women are on average shorter than men, and shortness makes crowding more of a nuisance, making it hard to reach poles and grab handles, not having good sightlines when standing among taller people (Börjesson and Rubensson, 2019).

Analysis of harassment incidents and the perceived security of public transport users

A survey was designed and distributed to six European metropolitan areas in the native language of each country. Aspects related to respondents' mobility behaviour, perception of security aspects and means to improve it were asked. Negative experiences (harassment incidents) were stated in one of the following ways: indication of the location where the harassment occurred on the map or indication of the street or place name. When possible, answers were geocoded, and the incidents mapped. The hotspot analysis allowed the identification of clustering of the spatial phenomenon through Microsoft Excel, GIS software and Python codes. The respondents' replies on the security aspects and possible interventions were analysed. With a focus on gender and age, passengers' perceptions with/without harassment experiences were compared. All the statistical analysis was conducted in SPSS software.

In total, 1955 replies were collected, and 372 respondents stated they had a harassment experience as travellers. A pattern appears across all the metropolitan areas analysed. In this sample, the percentage of harassment incidents ranged from 6 (Valencia) to 39% (Malmo). However, a relatively low percentage of travellers has reported the incident, from 17% (Malmo) to 35% (Paris). Table 1 presents the total number of replies obtained in each city and the number of harassment incidents.

Table 1. Harassment incidents in six European metropolitan areas and reasons for not reporting by popularity (1 - most voted)

Metropolitan areas	Lisbon	Malmo	Paris	Turin	Thessaloniki	Valencia
Sample size	373	210	279	420	231	442
Harassment incidents (No.)	96	81	34	62	73	26
Harassment incidents (%)	26%	39%	12%	15%	32%	6%
Reported (No.)	19	14	12	12	16	5
Reported (%)	20%	17%	35%	19%	22%	19%

Metropolitan areas	Lisbon	Malmo	Paris	Turin	Thessaloniki	Valencia
Reason for not reporting						
Afraid	3	4	2	4	4	4
Not aware of the process	2	5	3	3	2	1
No time to waste	4	2	4	2	3	2
Not a big deal	1	3	1	3	1	3
No trust in the police	5	1	2	1	3	3
Not my responsibility	6	6	5	5	5	5

Furthermore, it is presented in Table 1 some reasons why passengers did not report the incident to the Authorities by popularity, being one the most voted reason (each traveller could choose several motives). On the one hand, Malmo and Turin's respondents seem not to trust the police. In contrast, in Lisbon, the reasons behind underreporting are not connected with a lack of trust in the police. Furthermore, Lisbon, Paris, and Thessaloniki's travellers do not describe the harassment experienced as a big deal. Moreover, it should be highlighted that, in Malmo, Turin and Valencia, the respondents with a harassment experience stated that they received below the average income. While in Lisbon and Thessaloniki, most of the affected ones belong to the "average" monthly income category.

Nevertheless, there is a lack of information regarding the harassment reporting process (procedure and time spent) in all metropolitan areas. This situation may impede the improvements of security aspects, and the monitoring of the incident frequency in the cities analysed.

Regarding the sample, a description per city follows.

- **Paris Metropolitan Area**: The reports are distributed between the men (47%) and women (53%), with a higher number of reports from young women. Most incidents occurred while walking on the street and using public transport, such as metro and rail stations. Only 35% of people have said to have reported the incidents to authorities. According to the table below, people choose not to report a situation of harassment, in general, because they do not trust that the authorities will give the necessary attention to the problem or ignore the importance of the incident. This information aligns with previous evidence Malandrino and Berman (2020). They conducted several focus groups, and 14 participants stated that many users do not report the incidents because of their lack of trust in the justice system, believing that it would not result in anything and that the administrative procedures were considered too complicated. Consequently, it has been agreed to instruct public transport employees to assist victims in reporting incidents to act against this lack of confidence.
- **Thessaloniki Metropolitan Area:** The respondents from this city were the ones to report a higher number of incidents, with a similar distribution between gender (48% of men and 52% of women) and across age groups. Regarding the approximate location of each harassment, most of the reports occurred in the centre of the city, near bus/train stations, with a maximum of 27 occurrences in the same 1 km radius. The distribution between men and women does not follow any geographical pattern as both are concentrated in the city centre.
- **Valencia Metropolitan Area:** In Valencia metropolitan area, incidents were primarily reported by women (77%), people between 18 and 54 years of age (92%), and people with an average income below the average of the country (46%). It is also worth noting that 22% of people that have reported an incident have some disability. Incidents are predominantly located in the centre of Valencia. The maximum number of incidents is 4, located near Nord Adif station. Incidents reported by women are located in the centre of the city, near public transport waiting areas, while incidents reported by men do not show a clear pattern.

- **Turin Metropolitan Area:** Similar to the data collected in Valencia, most cases of harassment were reported by women (72%) and primarily by people in the 25-34 age group (51%). The maximum number of incidents is 5 in a radius of 1 km, located in Castello square next to the public transport stations located here. Only 19% of the people complained to the authorities. The two leading causes for people not filing a complaint are the lack of trust in the authorities to pursue the case and the unwillingness to waste any more time on the situation.
- **Lisbon Metropolitan Area**: The respondents from the Lisbon metropolitan area were the ones who reported the most incidents of harassment, with a similar distribution between gender (52% of women and 46% of men). Incidents are primarily in the Arroios parish, where 23 incidents were reported. The leading cause for people not filing a complaint is that they do not think it was a big deal and do not know how to proceed. 45% of those affected belong to the "below average" monthly income category. Figure 1 illustrates an example of the geographical analysis. It presents the results obtained for the Lisbon metropolitan area.

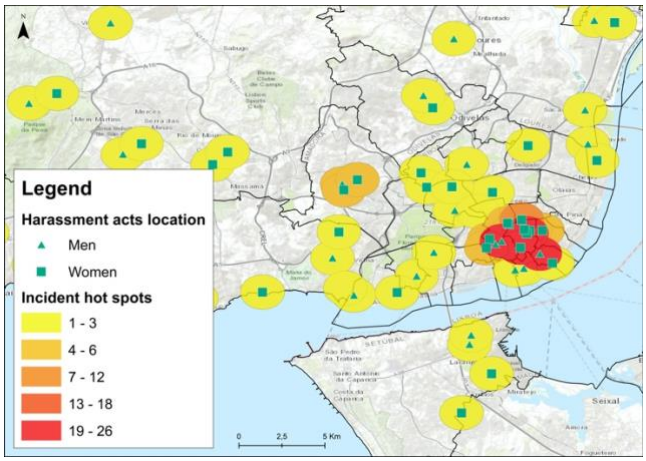

Figure 1. Incidents of harassment in the Lisbon Metropolitan Area

- **Malmo Metropolitan Area**: 81 incidents were reported in the Malmo metropolitan area, with a similar distribution between gender (49% of women and 51% of men). 46% of those affected belong to the "below average" monthly income category. The maximum number of incidents is 15 in a radius of 5 km. The leading cause for people not filing a complaint is the lack of trust in the authorities to pursue the case and the unwillingness to waste any more time on the situation.

4.2 Differences in harassment incidents according to gender and age

The areas where the harassment incidents are concentrated indicate potential urban spaces to which interventions could be introduced to increase public transport security. Statistical analysis demonstrated differences in the perception of security attributes among people who reported harassment experiences and those who did not. Table 2 demonstrates these differences ("+"), and it is observed that people with previous harassment experiences feel less secure at stations than other passengers in all metropolitan areas. While gender was not proved to affect passengers' perceptions, women of older ages rated lower in many security aspects when compared to younger women. This situation was observed in Turin, Paris and Lisbon, indicating that age can play a role in the perception of security.

Table 2. Differences in security aspects with and without harassment experiences

Metropolitan areas	Paris	Turin	Valencia	Thessaloniki	Lisbon	Malmo
Less satisfied with the number of security staff visible	+	+			+	

Less satisfied with crowding levels in vehicles or waiting areas	+	+		+		
Less satisfied with security cameras in waiting areas	+				+	
Feel less secure at stations	+	+	+	+	+	+
Feel less secure inside vehicles	+	+		+		
Overall, less satisfied with the security aspects		+	+	+	+	

5. Discussion and conclusions

Transport security is a critical factor in the choice of transport mode. Reports of incidents are generally related to the use of public transport. Findings indicate that certain security aspects of public transport are lower-rated after a negative experience. Most incidents are not reported to the authorities because of fear, lack of knowledge on how to proceed, lack of will to invest time, or belief that the police would not be taking allegations seriously. Additionally, both physical and social characteristics of transit environments and individual factors impact the occurrence of harassment incidents, thus affecting the passengers' security within the public transport. Contrary to what might be expected, the reported incidents do not skew towards any gender category due to the general characterisation of harassment, including sexual harassment, thief harassment, and verbal harassment.

In this analysis, Valencia's low percentage of harassment experiences indicates that the efforts to tackle these issues in the last few years have been successful compared with the other metropolitan areas. In particular, the transport authorities have taken measures to make passengers feel more secure in the transport stations and vehicles and prevent harassment incidents: (1) surveillance cameras are used, and the passengers are informed of their operation through announcements, (2) bus drivers are responsible for the security of the bus security and a harassment protocol placed on bus wallpapers presents a number phone where people are informed of the specific numbers to contact the police to report the situation, (3) stop-on-demand is possible in specific bus routes at night. In addition, more insights on the security topic were obtained through a workshop held by the Valencia hub under the TinnGO project.

In general, the results show that the women's perception of security could increase first by having more stops closer to their residences during the day and secondly by the availability of a smartphone application to communicate with the operators or police in case of potential incidents. On the other hand, men's perception of security could increase, first with a smartphone application to communicate with the operators or police and second with flexible stops to reduce walking distances at night. In this context, considering Valencia's successful results and what travellers stated in this survey regarding security aspects, public operators and authorities should consider developing applications to assist users in potentially dangerous situations and offer more flexible services. Notably, it was revealed that people feel less secure at the tram stations because there are no cameras in the public spaces. In contrast, there are higher perceptions of security in railway stations, where only people with a valid ticket can enter.

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13.30-13.45 / 14.30-14.45 Presentation 16: Wednesday, 17th November 2021

Quantifying the effectiveness of 20mph speed limits in rural areas: empirical evidence from the Scottish borders area

G. Fountas[1], A. Davis[1], A. Olowosegun[1], and P. Gilhooly[2]

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[2]Scottish Borders Council

Introduction

Vehicles' speeds have been widely acknowledged as one of the key factors affecting road safety globally. High speeds have been linked with higher frequencies of road collisions and with more severe injuries. To address the consequences of high speeds on road safety, various traffic calming measures have been introduced, and implemented by local Highway Authorities. Over the last few years, the introduction of the 20mph speed limit (30kmph) has proven an effective measure for reducing the frequencies of collisions and KSI casualties and assuaging the public health concerns arising from the presence of excessive speeds and especially in urban populations (Steinbach et al., 2013). According to Cleland et al. (2020), 20mph speed limits are mainly implemented in urban areas. However, evidence on 20 mph speed limits in rural areas is limited in the literature to date. This present study aims to fill in the research gap on the effectiveness of 20mph speed limits in predominantly rural areas.

The objective of this study is to provide empirical evidence about the effectiveness of a 20mph trial in the area of Scottish Borders, UK, which started in October 2020. The Scottish Borders are located in the Eastern part of the Southern Uplands of Scotland and is a largely rural area with most settlements having populations significantly less than 5,000. This trial constitutes one of the first-of-its-kind, large-scale 20mph speed limit scheme not only in the UK, but also across the globe.

Methods

A quantitative approach was adopted in this study to quantify the speed shift and determine the impact of the 20mph speed limit on several dimensions of vehicle speeds. Specifically, a "before-after" analysis of vehicle speeds was conducted. Data generated from four different survey waves were analysed for 156 sites, whereas approximately 5 million individual speed observations were

processed. The speed metrics used for the analysis include the mean and 85th percentile speed, standard deviation of speed, and proportions of vehicles exceeding the speed limit and other speeding thresholds. We also controlled for the impact of other exogenous factors on speeds, such as the school presence, the day of the week and the settlement type.

Results and Findings

Overall, the results indicated important speed reductions for nearly all sites across all survey waves. Interestingly, both the mean and 85th percentile speeds were found to reduce by 3.2 mph approximately after the introduction of the 20mph speed limit. Figure 1 and Table 1 provide a summary of speed differences between survey 1 ("before") and survey 2 ("after I").

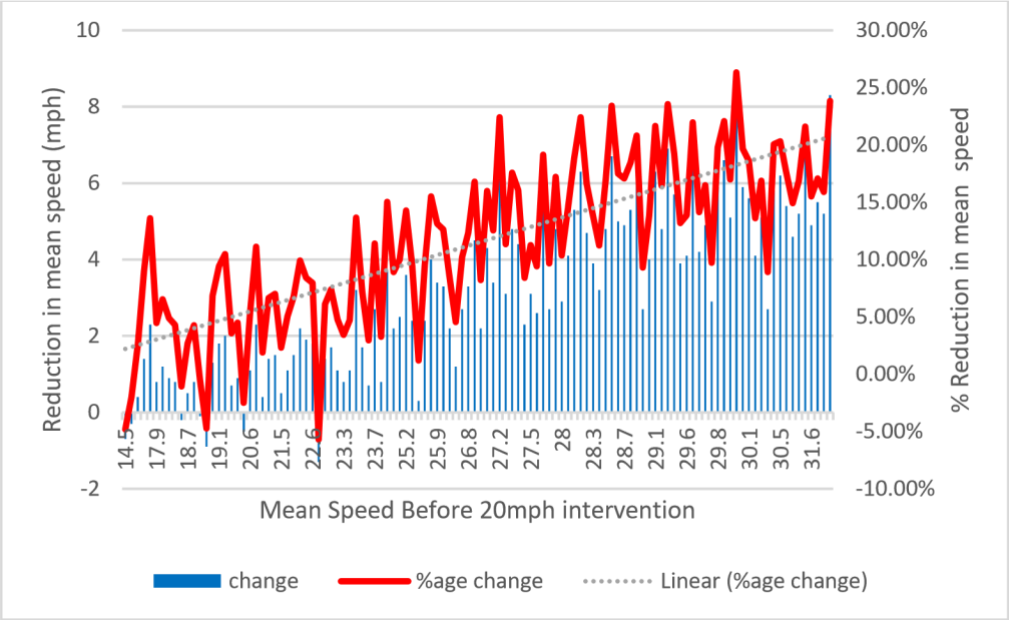

Figure 1: Absolute and relative speed changes "after I" compared to mean speed "before"

Table 1: Difference in mean speed per speed band

Speed band (mph)	Before	After I	Average difference
0-20	18.06	17.41	-0.66
>20-25	22.69	21.19	-1.50
>25-30	27.99	23.75	-4.25
>30-35	31.15	25.76	-5.40
Total	25.45	22.28	-3.17

The findings suggest that the 20mph speed limit is effective in reducing speeds, especially at locations exhibiting high mean speeds (>25 mph) before the intervention. These speed reductions seem to be maintained across time for the majority of locations.

Conclusion

We conclude that the 20 mph speed limits have a significant potential in tackling exceeding speeds in rural areas and so for improving safety, both perceived and objectively measured. However, 20mph

speed limit implementation should be accompanied by appropriate enforcement, as the compliance of drivers to the speed limit may wane over time without visible police enforcement.

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13.45-14.00 / 14.45-15.00 Presentation 17: Wednesday, 17th November 2021

AN UNDERSTANDING OF SAFETY PERCEPTION FOR WOMEN AS USERS OF SURFACE TRANSPORT COMBINED WITH A SNAP OF BARRIERS IN THE COVID PANDEMIC

A.A. Thimnu, M.C. Leva, L. Darcy and M. Kinahan

Technological University Dublin, Ireland

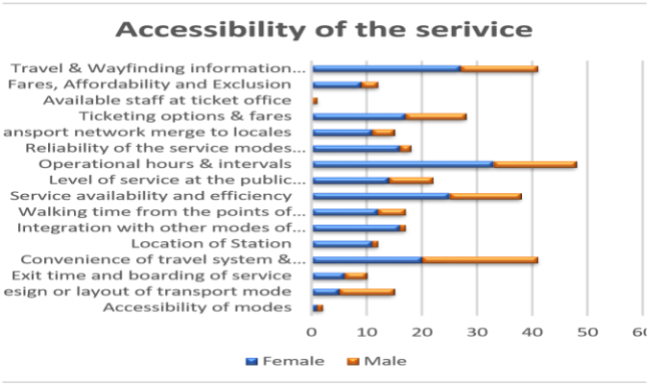
Abstract

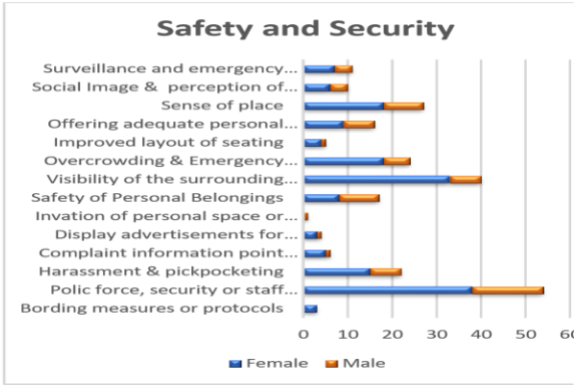
Safety concerns are viewed highly linked to women in comparison to men. Many surveys show disparity, and this is particularly seen to impact their daily travel choice and patterns (TII,2020). Approaches implemented in public transport are viewed to fail in their ability to provide equitable experiences, especially with failures of recognising imbalance in security requirements among genders (Gonzalez Carvajal, Alam 2014). Organisational attentions are seen to emphasize unwarranted and unwelcome verbal or physical contact women encounter in comparison to men while using public transport (Loukaitou-Sideris, 2017; Weinstein Agrawal et al, 2020). Similarly, the issue of visibility linked to dark hours are reported to prompt a feeling of unsafety for women as compared to men (Petterson, 2004).

Data collected from sample show women views of safety and security particularly linked to matters of security and environmental conditions. This paper explores women's perceptions of safety and its effect on their accessibility of public transport. It proposes that the safety perception of women is highly grounded in the preceding and goes beyond this, entwined with the accessibility of the service plus logistics surrounding safety and security. This study further examines concerns of the use of public transport during COVID.

Tables and figures

Tables show women highlighting issue with accessibility and safety. Presence of 'police force or security' and 'visibility of the surrounding area of the station' are seen to stand out as the major concern for women use of public transport. While in terms of accessibility study highlights an intertwined effect of safety linked to accessibility with matters of 'operational hours and interval', 'travel and wayfinding information' and 'service availability and efficiency'.





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14.00-14.15 / 15.00-15.15 Presentation 18: Wednesday, 17th November 2021

E-Scooters Dublin - An observational study on their users and key road safety behaviours

E. Chia Nasali and M.C. Leva

School of Environmental Health, Technological University Dublin, Grangegorman Dublin, Ireland

Abstract

According to Smith & Schweiterman (2018), the profile of urban transportation in Dublin and other European cities has changed recently, partly due to the shift towards more active forms of transportation, and the boom and growing interest for shared-use modes of travel such as, bike sharing, car-sharing, ride sourcing, and the use of e-scooters. Indeed, the use of e-scooters in Europe is gaining momentum and it is becoming increasingly popular as a mode of transport (Sokolowski, 2020). The advantages of e-scooters are wide-ranging. Smith & Schwieterman, (2018) suggest that e-scooters offer a cheaper and quicker alternative when compared to more conventional travel means

such as private automobiles or public transport for trips between half a mile (0.8Km) and two miles (3.2Km). This mode of transport also has environmental benefits. Davar, (2018) suggests that e-scooters can contribute to greener cities because they can take cars off the road and provide a much greener alternative. E-scooters are also cheap to run and are dock-less in mature making them convenient and easy to use. At moment in Ireland, such transport devices are prohibited for use in public spaces (Houses of the Oireachtas, 2019) leaving this area completely unregulated. This has led to a spread of noncompliance in the use of e-scooters in Ireland as countless e-scooters can be seen in use in most public spaces, and are ridden on the road, footpaths, and cycle lane without any form of restriction. It was decided to conduct further research into e-scooter us in Dublin, Ireland. The research set out to establish the key characteristics of e-scooters users in Dublin to include a profile of e-scooter users in Dublin and to establish the level of safety awareness among e- scooter users in Dublin and some suggestions for improvement. The data gathering methods for
this research involved an observational study conducted at seven locations across Dublin as well as the use of an online survey. The seven locations were selected as they had a large volume of traffic and commuters. The data was analysed for themes and characteristics.
The main findings from this research were that there was widespread noncompliant with PPE (helmet and HVC) requirement throughout the research. In addition, this research highlighted that female e-scooter users were more likely to wear PPE, most specifically a helmet compared to their male counterparts. This research also found that male e-scooter users were more likely to ride their escooters male e-scooter users were more likely to ride their e-scooters on the road than their female counterparts, confirming that male rider were more likely to engage in unsafe risky behaviours, like most other research studies crossed referenced within this study. Further research is needed to help identifying what are the potential public and environmental health effects of substituting active modes of transport such as walking and cycling by e-scooters and what are the environmental impacts of lifespan of FFES and the end-of-life of these vehicles, especially their electric batteries. Some short examples of the data collected are reported below.

Tables and figures of sample data collected

Observations were recorded for e-scooter users who wore helmets and for those who did not wear helmets as illustrated in Figure 1 below. Of all the observations, only 29.5% (151 out of 512) wore helmets, while 70.5% (361 out of 512) did not wear a helmet. Therefore, this highlights that most of the users observed did not wear a helmet.

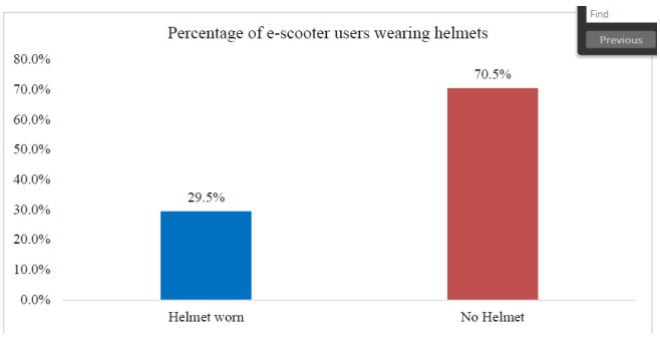

Figure 1 - Percentage of e-scooter users wearing helmets

Out of a total of 512 e-scooter users sampled, only 15.2% (78 out of 512) wore HVC, while 84.8% (434 out of 512) did not wear HVC. Therefore, this highlights that most of the users observed did not wear HVC.

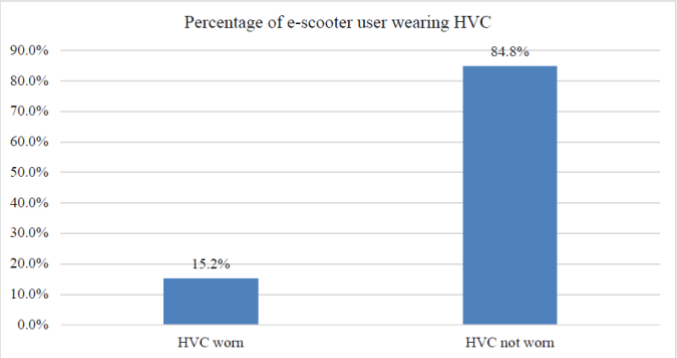

Figure 2 - Percentage of e-scooter user wearing HVC

Gender and use location: As illustrated in Figure 3 out of 512, 148 female and 364 male e-scooter users observed 4.1% (15 out of 364) who were male and 2.0% (3 out of 148), who were female were riding their e-scooter on the road, while 77.2% (281 out of 364) who were male and 79.1% (117 out of 148) who were female were riding on the cycle lane. Additionally, 18.7% (68 out of 364) who were of male, and 18.9% (28 out of 148) who were female were riding on the footpath.

A Pearson's Chi-Square Test was conducted which determined that no significant relationship exists (P=0.506122) between the variables gender and use location.

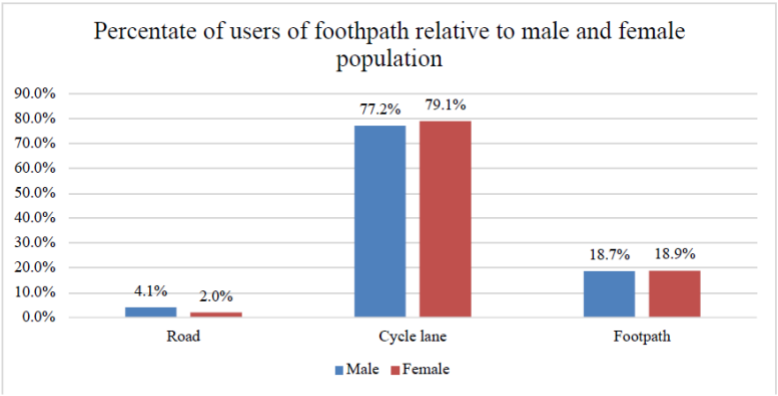

Figure 3 – Use of footpath /road/cycle lane relative to male and female population

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Thursday, 18th November 2021

Keynote

08.30-09.00 / 09.30-10.00 Keynote

Opening of Second Day

Javier Zabaleta - CEO of ITENE Pedro Ballester - President of ITENE
Mónica Oltra - Vice-President and Regional Minister for Equality and Inclusive Policies of the Valencian Regional Government (TBC)

Section V: Influencing policy

09.00-09.15 / 10.00-10.15 Presentation 19: Thursday, 18th November 2021

The concept of fairness in relation to women transport users: a review of the state of the art in the DIAMOND project

Yvonne Hail and Ronald McQuaid
School of Management, Stirling University, Scotland, UK

Abstract

Fairness all people and particularly women in transport covers a range of issues including different travel modes and employment issues. First, women generally, and different groups of women specifically, can have complex mobility patterns in comparison to men (e.g. mothers and older women have shorter commuting times). It is claimed that current transport systems do not always take these into account when both planning and delivering services. Second, for many women driving private vehicles modelled on the general physicality of men has also created issues with regards to seating, posture and the seatbelt safety; while AV's may use algorithms based on databases which reflect past biases in car use rather than fairness across the potential population of users. Third, bicycle and other types of transport sharing often inadequately take account of the specific needs of some groups of women. Fourth, women presently account for only 22% of the work force in the transport sector, affecting employment equality and diversity in perspectives.

Fairness can be a vague and somewhat ambiguous concept which evolves and changes over time and space and can be based on individual subjective reasoning and experiences. This makes any attempt at producing a universal definition a difficult process. Notwithstanding, notions of fairness in contemporary society are closely associated with the concept of justice, with both terms being used interchangeably within the wider academic literature. The terms "fairness" and "justice" tend to be used to describe both how decisions are made and how individuals are treated within a community but can also relate to the actual outcomes of transport system (Hail and McQuaid, 2021).

Gullo et.al. (2008), for instance, suggest that transportation mainly relates to equality of opportunity as without adequate transport access to education or employment is difficult, which further impacts income equality. Litman (2018) separates the concept of equity into two separate types, horizontal which relates to the egalitarian concept of equal treatment of equals and vertical equity which is related to social justice and social inclusion and focuses on the difference (in ability

or need) between and within groups, i.e. transport policies which favour disadvantaged groups such as people with disabilities. From this perspective inequitable or unfair transport policies and planning

can have diverse and significant impacts on different groups at various times in particular on individuals' economic and social opportunities.
For different contexts, there may be different aspects of fairness concepts that are most prominent and so operational definitions of fairness need to be developed. The DIAMOND project specifically considers "fairness" for women users of public transport, algorithms, vehicle sharing and employment in transport. It uses a working definition of fairness is: a state in which people are treated similarly, unimpeded by prejudices or unnecessary distinctions or barriers, except they can be explicitly justified.

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09.15-09.30 / 10.15-10.30 Presentation 20: Thursday, 18th November 2021

How to advance theories of gender and intersectionality into practice for transport planning

Lena Levin
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Abstract
Women and men must have the same power to shape society and their own lives in all sectors and at all levels. This is a human right and a matter of justice. Mobility is no exception, but how can we relate transport planning to gender equality goals: e.g., equal economic independence for women and men, promoting gender equality in decision making, end gender-based violence, and enhance equal division of unpaid homework? This paper takes its background in an intersectional approach to gender and mobility, providing recommendations for gender and diversity mainstreaming for contemporary transport planning drawn from the European research project TInnGO (Transport Innovation Gender Observatory).

Theoretical and methodological approach

Intersectional analysis means that discrimination grounds, such as gender, age, ethnicity, and disability cannot be analysed alone, but must be approached as closely interwoven and mutually affecting (Creenshaw 1989; West and Zimmerman 1987). We thereby emphasize both gender and diversity. The reason for this is not least because an exclusive focus on gender will be too simplistic but a broader view on diversity tend to let gender disappear in the complexity. Intersectionality aims to advance the understanding by including perspectives to gender, which show how transport resources also depend on age, income, and location, but also time factors and safety issues as well as control or constraints. Intersectionality can thus identify the multiple factors that leads to diversities within groups of women and men and their travel behaviours, choice of transport mode and the barriers to access transport. The methodological departure was taken in the existing framework for Gender Action Planning (GAP) and in existing tools for gender mainstreaming, which were developed and then tested in ten local contexts.

Results

An assessment of existing methods and tools was accomplished, and a toolbox for gender and diversity mainstreaming in relation to transport mobility was presented (Levin et al, 2020). The process from Gender Action Planning (GAP) to Gender and Diversity Action Planning (GaDAP) was developed and discussed in a series of workshops (Hvidt Breengaard et al, 2021). Measures were then taken in local areas, target groups were identified and addressed. This approach led into ten context specific measures and eleven policy briefs focused on, e.g.: inclusive design and planning of bike sharing systems in Scandinavia; accessible, affordable, and inclusive public transport in Thessaloniki, Greece; including gender in Sustainable Urban Planning in Turin, Italy; increased gender and diversity awareness in education for the transport sector in the Baltic region; and more women in transport entrepreneurship in Romania.

Discussion/Conclusions

To advance theories of gender and transport, TInnGO has explored transport as not just a means of physically moving people from one point to another, but also as a potential means towards the creation of gender equality and inclusion with a more context-specific approach, which can identify the actual differences between location, age, social class, modes of transport, etc. To address these issues, we turned to the scientific traditions of sex-gender analysis with established measures for intersectionality and transformed them into the transport sector. The study gave us both examples of success and insights in current challenges for the implementation. It was clear that planning for gender and diversity takes time, it needs informed leadership and there is a need for more expert knowledge in local contexts.

Acknowledgements

This project received funding from the European Union's H2020 research and innovation programme under grant agreement No 824349.

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09.30-09.45 / 10.30-10.45 Presentation 21: Thursday, 18th November 2021

Gender-equitable transport planning policies: An impact assessment framework

Augustus Ababio-Donkor[1], Wafaa Saleh[1], Milos Milenkovic[2] and Nebojsa Bojovic[2],

[1]*Transport Research Institute, Edinburgh Napier University*
[2]*University of Belgrade*

Abstract

This paper presents a framework based on equity-efficiency-effectiveness or 3Es Framework. The 3Es framework is a three-dimensional simultaneous planning system for allocating resources for public services provision. The framework attempt to modify the existing Cost-Benefit Analysis (CBA) framework to incorporate transport equity concerns (We use this framework of effectiveness, efficiency, and equity to provide a tool for deciding which fairness measures to implement and at which points in time. The framework is investigated using a case study of examining women's needs as users of public transport infrastructures and services with the aim of finding key drivers for supporting the inclusion of women in transport systems as users and supporting the development of gender-equitable transport planning policies. The final goal of the study is to present measures to increase the satisfaction and the percentage of women using public transport services. This impact assessment framework provides guidelines for transport professionals, policymakers and transport organisations on how to allocate resources to achieve transport equity and address the gender gaps in transport accessibility. The framework answers whether planned interventions are; i) Efficient (how productive are the measures proposed – how much does it cost to produce more inclusive transport systems?). ii) Effective (do the measures proposed produce the desired outputs, outcomes and gender-related benefits or impact?), and iii) Equitable (do the measures address specific gender-related needs?).

Keywords: women, employment, transport, inclusiveness, efficiency, effectiveness, equity, fairness

1. Introduction

Social Impact Assessments (SIAs) has been used as a tool to measure and mitigate the impact of projects, programmes, plans and policies (planned interventions) on the social well-being of communities and population groups (Esteves et al., 2012, Mahmoudi et al., 2013). SIAs have since evolved into a distinct discipline within the impact assessment field by integrating decision tools and procedures to enhance decision-making. These efforts have led to the development of a range of tools and procedures to assess the impact of a planned intervention. This allows decision-makers and researchers to account for the unique aspects of each case and specific individual needs as well as establishing the social benefits of planned interventions. SIAs also allows the assessment of the extent to which identified markers address the overall objective of the interventions. However, there are complex decisions with a significant impact that requires much information, analysis and reflection as possible to decide on the possible alternatives.

Equity in transport and accessibility has been discussed in several dimensions within which equity can be quantified, for example, horizontal equity, vertical equity, social equity etc. (Geurs, Dentinho and Patuelli, 2016). According to Di Ciommo and Shiftan (2017), the current tools and procedures assessing the impact of planned transport interventions (infrastructure and services) do not sufficiently consider equity considerations. The complexity in identifying the impacts of travel behaviours on society, the environment and equity. The authors found that issues related to equity are not addressed sufficiently in the assessment and appraisal of transport interventions and policies.

In this paper, we attempt to modify the existing impact assessment framework to incorporate transport equity concerns (Di Ciommo and Shiftan, 2017). As a result, the framework will help transport organisations better understand the benefits generated concerning the equitability of resource allocation and use. Furthermore, the concept of social performance will be adopted to assess the social impact of the proposed transport intervention and the extent to which the proposed planned interventions meet the beneficiaries' existing mobility needs. The framework answers whether a planned interventions are; i) Efficient (how productive are the measures proposed – how much does it cost to produce more inclusive transport systems?). ii) Effective (do the measures

proposed produce the desired outputs, outcomes and gender-related benefits or impact?), and iii) Equitable (do the measures achieve the specific goals of addressing specific gender-related needs?).

2 Literature review

Until recently, resource allocation, especially for public service delivery, was based on the objectives of maintaining aggregate fiscal discipline (i.e. prevent overspending), and ensure efficient resource allocation. However, recent research finding advocate a change of focus to the maximisation of social welfare in the allocation of public resources, which could be expressed operationally via the concepts of equity (Golany and Tamir, 1995). The cost-benefit-analysis (CBA) was the widely used method in resource allocation, in which an alternative satisfying the defined objectives with optimum use of resources was selected among the list of competing alternatives (NTNU, 2015). CBA may demonstrate the consequences of specific resource allocation, including the economic profitability of implementing a project or scheme (NTNU, 2015). However, concerns have been raised about the use of only economic-efficiency criteria (the CBA) in the prioritisation of projects. It has been argued that the CBA approach fails to account for social equity in the estimation of benefits and costs (Collier and Zhuang, 2010). Consequently, subsequent studies have argued that public resources allocation should be based on the maximisation of social welfare, which could be expressed operationally via the concepts of equity in a three-dimensional model involving equity, efficiency and effectiveness (3Es) for resource allocation (Golany and Tamir, 1995; Athanassopoulos, 1998).

The main objective of transport policies is to make effective decisions regarding the allocation of transport resources. CBA as the dominant methodology for policy analysis scores high for effectiveness and efficiency but it generally ignores equity. An economic evaluation of transport policies and measures should always be complemented by the potential equity implications.
It is evident from the discussion above that the widely used cost-benefit-analysis (CBA) decision support tools used for appraisal and resource allocation for transport infrastructure and services projects (planned transport interventions) do not sufficiently account for social equity in the estimation of benefits and costs (Collier and Zhuang, 2010). This observation is found to result from the complexity in identifying the impacts of travel behaviour on society, the environment and equity. Following the recommendation of Di Ciommo and Shiftan (2017), this study combines CBA with a multi-criteria decision-making (MCDM) in a single evaluation framework to incorporate equity in the decision support tool. The integration of equity in the models will improve the appraisal system, engender fairness and inclusiveness by favouring the vulnerable and transport-disadvantaged groups. The concepts of equity, justice, and fairness are subject to broad interpretation, which is perhaps why they were not considered in previous evaluation models for transport services appraisal and prioritising projects. Transport equity can be viewed as the distribution of a minimum required level of accessibility based on the principles of social justice and fairness (Martens, 2017; Brussel *et al.*, 2019).. DIAMOND is EU Horizon 2020 project with the objective of turning data into actionable knowledge with notions of fairness, in order to progress towards an inclusive and efficient transport system. In terms of DIAMOND, Equity is assessed in terms of how a proposed fairness measure achieves a specific goal, which group of users will benefit or the specific needs to be addressed Equity will be based on the selected fairness definitions for each use case and their evolution due to the implementation of recommendations (for example, improvement of disadvantaged women groups' accessibility to essential services and activities, depending on proximity and location, mobility options, financial costs, or for employment, an increase in women applying to job positions).

3 Methodology

3.1 Methodological Framework

The framework for the impact assessment uses Productive Equity assessment and Sensitivity analysis to assess the impact and robustness of the performance indicators defined in the study. This analysis and discussions presented in this paper considers the profile “Women as a homogeneous group”

Productive Equity assessment-3Es

The 3Es methodology defines KPIs for effectiveness, efficiency, and equity. These KPIs are based on ratios benefit/cost. Quantifying these benefits are based on real observations. Since the 3Es cannot be obtained in the project lifetime, simulation based on Bayesian Network (BN) analysis is applied to estimate these ratios on the expectations and feelings of women (Molero *et al.*, 2021).

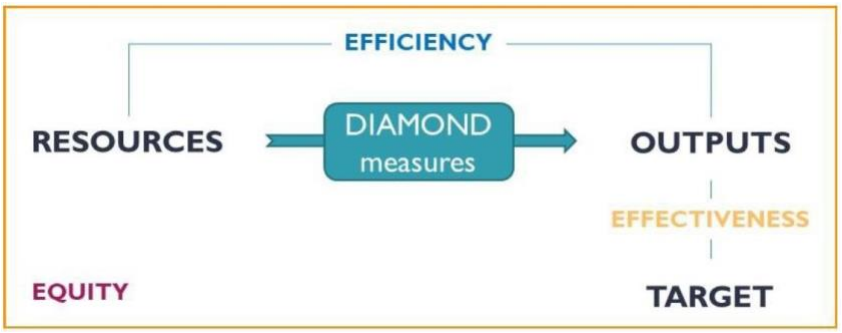

Figure 1: Productive equity analysis

The list of the top 10 FCs are developed by combining the results of the analytical hierarchical process (for level 1 and 2 FCs) and Bayesian networks (for level 3 FCs) (DIAMOND Project, 2021), and to each of the top 10 FCs it has been defined which (fairness) measures can be applied to improve the fairness and the women satisfaction as users of the public transport services. Bayesian networks allowed us to build a model that establishes the interrelations between variables and allows the evaluation of how a change in one variable (e.g. an answer to a survey, observation value, etc.) would influence in the another variable through inferences.

Inferences by sampling on the Bayesian Network with the lowest AIC (Akaike information criterion) has been used to simulate how the implementation of a Fairness Measure or recommendation affects the satisfaction on the other top 10 FCs by the users or employees. 3Es KPIs: Effectiveness, Equity and Efficiency have been calculated in this way (Molero et al, 2021) readers are advised to refer to Diamond deliverable 7.3 for details (DIAMOND Project, 2021).

Sensitivity and sustainability analysis

Sensitivity and sustainability analysis are carried out to assess the sensitivity and sustainability of DIAMOND's results over a period of time. In a multi-criteria decision making (MCDM), the selection and prioritisation (assigning weights) of criteria is essential. The Analytic Hierarchy Process (AHP) provides a mathematical framework for this purpose when analysing complex decision problems (Saaty, 1987). The AHP derives the weights through pairwise comparisons of the relative importance between each two criteria. Through a pairwise comparison matrix, the AHP utilises a decision-making technique involving numerical analysis of a set of discrete alternatives to calculate the weight value for each criterion (w_i) by taking the eigenvector corresponding to the largest eigenvalue of the matrix, and then normalising the sum of the components to unity (Saaty, 1987; Saaty and Vargas, 2013). This process is achieved through the following steps (Triantaphyllou and Sánchez, 1997);

- Determine the relevant FCs and sub-levels.
- Attach numerical measures to the relative importance (i.e., weights) of the FCs.
- Process the numerical values to determine a ranking FCs for each Use Case.

We analyse the robustness of the results (Top10 FCs) in different scenarios (present and future) in the mid and long term or in different cultures, because this evolution in the time or in the space is simulated through these variations in the weights of the preferences in the level 1 (Molero *et al.*, 2021).

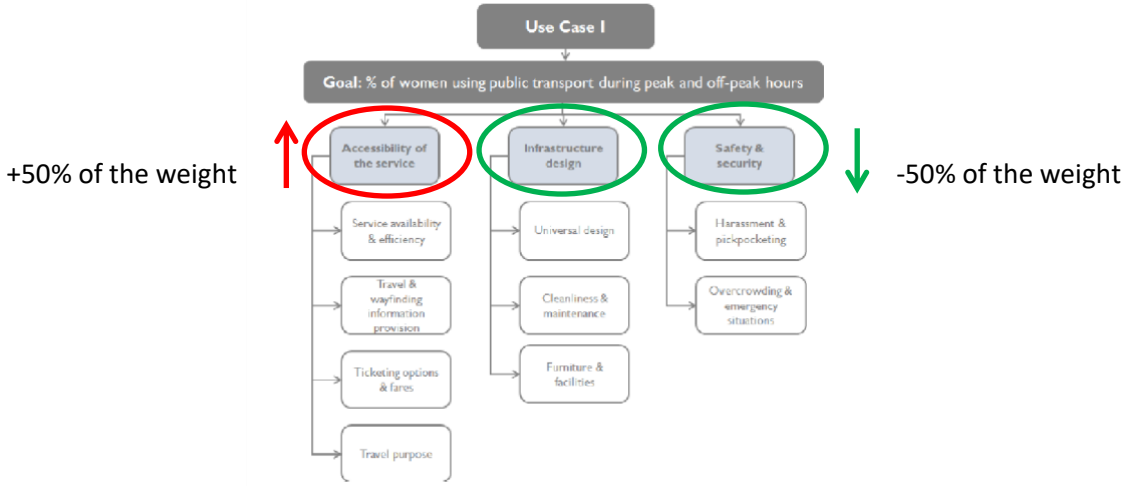

Figure 2: AHP Sensitivity Analysis

Additionally, the robustness of the results from two European countries are compared using the weights of level 3 TOP 10 FCs particularly, for POLAND (East of Europe) and for SPAIN (West of Europe). A comparative analysis between standard levels by using an ANOVA analysis has been also conducted to explain potential significant differences in the Top 10 FCs between POLAND and SPAIN.

3.2 Case study: Public transport and infrastructures (Railways)

More than 50% of the world's population live in cities and public transport is an essential public service, serving millions of people daily and playing an important role in the economic and social life of both men and women in cities (FIA Foundation, 2017). Duchène (2011) found that women are more dependent than men are on public transport to meet their travel needs in Europe. In France and Sweden, for example, men only use public transport for about 10% of their trips, while about twothirds of passengers on public transport services are women (Duchène, 2011). Meanwhile, it is claimed that the current public transport systems do not adequately consider gendered differences when either developing or delivering services.

Women, particularly public transport users have accessibility and safety/security concerns. The safety/security concerns sometimes make women fearful of certain transit environments, which arises in all EU members countries. These concerns often dedicate women behaviour and travel patterns, thus leading to the avoidance of certain services (Loukaitou-Sideris, 2014). For instance, it is worth noting that whilst women account for the majority of bus passengers during daytime, fewer women than men use the night buses (Saunders, 2019).

Literature on transport in countries in the European Union (European Commission, 2018), suggest that:

- The availability and quality of transport infrastructure is particularly low in some regions of the European Union.
- Transport infrastructure across the EU have been degrading because of too little maintenance. This has led to a worsening of the state of roads in many EU countries and has generated higher risks of accidents, congestion, increased noise, and a reduced service to society.
- The adaptation of infrastructure to new mobility patterns and the deployment of infrastructure poses additional challenges that require new investments and a different (innovative) approach to the design of networks and business models.
- The overall satisfaction with transport infrastructure is the lowest in the Central and Eastern European countries, namely Bulgaria, Poland, Romania, Slovakia and Slovenia as well as Greece and Malta. In contrast, Germany, Spain, Finland, France and the Netherlands rank the highest

The objective of this study 'Public Transport Infrastructures (Railways)' is to investigate women's needs as users of metro and urban railway infrastructures. The use case aimed at finding key drivers for supporting the inclusion of women in transport systems as users and supporting the development

of gender-equitable transport planning policies. The final goal of the study is to propose measures to increase the satisfaction and the percentage of women using metro and commuter railway public transports.

- Vertex V1 - Transport infrastructure and business model today;
  - Layer L3 - Public transport;
- Vertex V4 - Transport infrastructure and business models tomorrow;
  - Layer L1 - New technologies;
  - Layer L2 - New business models.

3.3 Fairness characteristics (FCs) and Fairness Measures

Fairness characteristics that reflect the preferences of women as users of public transport infrastructure are defined based on the above methodology; a comprehensive literature review, DAD surveys, online surveys, interviews and focus group discussions. The list of the Fairness Characteristics is obtained from the quantitative data analysis (AHP and machine learning techniques) and from the qualitative data analysis (through the interdisciplinary analysis, Focus groups and semi-structured interviews) and the list of Fairness Measures is obtained from the interdisciplinary analysis through the Maturity assessment models (García-jiménez et al., 2020). The Top 10 Fairness Characteristics (FCs) for the profile "Women as a homogeneous group" and their associated Fairness Measures (FMs) identified from the analysis of the data collected are shown below:

Table 1: Identified Fairness Characteristics

Fairness Characteristics				Fairness Measure
Code	Level 1 FC	Level 2 FC	Level 3 FC	
FC111	Accessibility	service and availability	Walking time from the points of interest to the public transport access points	Availability of information that indicate and allows access to key destination
FC112			Reliability of the service modes available	Coordinated timetables between the different transport modes in the stations.
FC114			Level of service at the public transport access point	Adapt the station access with ramps, escalators and lifts for users with special needs.
FC115			Number of service available within the transport infrastructure	Display the next services in the station.
FC116			Integration with other modes of public transport including bus, train, alternative shared mobility service,	Adapted connection paths and access points to all users (including people with reduced mobility, women with children...)
FC315	Safety and security	Harassment	Visibility of the surrounding area of the station	Increase lightning in the stations and their surroundings
FC316			Complaint information point in case of violations to personal safety	Improve response time of security staff
FC318			Display advertisements for public awareness campaigns and for publicizing helpline numbers	Train the people attending the help line on equality and gender.
FC321		overcrowding	Offering adequate personal space	Staff present to provide real-time assistance to people who need assistance
FC322			Improved ventilation and air-conditioning	Improve cross-ventilation and air-conditioned environments suitable for different seasons
FC323			Improved layout of seating (longitudinal seating included less social interaction compared to transverse seating)	Improve seating design that fulfils the need and/or with appropriation given to pregnant women, persons/carers with toddlers, disabled persons, etc.

4 Productive Equity Analysis for the profile "Women as a homogeneous group"

4.1 Effectiveness, Efficiency and Equity (3Es) for "Women as a homogeneous group"

Given that it is impossible to address all the fairness characteristics of groups of women, the equityefficiency-effectiveness framework which uses a three-dimensional simultaneous planning system for allocating resources for public services provision is applied as a tool for deciding which fairness measures to implement and at which points in time. Therefore, we evaluate the fairness measures through the lens of effectiveness to determine if they result in significant achievement of the project objectives. An efficiency perspective determines whether the fairness measures make the best use of resources. Whiles the equity indicator indicates whether the resources will be fairly distributed across groups (Aday et al. 2004). The following discussion highlights the application of the effectiveness, efficiency, and equity criteria in this study. Table 2 presents the 3Es indicators of the FCs.

4.1.1 Effectiveness of recommendations for the Top10FCs for Women

The effectiveness of the proposed interventions in table 1 above for the associated FC is measured by the extent to which the FC achieves the specific objective of the case study and the general objective of DIAMOND (Athanassopoulos, 1998). Fairness measure (which corresponds to fairness characteristic FC115 => Display the next services in the station) represents the most appreciated improvement from the aspect of women, as well in total (by satisfaction of men and women together). Measures related to seating design (FC323) and the supporting staff at the stations trained on equality and gender (FC318) are the least appreciated from the aspect of women.

4.1.2 Efficiency of recommendations for the Top10FCs for Women

Efficiency or production efficiency (PE), is related to cost-effectiveness and measured by the ratio of produced outputs (i.e., service delivery) to the required inputs (such as labour, infrastructure, vehicle design, and capital investment) (Chen et al., 2019). The study seeks to provide information on the possible resources required to implement each proposed fairness measure and which fairness measure is cost-effective in achieving the objectives of each Use Case (Athanassopoulos, 1998). The highest efficiency is assigned to the fairness measure that enables an enhanced provision of train service related information in stations (FC115). Since this measure requires investments on a specific railway line or a network as a whole, it includes significant investments also. The least efficient are the measures related to seating design (FC323) and to training the supporting staff in stations (FC318).

4.1.3 Equity of recommendations for the Top10FCs for Women

In general terms, equity is related to how resources are distributed throughout society according to the needs of people (Athanassopoulos, 1998; Murray and Davis, 2001). The Equity Indicators indicates which of the proposed FMs promote fairness in the delivery of the transport service to all groups of women and the extent to which they contribute to the achievement of the defined objectives. The rationale is to advocate for investments and allocation of resources to implement the proposed interventions/FMs with the potential of benefiting the disadvantaged and closing the gender disparities in the delivery of transport services. The Equity indicator provides information for maximizing the fairness of distribution and minimizing disparities across groups such as disparities between racial, ethnic, age, and socioeconomic groups.

The ranking of FMs significantly differs from that of effectiveness and efficiency. In terms of equity, the most important are those measures related to appropriate station access (ramps, escalators and lifts for persons with disabilities) which corresponds to FC114, coordination of timetables between the different transport modes in stations (FC112) and the availability of information that indicates and allows access to key destination (FC111). In terms of least preferred measures from the equity aspect, the situation is the same as in the case of efficiency and effectiveness indicators.

Table 2: 3Es KPI for Public Transport - Railways

LEVEL 3 FAIRNESS CHARACTERISTICS		FAIRNESS MEASURES	3Es KPI					COST DESCRIPTION
			EFFECTIVENESS INDICATOR		EQUITY INDICATOR	COST (€/YEAR)	EFFICIENCY INDICATOR	
			Women (A)	Men (B)	A/B	G	A/G	
FC114	Level of service at the public transport access point	Adapt the station access with ramps, escalators and lifts for users with special needs.	1.5	0.4	3.4	4610	32.0	Capital costs included for 5 wheelchair ramps and 5 handicap lifts, Economic life: 10 years
FC115	Number of service available within the transport infrastructure	Display the next services in the station.	1.6	1.1	1.5	121	1309.5	This FM must be line-based on-ground and on-board, not possible to implement it only in one station. The cost is estimated based on recent example from Polish railways: The system includes 101 dynamic passenger information boards, INFO/SOS communication, and 86 video-monitoring cameras 1.26 Mil EUR. Interest rate: 5%, economic life is different for different component, it is assumed 15 years.
FC321	Offering adequate personal space	Staff present to provide real-time assistance to people who need assistance	1.1	1.3	0.9	57600	1.9	Gross cost per employee per year is 28800. Two employees are included
FC322	Improved ventilation and air-conditioning	Improve cross-ventilation and air-conditioned environments suitable for different seasons	1.4	1.1	1.2	6168	22.1	For 500 sqm, the following cost components are included: capital cost, maintenance cost and energy cost, Economic life: 15 years.
FC111	Walking time from the points of interest to the public transport access points	Availability of information that indicate and allows access to key destination	0.8	0.5	1.5	3560	22.7	5 digital signage screens (one costs 712 EUR per annum); Economic life: 12 years.
FC116	Integration with other modes of public transport including bus, train, alternative shared mobility service.	Adapted connection paths and access points to all users (including people with reduced mobility, women with children...)	0.5	0.6	0.9	16803	3.2	Following assumptions are included in the estimation: Stopping points for other connecting modes of transport within the station (one bus stop); Economic life: 20 years Car park (30 spaces) Economic life: 20 years Accessible entrances and exits (five + five related to FM10) Five information boards Economic life: 5 years

Table 2: 3Es KPI for Public Transport - Railways - Continuation

LEVEL 3 FAIRNESS CHARACTERISTICS		FAIRNESS MEASURES	3Es KPI					COST DESCRIPTION
			EFFECTIVENESS INDICATOR		EQUITY INDICATOR	COST (€/YEAR)	EFFICIENCY INDICATOR	
			Women (A)	Men (B)	A/B	G	A/G	
FC316	Complaint information point in case of violations to personal safety	Improve response time of security staff	1.1	0.9	1.2	1190	89.5	Security Operations Centre: 12 employees + 24x7 active Security Operations Centre
FC315	Visibility of the surrounding area of the station	Increase lightning in the stations and their surroundings	0.5	1.1	0.5	1361	40.1	In stations: 500 sqm, 165 led bulbs needed, installation 5 EUR per bulb, life: 3 years, interest rate: 5%; Access roads: 500 sqm (100 m x 5 m of width): 0.35 EUR/sqm + energy consumption for internal leg lights (9.63 kWh per annum)
FC112	Reliability of the service modes available	Coordinated timetables between the different transport modes in the stations.	0.8	0.4	1.7	9393	8.1	Fixed schedule rail service; optimizing the schedules of bus services; Total cost (operating + passenger waiting cost + transfer cost) decreases due to the decrease of passenger waiting and transfer cost). Here only operating costs are included since they have a positive direction (increase). Input parameters: Unit bus operating cost: 212.5 EUR/km (average cost for London area) Average round trip time for a set of 10 routes: 60 min; Average headway for non-coordinated scenario is 15 min, for coordinated scenario is 13 min, This makes operating cost increase 1089.7 per hour and capital cost increase (additional buses needed) of 2233440 - this is a scenario if you need to buy the buses (other option is reallocation or leasing). Additional bus fleet needed for coordinated scenario: 110 buses (price of a bus is 180k EUR and economic life 12 years, interest rate: 5%)
FC323	Improved layout of seating (longitudinal seating included less social interaction compared to transverse seating)	Improve seating design that fulfils the need and/or with appropriation given to pregnant women, persons/carers with toddlers, disabled persons, etc.	0.0	0.0	0.0	613	0.0	Waiting room in station: 4732 EUR for 100 sqm for 40 places with 8 places for persons with wheelchairs or toddlers. Waiting room on platform (with glass walls and 4-side entrances): 46298.4 EUR. Distributed over a life of 10 years with interest rate of i=5% that is: 612.79 and 5995.6 per year, respectively.

5. Sensitivity and sustainability analysis

This Sensitivity Analysis (SA) is performed to assess how the hierarchy of level 3 FCs changes according to gender and to assess the sustainability of the results of the DIAMOND's project: This SA is carried out as a means of validating and calibrating the numerical data for each Use Case. This is useful in reducing uncertainty in multi-criteria decision-making (MCDM) by eliminating alternatives and providing information about the robustness of the outputs of the fairness measures proposed in the project. The SA illustrates the impact of small changes to specific input parameters (weights and hierarchy of Fairness Characteristics Level 3) on the outcomes of decisions (hierarchy of level 1 Fairness Characteristics). The section assesses, the sustainability of the results with respect to time and space/culture (geographical location).

5.1 Sustainability analysis

This section assesses the robustness of the hierarchized list of the FCs over time. We have performed several sensitivity analyses on the input parameters by varying the weightings of each Level 1 fairness characteristics. To determine how changes in women priorities with regard to the fairness characteristics over time will affect the outcomes for users of public transport infrastructure and services, the weights of each level I fairness characteristic is increased by 50% to provide insights into the robustness of the analysis against future changes in women priorities of the Level 1 fairness characteristics. We also investigate the rankings and relative importance of the fairness characteristics for women users in Spain and Poland.

5.1.1 Sustainability over time

Since two vertexes were considered (VI and V4) for the use case, the results of AHP ranking over time are obtained per each vertex. Tables 4 and 5 show the initial hierarchized list of the fairness characteristics of interest for women as the users of public transport infrastructure for vertex 1 and 4 respectively, ordered per criterion weight.

The results of Vertex V1 (Transport infrastructure and business model today) show that "CFC3-safety and security" and "CFC1-Accessibility of the service", are considered very important fairness characteristics from women's perspectives. CFC3 are ranked from first to third in the hierarchy. The important characteristics are "Offering adequate personal space", "Improving layout of seating" and "Improving ventilation and air-conditioning", according to the AHP and BN analysis.

Table 4 shows the top10 FCs obtained for the PRESENT scenario for WOMEN as a homogeneous group and the sensitivity analysis over time for vertex I (the PRESENT scenario)

The results in the table show the initial hierarchized top 10 FCs for women as well as the top 10 FCs if the weights of level 1 FCs are increased by 50%. The FCs in bold are those maintained from the initial hierarchy. This shows how robust are the results presented for PRESENT scenarios (and for the profile WOMEN as a homogeneous group) in the mid and long term.

Table 4: Sensitivity analysis over time for vertex 1

Initial Hierarchized list (Top10 for women)		**+50% Level 1 FC: Accessibility of the service**		**+50% Level 1 FC: Design of the infrastructure**		**+50% Level 1 FC: Safety and security**	
FC	*weight*	***FC***	*weight*	*FC*	*weight*	***FC***	*weight*
FC321	0.03615	**FC111**	0.04326	FC2112	0.03020	**FC321**	0.05638
FC323	0.03022	**FC116**	0.04021	FC214	0.02931	**FC323**	0.04712
FC322	0.02843	**FC115**	0.03869	FC215	0.02931	**FC322**	0.04434
FC111	0.02606	**FC112**	0.03717	FC218	0.02889	**FC316**	0.03963
FC116	0.02606	**FC117**	0.03717	FC212	0.02869	**FC315**	0.03938
FC316	0.02541	FC118	0.03717	FC216	0.02806	FC311	0.03742
FC315	0.02525	FC113	0.03565	FC217	0.02806	FC317	0.03742
FC115	0.02507	FC114	0.03109	FC219	0.02806	FC318	0.03595

FC112	0.02409	**FC321**	0.02790	FC211	0.02764	FC314	0.03472
FC117	0.02409	**FC323**	0.02332	**FC321**	0.02543	FC312	0.03389

The sensitivity analysis developed shows that the final top10 hierarchy changes less if the users of the system evaluate a 50% higher the cluster of FCs related to the accessibility of the service. In this case 70% of the preferences remain the same. The hierarchy is similar in a 50% also if the cluster of FCs related to safety and security increases in weight by a 50%. Finally, only one FC, "FC321 offering adequate personal space", is maintained from the initial list if the cluster of FC related to Design of the infrastructure is reviewed 50% higher. This indicates that this FC is very important even if huge changes in priorities (level 1 FCs) are produced. In addition, it should be noted that based on the work performed within DIAMOND, people are more concerned about safety and accessibility of the public transport system and not that much on its design, and thus a huge increase is not expected for level 1 FC design of the infrastructure.

In total, 43% (on average) of the top 10 FCs remain the same. This result indicates the robustness of the results in the mid-term (it has been defined that when the sensitivity analysis shows between 2080% of changes results are robust in the mid-term, if the percentage of changes is less than 20% it would be robust in the long term, and if more than 80% of FCs change then it would be robust in the short term since any small change in the context would change the preferences drastically).

A slightly different ranking of FCs is obtained for vertex 4 (FUTURE scenario; HYPERLOOP stations) assessed from a women perspective. Like Vertex 1, the most important FCs are those related to the "Overcrowding and emergency situations" cluster whiles the least important FCs are those related to "Service availability and efficiency". Table 5 shows the top10 FCs obtained for the FUTURE scenario (HYPERLOOP stations) for WOMEN as a homogeneous group and the sensitivity analysis for the vertex of the future (V4). The results in the table show the initial hierarchized list of the top 10 FCs for women as well as the top 10 FC when the weights of the level 1 FCs are increased by 50%. The FCs in bold are those retained from the initial hierarchy. This shows robustness of the results presented for FUTURE scenarios (and for the profile WOMEN as a homogeneous group) in the mid and long term.

Table 5: Sensitivity analysis over time for vertex 4

Initial Hierarchized list (Top10 for women)		**+50% Level 1 FC: Accessibility of the service**		**+50% Level 1 FC: Design of the infrastructure**		**+50% Level 1 FC: Safety and security**	
FC	*weight*	**FC**	weight	***FC***	weight	***FC***	weight
FC321	0.04441	**FC111**	0.05280	**FC321**	0.03660	**FC321**	0.06990
FC323	0.03712	**FC116**	0.04909	**FC323**	0.03059	**FC323**	0.05842
FC322	0.03493	**FC115**	0.04723	**FC322**	0.02879	**FC322**	0.05498
FC111	0.03481	**FC112**	0.04537	**FC111**	0.02802	**FC316**	0.04913
FC116	0.03224	**FC117**	0.04537	**FC116**	0.02605	**FC315**	0.04882
FC316	0.03121	FC118	0.04537	**FC316**	0.02572	FC311	0.04639
FC115	0.03114	FC113	0.04535	**FC315**	0.02556	FC317	0.04639
FC315	0.03102	FC114	0.03795	F**C115**	0.02506	FC318	0.04457
FC112	0.02992	**FC321**	0.03442	FC311	0.02429	FC314	0.04305
FC117	0.02992	**FC323**	0.02877	FC317	0.02429	FC312	0.04238

The sensitivity analysis over time for the vertex of the future of use case 1 shows that if the weight of level 1 fairness characteristics increases by 50%, i.e. if the priorities changes giving more importance to the accessibility of the service, 70% of the top 10 FCs are maintained. 80% of the top 10 FCs are maintained if the level 1 FC design of the infrastructure is increased by 50%; and 50% of the initial FCs are maintained if the level 1 FC safety and security is increased by 50%. On average 67% of the top 10FCs remain the same indicating that the results are robust in the mid-term.

5.1.2 Sustainability over the Space

This section presents AHP and BN based ranking over space (country) compares the rankings and relative importance of the fairness characteristics to women users in different countries. The aim of the analysis of the results over SPACE is to assess the validity of the DIAMOND's results in different cultures by analysing differences in results between POLAND (East of Europe) and SPAIN (West of Europe), and compare this difference in the results with the difference in the level standard of each country. For example, by analysing how different is the Top10 FCs list between POLAND and SPAIN regarding the use of Railways public transport, and by analysing if there are significant differences between the Railways public transport of POLAND and SPAIN. In this document, we assessed the sustainability of the results over SPACE for level 3 fairness characteristics. This analysis has been performed for the PRESENT scenario for two different countries: Poland and Spain.

Table 6 show the initial hierarchized list of FCs and the hierarchized list for women users in Poland and Spain. In Spain, "Service availability and efficiency" is the highest ranked criteria and in Poland the most relevant is "Overcrowding and emergency situations" for Vertex 1. By applying Analytic Hierarchy Process (AHP) and Bayesian Network (BN) analysis as detailed in Molero et al. (2021), the top 10 FCs for POLISH and SPANISH Women can be seen in the following table. In general, 60% of the top 10 FCs are found to be the same for users of Spanish and Polish railway service. The FCs common to both countries are shown in bold in Table 6.

Table 6: Top 10 FCs for POLISH and SPANISH Women

Initial Hierarchized list (Top10 for women)		**Top 10 FCs for POLISH Women**		**Top 10 FCs for SPANISH Women**	
FC	*weight*	**FC**	weight	***FC***	weight
FC321	0.04441	**FC323**	0.03461	**FC118**	0.02971
FC323	0.03712	FC321	0.02491	**FC117**	0.02843
FC322	0.03493	**FC117**	0.02404	**FC323**	0.02764
FC111	0.03481	**FC118**	0.02388	**FC318**	0.02674
FC116	0.03224	**FC317**	0.02131	FC115	0.02593
FC316	0.03121	**FC318**	0.0210	**FC317**	0.02583
FC115	0.03114	FC2110	0.02088	FC116	0.02427
FC315	0.03102	FC216	0.02079	FC315	0.02333
FC112	0.02992	FC215	0.02076	**FC217**	0.02205
FC117	0.02992	**FC217**	0.02073	FC212	0.02193

The main differences between these top 10FCs for each country are:

- Poland (ZTM users):
  - FC321 Offering adequate personal space
  - FC2110 Appropriate height steps or step-free access to trains
  - FC216 Safe and easily accessible drop-off and pick-up points
  - FC215 Availability of clear and visible signposting with large font and bright colours to assist people with visual impairment
- SPAIN (FGC users):
  - FC115 Number of service available within the transport infrastructure
  - FC116 Integration with other modes of public transport including bus, train, etc
  - FC315 Visibility of the surrounding area of the station
  - FC212 Ramps and escalator with enough room to carry shopping bags, baby strollers, luggage and wheelchair to access the station and transfer within the stations

An ANOVA test on the Observations checklist data for Poland and Spain has been performed in order to analyse the differences between the stations of the two companies. Significant differences were

found between both countries in terms of infrastructure. It was assumed that FGC railways stations have same infrastructure as the Spanish railways and similarly, ZTM railways have same level of infrastructure as the Polish. From the analysis, it was found that the POLISH and the SPANISH railways infrastructures are significantly different. We believe the 40% difference in top 10 FCs observed for the POLISH and SPANISH women could be due to the significant differences between the POLISH and the SPANISH railways infrastructures

6 Conclusions

From the equity analysis of the FCs for the case study, it is found that for UCI, the ranking of FMs significantly differs from that of effectiveness and efficiency. The most important FCs relates to accessibility of the stations (such as ramps, escalators and lifts for persons with disabilities) which corresponds to "FC114: Adapt the station access with ramps, escalators and lifts for users with special needs.", "FC112: Coordinated timetables between the different transport modes in the stations." and "FC111: Availability of information that indicate and allows access to key destination". The results indicate that 43% of FCs remained the in the top 10 FCs from the analysis of Vertex 1 of the Inclusion Diamond (Public transport Today) and 67% for Vertex 3 (Public transport tomorrow, under the futuristic scenario of Hyperloop). The results indicate 20-80% of the top 10 FCs changed in the hierarchized list in both vertexes, therefore the Top 10 FCs in the case study are sustainable in the mid-term. The finding of the sustainability analysis indicates that the Top10 FCs are robust over SPACE and over TIME

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09.45-10.00 / 10.45-11.00 Presentation 22: Thursday, 18th November 2021

How Can Gender Smart Mobility Become a More Intersectional Form of Mobility Justice?

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Abstract

Central discussions arguing the advancement of women and transport, as both users of and employed within the sector, have not really advanced in the past 20 years. While numerous tools have been put in place to support women's participation in the transport labour market, the figure remains low, with women only accounting for 22% of the workforce in the European Union. Women's mobility patterns have also not changed significantly over time, their journeys are still shorter and more complicated than those of men as a result of socio-cultural norms. To improve opportunities and outcomes Gender Mainstreaming has been adopted as an objective of transport policy in Europe but adoption on a country level has been fragmented. Mobility needs are evolving, Gender relevant aspects of a smart city, mobility, safety and security, employment and sustainability have already been identified as fields of action in previous research however whilst Smart Mobility is advancing choice and offering more sustainable modes of transport it is not clear whether these advancements will be advantageous to all groups in society.

This paper discusses ethical issues relating to equity in mobility with a focus on intersections of gender, race and class. We relate how unequal access to space in the context of smart mobility increases vulnerability to social exclusion related transport poverty and discuss how incorporating the theory of intersectionality into transport policy can build on advancements already made through the adoption of gender mainstreaming. Our discussion of the operationalization of intersectionality in smart mobility is a timely one in the era of COVID-19. Emerging evidence shows the effects of the pandemic are gendered and has exposed deep structural inequalities in society, particularly for women, BAME (Black and Minority Ethnic) communities and lowincome households. The ongoing pandemic crisis could potentially set back women's progress in the labour market and has also had a significant impact on the transport sector. In the face of economic downturn, the post COVID-19 landscape could also

encourage modal shift as we seek safer and more sustainable forms of transport. This must become a catalyst for more equitable and sustainable smart mobility.

Acknowledgements
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10.00-10.15 / 11.00-11.15 Presentation 23: Thursday, 18th November 2021

Gender in sustainable urban mobility plans: an Italian analysis

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Abstract
A Sustainable Urban Mobility Plan (SUMP) is a strategic planning tool required at the European level to promote a shift to more sustainable transport systems and modal choice. Following the TInnGO H2020 project approach, the current paper aims to raise the attention to these aspects and users that are commonly not considered during the mobility planning process, for instance, women. We investigate approved and adopted SUMPs in Italy through the definition of indices that can assess the gender inclusiveness of the plans. This preliminary analysis focuses on Italian "Metropolitan cities" and aims at providing a rational classification according to the attention to women's accessibility. Finally, suggestions are provided to Italian policy makers in charge of developing SUMPs to ensure more inclusive transport.

Introduction
The European Commission strongly recommends member states to promote Sustainable Urban Mobility Plans (SUMPs) at the national level as a tool to improve the overall quality of life for residents by addressing all significant challenges affecting the mobility of urban areas. The "Guidelines for developing and implementing a Sustainable Urban Mobility Plan" states that a sustainable transport system improves accessibility for all, regardless of income and social status, and improves economic viability, social equity, and environmental quality. (Rupprecht Consult, 2019). These guidelines are adopted in Italy, the country at the centre of the current paper, with Decree No. 397/2017 (and subsequent revisions DM 396/2019) to establish the obligation for all Italian cities to adopt SUMPs. The aim is the homogeneous and coordinated application of Guidelines for the drafting of SUMPs throughout the Country.
The current work fits into the TInnGO - Transport Innovation Gender Observatory project framework (www.tinngo.eu), which deals with gender inequalities in smart mobility opportunities and transport employment. This H2020 project relies on creating 10 national Hubs in different EU countries: each of them treats topics of local importance in gender and diversitysensitive smart mobility. One of the goals of the TInnGO Italian Hub is assessing the degree of inclusiveness and sensitiveness to gender issues of local SUMPs. Thus, following the project approach, we investigate how the mobility needs of special users, such as women, are considered during the SUMP implementation.

It is important to recall that the primary beneficiaries of the mobility planning process are citizens, who should be considered for their unique needs while traveling around the city. However, these differences are not so commonly taken into account while developing SUMPs. Some attention is found for aged people or children. Still, recent research in the field has shown that mobility is strongly influenced by aspects such as gender or age (Pirra et al., 2021) (Carboni, 2021), mainly due to daily activities schedule and accessibility, and safety perception. And as underlined in (Drăguțescu, 2020), the design of transport systems influences the mobility choices that citizens make, so systems need to be geared towards the needs of all users. They also propose the concept of 'gender planning' as a means of implementing gender-sensitive policy with the aim of ensuring gender-sensitive policy outcomes through a systematic and inclusive process.
Our research feeds from these elements and tries to shed light on the current situation in a selected European country, namely Italy. At this stage, some analyses are available in the literature on the topic, like those on the active travel measures undertaken in SUMPs adopted in major Italian cities (Maltese et al., 2021). Mozos-Blanco et al., indeed, propose a methodology to identify and evaluate the different specifically proposed mobility measures included in Spanish plans (Mozos-Blanco et al., 2018). However, not so many works analyse how the SUMPs geared the women mobility needs, while a focus on the equity concept is available in (Arsenio et al., 2016).

Methodology

Currently, 196 SUMPs are available in Italy, of which 98 are drafted, 53 approved, and 45 adopted (source: Osservatorio PUMS, September 2021, https://www.osservatoriopums.it). Therefore, our focus will be on the approved and adopted ones. In the former case, we deal with proposed plans available to citizens and stakeholders for a limited period during which observations can be made: an adopted SUMP may be subject to review. Instead, an approved SUMP has concluded its process and is immediately in force; this could be subject to check too.
The whole documentation associated with SUMPs is commonly made up of the main document, which contains the approved or implemented plan, and various annexes (documents, presentations, participatory process and so on). In the following, our analysis will focus only on the former one. This is done by investigating the contents of the approved and adopted SUMPs, only available in the National language, to check how they consider gender aspects thanks to defined indices.
First of all, the plans are compared through a classification based on their status (adopted or approved), corresponding year and inhabitants of the Metropolitan city. Then, a list of proper keywords is defined, namely “women”, “woman”, “gender”, “female”, “social inclusion” and their presence is checked in the SUMP main document. Moreover, we think that the context where these words are found (or not) is relevant to understanding how mobility needs are considered. The investigation focuses on various aspects, such as the attention to collecting disaggregated data while proposing new sustainable mobility measures and the presence of actions and indicators sensible to gender issues. This is done searching for the previously cited keywords in these sections usually present in a SUMP: “General aims”, “Data collection”, “Indicators”, “Measures”. Finally, the degree of inclusiveness of the images used in the plan is assessed too. This methodology for determining the degree of inclusiveness of SUMPs has been tested on Italian Metropolitan cities plans, as done in the following, and is easily replicable in other case studies.

Italian Metropolitan cities

Metropolitan cities are a particular type of Province with powers considerably wider and very close to the municipal ones, especially in the urban planning field, established on the initiative of the Municipalities concerned in the Metropolitan Areas (according to the Constitutional Law No 3/2001).

There are 14 Metropolitan cities in Italy: only 6 currently have an approved or adopted plan (September 2021). Table 1 shows the analysis operated following the methodology presented previously. In addition, the presence of the defined keywords and images in the text is evaluated through a three points scale that could help in the classification process: "-" if no word (or image) is found, "+" if they are present and "++" if it is possible to find them frequently.

The gender mobility issues seem overall not so relevant: only three Metropolitan cities include this word (or similar) in their plans, namely Firenze, Genova, and Torino. In the former case, the results of a survey on cycling mobility in the Tuscany region are proposed, and it provides specific information on women. Moreover, the plan declares an explicit request of guaranteeing gender equality with the participatory approach. The SUMP of Torino Metropolitan city says that it "must be based on the principles of gender equality and "universal planning"". The document shows a particular focus on female mobility needs when it declares: "overcoming gender disparities, through an increasingly accentuated attention to the issues of full accessibility and usability to care services, harmonization of life and work times, urban safety".

Table 1. Analysis of SUMPs of Metropolitan cities

SUMP	Bari[1]	Bologna[2]	Firenze[3]	Genova[4]	Milano[5]	Torino[6]
Status	Adopted	Approved	Approved	Approved	Approved	Adopted
Year	2021	2019	2021	2019	2021	2021
# of inhabitants	1,222,818	1,011,000	1,012,000	841,180	3,250,000	2,216,000
Keywords		-				
"gender"	-	-	+	+	-	++
"female"	-	-	-	-	-	+
"social inclusion"	+	+	-	++	++	+
Other	equity	universal	universal	equity		universal
Context						
Data collection			x	x		x
Indicators				x		
Measures		x	x		x	x
Other			Glossary			
Images		-	++	-	-	++

1 https://www.pumscmbari.it/ , 2 https://pumsbologna.it/, 3 https://www.cittametropolitana.fi.it/pums/, 4 https://pums.cittametropolitana.genova.it/ , 5 https://www.cittametropolitana.mi.it/PUMS/Pums, 6 http://www.cittametropolitana.torino.it/cms/trasporti-mobilita-sostenibile/pums

Instead, more interest is seen for the terms "social inclusion" which appears in all the SUMPs apart from Firenze. This concept states that mobility is fundamental to enable participation in society and provide access to life chances. Thus, this would (should?) refer to female needs too, also if this were not explicitly declared. Terms as "universal accessibility/design" are frequently found too, more precisely in Bologna, Firenze, and Torino SUMPs. However, they are commonly referring to the mobility of users with disabilities. For example, the Bologna plan identifies the 4 categories of users to whom to devote more attention, namely those with permanent and temporary motor disabilities, sensory disabled with visual impairment, sensory disabled with hearing impairment, and non-disabled over 65 years of age.

The Metropolitan cities of Bari and Genova propose the "equity" concept. In this case, the idea is associated with accessibility to transport for the most significant possible number of people, seeking fairness in mobility and accessibility across gender, disability, class, and race. Indeed, Genova SUMP states: "The SUMP promotes equal opportunities in urban mobility to achieve this fundamental objective of equity." The concept of "gender equity" is very important because refers to treating men and women fairly based on their respective need, even if it means a different treatment.

(a) (b)

(c) (d)

Figure 1. Example of inclusive images from the SUMP documentation of the following Metropolitan cities: (a) and (b) Turin, (c) and (d) Firenze.

Our analysis also observed the context where we found the keywords. While it is easier to propose these concepts in the "General aims" of the SUMP, only Genova presents clear indicators related to them. At the same time, this is the only Metropolitan city that lacks the presence of proper measures on the topic. Data collection is another relevant aspect when dealing with mobility planning: it is crucial to have adequately disaggregated data to understand the needs of various kinds of users. According to our research, they are available in half of the 6 Metropolitan cities considered (Firenze, Genova and Torino).

The last row of Table 1 details the presence of inclusive images in the SUMP documentation investigated, while Figure 1 proposes four examples. The central concept explained is the universal design, which includes the mobility needs of various kinds of users, mainly elderly and/or disabled people.

TInnGO Italian hub case study: Torino metropolitan city

TInnGO Italian Hub is located in Torino Metropolitan city that has drafted its SUMP in the last years. Following the interest of the Hub on the topic, it has obtained a formal involvement with the authorities in charge of developing the plan to make them aware of the gender issue while proceeding in the planning process. Indeed, the TInnGO Italian Hub proposed a document named "Inclusive and gender-based mobility: lines of action of the Italian hub of TInnGO" that suggests 5 main actions that we think should be addressed for gender-sensitive transport planning in the area considered. They include: the creation of a permanent Observatory for inclusive and gender-based mobility, the collection of gender-disaggregated mobility data, the drafting of mobility plans more attentive to gender, a push to more inclusive accessibility to means of transport and the general promotion of gender and diversity aware transport planning.

The results presented in Table 1 and the previous section demonstrate increased attention to the gender issues in the drafting of the SUMP of Torino. Indeed, it is the only Metropolitan city where an openly declared interest in the topic is found. For example, it is said that one of the SUMP goals is to "overcoming gender disparities".

Discussion and conclusions

The current work investigated the documentation of the SUMPs proposed in Italian Metropolitan cities, being Italy one of the European country location of a TInnGO hub. While searching for contents that would demonstrate the interest in women's mobility needs, the main results show that “universal design/accessibility” and “social inclusion” are often found. However, these terms are more often referring to disabilities only.

This investigation, also preceded by a discussion with different stakeholders and a careful analysis of literature, confirmed that gender is often not perceived as an inequality variable in transport. In fact, many aspects are not considered, but female and male mobility can be very different. Usually, the daily trip chains of women are multiple and at a more local level as opposed to men’s, which are more linear. This aspect should be considered both in the data collection phase and in the measures proposed in transport planning to facilitate different types of mobility patterns. For example, one solution could be to adapt the network, timetables and transport services to specific mobility needs.

Unfortunately, it is also known that women are more likely to be victims of violence during their travels, especially on public transport or when walking. Therefore, safety is another aspect that an inclusive transport plan should consider. For example, mapping the riskiest points and proposing improvements such as increased brightness or promotion of escape routes. In addition, not only public transport but also increasing the safety of cycle routes with appropriate separation from motorised traffic can improve the share of female cyclists.

The lack of indicators explicitly directed to measure the inclusivity of females and their mobility is one of the major issues found in our analysis. Moreover, we would like to stress the need to collect gender-disaggregated data: this is still somewhat latent in the SUMPs investigated. In fact, the starting point should be the recognition and integration of gender inequalities in mobility by identifying typical women's mobility patterns. Overall, the classification operated showed that Torino is somewhat a pioneer in this field, while other Metropolitan cities are still not yet attentive enough to the question. As pointed out, some plans talk about “equity”. This is a different concept from "gender equality," which means equal outcomes for all. Talking about equity means being aware that women, for historical and social reasons, do not have the same accessibility and use of transport as men. Identifying different solutions according to needs is the first step towards social equality.

In conclusion, Italian mobility planning must be more careful of gender and diversity issues to ensure more inclusive transport by considering how mobility needs change across gender, ethnicities, age, workplaces, and locations. Future analyses will investigate all the other SUMPs available at the Italian level to understand better how this country is sensitive to female mobility issues, also investigating which variables influence the results, such as the number of inhabitants or the historical period.

Acknowledgements

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Session VI: Data and intersectionality new methods and approaches

10.45-11.00/ 11.45-12.00 Presentation 24: Thursday, 18th November 2021

Gendered perceptions of new mobility services

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Abstract

Transport systems´ infrastructure and provided services affect people´s mode choices and define the users´ transport experience. This study focuses on the exploration of how perceptions of existing and new transport services vary among men and women and which potential measures can improve the users´ experiences. A survey is designed and replies from 1193 citizens of three European cities is collected. The data analysis aimed to indicate in which areas the perceptions of men and women differ. The results indicated that men have more trust in new technologies that can be used in mobility services such as autonomous vehicles while women have a positive attitude towards the inclusions of measures that can enhance security in the passenger experience, especially in the public transport sector.

Introduction

Transport systems' infrastructure and services affect people´s mode choices and define the users' transport experience. When dealing with gender issues in transport, although research affirms the importance of inclusive mobility as an essential factor for the development of societies, transport services and policies still do not equally respond to women's and men's mobility needs (Thynell, 2016). The lack of detailed gender statistics and the lack of robust data characterizing the experiences of women (Gauvin et al., 2019) have been identified as main barriers to the adoption of more gender-equal policies. Providing an environment in which male and female transport users would be equally satisfied is a fundamental point to sustainable transport services. This study focuses on the exploration of how perceptions of existing and new transport services vary among genders and which potential measures can improve the users´ experiences. Data in three European cities are collected and analyzed through statistical tools and insights are provided on the aspects that should be improved so

that female users´ experiences are ameliorated. The current work is part of the H2020 European project TInnGO (Transport Innovation Gender Observatory), aiming to create a framework and mechanism for a sustainable game change in European transport concerning gender and diversity (Pirra et al., 2021).

Theoretical background or state of the art

The social role that people undertake influence their mobility habits. In terms of gender, women's mobility is generally characterized as more problematic 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 centers, shopping centers, etc. as an outcome of the multiple responsibilities, reflective of the role they have in societies, they need to undertake in their daily lives. The experiences across the modes also vary.

Despite bikesharing becoming increasing popular all around the world, empirical data reveal that, though the gender gap may vary across bikesharing programs, bike share users are disproportionately male (Wang and Akar, 2019). Women seem to be more influenced by the environment and the infrastructure (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).

While talking about shared mobility, it is worth investigating the female perception towards car sharing. In general, the take-up of this mode is greater among men than among women (del Mar Alonso-Almeida, 2019), and the costs of car sharing compared to car ownership play a more significant role for female users than for male users (Kawgan-Kagan and Popp 2018). As also derived when investigating bike-sharing, the main limits in using shared mode stand in the difficulty while traveling with children, given by the absence of child seats. So, as women are commonly in charge of escorting duties, they seem to be more affected by this aspect in their mobility choice.

As far as new technologies are concerned, Ortega Hortelano et al. (2019) report that women hold less favourable attitudes towards 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. 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 Electric Vehicles, various works in the literature reveal that the female interest towards them is lower compared to the male counterpart.

Overall, differences among men and women have been reported in past studies. This study employs this knowledge to identify the specific aspects of transport modes and systems in which these differences are seen.

Methodology and results

The objective of the current work is to explore gendered perceptions of new mobility services and interventions in current systems. To achieve this objective, a survey is designed to collect information from users (Pirra et al., 2021). For all the analyzed transport aspects and future services, the respondents were asked the level of agreement on an 1-5 point Likert scale (1totally disagree and 5-totally agree for positive answers). Although 5 and 7-point likert scales are widely used and accepted (Krosnick and Tahk, 2013), a 5-point likert scale is chosen for this study because it targets a data

collection to the general population (Srinivasan and Basu, 1989) and because it would facilitate respondents compared to 7-point scale.

The survey was distributed between November 2020 and January 2021 in three big European cities, Valencia, Turin and Paris. To ensure consistency in the collection method, all cities followed the same strategy and collected information through web-based survey dissemination campaigns through the project´s and the participants´ social media channels, platforms and networks and to enhance the dissemination and increase the number of completed surveys, low-value prizes were given to each participant at subcontracted specialized companies. In all cities a representative sample of the population above 18 is involved in the data collection, reaching a total of 1193 replies: 190 men in Valencia, 182 women in Valencia, 204 women in Turin, 208 men in Turin, 204 women in Paris and 205 men in Paris. The gender and age of the participants were the variables that controlled the collection process in order to approximate the statistics presented in Malandrino and Berman (2020) and CIVITAS (2020).

First a Principal Component Analysis was run with all data using Varimax rotation for the aspects to be analyzed for gender differences later on. The results indicated the consistency of 5 different components that explain 67% of future trends that could improve transport services (KMO = 0.948). The identified components were related to new shared mobility services, interventions in public transport and the transport network and finally, perceptions on autonomous vehicles.

Out of the 14 aspects of shared mobility services analyzed, the respondents stated that taxi services with female drivers would be more welcome in Valencia and Paris by women while in Turin women would prefer to have a broader coverage of dock stations for shared bicycles. All the rest of the analyzed characteristics of future transport systems were not found to be differently perceived by men and women.

Figure 1 presents the statistics of the replies of the respondents in the three cities to questions related to measures that they believed that could improve the public transport services. Security-enhancing measures could make a difference in the cities of Valencia and Paris while such security measures were not perceived differently from men and women in Turin. For example, the use of telephones and alarms that could allow users to indicate that they are in danger need help (in and out of vehicles) and camera surveillance, located either at stops/stations and in the vehicles was considered more useful by women. The preference for services related to communication means in case of emergency were also slightly higher rated compared to other types of interventions. Also, women rated higher the utility of the provision of special fares for those passengers of public transport that perform various tasks per day using public transport probably due to the execution of various tasks related to both professional and personal tasks on a daily basis.

Figure 2 focuses on perceptions over AVs. The trust of women in AV technology seemed lower especially in the case of Paris while in the other cities the perception of the respondents was equally low indicating that potential benefits of AVs are still not entrusted by the population. On the contrary to the previous aspects, the expectations of the respondents over the beneficial role of AVs on mobility experiences and productive use of travel time were higher for men agreeing with previous research results.

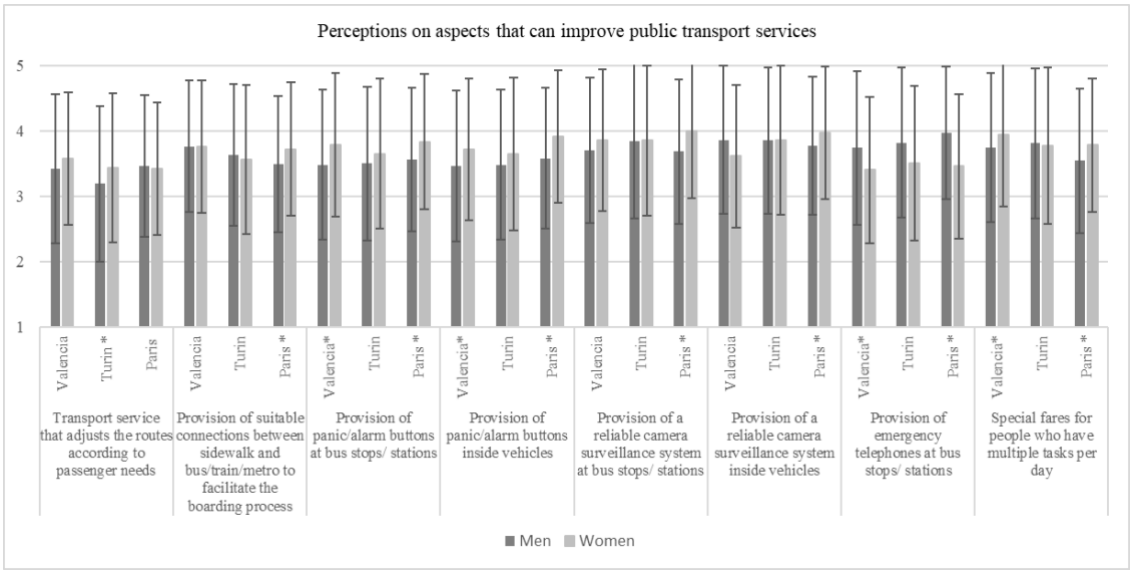

Figure 1. Mean values and standard errors of the perceptions of men and women on technological interventions in public transport

For all the remaining aspects and for the transport network component, no differences were found among the male and female respondents in the three cities. Also, no differences were found for the availability of schedules information either in smartphone applications or bus stops and stations which indicates that there is alignment in the perception of information sharing sources from both genders with satisfactory mean values. In addition to that, there was alignment in the preference of having suitable connections among all mode infrastructure showing that the need for the facilitation of multimodality is commonly perceived by men and women. These aspects were some of those which received the highest mean scores calling for the attention of transport operators. Other aspects that received high scores and form possible interventions that could help improve the experience of public transport users are the provision of special fares for people who perform multiple tasks during a day. Although the prices of public transport are not part of this survey, this result could be an indication of low levels of satisfaction with the value for money that passenger have for public transport. Finally, it was shown that use of surveillance cameras in the transport system is desired intervention with a moderate mean for all cities and genders.

The lowest mean values were given to the statements related to the provision of taxi services with female drivers only destinated to women for all cities. Also, the perception on the need for transforming docked shared bicycles systems in dockless systems was low in all cases. Contrary to what was expected based on the insights of the literature, there were no differences among men and women in the assessment of the space available in vehicles for equipment. However, for all genders and cities, the level of agreement with increase of space dedication for children or trolleys/ wheelchairs in public transport was moderate to high with mean values ranging from 3.16 to 3.59.

In what concerns AVs, the replies obtained from the city of Torino were assigning higher rates in the utility of AVs compared to the other cities. The expectations on autonomous vehicles of the citizens of the three cities coincided, independently of gender, in what concerns data protection in the use of AVs.

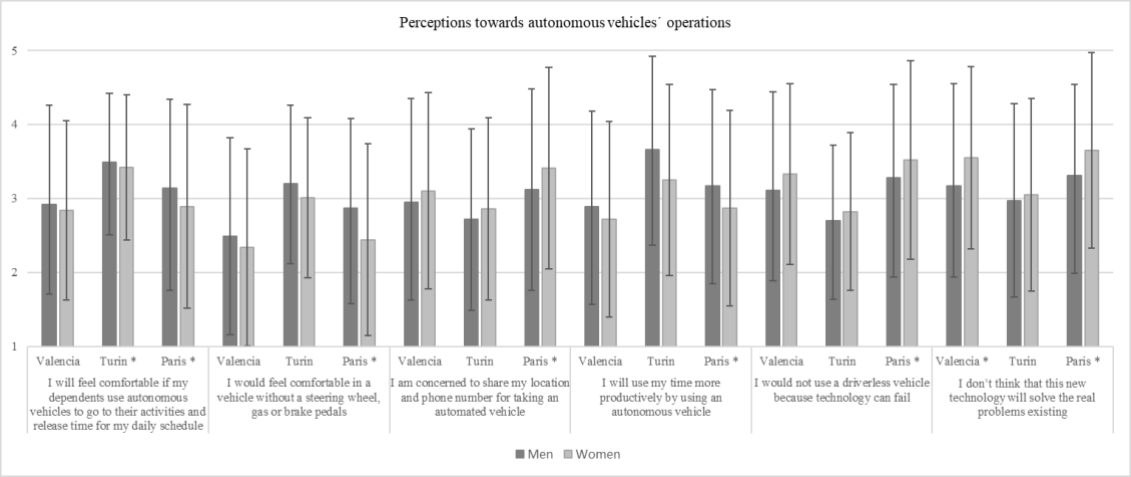

Figure 2. Mean values and standard errors of the perceptions of men and women on autonomous vehicles

Conclusion

Current transport systems need interventions to enhance their quality of service and improve the passenger experience. New technologies and changes in current operations can have positive results to this direction. However, it is not explored how people perceive such interventions and if they differ between men and women. In this study around 1100 replies from citizens of three European cities were collected to address how men and women perceive changes in current transport operations and the inclusion of new technologies. Interventions in transport systems are summarized by five components of future trends which are then analyzed based on the differences they present in the perception of men and women.

Regarding shared modes, few differences were found contrary to what was initially expected and assumed based on the literature review. However, the results of this study corroborate previous research indicating that men trust more autonomous vehicles and have a higher appreciation of their potential benefits in mobility experiences in all the cities under analysis. In what concerns public transport, new insights were obtained highlighting that women have a positive attitude towards the inclusions of measures that can enhance security in the passenger experience, such as camera surveillance and panic alarm buttons. The enhancement of multimodality through information and infrastructure integration was also concluded from the collected information but in a similar way among men and women.

In general, the city that demonstrated fewer differences among men and women was Turin while Paris was the city where differences in many aspects were found. The different role, activities and mix of population in these two cities may be the reason behind these differences. Paris, as well, covers a larger geographical area compared to Turin allowing for higher diversification in the characteristics of the transport system assessed and analyzed in this study. Future work aims to explore the designation of citizen clusters based on the collected information.

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11.00-11.15 / 12.00-12.15 Presentation 25: Thursday, 18th November 2021

Analysing the mobility patterns of urban transport users in five European cities

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Abstract
Gender aspects are a hot topic in different scientific fields, with a growing interest in the transport field. Since transport systems in both developed and developing countries are not gender-neutral, assessing mobility patterns by using gender disaggregated data may highlight various 'hidden' aspects of mobility behaviours of both men and women. Based on mobility patterns analysis, trips characterisation and mobility satisfaction models by gender, this paper aims to provide an overview of the transport systems of five European metropolitan areas from a gender perspective, highlighting the main differences between men and women, and their consequences on the local transport systems. The obtained results may be useful to decision-makers in the policy formulation processes in order to achieve more inclusive and gender-neutral mobility solutions and transport systems.

1 Introduction

Women's mobility patterns are different from men's due to demographic background, income, personal perceptions, and local transport governance (Cunha et al., 2014; Singh, 2019; Queirós and da Costa, 2020). Urban transport systems with good and different mobility options for both women and men can significantly impact people's quality of life and the way they organise the quotidian (Boisjoly and Yengoh, 2017; Pirra et al., 2021). Gender inequalities in trip characteristics may result into inequalities in opportunities and gender mobility segregation. Thus, enhancing women's urban transport accessibility is fundamental to change the status quo of nowadays' unequal gender mobility (Thynell, 2016; Singh, 2019).

Based on an intersectional approach, quantitative and qualitative methods, this research aimed at correlating and analysing the relationships between genders and mobility regarding social, cultural and geographical backgrounds in five different metropolitan areas - Lisbon (Portugal), Paris (France), Thessaloniki (Greece), Turin (Italy) and Valencia (Spain). The research's specific objectives were to (i) assess the main drivers of mobility patterns for different groups in terms of age, gender, and diversity, (ii) explore male and female commuting choices and (iii) evaluate the effects of personal characteristics and daily activities in the choice of transport modes. Firrstly, the research has been framed against the academic context regarding differences in mobility patterns from a gender perspective. The second part describes the conceptual framework of the paper. In the third part, the obtained results are presented, while the fourth part presents the findings and the conclusions.

The current work is part of the H2020 European project TInnGO (Transport Innovation Gender Observatory), aiming at developing a framework, tools and mechanism for a sustainable shift in European transport regarding gender and diversity.

2. Theoretical background

Gender aspects are a hot topic in different scientific fields, with a growing interest in the transport field. According to Uteng (2021), gender-based differences in daily mobility are a current phenomenon in both developed and developing countries. The majority of the studies that approached gender mobility have been focused on women's travel behaviour without paying attention to the causes and consequences of its complexity. Therefore, a comprehensive understanding of the daily mobility patterns by gender is missing (Peters, 2001). It is in line with the United Nations Economic and Social

Council (ECOSOC) statement from 1997, which endorsed "Gender mainstreaming" as a critical and strategic approach for achieving gender equality.
Moreover, several studies have shown that when gender aspects are not included in the urban planning process, the solutions tend to benefit men. On the contrary, regular gender inclusion throughout the processes of urban planning, design, implementation, monitoring, and evaluation is able to create more gender-neutral solutions.
Transport systems are not gender-neutral. The International Transport Forum – ITF (2021) has concluded that gender is one of the most robust determinants of transport choice. Nevertheless, gender mainstreaming is not regularly included in the transport planning process. On the other hand, gender-disaggregated data on mobility is either not collected or not systematically analysed, which leads to an unconscious bias towards men in transport and mobility planning.

3. Methodology

The paper's conceptual framework consisted of three stages: (i) mobility patterns by gender, (ii) trips characterisation and (iii) mobility satisfaction models. The data used to characterise the mobility patterns was obtained through a web-based survey disseminated in social media channels, platforms, and networks. The data from Paris (400 answers), Torino (421 answers), Thessaloniki (401 answers), and Valencia (442 answers) was collected from November 2020 until February 2021. In Lisbon, the 400 responses were collected between April and August 2021.
In the second section, the survey's data, geocoding and geospatial analysis were used to assess and characterise the samples' most frequent trips. The validated answers were then geocoded through GIS techniques, while the representation of aggregated flows for the most common journeys was carried out by joining the geocoded origins and destinations, zoning the territory and quantifying the trips between each pair of zones.
The third section assessed the mobility satisfaction level with the existing transport services in each city. Information was gathered regarding each metropolitan area's transport network and services as input for each city mobility model. Additionally, data was collected regarding travel costs per origin/destination, types of tariffs and existing discounts for specific groups, while the variables included in the analysis were the age, level of education, ethnicity, origin and income.

4. Assessing mobility patterns of five European cities from a gender perspective

The sections hereafter present the obtained results and provide insights on gender differences and inequalities in mobility. The results were analysed by gender, however, particular analyses were carried out aggregately to assess if gender was the explaining factor for differences when comparing different age groups, family composition and other variables.

4.1 Gender differences in mode choice

Generally, women are more likely to walk and use public transport when compared to men, except for Paris, where men do more trips on foot than women. Regarding the regular trips by private vehicle, men drive more than women, while women are more likely to be car passengers.

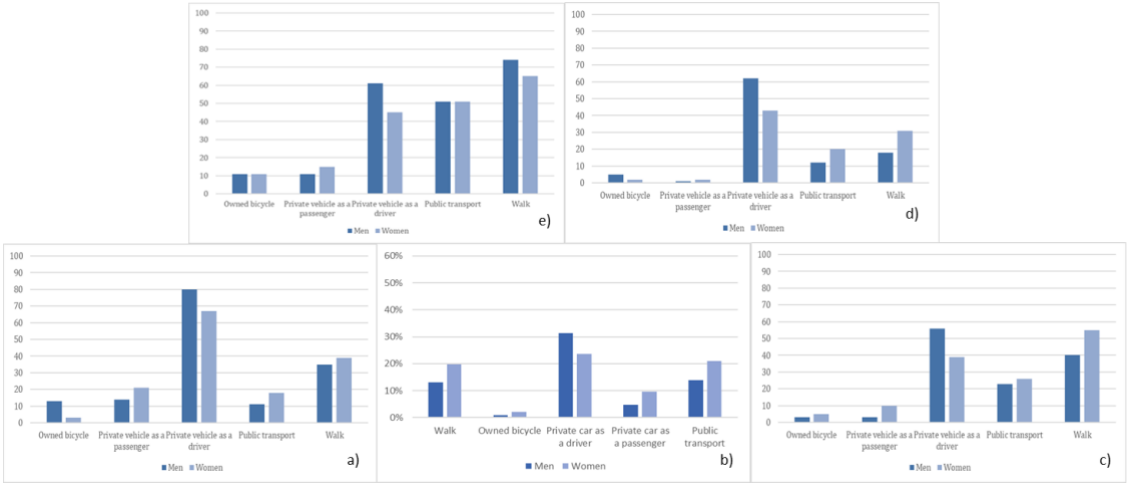

Figure 1. Transport modes used in a) Thessaloniki, b) Lisbon, c) Valencia, d) Turin and e) Paris

It is worth highlighting the low levels of bicycle use in all cities under analysis. In general, men do more trips by bike than women, except for Paris and Thessaloniki. Despite the low percentages, in Valencia and Lisbon women are more prone to use bicycle on their trips. Private vehicle is the most frequent mode of transport in all cities under analysis (Figure 1), and it is normally used for activities related to leisure. On the contrary, public transport is mainly used for commuting between home and job/university, with women using this transport mode more than men. Additionally, walking is used for at least one of the users' most frequent journeys. The high level of walking as a transport mode was confirmed in all cities, except for Lisbon that registered the lowest values. Accordingly, women prefer to walk more than men, except for Paris and Turin, as in these two particular cases no clear gender trend was observed. Concerning the cycling levels, all cities present low levels of bicycle use for regular journeys. Consequently, the use of shared bicycles and shared modes is not widespread among the transport systems users. However, it is worth noting that in Paris and Thessaloniki, the bicycle starts to be a prevalent option to get around between home and other activities, such as running an errand, shopping for groceries and activities related to work or study.

4.2 Gender differences in trips

Similarly to Paris (Figure 2), an aggregation of flows towards the city centre has been observed for each metropolitan area under analysis. The number of stops along the main journey is higher for women, and they normally stop during their journeys for activities related to shopping, leisure, work and medical appointments. At the same time, men use to stop for work-related reasons. Except for Thessaloniki, men stop for leisure more than women. Interestingly, in Turin and Thessaloniki, men stop more than women when travelling with dependents.

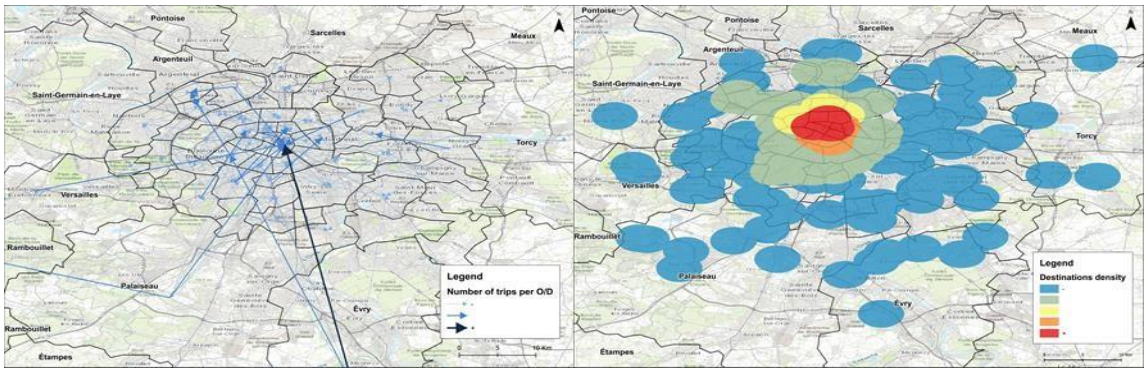

Figure 2. Aggregated flows and destinations density in Paris

Concerning the transport modes choice when travelling with dependents, it was possible to ascertain that both genders prefer to use private vehicles, with a higher frequency in the case of men. On the contrary, women in Valencia choose the car more often, while men move with their dependents on foot more frequently.

On average, women travel shorter distances than men per trip. Nevertheless, although women travel shorter distances to work, they spend more time to complete their journeys as a consequence of the transport modes they opt for. Concerning the analysis of distance travelled by age and gender, it was observed that men travel longer distances in the age groups between 25-64 years, except for Lisbon (Figure 3), where women travel longer distances than men in the same age groups.

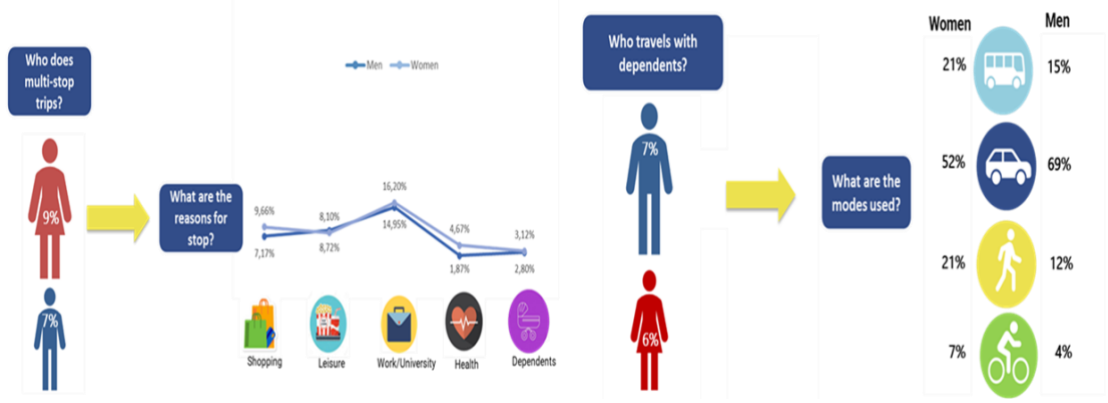

Figure 3. Trips differences by gender in Lisbon metropolitan area

Regarding the time spent per trip, less distance does not necessarily mean less travel time, except for Lisbon, where the average time per trip is higher for longer distances for working age groups, and lower for shorter trips in the case of elderly people. In Paris, women between 2534 and 65-74 years spend more time than men on their most frequent journeys. On the contrary, in Turin and Valencia women spend more time on their daily journeys in the age groups between 18-34 and over 64 years, while in Thessaloniki the same tendency was observed for the age groups between 25-54 years.

4.3 Gender differences in satisfaction levels: PT, car and soft modes

Although no relevant gender differences were found regarding the respondents' level of satisfaction with the use of private car, the overall satisfaction with public transport systems varies across the cities under analysis. Paris is the city with the highest satisfaction levels with the existing public transport systems. On the contrary, Thessaloniki presents the highest unsatisfaction rates, which reflects in the choice of transport modes. In all cases, women are less satisfied when compared to men. For example, the satisfaction level regarding safety and security in public transport is lower among women, except for Turin. Also, living in the urban environment increases the probability of liking public transport compared to the residents of suburban areas. Income has also affected the answers, as people with higher income are less likely to use public transport compared to people with lower income. Contrary to what was expected, gender, the number of cars, and driving licenses did not affect the perception of people on this aspect.

Concerning the satisfaction levels with the pedestrian mode, there is a considerable difference in the safety perception between men and women in all cities, as women feel more insecure and less satisfied with the existing infrastructure. On the contrary, in the case of the satisfaction levels with the bicycle use, relevant gender differences were found only among Turin users, where men are less satisfied than women with aspects such as bicycle paths, infrastructure conditions, necessity to share the space with other motorised vehicles and their traffic speed.

The intersectional age-gender users analysis has shown that the overall perception of safety aspects differs among gender and age. All the age-gender categories of people older than 44 years old presented higher values for men than women, indicating that when people are young, the services are perceived in almost the same way. In comparison, older people become more sensitive in the assessment of safety and security aspects. However, apart from gender differences, also among women, perceptions differ. Younger women have more positive perceptions of safety and security than older women considering all the different age groups.

5.0 Findings and conclusions

This research assessed the travel behaviour of five different transport systems users (Lisbon, Paris, Thessaloniki, Turin and Valencia) from a gender perspective, and identified the main differences in their travel behaviours, as well as the consequences on the local transport systems. The results in the TInnGO project show a minor representation of women in the samples compared with men. On the other hand, it has been observed an overall preference for traditional transport modes, such as private car and public transport. Consequently, it is desirable to prioritise, provide, maintain and expand infrastructures for walking and cycling.

Understanding the needs of both men and women can lead to inclusive transport systems and mobility services, hence providing adequate services, at the right time, at the right place, serving the right users. Within this context, the mobility satisfaction models have indicated that women normally feel more insecure and less satisfied with the existing transport services.

Urban transport policies and transport systems have mainly been designed to benefit men. Accordingly, the gender differences in mode choice, trips attributes, and satisfaction levels identified in this paper may be considered in the transport policy formulation. Thus, mobility policies should not exclude women, but consider their particular needs to achieve more equitable transport and mobility solutions.

Acknowledgements

The current paper is part of the activities of the H2020 European project TInnGO—Transport Innovation Gender Observatory, grant agreement no 824349. The Authors are thankful to the TInnGO Hubs and partners for their support in the data collection.

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11.15-11.30 / 12.15-12.30 Presentation 26: Thursday, 18th November 2021

A methodological approach to reveal fair and actionable knowledge from data to support women's inclusion in transport systems: the Diamond approach

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Abstract

Men and women used to have different mobility patterns when travelling, being women more likely to trip-chain for the presence of kids in the families. It is in the employment where the differences are even more critical. Women are underrepresented, especially in management positions and in some traditionally male-oriented professions.

Based on the Inclusion Diamond (ID) model (DIAMOND project 2019), four use cases were defined to set the needs and barriers that women face in them. Use case 1: Public transport infrastructure (Railways), use case 2: Autonomous Vehicles, use case 3: Bike sharing services and use case 4: Women recruitment in railways and freight.

The research applied a mixed-methods approach, combining both quantitative and qualitative research methods, comprising a comprehensive Dynamic Argumentative Delphy (DAD) surveys, online surveys, interviews, user satisfaction surveys and focus group discussions. The list of the most relevant Fairness Characteristics (FCs), or needs and barriers of women, was obtained from the quantitative data analysis (machine learning techniques) and from the qualitative data analysis (through the interdisciplinary analysis, Focus groups and semi-structured interviews).

The most relevant FCs were weighted and hierarchized using the Analytic Hierarchy Process (AHP) (Poveda-Reyes et al. 2021) and a Bayesian Network analysis (Molero et al. 2021).

An interdisciplinary panel made by experts provided recommendations or Fairness Measures (FM) for all FCs, which were validated through workshops and online questionnaires. A FM was considered as validated if at least 80% of the experts considered it as appropriate to meet the requirements of the FC, and at least 5 experts took part in the validation process.

An impact assessment based on the 3Es (Effectiveness, Efficiency and Equity) KPIs methodology and on simulations carried out by sampling on the Bayesian network with the lowest AIC (Akaike

information criterion) was used in each use case to identify the highest priority FMs, among those linked to the Top10 FCs.
Computational solutions allow applying this methodology to specific profiles, based on socio-demographic characteristics that were linked to questionnaires and surveys used in the data collection process.

The profile "Women as a homogeneous group" was initially addressed to identify the Top 10 FCs, and the FMs generated to meet with the requirements of these top10 FCs took into account an ANOVA analysis in order to address the most unsatisfied profile of women per each of these top 10 topics.

The most relevant FM for this generic profile is "Real-time assistance to people" in use case 1 (railways public transport), "Vehicle design facilitates non-driving tasks" in use case 2 (autonomous driving), "Inclusive promotional campaigns including disability persons" in use case 3 (bike sharing), and "provide option for working from home/teleworking/remote working" in use case 4 (employment).
This Diamond methodology can be the basis for further developments to improve the fairness from a gender perspective in each of these use cases through the utilization of a toolbox capable to assess the fairness of an organization or service and recommend the most appropriate fairness measures.

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11.30-11.45 / 12.30-12.45 Presentation 27: Thursday, 18th November 2021

Location-based data and GIS analysis for the study of the women's needs as users of public transport: the H2020 Diamond project

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Abstract
Despite recent efforts, the measures currently in place to design and manage public transport do not sufficiently consider women's needs and expectations as users of the service. The European Charter for Women Right in the City (1994) highlighted, in fact, that women experience and use transport systems differently than men, since they are more concerned with economic, accessibility and security issues.

In this regard, the H2020 DIAMOND research project (grant No. 824326) aims at turning data from different sources into actionable knowledge for ensuring the inclusion of the women's needs in current and future transport systems. The project is a collaboration between 8 European Countries (France, Italy, Ireland, Poland, Scotland, Serbia, Spain and the United Kingdom) and brings together urban and mobility experts, transport authorities, computer and data scientists, mobility economists and social scientists. According to the objectives of the project, the presentation will proposes a gender-sensitive approach for investigating women's needs as users of urban railway infrastructures (Gorrini et al., 2019) and bike sharing service (Gorrini et al., 2021). This focuses on the railway network managed by Ferrocarrils de la Generalitat de Catalunya (Province of Barcelona, Spain) and by Zarzad Transportu Miejskiego (Metropolitan Area of Warsaw, Poland), and on the bike sharing service managed by Sindicat Mixte Autolib et Velib Métropole (Paris Region, France). The methodology is based on the analysis of geolocated datasets related to land, demographic and mobility characteristics of the considered EU cities through the application of Geographic Information Systems (see Figure 1). This was aimed at identifying a short list of relevant railway stations and bike sharing docking stations (see Figure 2), which were successively characterized through proprietary data related to travel demand, onsite observations focused on universal design indicators, survey questionnaires and social media data focused on women's concerns, needs and expectations. The proposed research work was aimed at investigating the possibility to analyze digitally widespread data sources as a valuable support of the activity of decision-makers by unveiling hidden mobility patterns and specific target-users' needs. The research was finally aimed at supporting the development of an interoperable and user-friendly toolbox for fairness, self-diagnosis and decision support in transport planning.

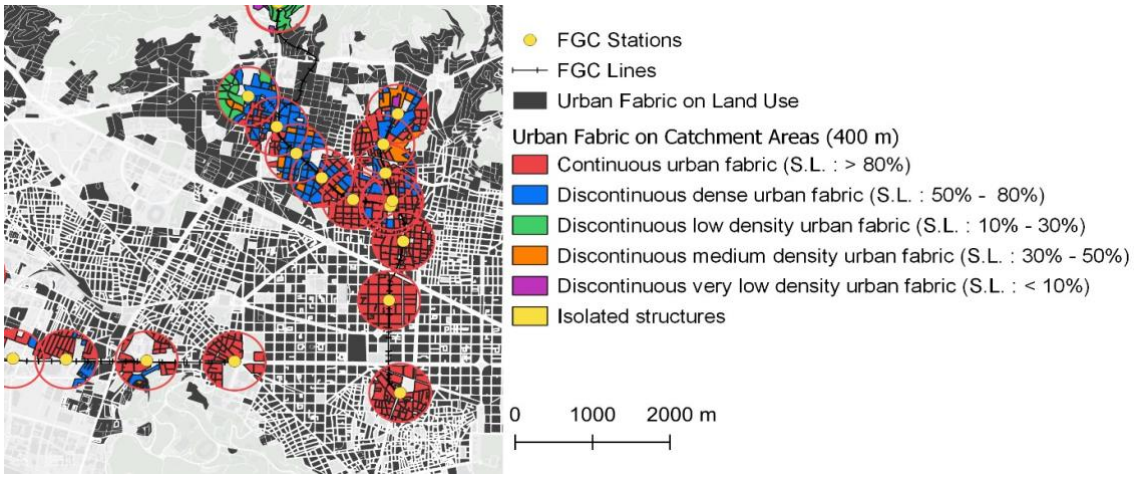

Figure 1 Spatial distribution of urban fabric on the territory of the Province of Barcelona and on catchment areas surrounding the stations managed by FGC.

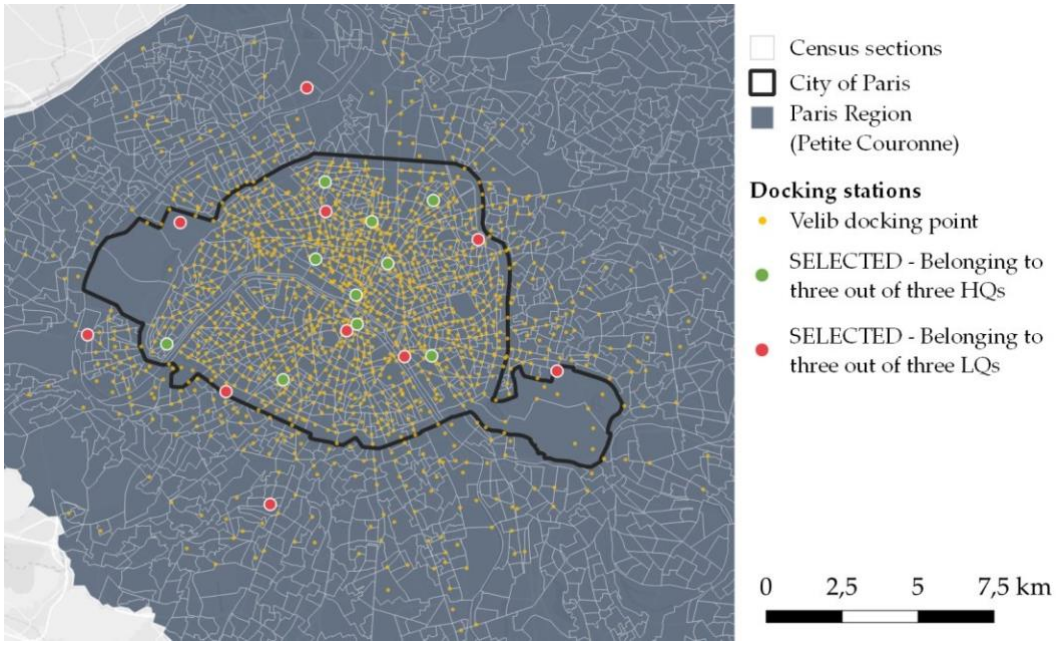

Figure 2 The total number of bike-sharing docking stations managed by VELIB and the group of twenty stations, which were selected through the proposed GIS-based analysis.

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11.45-12.00 / 12.45-13.00 Presentation 28: Thursday, 18th November 2021

The lure of Smart Cars. How to analyze gender and diversity in visual car branding

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Abstract

Currently Europe regards itself as a leading part in the global race towards smart automated transport. According to ERTRAC, European Road Transport Research Advisory Council, automated driving innovation is motivated by both technological advancements as well as social goals of equality.

This paper shows how such perspectives of technology and social goals of equality are carved out and handled in visual e-marketing strategies by a couple of high end car producers. Using visual analysis, a range of yOUtube videos from car producers such as Volvo and BMW are scrutinized with a focus on representations of gender, class, and ethnicity.

The visual representations in the promotional videos show that the car companies try to maintain their own unique profile and brand including a blend of social, gendered, and national and regional characteristics in the intensified competition at the global car market. Both Volvo and BMW use e-marketing in a broader effort of mobilization of memories, feelings, and identities in favor of energy saving; yet they still promote a car centric society as a signpost for modern society and smart middle class mobility.

Introduction

Visions of smart mobility are at present led by producers and manufacturers who promote an optimistic vision of a society in which technological advances will deliver a "benign mobility system that all users can access seamlessly and on demand" (Marsden & Reardon 2017). Also, the European Union and its aligned agencies endorse itself as a leading party in the development of what is now called CAD, i.e., Connected and Automated Driving. Smart cars are envisioned as a solution that can avoid many of the problems of today's conditions. Smart mobility will, according to both producers, politicians, and some experts bring massive gains in safety, cost reduction, and infrastructures and vehicles will be used more efficiently and extend accessibility for all. [i] Critical scholars and NGOs on the other hand have made more pessimistic assessments. They forecast a reinforcement of the prevailing 'system of automobility', including all its evils of waste, pollution, and environmental degradation with the coming of the electric and automated cars (Freudendal-Pedersen, Kesselring & Servou 2019). Private cars are perhaps not what comes to mind, when one speaks of a sustainable and diverse transportation system, and this is not surprising, as cars in 2019 constituted 60,7 % of the total transport CO2 emissions in Europe (European Parliament 2019). This only stresses the need to investigate how the car models today respond to requests regarding sustainability, diversity, and inclusiveness (jf. Christensen and Breengaard 2019:46)

In this paper, we will analyse how such perspectives are carved out and handled in marketing strategies, which connect to the current visual turn in smart mobility and the smart cities discourse (Rose and Willis 2018/2021). A special focus will in addition to the challenges of future urban mobility be on the reproduction or potential break up from social and gendered stereotypes. Such images have routinely associated men and masculinity with speed and mobility while women and femininity are seen as immobility and aligned with home and domesticity and care work. As for class it is evident that leading car brands seek to attract both the local and the global middle class which so far have been mainly composed of men. Notwithstanding similarities among todays (European) and globalized car producers we will show how car companies also seek to maintain their own unique profile and brand including a blend of social, gendered, and national/ local characteristics.

In the following we outline the conceptual framework and the methodology of the visual analysis of videos and YouTube representations of what used to be some of leading European car firms: Volvo and BMW. We will demonstrate how the companies use e-marketing in various ways – and how they

present the prospects of smart mobility. How is new technology and designs represented? How are categories such as gender, age, class, ethnicity, and locality used and visualized? At the end we will confront the visual branding with the notions of Gender smart mobility developed in the EU Horizon 2020 project TiNNGO (Christensen and Breengaard 2019/2021). Do the new models meet the indicators of being attractive, affordable, effective, sustainable, and inclusive?

Figure 1: ***360c The Future of Autonomous Travel (Source: (Volvo Cars 2018a)***[2] *shows how the future mobility culture is imagined in the context of a natural and peaceful environment with climate friendly mobility and energy production. This idealized depiction is far from both current and future realities with intensified urbanization, crowds and mobility.*

Methods and data material: YouTube videos as data material

From an analytical perspective, it makes sense to apply YouTube videos as visual data representing the aspirations and products of the various car firms, since the videos are purpose designed and present a coherent visual form. YouTube is an online video sharing and social media platform, which is owned by Google. YouTube is used both as a personal platform, where individuals can upload content and has become a central platform also for social connectivity. The users can watch and upload their own videos, comment on videos, respond, like and dislike as well as they can subscribe to users and channels. The easy accessibility makes YouTube a popular platform with more than 2 billion users worldwide (YouTube 2021). The benefits of social media for the companies are cost reduction, information collection, database enhancement and service delivery – and expanded geographical/ global reach (Barnes, 2010). Also, the car companies analysed in this report uses both the YouTube and a range of additional platforms for branding and marketing purposes.

YouTube has been an important channel for marketing of smart cars for both companies analysed in this paper.[ii] BMW comes in as the leading company in terms of smart visuals and viewers. The official BMW YouTube channel "BMW" was established in 2006. By April 2021 it counted more than 1.2. million subscribers and attracted more than 169 million views. Volvo established its YouTube channel Volvo Cars in 2008 and as of January 2021 the channel had more than 166.000 regular subscribers and has since 2008 been visited by over 70 million viewers. The variations in numbers of "smart" subscribers and views might also indicate the particular profile of the car brand and its customers and their level of perceived smartness. From a conceptual angle one can argue that social media platforms such as YouTube forms part of new communicative infrastructures, which also enable new forms of social connectivity and social being (Dijk 2013). Social media images have more specifically been

[2] [2] See Volvo's video on future autonomous travel on the direct link here (time 5:04).

staged as an important part of the emergence of smart as a peculiar digital form of urban being - and as connected to nearly all forms of being in advanced capitalist societies. As such YouTube videos forms part of the new social media landscape which also co-constitute human beings in human material intersections. We have applied a systematic search and made the car companies' own YouTube Channels focus of the analysis, from where, we have been able to conduct specific case studies. They reflect how the car companies represent themselves and address potential consumers in terms of smart cars and mobility.

Table 1: YouTube Channels for two smart car manufacturers

	Established	Subscribers	Views (mio.)
Volvo	2008	166.000	70
BMW	2006	1.200.000	169

In the YouTube analysis of smart car images we have been inspired by an approach developed in social science. The explorative research design can be spelled out in three steps, which we have connected into the framework of smart cars and their YouTube brandings (Doerr and Milman 2014, 430ff; Müller and Özcan, 2007: 288) The three steps include the following dimensions and guidelines for looking at content and interpretation of images:

1. visual content analysis
2. deeper iconographic analysis of distinct symbols
3. connection of the two first steps with contextual analysis and use of extended data and literature.

We have connected these three steps and transposed them into an explorative research design, meaning that we present and analyze the particular profiles of smart cars and how these interface with both the particular brand image as well as the depictions of gender, class, and diversity. We apply a broad and fluid concept of smart cars, as meaning various models of existing electric cars and the future vision of the autonomous car. Most of todays high-end car producers aim at presenting the full automated car as the end goal. Most advanced car producers, notably Volvo and BMW are located in a middle step 3 – yet both are striving towards step 4 and 5 and the full automatisation.

The analysis of the the YouTube videos will be presented following the 1) A short presentation of the Car Company, 2) detailed description of the most popular and significant YouTube videos, and 3) Reflecting on how the depiction, narratives, and expressions correspond with the ideas of social equality implied in the notion of Gender Smart mobility. All material was collected between January and May 2021.

Volvo case study:

Volvo was founded in Sweden in 1927 and is today a well-known international car brand, known for its historical Nordic and Scandinavian roots and qualities. From early on Volvo was promoted as a strong and safe car, which echoed the characteristics of "The people's home", the Swedish term for a well-ordered democracy and elaborate welfare state that protected its citizens. These ideas were

carried on in the 21st century where the "Volvo for Life" was used as a bold campaign slogan that pretended to address all walks of life. Volvo catered for safety and security in individual car mobility as did the welfare state, the Peoples Home, in social affairs.

The Volvo XC 40 Recharge: Walkaround[3]

In the beginning of the over 14 minutes long video, we see a picture of the new car in an off-white version on a background of bright walls. The music soundtrack is after a few seconds partly interrupted by the sound of high heels, which indicate the arrival of a woman. It is a younger woman – in high heels – walking energetic and with loud steps towards the spectator. "HI, I am Beatrice Simonsen, I am product manager." She is dressed in black trousers and a sand-coloured jacket, with hair tightly set up. In front of the robust car, she reminds of Alice in Wonderland, a little girl in front of an oversized car. The car is, she argues, designed for an active, urban lifestyle. Everything to make your life easier - and it is all about making life less complicated. "You can activate your preheated seats over the Volvo app on the phone, and all you have to do to drive is to carry your key".

She enters the car and looks directly at the spectator: "Do not look for the pedal there isn't any" – and with a certain thrill: "in fact it is integrated in the seat as a sensor so once seated just push the brake pedal, choose your gear and off you go, it cannot be easier." The setting of the video is a - raw factory grey environment the car takes centre stage which echoes the rational and hands on simple information – delivered by women experts. These visual effects accentuates the focus on the technical achievement and easy handling of the technology – accompanied by the presentations by the women experts talking with assertive and clear voices with Swedish accents. All in all the video conveys a portrait the VOLVO driver as a professional woman with a rational approach to cars, which are now easier and more practical to use and handle.

Volvo 360c. The Future of Autonomous Travel[4]

Central in this future oriented concept video is the visualization of four scenarios of the future of life in an autonomous car, where the businessman – routinely to be visual addressed – was exchanged by businesswomen. The four scenarios clearly addressed so-called daily life at the business class level. This futuristic video which was indicated in the opening question of "Why fly when you can be driven?" The setting of the model autonomous car is depicted in a setting with large and comfortable chairs and table and big windows screens and an dynamic environment where women are underway – from one to another urban setting.

Here women are presented as the central actors and beneficials. The autonomous car is depicted as a time saver, where one can enjoy meals and as a professional space where meetings can be conducted while underway. Notwithstanding the business atmosphere, the outfit and gesture exhibit the plain and minimalistic feminine details such as a horse-tale, and plan jeans and skirts. The women are depicted as engaged actors, going from a to b in an urban environment. The VIDEO portraits the VOLVO as a front runner in the future of autonomous cars and shows Volvo as an inclusive car producer when it comes to gender notably the inclusion of professional women.

Everything showed in a business class atmosphere and devoid of family obligations. Volvo is the only one of the car producers in this sample who has produced a video on the future of autonomous driving. The video which takes a forward leap into the future asserted the Volvo trajectory of developing advanced and safe technology also for the new era. While electric and autonomous cars have inherently been addressed as meeting the needs and affordances of the male business elite

[3] See the Walkaround of the Volvo XC 40 Recharge on the direct link here.

[4] See Volvo future autonomous travel on the direct link here (time 5:04).

(Hildebrand & Scheller 2018). Here, Volvo again try to carve out its own trajectory of including women. The most clear-cut visual representation of the imagined future of the Volvos autonomous car seem to relocated this exclusive male and masculine focus and to widen the circle of the business community to include women both as users and as experts

Summary: Volvo has been part of the national identity in Sweden and played a crucial role as a core industry and in terms of export value. Volvo cars was however separated from other parts of the company in 1999, where its branch of person car production was sold to the Ford company. In 2010 – due to enduring economic crisis, the Volvo Company was acquired by the Chinese Zhejiang Geeley group, whose owner wanted to get access to a western quality brand and technology. Volvo however has sought to maintain a certain independence, and the headquarters of Volvo cars is still in Sweden, even though most of the production takes place in various other parts of the world. Volvo cars have time and again used and reinvigorated its reputation as a Scandinavian car producer and maintained its historical heritage providing safety and security, as well as a whole way of life. As for addressing gender issues Volvo has been both explicit and implicit. Both family orientation and gender equality has been echoed with various strength in the visual marketing over the past decades. In a 2007 analysis Volvo Cars was appreciated for its family orientation: "*The company wants the public eye to see a "Volvo Family". They are concentrating on family unity and how the safety of these vehicles will lead to a happier and healthier family*" (Ruiz 2007). This was an outstanding feature of the Volvo websites compared with competitors where the focus was on performance and technology as the first components. Already then, the Volvo website in the order of links showed the priorities of the company as safety, design, performance, and environment (Ruiz 2007). These priorities have over time been materialized e.g., in the early introduction of the seat belt in 1959 and later in the build in child booster seat in the rear seat (Volvo 2018) .

Another example of how Volvo has addressed gender issues and women as drivers is the Volvo concept car, which was developed by an all-female team of Volvo engineers, designers, and technicians in 2004 (Volvo 2002). The car was promoted as "all decisions made by women" and aimed at addressing "the most demanding premium customer: The independent woman professional". The woman concept car was never put into production, but innovative elements have been recycled in later models and not least in today's electric cars. They consist in a range of design and maintenance details, such as easy access and handling of trouble shooting in the new Volvo care program. Also, the emphasis on bodily affordances, on personal storage space and hooks for the handbag, easy removal of seats, better and more space for cargo and baby strollers were introduced in the Volvo concept car and have been transposed into the latest electric models.

While electric and autonomous cars have inherently been addressed as meeting the needs and affordances of the male business elite (Hildebrand & Scheller 2018) Volvo has taken a different track. The branding addresses a broader constituency through the visualizations of sustainability and corporate gender equality in a parallel move. Yet still a more traditional track of cars as a primarily masculine asset can be observed both in in the wider range of Volvo YouTube presentations and using male professionals in the presentation of new digital assets. While Volvo has been known for paying attention to family life, there seems in the more recent YouTube videos of autonomous and electric cars to be a narrower emphasis on corporate gender equality. This is an observation which address mainly the liberal norm of integrating women in the mainstream – rather than creating a more fundamental change of norms in the Western world and in the global business community.

BMW case study

BMW is a German multinational corporation, which produces highly luxury cars and motorcycles. The company was founded in 1916 and has since then growth into one of the World's leading car brands – both in terms of luxury, innovation, and sustainability. BMW strives to be a fully sustainable company, e.g., by cutting CO_2 emissions, to recycling, to expanding hydrogen technologies, and even to planting peanuts (BMW 2020b).

The Small Escape[5]

The Small Escape is the most popular BMW YouTube video with more than 23 million views and 88.000 likes. The video depicts a historic landmark of Berlin in 1964 where East Berliners desperately tried to cross the border to West Berlin. The video then illustrates scenes from the Berlin Wall and its checkpoints where West Berliners could cross the borders to East Berlin to commute to work. The lightning is still dark due to the evening atmosphere. The only lightning within the scene is from the projectors surrounding the checkpoint, which leaves the audience with a feeling of coldness. The scene then changes from a bird perspective to ground perspective where we witness how a car is closely examined by the checkpoint guards. Suddenly, the owner of the car starts running and the guards tries to stop him. The scene ends with the main character, a middle-aged white man, wakes up. He gets out of bed and sits at his desk – the same desk, we as an audience saw in the beginning of the video with technical drawings of a BMW vehicle laying around. The choice of selecting such a historical moment of Berlin suggest an embracing of the German history and Western values. It illustrates a story of the innovative, intelligent, and brave man, who stands up against the oppressive system. It emphasises freedom, independence, and leadership, and underscore the identity of BMW as a strong car brand, which we can count on. It paves the way and drives us into the future.

The Epic Driftmob feat. BMW M235i[6]

In the second most popular BMW YouTube video, '*The Epic Driftmob',* we are watching five BMW 235i cars performing a drift-choreography in about 90 seconds. The setting is a modern urban area with admiring pedestrians on the sidewalks as audience. All five drivers are men and the video show remarkable drifting skills, speed, and playfulness. The sound is heavily dominated by the noise of the vehicles when drifting, which accentuate a wow-feeling when watching the video.

Obviously, drifting is not to be confused with usual and responsible driving. On the contrary, drifting is a high-risk activity that requires an extensive amount of training and the acquisition of professional driving skills. Only few people will have the proper skillset and knowledge to perform and control such a situation. Both edgework and drifting involve risk taking, and control of a dangerous situation (through acquired skillsets) is a key factor (Lyng 1990).

Taken together, these compositions of the video portraits an image of the BMW driver as a person read: male), who leads with power, risk-taking, while at the same time having the professional skillset to control what others consider to be a dangerous or risky situation. He stands out of the mainstream and is not afraid to do so. Such portray resembles a hegemonic masculinity, where certain traits and characteristics become idealized and receive social recognition (Connell 1987, 1995). By employing an

[5] See the full video on the direct link here.
[6] See the full video on the direct link here.

idealized form of masculinity, which only few men are able to live up to, BMW become an identity marker and an efficient way of position oneself socially from the crowd.

BMW: Pioneering Electric and Smart Mobility

The storytelling and identity of BMW as a leading, innovative, and business-oriented car brand is furthermore extended through its development of electronic cars and focus on smart mobility in general. When examining a selected amount of YouTube videos from the YouTube Channel BMWi, which has existed since September 2006 and currently has more than 47.800 subscribers, it becomes evident that BMW considers themselves as pioneers when it comes to electronic mobility.

Summary: The choice of extending the brand of BMW by including the development of electronic cars and their use of marketing strategies, such as *'Remembering the future',* seems to prolong the identity of BMW as the brand for leaders – for people, who dare to try something new and to lead the future. However, research on electrified car brands and the role of brand personality, experiential brand associations and emotional design suggests what appears to be a discrepancy between the identity of BMW and the extension of electrical cars (Moons and de Pelsmacker 2015). Based on surveys and interviews, Moons and De Pelsmacker finds that people commonly associate the brand personality of BMW with being an active, sporty, and even aggressive brand. It was described as sharp, strong, and masculine, and with a focus on technology and luxury. This stands somewhat in contrast to electrical cars, which were commonly associated with being softer, feminine, and more responsible and reflective.

At an overall level there seems to be shift within the framework of BMW, wherein the narrative of leadership is extended yet added with some more feminine and softer traits. This shift suggests a greater focus on driver diversity and the everyday life of families. Where some of the earlier videos focus mainly on comfort for a stereotype businessman, such as working lounges, these videos focus much more on efficient and mobile transportation, fast charging systems and making sustainable choices for future generations

Discussion: YouTube analysis in the context of gender smart indicators

What was apparent from the two car companies were that image and visual representation was in the centre of attention when promoting very different car products. Volvo reassured its Scandinavian traits through quality, safety, and sturdiness, and this also included the attention to explicit gender equality. BMW showed with promoting videos "The small escape" and "The Epic Drift Mob" that this is a company with a narrative that includes characteristics which have been traditionally identified as masculine, such as leadership, independence, skills and competence, control, luxury, innovation, and technology.

In the TinnGO Roadmap, the notion of Gender smart mobility was adressing whether the upcoming smart transport systems address various groups of citizens in non-stereotyping ways, and how this is expressed in the transport systems design, accessibility, safety, public campaigns, market promotions, living labs etc. (Christensen and Breengaard 2019:46). The notion of gender smart mobility was transposed into five indicators, against which we will discuss the outcome of the YouTube analysis:

Inclusive transportation: Our visual analysis of the Volvo and BMW YouTube videos point towards a lack of inclusiveness. Although the analysis occasionally identifies both female and non-white characters, there continues to be strong reproduction of gendered stereotypes within the videos. For example, the notion of 'hyper masculinity' storytelling in BMW and how leaders (be they women or men) look like. Such 'inclusion gap' and strong identification with leadership and masculinity may be a turn off for potential buyers in that they reproduce gender stereotypical images (which can be impossible to leave up to) and primarily appeals to men (Dron 2018).

However, it should be emphasized that we across the car companies did identify examples of diversity and inclusiveness, although in a much smaller scale compared with the representations of white male drivers and experts. Volvo has time and again addressed gender issues and women as drivers in their Volvo Concept Car, which was developed by an all-female team of Volvo engineers, designers, and technicians in 2004. Another example is BMW's choice of including Sara Al Mandani and her visions for technology and leadership. Though, despite of the positive shift initiated by the car companies in terms of inclusion and diversity, there continues to persist an 'inclusion gap' within the visual expressions of the videos. This gap invites for further inclusion development and points towards possible potentials for change and greater diversity.

Affordable Transportation The affordable transportation indicator *address robust and stable public transit provisions, e.g., if investments support the innovation of smart small cars for all rather than luxury cars for the few, keeping in mind the gender pay gap, and that women in general are less economical resourceful than men* (Christensen and Breengaard 2019:46). The price for a new BMWi3 starts from €37.600, which suggest that only middleclass families and above will have the financial resources to buy such. The price for a XC40 Recharge Volvo begins from €65.895, making it difficult even for most middleclass families to purchase such.

Effective Transportation According to the TinnGO Roadmap, effective transportation is when *transport planning and policies provide seamless transport for all including, e.g., walking and biking in relation to smart mobility provisions, and that market stakeholders are directed to produce smart and efficient public transport rather than smart luxury cars* (Christensen and Breengaard 2019:46). Both car companies display a high degree of effective transportation in terms of providing seamless transportation, as private transport gives a high degree of flexibility. The key question here is: For whom. The electric vehicles that the car companies offer, are private solutions – not public or shared – and the variation in price of the vehicles shape the accessibility to space and transport in urban areas.

Attractive Transportation Whether the transport is attractive can be defined as if *the planning provides safe, accessible, and liveable spaces in all parts of the city, and if it provides smart solutions for shared transport for broader and diverse groups of people* (Christensen and Breengaard 2019:46). The YouTube channels that were under the loop in this analysis all represented car firms which offered private – and not shared – forms of transport. Again the question of attractive for whom may be considered.

Sustainable Transportation When speaking of sustainable transportation, it is not usually private cars that come into mind. In the roadmap developed by project TinnGO it is also the non-motorized transport or connected modalities that is considered to be at the core of ensuring sustainable transport (Christensen and Breengaard 2019:46). However, non-motorized vehicles may not be an opportunity for everyone on all journeys, and despite that it is fundamental to incorporate non-motorized transport as part of the transport system, it is still relevant to ask how the motorized transport too can be reflected a sustainability criterion. Sustainability was in this analysis indicated as

cars that were small and electric, and reused its materials. When reflecting on sustainability when speaking of motorized vehicles, it seems that we need a more scaled indicator that measures across different dimensions which includes accessibility, production effects, energy and infrastructure and actual use

Conclusion

In returning back to the issues that were raised in the beginning of this paper regarding the potential and limitations of the coming of smart cars this analysis sheds light on the complexity and scale of the topic: It has been argued that the making of 21st century modernity and consumer communities correspond to the formation of nation states as imagined communities in the 19th century (Christensen 2015, Small 2013; Cayla 2008; Eckhardt 2008). Today it is claimed that cars and other consumer goods have replaced media and political arenas as the channel for the imagination; and that the imagination is now situated in transnational connections and regional consciousness rather than within national boundaries. We have shown how such developments are manifested in the visual representations where national features in various ways are entangled with the cosmopolitan and global trends and attention to sustainability and climate change. At the same time new branding strategies tend to maintain the business elite as a target group while at the same time aiming at widening the scope to include gender and to a lesser degree ethnic minorities as potential consumers. As for class it is evident that leading car brands seek to attract both the local and the global middle class which so far have been mainly composed by men. Notwithstanding similarities among todays (European) and globalized car producers the visual representations in YouTube videos show that the car companies try to maintain their own unique profile and brand including a blend of social, gendered, and national/ local characteristics in the intensified competition at the global car market. They use e-marketing in a broader effort of mobilization of memories, feelings in favour of energy saving, yet they still promote a car centric society as a signpost for modern society and smart middle class mobility. The interest of the car producers are not to destabilize or decode the car discourse and practices. Meaning that the broader issues of climate friendly solutions boil down to providing a better and more safe and sturdy car for the individuals and their families. Car producers as we have seen – apply sophisticated marketing tools and methods, which as noted not only promotes the cars as isolated devises but in certain and specific contexts. Their e-marketing both takes issue of the new communication technologies – here in the shape of YouTube videos where they try to maintain and to build up alliances with new consumer values and preferences. Moreover the car companies in their e-marketing very distinctively “reads” and reflects current buzz words and political trends related to climate and CO_2 reductions and various urban problems and maladies. Traditional car companies such as Volvo and BMW are up against threats from many sites – technologically, politically, and in terms of global competition. The visual representations in the promotional videos show that the car companies try to maintain their own unique profile and brand including a blend of social, gendered, and national and regional characteristics in the intensified competition at the global car market. Both Volvo and BMW use e-marketing in a broader effort of mobilization of memories, feelings and identities in favor of energy saving; yet they still promote a car centric society as a signpost for modern society and smart middle class mobility . Time will show if and car producers are willing and able to make a more fundamental shift which connect with customers growing interests and desires for climate and shared solutions with advanced technologies.

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12.00-12.15 / 13.00-13.15 Presentation 29: Thursday, 18th November 2021

Autonomous vehicles, a new opportunity to gain women fairness. Main results of the diamond project.

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Abstract
Traditionally in the automotive sector human centred design has been overshadowed by technology-led innovation. In those cases, in which people have been included into the equation, it has been an "average man". This has even raised serious safety issues for certain groups, notoriously women. Being AVs a field under development we have the opportunity to implement a gender vision to traditional ergonomics and safety elements while dealing, for example, with the future HMI that will allow regaining or transferring control or performing different NonRelated Driving Tasks inside the vehicle. A gender approach also introduces concepts such as mobility of care or trip-chaining vs. simple commute. The aim of the guidelines developed in the framework of the DIAMOND project is to heighten awareness, identify key points and strategic lines for women fair development.

Introduction
As it happens in other fields, women needs and requirements are not well addressed in the automotive sector either (Criado-Pérez, 2019). Now that autonomous vehicles could become a reality in the near future (Fisher et al., 2020), it is time for a more human centred approach, incorporating women into the equation to avoid ending with designs only suitable for an "average man" which have demonstrated fatal consequences for women. The use of different methods together with the results obtained in DIAMOND project, permitted to identify the key points and strategic lines, from a human factors perspective, for the development of women fair in AVs.

Methods
The bibliographic review and collaboration with SUaaVE project focused on: (1) gender perspective in mobility patterns, ergonomics and safety; (2) acceptability and emotions related to autonomous vehicles; and (3) technology and design to cover old and new needs and potential functionalities which may come up with the development of the AV.

The focus groups were used to complete the whole framework of the acceptance of AVs and advanced technologies in the vehicles, as well as to better understand the different patterns of mobility and the influence of taking care of children or other dependents.

The Human Autonomous Vehicle (HAV) (Belda-Lois et al., 2021), a dynamic driving simulator developed by IBV**,** was used to emulate scenarios in which passengers' emotions were monitored.

Forty potential AVs users, sex-balanced and having (or not) family dependents, participated and answered an extensive questionnaire.

Results and conclusions
Strategic lines are structured following the women Fairness and Inclusiveness Maturity Model developed in the DIAMOND project: (1) capacity to meet required needs, (2) accessibility and (3) safety and security. In terms of needs the importance of the NonDriving Related Tasks will be notorious while applying a gender view would imply to pay attention to care mobility and defining trip-chaining related functionalities. Concerning accessibility, in addition to affordability which has a strong gender bias and attention to functional diversity, the implementation of shared vehicles will imply the introduction of a nomadic user concept with their unique features. This will imply an increasing importance of the flexibility of the layout of the vehicle. In safety and security, to the traditional concept of safety we need to add the need of trust to the system, being women more reluctant to give power to the vehicle, the key elements may be proper training and communication between the vehicle and the passenger.

This work covers only a tiny but important part of all what is going on in the field of Automated, Connected and Intelligent Vehicles, women fairness in AVs.

Acknowledgements
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Keynote

13.00-13.30 / 14.00-14.30 I**nternational Keynote speaker**:

Inclusive Mobility: An intersectional perspective
Eleanor Linsey

Session VII: Inclusivity for transport planning and design

13.30-13.45 / 14.30-14.45 Presentation 30: Thursday, 18th November 2021

Gender- and diversity- oriented design of social media for participation in public transport: extended case study of German transport companies

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Introduction/ Background

In the context of this abstract/ paper, the authors follow up on their publication "Gender- and Diversity- oriented Design of Social Media for Participation in Public Transport" (Schöne et al., 2020). This focus results from the participation of the authors in the TInnGO project, in which a pan-European knowledge platform (an observatory) for gender- and diversity-specific intelligent transport innovation will be developed. The TInnGO-platform will be used for data collection, analysis and dissemination of gender mainstreaming tools and will provide space for open innovation. Therefore, partners from 13 EU countries form 10 Hubs. The individual hubs deal with a variety of different current gender and diversity specific challenges in the transport ecosystem as well as the mobility needs of women. The German Hub specialized on gender- and diversity-sensitive participation culture. This of course also includes possible participation in the mobility planning process via social media.
Based on the design recommendations for gender- and diversity-sensitive social media appearances defined in the paper, the authors conducted a German case study and examined social media posts of 16 German transport companies. For this purpose, the analytical framework was expanded. On the one hand, to be able to make statements with regard to a possible change in the use of social media channels in times of the Corona pandemic. On the other hand, to shed light on the use of social media channels for their own image presentation, but also for recruiting purposes.

Methods

With the user groups and their specific requirements in mind, the analysis of the social media appearances of 16 public transport companies all over Germany was conducted with regard to the design, enabling, implementation and active involvement of users within the framework of the participation culture. The elements for gender- and diversity-sensitive design of social media appearances defined in the previous study served as a basis:

- UI-related gender- and diversity elements
- Content-related gender- and diversity elements
- Participation-related gender- and diversity elements

The framework of the analysis was expanded to the effect that users of the social media channels were not only understood as mobility users, i.e. as travellers, but also as people interested in the public transport company itself, i.e. as future employees. In this context, the topics of image presentation and recruiting played a major role. Therefore, in addition to the Facebook, Twitter and Instagram channels, Xing and LinkedIn were also included in the list of channels to be examined.
Furthermore, this case study analysed the channels over a larger period of time - five weeks in the period from 20.01.2020 - 30.05.2021. This approach was based on the assumption that social media would become more relevant and would be used more extensively and in a more targeted manner - both by users and by public transport companies - due to the social distancing caused by Corona and the restrictions including lockdowns and the associated tightened situation in public transport.

The social media appearances are analysed to determine whether and what types of participation processes are carried out, how they are communicated and designed, and to what extent they meet user needs within the participation culture and enable active participation by all users.

Results and Discussion

The analysis of the social media appearances of 16 German public transport companies contributes to the uncovering of hurdles and gaps in addressing and interacting with users on the part of public transport companies via social media, which in turn provides potential for optimisation and innovation. In this way, the potential becomes apparent, that social media not only serve the purpose of purely conveying information, but can also serve for an interactive exchange about it and thus represent an effective instrument of participation culture.

Acknowledgements

TInnGO Transport Innovation Gender Observatory

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Reference list

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13.45-14.00 / 14.45-15.00 Presentation 31: Thursday, 18th November 2021

Railway station accessibility: an assessment tool

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Abstract

Accessibility refers to how easily someone can reach their destination. It also can be used as an indicator of transport performance and the quality of land use. Moreover, it is well-known that accessibility strongly influences access to basic needs, such as jobs, education and health care. Unsurprisingly, personal mobility is one of the fundamental human rights and it is vitally important to ensuring a productive and dignified life. According to the World Health Organization (2011), 15% of the world's population has some type of disability and forecasts show that this number is likely to rise as the population ages. Moreover, studies have shown that people with reduced mobility often face difficulties over simple daily trips, due to inadequate infrastructure in urban areas. Thus, to safeguard equity of mobility, it is imperative to provide urban environments and transport systems, particularly public ones, that are accessible to everyone, without discrimination. Urban rail systems are a common

alternative in urbanized and heavily populated cities, due to their high capacity, safety and ease of use. Because of the central role played by this mode, strategies such as Transit-Oriented Development have emerged and gained popularity. The TOD refers to the creation of dense, diversified, integrated and connected urban communities around transport stations, which helps to reduce the demand for transport, thus favoring the use of active mobility. Despite its significance, globally, only 41.5% of the urban rail systems are fully accessible to people with disabilities who require the use of a wheelchair (Ferreira et al., 2020). In this context, and considering both the importance of the topic and the scarcity of literature about it, this research aims to propose a method to evaluate the accessibility level of urban rail stations for people with reduced mobility, in the context of Transit-Oriented Development urban design. The tool that we are proposing in this study comprises over 40 indicators. These indicators are distributed in three categories: (1) Information about accessibility; (2) Accessibility of urban rail stations; and (3) Accessibility of station surroundings and transfers. To develop the indicators, we examined many international guides, manuals, standards and assessment tools. The list of indicators was also assessed by a specialist in accessibility for people with disabilities. To determine the weighting of the categories and subcategories under analysis, we used an expert assessment panel and an analytical hierarchy process (AHP) model. The panel was composed of acknowledged experts with diverse professional backgrounds. We also tried to include professionals with disabilities, as they would be able to provide some feedback from their own user experience. We also submitted the tool to a trial application in a few Taipei city metro stations. The results of this study suggest that this novel method can be valuable for researchers and decision-makers during different stages of the TOD implementation process. In addition to being an easy-to-use tool to measure the current accessibility status of urban rail stations, the proposed method also enables multi-category classification, which can help to identify critical points that need to be prioritized.

Acknowledgements

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14.00-14.15 / 15.00-15.15 Presentation 32: Thursday, 18th November 2021

Bigger than transport design: beneficial undergraduate experience of gender and diversity sensitive smart and sustainable mobility innovations

P. Magee, A. Woodcock, K. Gut
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Abstract

This paper draws on the experience of the TInnGO design team and undergraduate students on co-designing activities facilitated online during pandemic Covid19. Student interns were guided in the creation of over 30 smart mobility design concepts from received briefs, or problem suggestions addressing marginalised transport users from 10 partners across Europe. Design concepts from students illustrate how reflective practice enabled them to create empathy led designs provocations. Testimonies from students collected after internships evidenced greater awareness on gender and diversity sensitive smart mobility.

Introduction

The Horizon 2020 TInnGO project was intended to facilitate and empower underrepresented and diverse groups to engage in conversations about mobility challenges, with a view to informing more inclusive design solutions. Due to Covid19, most co-design, face-to-face contact with vulnerable groups was not possible. This has severely limited the transmission of the lived experiences of vulnerable groups to the wider project and beyond. Our experiences of working with undergraduate, remotely located design interns to develop smart mobility design provocations for European hubs has been published (Woodcock, et al 2020; Magee et al, 2021). The aim of this paper is to tease out what gender and diversity smart mobility innovation can learn from this experience.

Developing gender and diversity sensitive smart and sustainable mobility innovations

This qualitative, participant observation study uses the rich and wide-ranging conversations held amongst the UK design team who acted as tutors, expert informants, and codesign partners. Design activities lasted over 18 months, generating over 30 concept designs, some of which may be found on our Open Innovation Platform (OIP). We did not know at the beginning, nor did we choose to be prescriptive, which topic would be addressed by which intern. Following group discussion, we directed their activity based on their interest and interaction level in the discussion.

At the outset of the design phase, we met with the students as a group and individually, to get to know their way of working and preferred communication styles. Whilst they all had their own way of illustrating it was clear that in lockdown, they did not have the peer influence of being in a shared design studio; consequently, their style had limited development. A typical method used by the TInnGO team members in previous internships is to encourage freehand sketching. At first some interns were sceptical about the usefulness but at the request of the team, agreed to work on their own sketching skills. Some did this throughout, others did not. The difference in quality of sketch communication and speed of sketching with clarity is an immediate differentiator between them. Indeed, this freehand ability will be a useful differentiator for them when being interviewed for employment, despite the propensity of digital modelling tools - a sketch remains a more intimate way to communicate thinking around the design and its origins.

To maintain momentum and be ‘there’ as a supporting community, critical reviews occurred on a weekly basis, for 2 -3 hours, with 4-6 partners.

In our reviews, we talked through the design ideas and teased out what the designs mean in relation to the ambitions of TInnGO, with some deeply philosophical debate, negotiation and contrasting opinions. We found variations in direction taken from the design briefs and a good measure of

personality in the ideas and narratives from each contributor. Although each final sketch or rendered image on the OIP is accompanied by an edited, short narrative, these cannot fully convey the topics covered, the insights, experiences and information shared. Nor can they really explain the journey of creation that has occurred, partly because the nature of the discussion is extremely organic, and it would be too time consuming to go back over the discussion and present it in a formal way for review. In essence, we experienced the discussion, we judged the next direction based on our collective experience, and mostly followed that route to its conclusion.

At the same time, we lacked the benefit of seeing idea development first hand between critical reviews and consequently, some of the chosen routes took tangents that did not fully match expectations. Where interim meetings did take place, students shared the edited highlights of their work – the sketches they were pleased with, or felt that conveyed the most complete idea.

From the above, it is clear that 'not being there' i.e., co-located, is a key issue in codesign. When working in isolation, our student designers were not able to work alongside users and gain insight. Also, wider stakeholders (such as hub members we were designing for, the project team and transport operators etc) were not able to contribute or learn from discussions. It is very easy to press record buttons to record meetings, but how much of this is played back or acted upon?

Two or more factors were conflated in the work. We required designers to develop gender and diversity sensitive smart mobility products, when these have not been well defined (e.g., is *smart* simply IT enabled or connected). At the same time an unwritten requirement was that the design was sustainable and would lead to behavioural change. These are all wicked problems requiring multi-agency and multidisciplinary actions.

Even seemingly stand alone, gender and diversity sensitive smart mobility innovations, such as child bicycle seats are complex, as they need to be informed by experiences and lifestyles unfamiliar to young designers. It became clear that almost all the designs were service or systems oriented, relying on or requiring integration with other agents/devices/systems before they could be implemented. Which leads us to question whether asking transport designers, to design for an existing flawed system, is not only skewed but also reinforcing the problem.

The TInnGO project aims to create a paradigm shift in transport. Part of this remit requires building up the capacity and understanding of future transport designers and engineers to enable them to create more gender and diversity sensitive smart mobility products. To fulfil this aim, a number of design and engineering students worked on concept designs (or provocations) using ideas submitted from 10 EU hubs relating to current, context specific, mobility related challenges (Magee et al, 2021).

Reflective practice as an enabler

Design students, and professional designers face difficulties when communicating with traditionally hard to reach groups. There are cultural, social and language barriers to overcome which leads to a sense of designing 'for the other' and unequal power relationships. Such inequity can render citizen engagement tokenistic, leading to dissatisfaction and further disengagement – especially if the reasons for seemingly ignoring user suggestions are not conveyed.

The issue for designers is in knowing how to communicate in an appropriate manner; be that at a personal, casual, investigative, or business/ professional level. The real difficulty arises when we consider, what is appropriate? The purpose of engaging with citizens is to learn from their experience; to 'walk in their shoes'; to empathise with them and their situation. If, as enquirers, we fail to probe deeply enough due to communication limitations, then our understanding is shallow, designs do not meet user needs and opportunities are lost. From a mobility perspective this means that smart mobility innovations (both products and services) may 'exclude' certain groups – as a consequence

uptake may be limited and innovations closed down before they can lead to sustainable behavioural change. Consequently, the paradigm shift of the next generation of transport stumbles.
We have published elsewhere about the tool for dissemination of ideas, the Design Provocation. It should be remembered that the internship is not only to benefit the project – it is also a learning experience for the students. As such we have a responsibility to guide their decision making, tutor their outputs, manage their own expectation and to encourage them to explore new concepts, developing their own distinct voice or visual language. It is clear that throughout the period of the internship, there was a great deal of maturing in terms of outputs. That maturity also enabled the students to engage as professionally as could be expected of them, given their modest experience. Hence the development of the Design Provocation; our method to provide a dissemination framework but without the requirement to fully develop the design – it is an idea, that's all, yet the framework can be used to illustrate the idea visually, and quickly for better communication. Importantly, creating the design provocations, requires the designers to present and defend their idea. The ensuing discussion makes them think of ways to reinforce their claims, or resolve issues so that they can not only present more convincingly, but also can present the idea with enhanced depth.

Benefits derived by undergraduate students on TInnGO

Reflective practice (Schon, 1974) is a core pillar of design research, in which designers reflect in, on and through practice with the aim of improving their own practice (and, therefore, designs), personal knowledge of target groups and contribute to wider knowledge when design outcomes push against existing boundaries - as in the case of smart mobility products where user needs and technology transfer are new.
Our interns have had an unusual experience. It may be that, in years to come, they see this as an example of how their working environment became established – that remote engagement is the best way to ensure widespread, sustainable interaction. A characteristic that the interns may have inadvertently adopted is to question the validity of a design within the framework of the client (in this instance TInnGO), rather than simply answering the brief they are charged with.
Despite the lack of co-location, we maintain that our influence on the student's visual communication skills has increased their ability to communicate their ideas, and to be prepared and able to pose a suitable defence of the point. Additionally, we have helped them to welcome feedback, to respond to it positively, rather than to feel it is a criticism. Each of their pieces of work was improved by sharing it with the collective team.
This paper draws on notes from weekly design meetings, the reflections of project staff and students to gain insight into the extent to which working on the project and creating smart mobility products increased empathy and understanding of gender and diversity in young, undergraduate design students. Analysis of the reflective statements from the interns have been thematically analysed. This has revealed key themes relating to 1) a better understanding of the design process (such as group work, actors in the design process – co-creators, expert informants - their skill sets and how to work with a design brief); 2) the role of empathy; 3) design for gender sensitivity and diversity and 4) difficulties in working remotely.
In their self-reflective statements students highlighted the importance of working in a multidisciplinary team, which taught them how to better communicate their design ideas to non-designer audiences:

> *Working with TInnGO through my internship year was instrumental to prepare me for my future in the design industry. (…) I had never worked directly with researchers, this*

> *year taught me to better communicate my designs and ideas so people who were not familiar with the design process could understand and appreciate the output of each project. [P2]*

Immersing into the design process using different perspectives allowed better and deeper understanding of the design process. As another student concluded:

> *I was able to expand my thinking and portfolio to address gender and diversity issues in mobility, which is something that I will take forward with me in the future when thinking about new design concepts. (…) I enjoyed working with them and discussing topics that I can now approach in a greater depth than before. [P3]*

A broader and holistic problem-solving that derives from different points of view led to gender and diversity sensitive solutions. Another common theme emerging from student's accounts was that seeing design process through inclusivity lenses was a turning point and `eye opener` in their education:

> *My internship with TInnGO has been an eye-opener. It was my first time designing as a professional (…) I am very glad that I was given the chance to work with other hubs of TInnGO and gained different perspectives on gender and diversity aspects in design. Overall, I am very glad I joined TInnGO for my internship programme as I got to learn a lot from people and about things I otherwise would never encounter on my course. [P4]*

This stance was echoed in other students` reflections pointing out that working with TInnGO was the first experience with empathic design thinking, which calls for creative interactions among members of an interdisciplinary team and end-users.

Lastly, all student interns experienced difficulties related to working remotely. All meetings were held via Microsoft Teams due to global pandemic and some of the students had to adjust for different time zones when working from oversees. Lack of face-to-face interactions was a common barrier in communication. However, in the light of national lockdowns, regular weekly online meetings played a positive role in overall wellbeing:

> *During the pandemic time (2020-2021), this internship was a huge support for my mental health as well, as I engaged in the project with wonderful people (from different time zones). [P5]*

Comments like those above prove that despite a lack of physical meetings and access to design studios, online collaboration can be a positive experience, if carried out in supportive environment.

Discussion

Student interns were guided in the creation of over 30 smart mobility design concepts from received briefs, design ideas or problem suggestions from partners across Europe. For the designers the contexts and users were unfamiliar. Initial ideas and sketches were discussed openly every week. Challenges of initial ideas and assumptions were made based on the lived experience of TInnGO team members who could adopt the role of expert informants. This sharing would not have occurred

without the design provocations. Through this mechanism students were able to develop more empathic insights into the mobility needs of women and diverse transport users.
Reflecting on the outputs of the intern work, there is a clear indication of systems, interacting with further systems. Yet we asked students of transport design, to consider challenges based upon transport. The advantage of being new to the task for our interns is that they are less filtered; their perception is not so clearly defined by experience and to be frank, they tend to be more open minded. So, when they think through the tricky problems of transport, it is interesting that they do not necessarily just design another vehicle (although some examples were created). Instead working on the TInnGO design briefs enabled them to see problems on a macro scale, and only to zoom in to a specific object/task/service/product or vehicle when the surrounding discussion about the brief made that requirement clear.
Assuming that the answer to poor mobility is to design another form of transport is skewed thinking. A different perspective is needed which challenges the perception of root cause of poor mobility – from which solutions may be developed – and that new societal values may inform.
A smart mobility design lens can be used to clarify intersectional issues at the heart of gender transport poverty. It is therefore worthwhile to use design research methods such as co and participatory design, at the start of any transport innovation to ensure that the design team and wider stakeholders have a sound understanding of the users and usage context and wider barriers which may affect uptake of their schemes. Lastly, the field of transport needs to act more in concert with other disciplines to understand its role in tackling wider societal and environmental issues.

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14.15-14.30 / 15.15-15.30 Presentation 32: Thursday, 18th November 2021

Observation checklist for evaluation of inclusive railway infrastructures and transport services: the H2020 DIAMOND project

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Abstract

Despite recent efforts, the measures currently in place to design and manage urban railway and metro infrastructures do not sufficiently consider women's needs and expectations as users of the service. In this regard, the H2020 DIAMOND research project (grant No. 824326) aims at turning data from different sources into actionable knowledge for ensuring the inclusion of the women's needs in current and future transport systems. The project is a collaboration between 8 European Countries (France, Italy, Ireland, Poland, Scotland, Serbia, Spain and the United Kingdom) and brings together urban and mobility experts, transport authorities, computer and data scientists, mobility economists and social scientists. According to the objectives of the project, the presentation will proposes a gender-sensitive approach for investigating women's needs as users of the urban railway and metro infrastructures managed by Zarzad Transportu Miejskiego in the Metropolitan Area of Warsaw (Poland). A preliminary GIS-based analysis of location-based open data (Gorrini et al., 2019) allowed the identification and characterization of a short list of relevant stations, which were successively characterized through onsite observations focused on universal design indicators. Observations were performed by using an ad hoc designed checklist for the annotation and evaluation of relevant infrastructure design and surrounding context characteristics. In particular, thanks to a previous contribution already presented by the authors (García-Jiménez et al., 2020), the checklist was designed by taking into account the most influencing architectural/design characteristics of railway infrastructures with reference to women's needs (e.g., universal accessibility of the environment, furniture and facilities, cleanliness and maintenance of the infrastructures, etc). The checklist was focused on four main scenarios of investigation: (i) area surrounding the station; (ii) concourse level of the station; (iii) platform level of the station; and (iv) carriage. Data collection campaigns were executed by the staff of Zarzad Transportu Miejskiego in January 2020 at different time periods of the day (day and night) in order to capture any variations across commuting times. Onsite observations took the form of researchers visually observing the public and recording their finding on paper. Results were organized in a tabular structure based on a collaborative Excel worksheet. In addition, still-photo surveys of the urban railway infrastructures and docking stations were carried out. The data collected were post-processed through normalization of values (range between 0 and 1), since some of the items included in the checklists were based on Likert scales. Quintile frequency distribution of data related to the analysis of location-based open data made it possible to compare observations results related to the railway infrastructures characterized by high and low levels of accessibility for women (see Figure 1). The objective of the study was to further characterize the selected metro and urban railway stations in order to compare data with other data collection techniques, such as survey questionnaires and social media data from Twitter. The proposed research work represents a valuable support for the activity of decision-makers and transport operators in the EU, by unveiling specific target-users' needs. The data set collected alongside the results of a survey of end users' perceptions on fairness and inclusivity characteristics of the service was also used to predict how those features affect the end users general travel satisfaction in an Bayesian Belief Network. The network was developed and displayed on a web page on line through the use of the Hugin tool and platform (see http://demo.hugin.com/example/TravelSatisfaction for more details).

Figure 1 Observations results related to the railway infrastructures managed by ZTM, as characterized by high (Q1) and low (Q5) levels of accessibility for women.

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15.00-15.15 / 16.00-16.15 Presentation 32: Thursday, 18th November 2021

For who does the transport system care for? – Mobilities of care in cycling

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Introduction

Transport planning and design still focus on how to move people from A to B, where 'people' are expressed in generic terms with little attention to gender or other diversifying social categories (Hanson, 2010). Based in research on cycling as a means of transport, this paper scrutinizes cycling in a Scandinavian context through an intersectional perspective, with a specific focus on the concept of care. Being 'cycling nations,' Denmark and Sweden have a large share of cyclists and in contrast to other countries, and men and women cycle to a similar extent. Does this "cycling utopia" mean that everybody benefits equally from cycling policy, or that cycling can be described as gender neutral? In gender research, the mobilities of care have been highlighted as an important issue for transport research (de Madariaga & Zucchini, 2019). Care trips, which includes travelling with dependents, is a gendered practice that is carried out mainly by women. This implies an empirical focus on care givers. Yet, we argue that the transport system also can be analysed in terms of care, spelled out as a question of who the transport system cares for. By analysing stories of cycling, we will shed light on different forms of care and caring.

Methods

The paper is based on ethnographic field work carried out in two cities in Denmark and Sweden. The material consists of interviews with users and non-users of bike sharing systems, as well as observations and interviews with ethnic-minority women enrolled in cycling courses. The analysis highlights cycling narratives.

Results and conclusions

The results points to narratives of cycling that emphasize the perspectives of cycling parents and inexperienced cyclists. The material aspects of cycling, when it comes to traffic, infrastructure and bicycle design shape the narratives. Our results point to that the present transport system does not care for all. Even though bike sharing systems mainly offer a "one size fits all" model, these systems does not "listen" to the needs of people with caring responsibilities, or with impairments that makes standard forms of cycling difficult. Norms about cycling also makes it difficult for ethnic minority women to adopt cycling as an everyday mode. We challenge policy makers and bike sharing operators to adopt caring as a new practice and start asking how to care for groups that for different reasons are excluded in cycle planning and design today.

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15.15-15.30 / 16.15-16.30 Presentation 33: Thursday, 18th November 2021

Female-only cycling initiatives: An avenue for gender equal mobility?

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Abstract

Across much of Europe, cycling, as both a mode of transport and leisure practice, is male dominated. Women make up under 30% of those using bicycles for everyday transport (Pucher and Buehler, 2012), and in 2014-16, males made three times more cycle trips than females (Sustrans, 2017). In the UK, according to British Cycling (2018), under 24% of participants across recreational cycling events are women.

As such, cycling has become a critical locale for feminist approaches to mobility, as academia and civil society have sought to challenge the marginalisation of women (and other minorities) and identify opportunities for inclusion.

In an attempt to promote women's cycling- and other sustainable transit modes- local authorities, NGOs (and even the cycling industry itself) have established "female-only" cycling groups, events, shared services and other mobility infrastructure. These are initiatives reserved for women, with the aim of encouraging uptake in safe and supportive environments, thus shifting the current gender imbalance. While these have been widely praised for supporting women's recreational cycling, their impact on female mobility and wider gendered power relationships has been less interrogated. If such sex-segregated approaches are to be integrated into gender policies, they must be scrutinised in order to avoid reproducing existing gendered mobility hierarchies.

This paper examines the efficacy of female-only recreational cycling clubs for making active mobility more inclusive for women. Through ethnography and indepth interviews with members of female-only and mixed sex clubs I explore the extent to which they serve as avenues for redressing current gender imbalance in cycling and wider empowerment of women across their wider life course.

Introduction

This research provides clear lessons for gender equality initiatives across Europe and recommendations for future policy agendas.

This paper seeks to assist policymakers by investigating:

- How and why women do- or do not- join all-female cycling spaces
- The value of such spaces for encouraging uptake of cycling, and their shortcomings
- The role of the bicycle and cycling infrastructure in facilitating and inhibiting women's cycling.

Research methodology: moving away from the quantitative paradigm

Research has been dominated by quantitative methods, using macro data and survey samples to trace attitudes and patterns of behaviour (Ker & Tranter, 2003), charting differences between male and female cyclists, examining the volumes of women taking to the saddle (Law, 1999; Gerrard et al, 2008; Hanson, 2010).

However, this often ignores the complexity and multiplicity of individual experience which is central to feminist inquiry and critical for interpreting the ways in which gendered identities and power relations shape cycling, and are reconstructed through cycling behaviours.
As a result, this research adopts a more qualitative approach. Drawing from six months of indepth interviews with women in Cambridge, Oxford and London (UK), who participate in single sex and mixed recreational cycling groups- as well as ethnographies of these spaces- this research explores the influence of female-only cycling clubs in shaping women's mobility, and the factors governing the success of such clubs.

Club cycling as an avenue for studying active mobility
The cycling club is an effective arena for identifying and evaluating the factors determining the take up of cycling for transportation. In the UK, the rise of road cycling for leisure has been accompanied by, and simultaneously strengthened the adoption of active travel. Gender studies has largely ignored road cycling for pleasure; peculiar considering the resurgence in leisure cycling in the UK over the last decade- combined with the fact bikes were originally designed as a form of active recreation, the engineering of the bicycles fundamentally linked to racing (Fitzpatrick, 1998). Therefore, an analysis of the cycling club is a unique opportunity to understand the cultures shaping cycling.
However, the growth of club cycling has been a distinctly gendered and racialised phenomena. Diversity has become a significant concern within cycling clubs, as many have been criticised for their lack of gender, racial and class diversity (Hill, 2020). BAME groups make up just 7% of London's cycling groups (Hill, 2020), while women account for less than 20% in most clubs (Rowe et al, 2016). This has led to criticism of the elitist and masculine cultures in these spaces (Moore & Wyatt, 2018).

As a result, women-only clubs have become increasingly popular options for challenging the absence of female riders and encouraging more women to join. Several organisations including British Cycling have established and promoted women-only cycling clubs and events as an avenue for increasing female participation. British Cycling's 'Breeze' rides have been part of their effort to "close the gender gap" (British Cycling, 2019:24) by encouraging one million women cycling regularly.
Women only clubs such as Velociposse, founded in 2015; Kent Velo Girls, established in 2008; and Team Glow in Manchester- active for over 125 years, have provided forums for amateur female cyclists to ride together. Such clubs have been promoted as inclusion centred spaces and means of building women's confidence and evading the intimidation and harassment many fear when cycling (May, 2018).
Female only cycling clubs are apt spaces to assess the value of female-only mobility initiatives in facilitating greater uptake of sustainable mobility options - particularly cycling. Female-only leisure clubs and events have been the subject of several ethnographic studies, and Green observes these as spaces of "gender work" (1998: 171), where practices and discourses reflect traditional ideologies of femininity, while simultaneously facilitating resistance.
Recent expansion in female-only cycling has seen separate leisure and transport spaces dominate policy debates around gender equality (Women's Sports and Fitness Foundation, 2015; British Cycling, 2019). Single-sex clubs have been widely hailed as avenues for encouraging egalitarian practices and "empowering" women by challenging the androcentricity of participation regimes (Raisborough, 2006).
Female-only mobility initiatives have also become popular in mobility agendas seeking to support gender diversity in transport options- like cycling- where women account for a substantially lower proportion of users, or as avenues for support safety and security. Yet, as we have seen in aborted projects such as single sex train carriages in Manilla and Jakarta, segregation is not necessarily the correct approach, and if it is, it must be designed incredibly carefully.
Indeed, separationist policies are facing growing backlash and many have argued sex segregation hinders gender equity by naturalising binary phenotypes and reproducing hierarchical conceptions of difference (McDonagh & Pappano, 2008); charged with maintaining a "Hegemonic stranglehold on our abilities to think differently, to imagine a better model of gender integration" (Messner, 1990:215).

As this research reveals, such spaces are not necessarily wholly and consistently empowering, liberating and intimate; relations between women mean these are also spaces of negotiation and contestation between differently classed, raced and physically abled participants. At a time when local authorities, NGOs and the cycling industry is seeking to close the gender gap in cycling, this approach is essential if we are to understand the multifaceted ways cyclists' active leisure is continually gendered.

Negotiating Femininities

For a large proportion of female respondents, cycling with the club was an avenue for challenging narratives of femininity which typecast women as docile or timid when riding a bike- and across other everyday activities. Their bodies were at the fore of this, as the women sought to configure and deploy corporeality as capital, in a space where feminine physiognomy is not traditionally conceived as such. The physicality of the ride and ability to push their bodies further and faster- in ways perceived contradictory to normative discourses of femininity- underpinned this active, empowered female identity. Each club ride demands intense physical and mental strength, as well as stamina, to cycle in the club peloton for up to 100km, maintaining the speed set by the group- usually upwards of 16km/hr. The ability to do this each week was a source of great satisfaction for the women in proving their bodies were able to perform at the same level as that of their male counterparts.

These women observe their bodies as the front line in carving and defending their identity and habitus within the club. Control over the body, being able to manoeuvre oneself confidently alongside other riders lends the women a feeling of authority. Thus, foregrounding the body is central to their capacity to prove their standing in the club, by contrasting their physical aptitude against assumed female timidity- what Young (1980) would term 'inhibited intentionality'- they challenge normative narratives which position the male body as the dominant agent.

Self-identity as a club member is forged from this process, the resilience it required to maintain their membership in this male dominated environment underpins their pride in being a strong (female) cyclist. The sense of self-identity produced through this physical improvement was equally true for many men, who also recounted their first forays into the group and despondence on being dropped when discovering they were not fast enough. For women achieving inclusion in the club was more than improving their riding ability, it was a distinctly political process, and required earning respect from male riders in the group.

De-gendering through the bike

Securing their identity within the club was not about total rejection of female stereotypes, rather how they as individuals diverted from these to imitate male attributes. As we see from the comments, comparing themselves with other women cyclists emphasises their own authority and strength as a rider. Where other women are "too slow" or timid, my participants construct themselves as the antithesis. For Julie, riding with other women is a technique for highlighting her own capability; selecting a group with more women ensures she is faster that at least one other member, not building solidarity with other female cyclists.

Thus, their position as a successful female rider is premised on not being a feminine rider; integrating into the club and- as Bourdieu terms it, getting a "feel for the game", was almost a process of de-gendering. Across our discussions, women roundly renounced traits, comportments and cycling apparatus associated with femininity.

Therefore, we see construction of the 'female cyclist' through such phenomenological narratives are not necessarily the direct subversion or challenge to dominant gender discourses, as assumed by much leisure literature (Shaw, 2004); rather we see participants playing into binarized configurations of masculinity and femininity in order to distance themselves as individuals from this dualism. More nuanced understandings of empowerment, resistance and marginalisation are required when understanding cycling and the formation of gendered subjectivity and power relationships.

Single-sex cycling groups

The importance of individual subjectivity within a recognised gender order- as revealed in the above discussion - has critical implications for the design and implementation of gender equality cycling initiatives. This research revealed how female-only spaces may offer a valuable community for supporting leisure practices, yet they risk circumscribing the 'female cyclist' and ignoring the multiple axes of identity shaping individual experiences of cycling.

Many women interviewed chose to cycle with female only groups as well as the mixed sex club. For several, cycling in female only groups became a critical part of their cycling lifeworld, being surrounded by women in a sport dominated by men was a challenge to male control and an assertion of their right to space within the sport.

Yet, most women did not completely abandon mixed-sex cycling, rather they migrated between the two in accordance with what they felt they required from a ride on any given day. Cycling with female-only groups provided these women with a distinctly different sense of community and solidarity from that of the mix-sex clubs.

The women exhibit their emotional bond with these groups- or "tribes" as some defined them, and the feeling of empowerment as a female cyclist. Their engagement in female-only spaces went beyond just the physicality of the ride, it was a political action, as one suggested, a "movement", in subverting the traditional male dominance of the sport and creating what another called a "modern" egalitarian future for cycling.

Yet, these groups did not just represent resistance to gender-based oppression in cycling, they were an affront to marginalisation across their lifeworld. This departs from women's deliberate rejection or obfuscation of femininity in mixed-sex spaces. Where these same women eschew overt displays of femininity in male dominated clubs, here they integrate feminine subjectivity and cycling identities, simultaneously celebrating both.

This disparity poses a critical question for how- and where- leisure is conceptualised as a practice of resistance within feminist literature. There is a clear dissonance between personal experiences, benefits or subjectivities procured from cycling, verses structured relations of power and societal change, one does not necessarily preclude or shape the other.

The role of age in single-sex groups

However, this research also exhibited the imperative for attention to understanding the axes of identity which intersect gender- and often undermine single-sex spaces.

Age was a clear factor deterring their affinity with female-only spaces. For some, cycling with female-only groups did not provide this sense of solidarity and empowerment, rather they felt further marginalised. This feeling of exclusion within a women's only group demonstrates the multiple axes of identity which interweave with gender to structure women's- and men's- engagement with the club. The extent to which women established value in single-sex spaces was fundamentally mediated by age. Leisure studies has paid increasing attention to age as a central organising principle in physical activity (Minello & Nixon, 2017; Wiersma & Chesser, 2011).

Placing the lived body at the forefront of inquiry, research has explored how the physicality of the ageing process structures negotiation of capability and constraint of the gendered body, shifting continually over the life course (Phoenix & Grant, 2009). This was echoed across discussions with cycling club members, as age was a constituent component in how women and men situated themselves within the cycling club and the relationships formed here, magnifying or diminishing the influence of gender.

For many, identity as a cyclist is shaped as much by age as gender. As older riders, many did not hold a sense solidarity with younger women. For many understanding of their bodies changing and slowing with age, against a backdrop of western culture which does not values her physiognomy in the same way it does younger women (and arguably older men), inhibits her sense of alliance with every female rider. As an older woman, she distances herself as much from younger female cyclist as she does men, feeling marginalised by both.

This is articulated clearly by one female rider:

"There are some very aggressive women, nothing wrong with that. But in the same way guys in my club want to cycle with guys their own speed, a lot of the younger women will cycle with the faster groups with older guys."

The exclusion recounted in all female spaces mirrors- if not eclipses- that which she encounters in interactions with male club members, and she is left with the same sense of inferiority based on her body as she does in a mixed sex environment. In fact, one described the exchange as "aggressive", a sentiment she does not convey when discussing her experiences with men. Understanding the significance of age here is critical in delineating the multiple ways gender identity is constructed through the body within cycling and how this structures engagement with club spaces as resistance.
Women's narratives of empowerment in mixed sex clubs centred on individual development and opportunities, not collective female resistance; indeed, they arguably re-intrenched gendered dualisms. In contrast, cycling with the female only club was a wider collective effort to challenge normative gender relations. Both can be conceptualised as forms of resistance; yet, the two spaces produce dichotomous images of femininity and relationships between cycling capital and gendered subjectivity.

Policy repercussions
This research has explored practices and discourses constructing and reproducing gendered subjectivities and power relationships in British amateur road cycling clubs. It exhibits the significance of corporeality, examining how male and female riders negotiate gendered identity and cycling capital through physical movement and comportment of the sexed body. Drawing in contiguous material relations, it highlights the ways such embodied interactions are enmeshed in material-body assemblages, as bicycles, clothing and digital technologies actively shape discursive parameters of the gendered body. Finally, exploring how cycling identities are deployed in organising domestic identities and power relationships reveals the importance of active leisure in structuring relations beyond the club.
Furthermore, in pushing analyses of cycling beyond its preoccupation with quantitative methods, this study placed cycling within individuals' gendered lifeworld, exhibiting how cycling does not just reflect social relations, but actively reconstructs these subjectivities and resulting hierarchies.

These finding hold clear lessons for the design and implementation of cycling initiatives aiming to redress gender disparities, particularly female-only cycling services. Single sex cycling spaces can serve as mechanisms for encouraging women into cycling and have social benefits beyond the act of cycling itself. However, such clubs and services must not presume women hold a shared identity based singularly on their gender; their needs and desires around cycling are shaped by age too.
Policy makers and the cycling industry must build on this research to work with women to establish and shape services which accommodate their needs and desires as cyclists, understanding the multiple and often conflicting axis of identity at play in these spaces. While this will not be an easy task, this research reveals the considerable rewards of putting in the hard work.

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15.30-15.45 / 16.30-16.45 Presentation 34: Thursday, 18th November 2021

Opportunities and challenges for women using bike sharing services: DIAMOND data collection results

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Abstract

Gender responsibilities exist to some extent and have a significant impact on women mobility. Due to constructed normative roles, women make more shorter and multi-purpose or multi-stop trips than men. Most of these trips patterns make the use of public transportation time consuming and inconvenient. Cycling/Bike-share provides a better alternative for such trips when service is consistent. Women cycle less than men however. Evidence suggests that the gap in gender split is gradually closing bike-share users than general cycling. There is gender difference in terms of trips people make for many purposes, due to constructed normative roles. These include: Shopping, travelling with kids, visiting GP, School trips, Work trips and Leisure/recreation. Bike sharing provides better mobility for women in short trips, multi-stop trips, mixed-mode journeys, tourist (visiting places). The current bike-sharing services are good for leisure/recreation trips but is limited support for shopping trips, does not always support all multi-purpose / multi-stop trips does not often support trips involving children and does not always support trips within the outskirts. Some users comments include: "And I remember the freedom when I finally took the plunge. And seeing Paris from another perspective". It's really a mode of transport that brings lots of joy, the feeling of being free when you cycle". "… offers huge freedom. It's great. For me, it means being rid of all restrictions". Such indications endorse the urgent need of facilitating these options of travel on equal basis. The investigation highlights the needs to include: Visibility and security at the stations and paths, availability of equipment for transporting kids and

goods and protective Infrastructure (separating cyclists from vehicular traffic). The users reported that a wide range of barriers to the use of bike-sharing services still exist. These include: shortage of bikes at the station, limited and unsafe infrastructure, lack of appropriate equipment and accessories and safety. The recommendations of this research highlight four areas of improvements; design of bikes, safety and security, considerations of culture aspects and accessibility issues.

Keywords: Bike-sharing, Gender, cycling, women

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Session IX: Users of public transport: New approaches looking at gender related issues (in parallel with session VIII)

15.00-15.15 / 16.00-16.15 Presentation 35: Thursday, 18th November 2021

"EAASI" A Gender- and Diversity- Sensitive Usability Evaluation Tool

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Abstract

The TInnGO project encourages a gender and diversity perspective in design and deployment of smart mobility products. The project has established 5 key criteria – products should be effective, attractive, affordable, sustainable, and inclusive. To encourage designers to focus on these indicators and to inform procurement teams and organisations choosing a product, we developed 'EAASI' - a tool for evaluating smart mobility products from a gender and diversity perspective. The tool consists of a checklist of questions regarding gender and intersectional diversity. It was refined through the design experiences of the UK Hub evaluating products in use and 'design provocations' developed during group work with design students. The focus of this tool on gender- and diversity-smart thinking in transport gives it a strong appeal over more generic 'usability' methods and assessment tools.

Introduction

One of the aims of the Transport Innovation Gender Observatory (TInnGO)[1] is to encourage the development and adoption of smart-mobility ideas and products that are 'gender and diversity smart'. The project established five key criteria for assessing gender and diversity smart mobility: *Effective,*

7 https://www.tinngo.eu/

Attractive; Affordable; Sustainable and Inclusive. To assist users and evaluators of products we have developed an evaluation tool 'EAASI', (an acronym of the criteria) a checklist extending the concept of generic product usability to include 'gender and diversity smart' criteria. The challenge was to make gender and diversity smart criteria *explicit in an evaluation*. In particular, the last criteria 'inclusive' needs to cover a wide brief, reflecting the usual aspects of 'inclusive design' relating to physical and cognitive ability, (in other words, 'accessibility') and a focus on gender and other aspects of diversity.

Context

From a product usability perspective, product evaluation usually combines the use of 'evaluation checklists', (a concept owing much to an Ergonomics approach), together with a practical evaluation methodology involving real human users who represent the target audience (often called a 'usability evaluation' or 'user trial' and ideally used throughout the product design process). The 'evaluation checklist' approach exposes the product to an 'expert review', in which checklists are used to rate the product against standard and mutually agreed criteria. The 'usability trial' approach involves task-based evaluation with real users, representing a range of typical or target users, with an expert facilitator to guide the evaluation and collect data through observation, user feedback, interviews, focus groups etc. To ensure inclusivity and consideration of age, gender and varied ability differences, any checklist or test design should address the needs of a wide range of users.

The traditional criteria considered when focusing on 'Usability' in product evaluation are: Efficient, Effective, Engaging, Error tolerant and Easy to learn, with some variations according to the context, (Van Kuijk et al., 2015). An 'inclusive design' approach should cover product adaptability and accessibility in the early design stages, and return to these as design and development progresses, but in many cases 'accessibility' is often treated as a separate stage or area of responsibility. Inclusivity to extend to gender and diversity is often implicit, not explicit.

The concept of 'Sustainability' is also absent from the traditional functional approach to product evaluation. In TInnGO our five criteria require that 'Inclusivity' and 'Sustainability' be made explicit in the evaluation, while 'Affordability' is also necessary for the widest inclusivity and to comply with the UN Sustainable Development Goal 1 of eradicating poverty, which in our context, means 'transport poverty' affecting access to employment, education, leisure, and services, (Lucas et al., 2016, Iqbal et al, 2020).

Checklists using paper or online forms to generate design-related information are a wellestablished method in the 'Design for All' arena, since the days of USERfit, (Abascal, 2003)[8]. However, using desk-based research (largely focusing on design resources), we did not discover any one evaluation 'tool' that could combine usability with our key criteria, to focus on gender and diversity mainstreaming, and sustainability within the context of 'Smart Mobility'. To achieve this synergy in EAASI, we brought together the five criteria drawn up by the TInnGO project, developed into a checklist through testing and refinement against existing products and product ideas developed within the project. This is not a 'score-sheet' approach. Rather it is a means of providing relevant 'questions' for designers to ask in evaluating a product or design against all the necessary criteria. Answering these questions provides an overview of how well the product meets its design goals, together with the 'gender and diversity smart' criteria – and where it falls short, to inform designers with a *rich description* of where needs

8 USERfit is a well-established methodology focused on the generation of usability specifications. It was created for the assistive technology field and proved to be very suitable for the 'Design for All' paradigm.

are met – or not met, offering scope for further development of the product or design brief to meet those needs.

Influences

The EAASI checklist is influenced by The Cambridge Inclusive Design Toolkit, (Clarkson et al., 2007), which focuses on an Ergonomics checklist approach, set against a database of population statistics, to calculate what proportion of the population will be excluded from using a tool, artefact, or service, depending on accessibility criteria. The Cambridge product's focus on *identifying who is excluded and why* is especially useful, when thinking about 'inclusivity' and in respect to the needs of inter-sectional groups, (Waller et al., 2013, Keates and Clarkson, 2004). Asking 'Who is excluded?' is incorporated into the EAASI checklist.

The checklist is also influenced by the UK Design Council's insightful online article 'Designing for Diversity' (Jenkins and Baker, 2019), which takes the concept of 'Usability' beyond the purely functional to accommodate Physical, Sensory and Cognitive features. These features are then set *alongside* an approach 'Designing for Diversity' which considers factors of: Age, Diets, Culture and Customs, Language and Communication abilities, Education and Training, Income and Social Class, Ethnicity, Gender and Sexuality, Size and Shape. The UK

Design Council has also launched a 'systemic design framework': 'Beyond Net Zero: A Systemic Design Approach', (Design Council, 2021). This approach combines a focus on sustainability, with a 'systems thinking' approach to design that includes 'people and planet'; micro to macro; inclusivity and welcoming difference; creating safe, shared spaces and language to bring in multiple and marginalised perspectives; collaborating, reuse and regenerative ideas.

These all point to a general new direction in design thinking. This design framework synergises with TInnGO's focus on sustainability and on inclusivity. The EAASI tool fits very much into this 'people and planet' design framework.

Evaluation against design goals

The EAASI checklist evaluates products or services using what we have learned in the TInnGO project – the five 'smart mobility indicators' are identified by TInnGO as important in achieving smart mobility that is gender and diversity sensitive, inclusive and sustainable. However, the 'Effectiveness' of a product or service must be judged against its own design goals or design brief – who was it created for to solve what problem? Where products are already in the marketplace, we cannot see full briefs or know the full design intention. We can however use online marketing descriptions etc. to discover what design problem the product was intended to solve. When evaluating, it is helpful if the evaluator can discover what the design process was – and how the design brief was created – i.e., was there some co-creation involved – were diverse people consulted? It is not always possible to know this, of course. In the EAASI checklist, this question also acts as a prompt to commissioners/designers to consider their user research and how far they are consulting any target users.

It is important to be specific about what aspect of the product is being evaluated. For example, in the case of a bus design – is it the exterior, entrance and exits, or aspects of the interior – or both? Are we including the service model, such as ticketing – or simply the product itself? EAASI ensures this is made clear on the evaluation.

Recommendations are also an important method of prompting deeper thinking, for example, in EAASI evaluators can suggest 'What would need to change about this product – to make it better from a 'Gender and Diversity Smart' point of view?'.

Intersectionality

TInnGO has focused on the concept of intersectionality – that a person is made up of more than one characteristic – so assessing the design of an artefact will not be from just one perspective e.g., older people, different abilities, women, but consider potential intersecting characteristics (Hankivsky, 2014). We aim to broaden the evaluation of transport and mobility needs, so EAASI repeats a list of groups for each criterion, to prompt evaluators to keep intersectional characteristics in mind when looking at context of use and fitness for purpose. To assist evaluators to visualise 'Intersectionality', the EAASI tool introduces the 'TInnGO InterSectional Design Wheel'. This is an emerging output of TInnGO which helps to visualise the layers of intersecting characteristics against the five indicators. In this diagram we indicate three different levels, with intersectional characteristics in the yellow and pale blue circles, with the five EAASI indicators set against them. Any of these layers could spin around the circle and intersect with elements on the other discs.

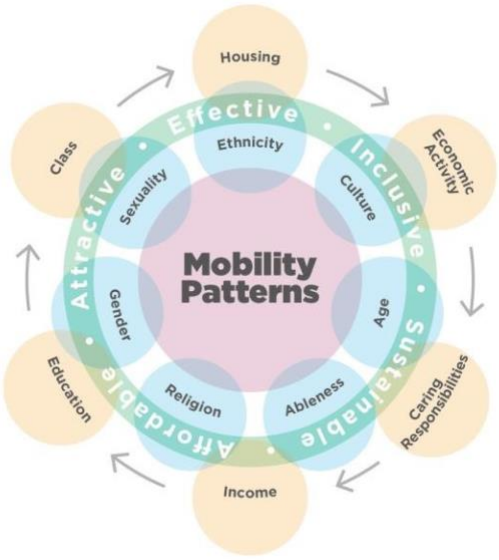

Figure 1 TInnGO Intersectional Design Wheel

Rating System

It is useful to be able to make comparisons, between a group of evaluators, or between products. For this, a rating system needs to as unambiguous as possible. We trialled a variety of rating systems. 'Traffic lights' with colour coding was considered but quickly rejected as being poor ergonomics (issues with colour blindness and different systems for 'Traffic lights' around Europe). Awarding 'stars' such as in online review ratings was also trialled, where 5 stars was the highest rating to 1 star as the lowest rating, 3 as neutral. A 'star' system is very familiar to users of online reviews, however what is not so commonly understood is that the star system is like a 5-point Likert scale in that 1 star is poor, 5 is excellent, and 3 is neutral – so 3 often means only just acceptable. This could easily be confused with a system where even 1 star is a 'good rating', up to 5 for excellent, as opposed to no stars at all. Because of this lack of clarity this system was discarded.

We arrived at an evaluation system that focuses more on prompting evaluation comments and recommendations, rather than simply awarding a 'mark'. In this way, the tool can be useful for designers, developers and procurement evaluating, adding value over the use of a rating scale. Some element of rating is left in the tool with a percentage mark awarded and a 5-point 'Smiley' assessment, which is reasonably cross-cultural and doesn't require translation.

Part C: Overall Assessment

This is intended to summarize how the product fits with its own defined goals and how far it meets 'Gender and diversity smart' criteria. The Evaluator should complete a rating based on the ratings per each indicator already completed.

Does the design meet its own goals?	Percent	Smiley	Notes
e.g. The e-scooter meets the design brief needs of appealing to young people and active, reasonably fit commuters who may choose to integrate use of an e-scooter into their daily commute from a train or bus hub.	*80%*		
e.g. the e-scooter could be an alternative to bringing a car into the city	*70%*		
Does the design meet the Gender & Diversity Smart goals - EAASI?			
1 - Effective Is the product effective?	43%		*Effective for those who can use it – speedy and anywhere within city*
2 - Attractive Is the product attractive to a wide range of users?	34%		*Attractive to certain groups of users, mainly younger persons, possibly more males, but not others*
3 - Affordable Is the product affordable to a wide range of users?	52%		*This is a Shared transport solution so affordable depending on charges for users and break even point for providers*
4 - Sustainable Is the product sustainable / does it encourage sustainable behaviour?	55%		*Good sustainability, as alternative to car travel, easy maintenance, OK so long as they are not stolen*
5 - Inclusive Is the product inclusive from the point of view of gender and diversity? From the point of view of Accessibility?	6%		***Not very inclusive**, does not support chained trips, useful only for those with fitness and confidence, appropriate clothing, minimal luggage, reported to have negative effects and even dangerous to some disabled and elder pedestrians. Not inclusive for people with disabilities.*

Key

Excellent (70 to100%)	Good (60-69%)	Satisfactory (50-59%)	Poor (40-49%)	Fails this indicator (0-39%)

Figure 2. EAASI example summary page

Using the checklist

The checklist tool aims to address each of the TInnGO five smart mobility indicators plus some additional checkpoints for Accessibility, incorporating key questions to address gender and diversity, and drawing attention to distinct user groups to ensure that their perspectives are considered in the evaluation. The checklist provides for each Indicator:

A definition of Goals for that product and how it would meet them

A list of questions related to that indicator – with boxes to complete answers

A list of User Groups which might need a special consideration or note – with boxes to complete answers

The list of user groups is *repeated* for every indicator to ensure all groups are considered by the evaluator, apart from 'inclusivity' where it is implicit. Answers can of course be left blank – what is important is asking the questions and thinking about the groups in each section.

The checklist is designed to be used in several contexts: by evaluators, working singly or as a group to evaluate a product for procurement to check how 'diversity or gender smart' it is; by designers as a self-checking tool; or by independent evaluators perhaps comparing marketplace products for review. There is always a subjective element to product evaluation, and although using the checklist will reduce subjectivity, several evaluators are usually better than one alone: a small team could use the checklist (perhaps independently at first) then discuss and evaluate co-creatively and then arrive at consensus.

The EAASI tool can be found with a blank template and a worked example on the TInnGO Website, https://www.tinngo.eu/.

Acknowledgements

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16:05-16:25 Presentation 36: Thursday, 18th November 2021

Factors effecting the mobility of breastfeeding mums in public spaces

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Abstract

This study explores barriers to mobility and freedom of mums who would like to breastfeed in the public domain. Desk based and ethnographic interviews have been used to extend and discuss conceptual design provocations through an analysis of the relationships between breastfeeding behaviours, acculturation, embodiment, and social identities. This has implications for practice, policy and design. Future designs should recognise and address the complex needs of mothers, especially marginalised mothers, who are more likely to disappear from public spaces in order to avoid breastfeeding in public. As such their mobility, health and wellbeing, and that of their children may be effected at a time when they need additional support and consideration.

Introduction

The UK has some of the lowest breastfeeding duration rates in the industrialised world. In the 2010 UK Infant Feeding Survey, 81% of mothers in the UK initiated breastfeeding, but only 34% and 0.5% were breastfeeding at 6 and 12 months respectively. The prevalence of breastfeeding is particularly low among very young mothers and disadvantaged socio-economic groups, potentially widening existing health inequalities and contributing further to the cycle of deprivation (Brown, 2019). Yet, very little is known about women`s breastfeeding experiences outside their homes (Spencer, 2008). Some argue (Boyer, 2012) that despite campaigning for positive attitudes toward breastfeeding, mothers in the UK are still marginalised and censored in the public sphere, what has significant impact on mobility of breastfeeding mothers and their overall health and wellbeing (Yantzi et al., 2007; Ahmed et al., 2008). Lack of support for public breastfeeding may prevent women from breastfeeding in public may limit or even prevent them from taking recreational and shopping trips and participating in social life. Thus, the main aim of the research was to investigate infrastructural and environmental, as well as social and cultural, barriers to breastfeeding in the public and in public transportation. Its aims are three-folded. Firstly, to identify experiences, attitudes and beliefs related to breastfeeding in public across different populations. Secondly, to understand barriers to breastfeeding in public and travelling with infants. Thirdly, to identify needs for products or designs solutions in public areas and transport that would encourage breastfeeding.

Background

A number of different factors have been associated with breastfeeding cessation. Biological factors are very often presented by the literature as the primary reason for ending breastfeeding (Binns and Scott, 2002; Bolling et al., 2006; Morrison et al., 2019). Alongside biological barriers, social factors and environmental factors also contribute to breastfeeding cessation such as: mother`s return to work (Walburg et al., 2010; Dagher et al., 2016; Mangrio et al., 2017), family history and prior exposure to breastfeeding (Emmott et al., 2020). Another determinant of breastfeeding behaviour are demographic characteristics such as: socio-economic background, age, education, marital status and ethnicity. It has been established that among variables influencing early cessation are: younger age of mother, lower level of education and lower household income (Burdette, 2013; Brown, 2019). In the

UK, young white mothers from low income households are at the highest risk of stopping breastfeeding or not breastfeeding at all (McAndrew et al., 2012).
There is no research looking into particular groups of minorities nor relationships between their mothering practices and infant-feeding practices in the UK. More importantly, there is very little narrative from migrant women about changes in breastfeeding practices after transition to a new country (Kimbro, 2008; Choudhry&Wallace, 2012; Gibson-Davis et al., 2005).
There is a growing body of literature, which seeks to understand barriers to breastfeeding by exploring the perspectives of breastfeeding mothers (Afoakwah et al., 2013; Nelson 2006). Despite the existing literature, a number of researchers have argued that insufficient attention has been paid to the experience of breastfeeding (Spencer, 2008; Mozingo et al., 2000), particularly in a social context (Leeming et al, 2013). While breastfeeding in the public has received some attention it is still unclear how this translates into the lived experience of mothers, particularly mothers from different ethnic backgrounds. Consequently, there is very little research focusing on mothers from diverse urban communities representing ethnic minorities and marginalised groups whose voices are absent from current discourse. Thus, a more holistic approach is needed to acknowledge co-existence of multiple experiences including those not embedded in dominant culture. Understanding more about the obstacles women have to face in built environment may help to reduce the gap in breastfeeding rates between different demographic groups.

Methodology
A theoretical framework for this study draws on an intersectional approach that acknowledges overlapping social identities that historically were associated with discrimination and exclusion (Crenshaw, 1991). This approach goes beyond `identities` theory` and recognizes how the interplay of different characteristics such as gender, race, age, sexual orientation, disability and geographical location can interact at multiple levels and exacerbate existing power relations leading to oppression and exclusion (Crenshaw, 1991; McCall, 2005; Murphy et al., 2009, Collins & Bilge, 2016). Consequently, an intersectional approach can provide a conceptual framework for research on social justice and distribution of resources via public services (Bauer, 2014). By facilitating an in-depth holistic view on human experience, the intersectional framework became common lenses for research on public health inequalities (Bowleg, 2012). The need for intersectionality has been also recognised in research on mobility, transport poverty and urban well-being (Alam et al., 2019).

Method
A qualitative mixed method design has been adopted. The data discussed comprises of:
Visual analysis of over 100 images from Instagram. The data discussed here come from two hashtags on Instagram, #breastfeedingjourney (140,368 posts) and #breastfeedingmoms (64,191 posts).
Thematic analysis of stories from Mumsnet Forum. Forum was searched for instances of threads containing: `breastfeeding`, `public`. The first 100 stories were used.
In-depth interviews with 8 breastfeeding women from Birmingham, Coventry and London, and 3 interviews with community-based practitioners working for registered nationwide charities in the UK promoting natural breastfeeding.

Interviewing new mothers was to explore lived experiences of breastfeeding in the public areas. Interviewing practitioners facilitated two goals: to understand support service provision that is available to breastfeeding mothers, and to identify patterns in struggles and barriers experienced by new mothers in built environment or transport. All interviews were carried out over the phone or

online due to the global Covid19 pandemic. The majority of Mother Participants were non-British white, first-generation migrants. There was one British participant. The majority of interviewees were Polish origin and although they spoke English, they chose to share their stories in native language.
All of the Mothers-Participants had recent experiences of breastfeeding in urban spaces in the UK. For each account, contextual factors were considered including socio-economic background. This was allowed due to Demographic Questionnaires that were given to participants after each interview.

Intense moment of intimacy between mother and child

The data discussed here come from two hashtags on Instagram, #breastfeedingjourney (140,368 posts) and #breastfeedingmoms (64,191 posts). The images have been collected alongside the texts discussed below. They are fairly similar in style, often featuring a selfie with the child feeding. They demonstrate a range of locations, e.g. parks, in homes, but are often less 'busy' (i.e. there are few taken in urban-looking spaces, shops or restaurants – although it's difficult to say how much location could be determined by Covid regulations). The majority of women in the images are white, with a few exceptions. The hashtag #breastfeedingmoms is more popular than #breastfeedingmums, which is why this hashtag was followed. This may lead to a more American sample, however there are also a number of captions here that are not in English, or where English and another language have been used.
For many of the women posting images to #breastfeedingjourney and #breastfeedingmoms on Instagram, the practice of breastfeeding was presented as an intense moment of intimacy between mother and child. For example:

Extract 1
"…I love that I am still his safe place. When he needs an emotional reset, nursing him ends up being the break I need, too..."

Extract 2
"…Some things never change .. look at [Anon's] position! It's always like that! she still always falls asleep hugging my boob and listening to my heart beat!"

In extract 1 and 2 and across the data, the breastfeeding moment represents a reciprocal bodily and emotional experience. In extract 1, the "emotional reset" is prompted by the child, allowing the nursing mother to also take time out. While in extract 2, the body is reciprocated – the sleeping child imagined to be falling asleep to the mother's heartbeat. For many women, this deep intimacy was connected to a sense of this intimacy being unique, for example:

Extract 3
"…There are days where I have enjoyed these special slow moments together, being able to be the only person who can care for [Anon] in this way and enjoy those long gazes when he looks up at you…"

As above, this connection was facilitated by a bodily interaction. In all the extracts discussed above, there is a temporal aspect to the intimacy being experienced, since the breastfeeding experience is either presented as an ongoing return, in the word 'still' (extracts 1 and 2), or where the women highlight "days" and the slowness of time.

Negotiating a space. Not leaving it.

Data collected on Mumsnet Forum shows public breastfeeding as a problematic, yet unavoidable practice. It appears that women were aware of ambiguous attitudes in society toward breastfeeding in public. They also wanted to protect an intense moment of intimacy between mother and child. Therefore, they were often adapting different strategies to manage it discretely or to cover themselves. In many cases, covering or shielding was the only option as there was no designated space for parents with little children. Many threads provided a list of recommendation on how to combine appropriate clothing with a shielding scarf or blanket. Like in following comments, it is all about shielding private sphere from the public.

`Yes to taking Dh [dear husband] or a friend, it is nice to tuck yourself in a corner and stick someone`s large back between you and the room. […] Things that gave me confidence were taking someone with me as a human shield.`[A9]

Shielding and covering theme was the most prevalent. Using covers, scarfs, bags or any other method of shielding women were trying to combat negative attitudes toward breastfeeding in public and negotiate own place in urban environment. It was more about adapting of `what is` in the urban space rather than avoiding or leaving it. It was very often translated into search for the quiet corner or quiet, resting sites:

`I gave up in the end, but the few times I did feed her in public I did try and find a quiet corner.` [A11]

These practices were evidencing negotiating space within both: built urban environment and cultural construct of female body understood via gender scripts as sexual entity. Consequently, leaving the space was not a solution to the problem. In many threads women complained that going to a separate room or car is not only not accessible at all-time but also not practical if they are out with other children, family or friends.

Normalising instead of stigmatising

The majority of interviewed mums reported that they found breastfeeding outside the home challenging, specifically, in the first few weeks after birth. Moreover, comments from the migrant mothers showed acculturative practices affected their nurturing and mothering. In other words, all mothers who had had experience of breastfeeding in their country of origin and then in the UK reported they changed their behaviour and tried to adjust to the dominant culture.
This is illustrated in quote from Senait, Eritrean refugee mother of five:

In our country it`s normal, even in busy places, you can have a lot of strangers around and still breastfeed but in this country you can`t, you need to cover or something like that. You cannot feel relaxed if you have people around you they will look and make you feel ashamed. So I always prefer to give him bottle when I`m outside… so yes, if I have to go outside I try to feed him with bottle; for instance if you are on the bus you can`t breastfeed, you have to be all the time cover; my baby boy is just one week old and I`m all the time home but soon I`ll start going out and I need to plan feedings with bottles [Senait]

Senait after arrival to the UK completely changed her breastfeeding practices outside her home. She was a mother of three at the time and pregnant with her fourth child. She stopped breastfeeding in

public and would prepare bottles with expressed milk every time she went out. Senait was certain this time she will continue expressing her milk before going out.

Interviews with practitioners working with breastfeeding mothers confirmed that more vulnerable mothers were hard to reach. Interviewees pointed at different factors contributing to vulnerabilities: socio-economic background, living in deprived areas, ethnicity. English language seemed to be a barrier in accessing professional support. Normalising breastfeeding, creating friendly supportive environment were frequently mentioned. However, it emerged that efforts to normalise breastfeeding in urban settings can turn to stigmatising:

Physical environment is one of the barriers; look at the geography of offices, they moved to large glass open spaces, where you share your desk, very few people have private offices now […] We worked in one big organisation in London to improve breastfeeding opportunities for their employees; if you are a new parent going back to work physical space is challenging. Sometimes you can use meeting rooms but they have glass walls too; something like a breastfeeding pod obviously feels like a solution but it`s sending a very strong message, it says that breastfeeding is not to be seen by others and I don`t think it helps to change the culture around us; I think it`s inevitable that pod will exist and parents if they feel uncomfortable may use it; but it`s not a long term solution; its` perpetuating that feeling that breastfeeding must be private. [Gemma]

This stance was echoed in other interviews with practitioners pointing out that creating inclusive, supportive environment for women with babies does not require sophisticated architectural solutions and can be incorporated into existing urban landscape. It appeared most mothers would be happy with safe, dignified space to sit down that would not necessarily isolate them from surroundings and make them feel excluded from urban space.

Existing and new designs

Breastfeeding facilitates an intimate relationship between mother and baby. There is some evidence from built environment suggesting that existing designs for breastfeeding mums do not recognise and do not protect the moment of intimacy between mother and her child (Figure 1, 2). Moreover, some of the designs follow `public toilet aesthetics`, which makes impossible to enjoy intimate moment between baby and mother.

Figure 1. An example of existing design following `toilet aesthetics`

Figure 2. An example of existing design

Above solutions exemplify how existing designs rather than helping to integrate breastfeeding into the day-to-day life of the city, set it farther apart. In this sense, they contribute to excluding breastfeeding mothers from public sphere, and keep them out of view.

Nursing spaces both transmit messages about how breastfeeding should occur, as well as shaping how it can and does occur. To consider nursing room as a space to protect the moment of intense intimacy without excluding mother and her child from urban space I would like to refer to a nursing pod design (Figure 3.).

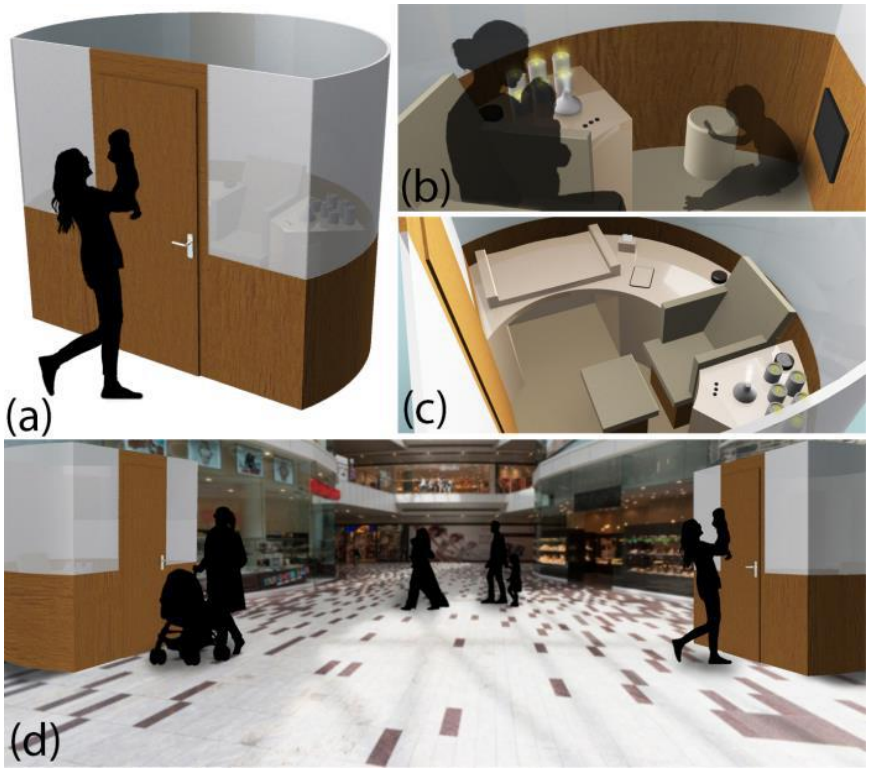

Figure 3. Nursing pod design: exterior with frosted panels/windows (a), interior (b) and (c), and in a public shopping centre location (d).

The pod could offer a private space where women can breastfeed and relax with their small families in public spaces such as in shopping centres, airports, etc., without feeling isolated from their surroundings. The inclusion of music, aromatherapy, and lighting within the design creates an experience that is uniquely comfortable and relaxing, compared to its competitors. This design was developed on the WEMOBILE project , and further developed on the TInnGO project .

Conclusions

Despite many other researchers noting the heteronormativity of pregnancy on Instagram and similar social media platforms, the content in relation to breastfeeding primarily focuses on the relationship between mother and child – with little mention of significant others in the texts. Thus, design solutions should protect an intense moment of intimacy between mother and child. Additionally, variation of approaches to breastfeeding in the public space amongst interviewed mothers calls for intersectional lenses in future design concepts. Data shows that more vulnerable migrant mothers need more environmental support to breastfeed in public.

Vulnerable mothers were also more like to feel pressure to shield, cover, leave the space or change everyday mobility behaviours to facilitate breastfeeding.

Future designs should take into account all range of barriers to breastfeeding mum in public spheres, including environmental, infrastructural, cultural, social, organisational, and personal challenges (Figure 4.).

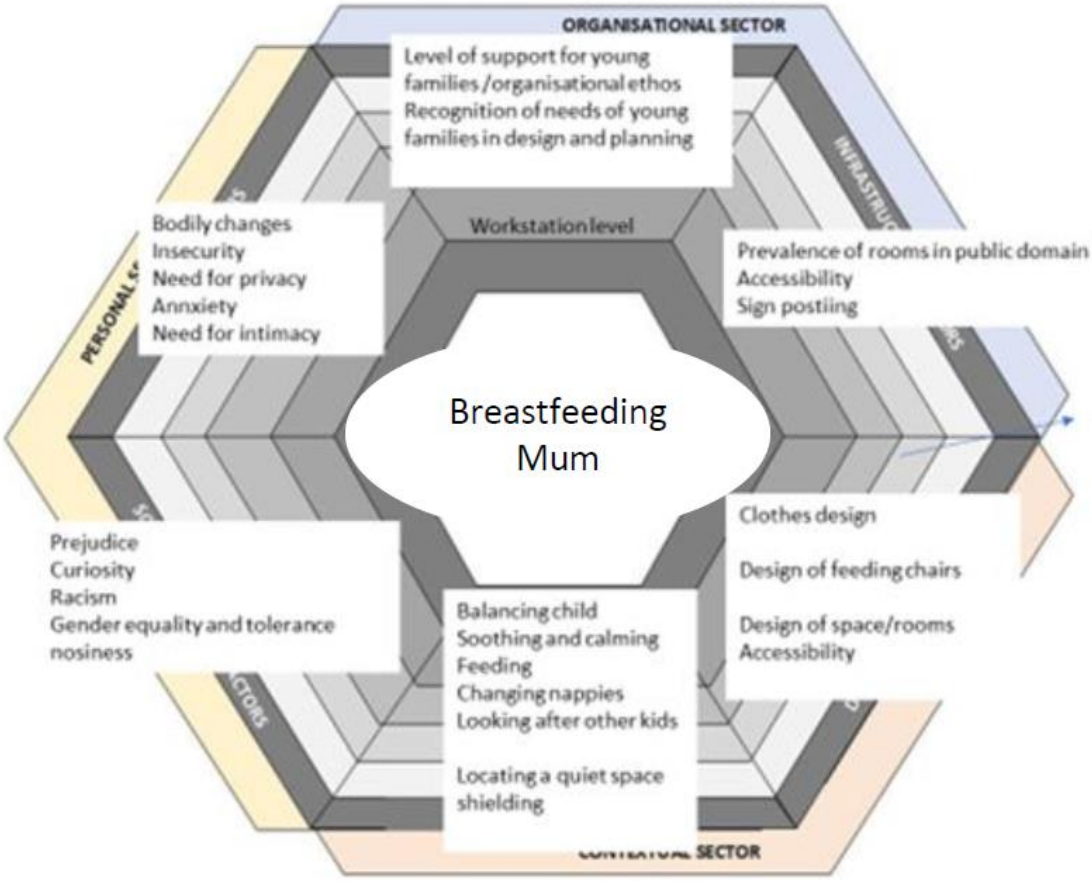

Figure 4. Barriers to breastfeeding mums in public spaces

Designs addressing nurturing mothers or parents should renegotiate the built urban environment to provide support to all demographic groups, whilst taking into consideration the accessibility determined by intersecting social identities and power relations within personal and political dimensions.

Acknowledgements

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15.30-15.45 / 16.30-16.45 Presentation 37: Thursday, 18th November 2021

Issues raised and challenges faced by women in surface transport from Diamond data and the diamond idea of maturity model for Service provision evaluation

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Abstract

The main goal of this presentation is to identify possible differences in needs and perception for fairness characteristics of urban and suburban rail services and how they impact users' satisfaction considering also socio–demographic features. A survey was conducted in a Polish and in a Spanish Rail Service operator on trains and stations at pre–approved routes and times. The survey was conducted as part of an EU project called DIAMOND aimed at identifying key drivers for a fair and inclusive transport system. The findings indicate that different socio–demographic factors and attributes affect users' travel satisfaction between the two carriers. For Southern users, among socio–demographic variables: 'Nationality', 'ethnicity', 'sex', 'having experienced discrimination' and 'travel to work method' were useful to explain their travel satisfaction; whereas for Eastern users: 'Age', 'education', 'status', 'ethnicity' and 'travel to work method' were found to be significant characteristics to explain their travel satisfaction. Regarding the attributes included, for the Spanish sample users the variable marked as 'Travel info updates and announcements' showed a very significant weight on travel satisfaction; whereas for the polish sample users the variable marked as 'travel satisfaction security' showed the most significant weight on the travel satisfaction.

Following up on the data analysed and collected we were also able to formulate an approach to help transport organizations evaluate how fair and inclusive their services are based on a so-called Fairness Maturity Model. The model was based on a similar model used to assess safety culture in offshore industry issued by the UK HSE (Fleming 2000). The maturity model concept is particularly useful in the context of the DIAMOND project because it can be used as a diagnostic tool, to enable transport organisations to establish their current level of maturity and the actions required to reach the next level. The core elements that form the safety culture maturity model have been adapted from the

safety culture components listed by the UK HSE in a guidance document called HSG48 (HSE 1999) and adapted to incorporate key fairness characteristics identified from the survey carried out on users of public surface transport in Ireland, Poland and Spain within the Diamond project. In summary the Fairness and inclusiveness dimensions considered are those aspects that different and diverse female users find important for a comfortable, safe, and useful service or for inclusive and fair employment in transport (From more details see Leva et al. 2021).

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Friday, 19th November 2021

Keynote

08.15-08.45 / 09.15-09.45 **International keynote speaker:**

Dag Balkmar[1], Susanne Andersson[2] and Anne-Charlottes Callerstig[3]
[1,3] *Örebro University, School of Humanities, Education and Social Sciences Örebro, SWEDEN*
[2] *Stockholm University, Department of Education, Stockholm, SWEDEN*

Women truck drivers and (future) mobile work: Towards gender equal transport futures?

Introduction

This paper focuses gender and gender equality in contemporary and future haulage business, arguing for a need for norm-critical approaches to build more gender equal transport futures. Currently, there is a general demand for more drivers internationally and in Sweden. Following the current driver shortage in occupational road freight, transport companies in Europe and Sweden recognise the need to recruit more women chauffeurs. Part of the problem is how transport is gendered, strongly intertwined with masculine norms that prevents nonnormative bodies to identify themselves as drivers. In Sweden, a country with a world reputation as champions in gender equality, men still make up more than 90 % of the work force in the Swedish transport business. While recruiting more women would contribute to solve the urgent problem of driver shortage, women drivers typically face *gendered* problems, concerning their personal safety, harassments, hygiene, and work/life (im)balance. From the perspective of the haulage business, addressing these gendered problems can increase the ability hire more women drivers, but would also need to develop transport innovations that suit not only today's male users but also those of tomorrow.

Future road freight and transport innovations such as more autonomous vehicles are often imagined to 'solve' some of the current problems that transport companies struggle with, including driver shortage. With the advent of autonomous, electrified and connected mobilities, we may anticipate both a gendered re-segregation and that fewer drivers would be needed (Balkmar and Mellström 2018). Nevertheless, problems of road transportation and the lack of gender equality in the haulage business can't be solved following the "old logics of a technological fix", gendered social and cultural issues need to be part of the solution (Kröger and Weber, 2018). Against this background, the aim of this paper is to explore how normcritical perspectives can offer ways forward with regards to gender and (lack of) gender equality in the haulage business. This includes to consider how technological innovations may change what it entails to be a truck driver and open new opportunities for the profession with regards to gender equality.

Norm-critique and non-normative bodies

This paper builds on an interactive project performed in collaboration with one of the world leading truck companies in Sweden on norm-critical innovation. In the project, a process was initiated to reflect upon how invisible and implicit norms may lead to specific privileged perspectives prevail, including how norms can be made visible and modified. *Norm-critical* refers to the analytic process of detecting and de-constructing norms. *Norm-reflexivity* refers to the process of reasoning about the impact of norms and the consequences that different norms might have for the outcomes in terms of inclusive/excluding innovation. The goal with such a norm-critical methodology was used to visualise implicit taken for granted norms in the haulage business and co-create tools for change. This was done by a) making visible women's non-normative experiences and their coping strategies for working in a male dominated business, and b) utilising norm-breaking technological innovations (in this case,

electrical trucks) to inspire workshop participants to imagine categories of users beyond the male norm.

Like other designed artefacts, trucks are technologies that may express and reproduce, gender stereotypes (Petersson McIntyre, 2015). Some bodies are recognised as "the rightful holders of certain places, such as the driver's seat in a [truck]. Those bodies feel as if they belong there, but others feel out of place." (Petersson McIntyre 2015, 6). Following this, gender and technology needs to be considered as co-constructed, to highlight the need for understanding the importance of considering technology's complex role in (re-)shaping gender, and vice versa. It also urges us to consider what happens if technology changes. For example, with increased automation and more electric trucks available, the driver/technology relation may also change in ways that challenge the male norm (Hildebrand and Sheller, 2018).

Methods and research design

The material that this paper is based on has been generated through; 1) interviews with male and female truck drivers and other actors in the transport business; 2), norm-reflexive workshops with the truck manufacturer. The research design build on gender researcher's interactive collaboration with staff specialised in developing driver/truck interfaces, cabin design features, engineering, and innovation managing, to explore underlying norms that influence innovation processes. Three norm-reflexive workshops were initiated, focusing on co-workers/culture, gendered users and (future) transport innovation.

The availability of studies on women truck drivers working experiences is very limited (for exceptions see Gregson, 2018; Naysmith and Rubincam, 2012). Therefore, as a first step, based on qualitative interviews with 7 women and 5 men working in the Swedish haulage business, a report on truck drivers' gender-specific experiences were produced. When interviewing, we used the same questions as the truck company did to develop their user profiles (so called personas), with additional questions related to gender, personal safety and social interaction with colleagues and customers. As a second step, the researchers built on these insights to produce and test norm-reflexive tools designed to secure that non-normative bodies are considered in the innovation processes (described below as *pain/pleasure points*, and a total of 5 *alternative female user personas*). As a third step, a *future workshop* was developed to explore how future technologies (automated, electric, and connected trucks) may come to change current dominant ideas about users and open up for more gender equal transport futures.

Results

The interview material provided a broad picture of what trucking is about for Swedish truckers. Many issues and themes overlapped both men's and women's narratives, while some themes were more clearly gendered, foremost related to *hygiene* and personal *safety*. During the analytical process, the material was read to establish what signifies the ways in which informants made sense of mobile work and (being) female truck driver. Experiences and issues related to design, safety, work/life balance, harassments and personal hygiene was gendered themes that stood out. The interviews showed that women also develop strategies for coping with the prevailing masculine norms permeating the business.

Personal safety

The issue of personal safety was addressed in the interviews by asking informants whether they could talk about specific occasions they relate to as having been particularly unsafe, including describing what happened, how they dealt with the situation and possible strategies for avoiding similar situations. Interviewees expressed concerns about cargo theft, and a strong wish for secure, supervised, and manned parking places than is currently available. Interviewees, both men and women, described how they have witnessed criminal activity and people they identify as living outside

mainstream society in the proximity of their trucks. Female interviewees talked about how they feel unsafe to sleep overnight in the truck. For example, informants talked about the feeling of risking nightly tapping's on their truck makes it uncomfortable to sleep in the truck, making over-night transfers a non-option for these women. While concerns about unsafe places to rest is shared between both men and women, for women drivers in particular, the risk was associated with their visibility *as a woman*:

> *Each time we stop to fill up gas, everybody checks you out and gives you stares. It is common to be like that, I look down into the ground, I don't look at anybody, because then it becomes too much. (Wera)*

Wera describes how women truck drivers become hyper visible at truck stops, attracting unwanted visibility. The informant's strategy for escaping what we perceive as a judging male gaze is though avoidance, to look down (Bäckström & Nairn, 2018) and by doing so, make her visibility manageable. Strategies for safety is also shared in online communities. One shared strategy is not to reveal you are alone in the truck. At truck stops, you move out of the cabin using the passenger side, not the driver's side, to make people believe you are a co-passenger to a male driver. By sharing advice in women only Facebook groups, women truckers build up a shared strategies based on their previous experiences on how to increase their personal safety.

Harassments and macho-culture

To be a woman in a male-dominated industry may mean you are being *acknowledged* as woman in a positive way – as when business representatives position women drivers are more risk aware, safer, and economically beneficial than men (Naysmith & Rubincam 2012, 589). Some women interviewees emphasized how they have chosen the profession because they find themselves suited for the job, but at the same time must "prove" that they are good enough. Even though informants agree everyone should be treated the same regardless of gender, harassments and jargon is an expected and part of the job. To claim your space as a women driver, you must be able to cope with the macho culture. Those who complain can be positioned as less capable, as complaining too much, and being in the wrong place.

Personal hygiene

Previous studies have discussed the crisis of mobility work in relation to a "politics of sanitation" affecting the life of truck drivers negatively (Gregson, 2018). While the male informants in this study did not express any difficulties with sanitation, several of the female interviewees reported that there are insufficient toilet facilities for them to use while at work. All female truck drivers had different strategies of coping with lack of safe toilet facilities. We interviewed a female horse transport driver, who solved the lack of safe toilet facilitates by simply using the horse box. A more common narrative is that of Desiree, who either avoided drinking too much water to prevent having to go to the restroom or planned when and where she may encounter a clean enough toilet to use when visiting loading / unloading docs: "sometimes I go to the toilet in the morning and then have to hold myself until 4.30 PM" (Desiree). To visit a toilet also mean that you must leave the truck, which can increase experiences of unsafety. Desiree described how she uses baby-wipes for personal cleaning. This way she did not have to embark the truck at truck stops she considered dirty and unsafe.

Work/life (im)balance

Problems with combining life on the roads with care responsibilities is one reasons why drivers fall out of the driving labour market (Gregson 2018). Many informants talk about family responsibilities while being on the road as hard to combine with life as a truck driver. It demands a partner (often a woman) who "accept and support" their work choice, as one of the men informants said. Most drivers, both women and men, said they would need to work locally/regionally if having children, it simply wouldn't work if you are a long way from home. Regional distribution could offer the flexibility needed to

mitigate such discomforts; some informants talked about how they used to take their kids with them in the truck if they were ill and home from school. While work/life balance is often portrayed as a problem, drivers found ways of living up to their care obligations, and doing so, blurring any clear distinctions between work/home, public/private spaces.

Tools for norm-reflexivity

The results discussed above formed the basis for developing norm-reflexive tools to be used in workshops and innovation processes. Based on the interview data, we re-calibrated some of the truck companies existing tools for understanding their users by adding the gender dimension explicitly. For example, the concept of pain points was elaborated to encompass *gendered pain- and pleasure points*. Gendered *pain points* are based on user experience that can be explained by applying a gender perspective, such user experiences are likely to produce specific – more or less frequently experienced – *gendered problem areas for women drivers*. These are illustrated above as experiences of harassments, problems taking care of personal hygiene and personal safety. By emphasising users *pleasure points*, we also wanted to highlight women's positive experiences from trucking, their pleasures in mastering their trucks, including their experiences of freedom and pride in being part of a (masculine) trucker lifestyle.

The future workshop

The results from the interview study and the tools developed was tested in a so-called future workshop. This workshop urged participants to imagine future users and electrical trucks more particularly. The goal was to discuss and start developing new user profiles/personas, based on the possible impact electro-mobility may have on gendered norms in the haulage business. To spur the discussions, we introduced in total five *alternative persona representations* based on the interviews outlined above. These personas are archetypes that represent different user categories than the mainstream and was introduced to illustrate different narratives on truck driving compared to the dominant norm.

As mentioned, the future workshop utilised the electric truck as a potentially norm-breaking technological innovation. The e-truck managed to inspire the workshop participants to imagine the need for safe networks of charging hubs, places where users would be offered safe places to rest and exercise while charging the truck. The workshop participants also imagined future e-truck drivers to be a much more diverse category of users compared with what is currently the case. The user personas presented by the workshop participants was mainly female, young aged, entrepreneurial, and with a desire to develop new technological innovations. Future users were not simply truck drivers, they were called early adaptors who aspired to be working with trendy, intelligent trucks. Throughout the workshop, trucking was transformed from being the dirty, dangerous, and stressful work we may associate with life on the roads today, into a high-tech, hip and environmentally friendly job. E-trucking as it was imagined by the workshop, was attracting high skilled users with an interest in sustainable technology and logistics.

The future workshop suggested that technological innovations are anticipated to improve gender equality significantly. E-trucks were ascribed the capacity to transform truck cultures, work conditions and trucker's role in significant ways, and thereby open for a space for a more diverse transport system. Clearly, there is a need to critically discuss the likelihood of such scenarios, equally important is to note how the future workshop made visible for the participants technology's role in (re-)shaping gender.

Discussion

To change constraining gender norms is not easy and takes time. In the case of the haulage business, it requires that women's perspectives, needs, and experiences are included in technology shifts, design processes, changes of business and everyday work. Drawing on Bäckström and Narin (2018), a combination of two norm-reflexive strategic interventions can foster a more inclusive haulage business: 1) *strategic visibility* makes women's experiences visible and recognises the significance that gender makes in the business; 2) *strategic entitlement* emphasises the ordinariness of women's' competence as truck drivers. Both strategies build on norm-reflexive skills to succeed in making any real impact on gender equality. Norm-reflexivity is a way forward if drivers are to meet a business where women's participation is considered entitled, competent, and "normal" as opposed to special and "other" than men.

A norm-reflexive methodology can be used to visualise implicit taken for granted norms in technological innovations. While the e-truck could be used to imagine new categories of users beyond the male norm, technology remains a masculine realm. It is therefore important to consider how gendered power and control over vehicles and transport systems is more and more being reassigned from the driver's seat to the system designers, programmers, and engineers (Balkmar and Mellström, 2018), industries and sectors typically dominated by certain men and certain forms of masculinities (Hildebrand and Sheller, 2018). While any imagination of technological fixes remains problematic, this project nevertheless shows how non-normative experiences and technological innovations such as the e-truck can be used as tools for imagining more gender equal scenarios in (future) road-transport.

Acknowledgements

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08.45-09.30 / 09.45-10.30 Presentation 39: Friday, 19th November 2021

Gender smart mobility: Living lab using gender smart indicators in the creation of GaDAP plans

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Smart mobility and smart cities has become a popular buzzwords in the 21 Century city planning and management and as such closely intertwined with the dominant ideas of urban developments. Many cities – challenged by growing populations, pressing and visible demands on daily mobility and housing and fuelled by ambitions of growth and environmental concerns have located themselves as smart. Smart mobility as closely embedded in notions of smart city has become an imperative and leading guideline for urban developments in the 21st century. The idea of the smart city been created as a solution to multiple urban problems, and addressing a variety of mounting problems of traffic congestion, inefficient services and economic stagnation after the 2008 financiala crises. The smart city has become identical with aspirations of prosperity and for promoting healthy and inclusive lifestyles for.

Gender Smart mobility is a composite concept that includes gender as an intersectional category seen in context of locality, age, ethnicity and sexuality and potential other relevant dimensions. Gender Smart mobility also implies the use and development of smart methods addressing various mobility modalities and forms. Moreover Gender Smart mobility implies a proactive approach to innovation and design. Last but not least Gender smart mobility is a strategic concept aimed at interventions in smart city policy and mobility strategies as launched by major European and global policy institutions such as the EU as well as in city planning and innovations. EU smart mobility strategy 2020) Gender smart mobility is an ambitious concept which is foreseen to create change at many levels. The ambition is to advance the understandings of in particular the social aspects of smart mobility in combinations with environmental and economical dimensions of smart city concepts.
In this session we will offer a brief introduction to the concept and idea of Gender smart mobility and the principles of GADAPS : Gender and Diversity Action Plans. The aim is to invite participants to a living lab/ a around the gender smart mobility indicators: Affordable, Effective, Attractice, Sustainable, Inclusive.

Such indicators have been applied in multipe ways in the TINNGO project. The aim of this session is to introduce to gender smart mobility thinking and to apply the indicators in practice! https://www.tinngo.eu/

Session X: Bringing the community together

09.40-10.00 / 10.40-11.00 Presentation 40: Friday, 19th November 2021

The TInnGO Observatory and the DIAMOND toolbox: self-assessment for service operators on fairness and inclusivity.

A.Gorrini, F. Liotopoulos, P. Magee, S. Ouillon, L. Piras, C. Prieto, W. Saleh, F. Santarremigia, M.C Leva, C. Schone, L. Tzampazis and A. Woodcock[1]
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Abstract

This paper summarises the contributions of both projects towards bring the community together, as presented in Session IX of the final conference/TDM Symposium 2021. This session featured a series of presentations from both projects on the steps and outputs that together contribute to the legacy of

our projects. Both projects addressed the challenge outlined in the call MG-4-3-2018: Demographic change and participation of women in transport. Through our work we have understood the challenges and barriers to creating a fairer transport system. Here we present practical contributions, tools and strategies which can be built on by other researchers.

Introduction

Bringing the community together, developing tools and raising the attention of stakeholders is a fundamental requirement of EU projects and creating a legacy which can built on by other projects and research teams. This may be achieved in a number of means including consideration in data collection, sub population groups, methodologies, educational curriculum as well as other conventional means. In the following sections, we present a range of tools developed by both projects to address this requirement which can be used by current and new researchers.

In the transport sectors, policy makers, transport planners and service providers are oblivious of knowledge gaps on gender equality. This is due in part to lack of a fuller understanding of the association between women's mobility, economic development, sustainable transport and social equity, and in part due to lack in available tools and methodologies that are capable of addressing these gaps. In the following sections, we present a range of tools which can be used by current and new researchers.

The TInnGO observatory and Open Innovation Platform

The Transport Innovation and Gender Observatory (https://www.tinngo.eu/) was designed as a central, sustainable, virtual space for collecting material related to gender smart mobility. During the lifetime of the project, as a proof of concept this material has been collated and donated by the 10 TInnGO hubs in order to provide a snapshot of what is happening across Europe. Our objectives in doing so were to build a community, showcase issues of gender and diversity, fight inequalities, back research with data, support local initiatives in gender smart mobility, co-create gender sensitive transport innovations, boost women's engagement in transport. The observatory contains the sections outlined in Table 1.

Table 1: Sections of the TInnGO observatory

Content	Description
News	the Observatory's blog is populated with content on a regular basis
Initiatives on gender and transport	Updates of related work from the TInnGO Baltic, Scandinavian, Romanian, UK, French, Portuguese, Spanish, Italian, German and Greek hubs
Gender and Diversity Action Plans (GaDAPs) page	GaDAPs to support gender equality taking into account diversity issues. Two formats of materials: policy briefs and explanatory videos
Portraits of successful women in smart transport:	inspirational case studies of women employed in the fields of transport and smart mobility in ten socially and politically divergent national contexts.
Interviews with experts in the gender and transport sector	showcases interviews to 20 experts and opinion leaders in the field of gender smart mobility
Survey on mobility patterns:	presents the findings of the mobility patterns survey carried out by VTM in a visually attractive way.
TInnGO publications:	lists scientific publications by TInnGO members
Initiatives on gender and transport:	a list of observatories, networks and initiatives working on gender and transport matters at European level.
Reports:	reports of interest in the topic of gender and transport published by other organisations.
TInnGO tools:	Open Data Repository, Incident Reporting Tool and Transport Surveys
Training materials	a set of training materials designed by LEVER will be added to the resources section of the website once ready

TInnGO Open Innovation Platform	A collaborative platform bringing together TInnGO national hubs, stakeholders and European citizens to address the challenges on gender and diversity in transport comprising of an ideas lab, discussion and initiatives section

10.00-10.20 / 11.00-11.20 Presentation 40: Friday, 19th November 2021

Hubs as beacons of engagement in TInnGO and DIAMOND "Corporate Social Responsibility protocols and White paper"

Francisco Santarremigia[1], Maria Chiara Leva[2], AJeni Thimnu[2], Aoife Burns[2] E. García-Jiménez[1], G.D. Molero[1], S. Poveda-Reyes[1], A. Kumar Malviya[1], M. Hervás-Peralta[1], Cathleen Schöne[3]

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Hubs as beacons of engagement *(Cathleen Schöne-Technische Universität Ilmenau)*

Women face higher risks and burdens than men in transport, due to unequal access to resources, education, job opportunities and entrenched socio-cultural norms. To counteract this the 10 TInnGO Hubs address gender related contemporary challenges in the transport ecosystem and women's mobility needs by considering the diversity of different groups.

The Hubs (https://transportgenderobservatory.eu/national-hubs/) were designed as the mechanism through which TInnGO did most of its research and dissemination/impact activities. They extracted and prepared nationally and internationally available knowledge in the field of mobility, gender and diversity, feeding the TInnGO Observatory with prepared knowledge, data, open innovation, tools and practical examples (e.g. Mobility Data and Statistics, Research Publications, Media Reports, Project Reports, Good Practice, Local Practice, Case Studies, Guidelines, Policies etc.). Dissemination via the TInnGO observatory means that this material is made available to a broad group of users in an application-oriented manner. To ensure this the hubs have worked together with regional stakeholders to understand their context, tasks, goals and interests and at the same time sensitise them to Gender Smart Mobility and increase their capacity to act through the transfer of knowledge and training materials.

The hubs selected their area of interest based on local knowledge, needs and concerns. This included Gender Smart Mobility, Smart Biking, Safety and Security, Education and Employment in Public Transport, Participation Culture. The original aim was to set up associated Transport Innovation Gender Idea Labs (TInnGIdLabs) along Living lab and citizen guidelines, to co-design solutions with stakeholders and test them with users and disseminate the results. The goals and the work of the Hubs and Labs are inseparably linked. While the Hubs set the gender and diversity-oriented goals and build and drive collaboration with stakeholders, the Labs serve to implement these goals by providing open workshops giving private individuals access to production facilities and modern production processes and by giving cities space/possibilities to work together with citizens on the development and evaluation of innovative mobility solutions. Unfortunately, this was not realised due to covid restrictions preventing face to face working. Although some of these activities were moved online, this could not overcome covid related problems,

In their collaboration with the stakeholders, the Hubs make use of various methods and research approaches, such as intersectionality, agent-based modelling, citizen science, but also the within the scope of the project newly developed approach of gender and diversity action plans which were created in cooperation with the individual hub stakeholders.

Corporate Social Responsibility Protocols and White paper *(Francisco Santarremigi-DIAMOND)*
In the DIAMOND project, Corporate Social Responsibility (CSR) protocols were created to develop sustainable and fair working environments. These voluntary protocols include aspects of human, environmental and product responsibility. Their aim is to identify, manage and mitigate any negative impacts that companies may cause on society as a whole.
A Fairness Measure (FM) was set for each FC by an interdisciplinary expert panel. The profile "Women as a homogeneous group" was initially addressed to identify the Top 10 FCs and the recommendations generated for them using ANOVA analysis. These are "those with small children to be given the opportunity to change shifts or to reduce their working time", "employment opportunities should be advertised widely and all applications welcomed" and "security staff available to intervene in case of need". Other more specific profiles of women can also be addressed by applying computational solutions, updating the Top10 FCs and the FMs to specific profiles, making, "Diamond CSR protocols version 2.0", more effective. All FMs were validated by external gender experts. Women's main concerns and barriers for off-site jobs include: "Security staff available to intervene in case of need" and "fewer job choices". Personal circumstances such as "caring and parenting responsibilities", "facility to access funds to travel to work" or the fact that they "feel having fewer job choices than men" were also significant factors.
The DIAMOND CSR protocols version 2.0 is a tool which recommendations, customized for specific profiles, will improve the fairness from a gender perspective of transport companies, and the willingness of women to work in them, especially in transport off-site jobs.

The White Paper considers key issues and actions for moving towards a fair, inclusive, and women-participated mobility and transport system. Within this context, the document will recommend concrete measures to enhance women's participation as users and employees to support the design of transport modes and access of infrastructure able to be more inclusive and informed also by women's need. The White Paper is informed by the main findings and recommendations of the EU Horizon 2020 funded DIAMOND project and other related projects.
Therefore in the white paper we succinctly provided an overview of the literature reviewed, the various data set collected and analysed the results of the analysis and how they were used to formulate an integrated interdisciplinary approach for the representing the knowledge acquired into a So-called Fairness Maturity model that users can apply for self-evaluation and benchmarking purposes. The model has been applied to the four uses cases considered in the project. This represents one of the main outputs, and lessons learnt from the data analysis that was passed on for the development of the DIAMOND on-line toolbox. This task also summarized the knowledge acquired from workshops that involved experts in mobility and gender studies to get their opinions and feedback on the interdisciplinary analysis findings. All partners who have carried out the studies participate in the integration of their results in a format that is accessible for policy makers, transport organisations and members of the public.

10.20-10.40 / 11.20-11.40 Presentation 41: Friday, 19th November 2021

Open data collection and repository (TInnGO and DIAMOND)

Fotis Liotopoulos[1], Andrea Gorrini[2]
[1]SBOING -TInnGO; [2]Systematica -DIAMOND

The DIAMOND Toolbox: Self-assessment for service operators on fairness and inclusivity (Luca Piras: luca.piras@eurecat.org, EURECAT)
This Diamond methodology can be the basis for further developments to improve the fairness from a gender perspective in each of these use cases through the utilization of a toolbox capable to assess the fairness of an organization or service and recommend the most appropriate fairness measures.

Open data collection and repository *(Fotis Liotopoulos: liotop@sboing.net, SBOING)*
Open Data is defined by "Open Definition" (www.opendefinition.org) as data that can be freely used, re-used, and redistributed by anyone - subject only, at most, to the requirement to attribute and share-alike. It should be easily available, accessible, have terms that provide its reuse and redistributions and enable universal participation.
The Open data collections provided by TInnGO and other contributors comply with EU policies relating to Research Data and Data Protection. Our repository has been designed to meet the "F.A.I.R." requirements for managed data, i.e., *Findable*, *Accessible*, *Interoperable* and *Reusable*.
The repository is freely available for the research community to use and contribute to, especially in relation to the sharing and extracting of national and international data in the field of mobility, gender, and diversity and socio-demographic mobility data, which enables women's travel behaviour to be prioritized using intersectional analysis. Data is categorised by type, method, time, and location. The repository supports most data formats and data types (e.g., tabular data with metadata, textual, geospatial, image, audio, video, documentation, scripts, etc).
The TInnGO Open data repository has been designed for use by those conducting research in the fields of gender issues in transport, urban policies, urban planning; transport stakeholders, including public transport organizations, transport authorities, logistics, etc; Local authorities dealing with gender issues.
It has been established and will be maintained by SBOING as a web platform to securely store open datasets in standard and common formats. It provides a public storage space for making available new datasets and data collections. All sensitive data in the Repository are required to be anonymized or pseudonymized to be GDPR-compliant by data providers. A searchable index and an information classification system of all available datasets along with a user-friendly GUI facilitate easy public access. All relevant IPR, licensing and copyrights pertaining to these datasets are well recognized and respected.
During its lifetime, TInnGO has collected, generated, and managed data from the 10 national hubs of the TInnGO Gender Observatory coming from 13 countries: UK, Germany, France, Italy, Spain, Sweden, Denmark, Greece, Romania, Lithuania, Estonia, Latvia, and Portugal.
The TInnGO-ODR is available through https://tinngo.sboing.net, https://www.tinngo.eu/, and http://transportgenderobservatory.eu/. *Visitors* can browse through the entire database of deposited data collections, using an advanced search engine. *Contributors* can upload and publish their data collections by following an easy five-step process.

H2020 DIAMOND Project – Methodology and requirements for data collection
(Andrea Gorrini: a.gorrini@systematica.net, Systematica)
Despite recent efforts, measures to design and manage public transport do not sufficiently consider women's needs and expectations as users of the service. To address this, the H2020 DIAMOND project aimed at turning data from different sources into actionable knowledge for ensuring the inclusion of women's needs in current and future transport systems.

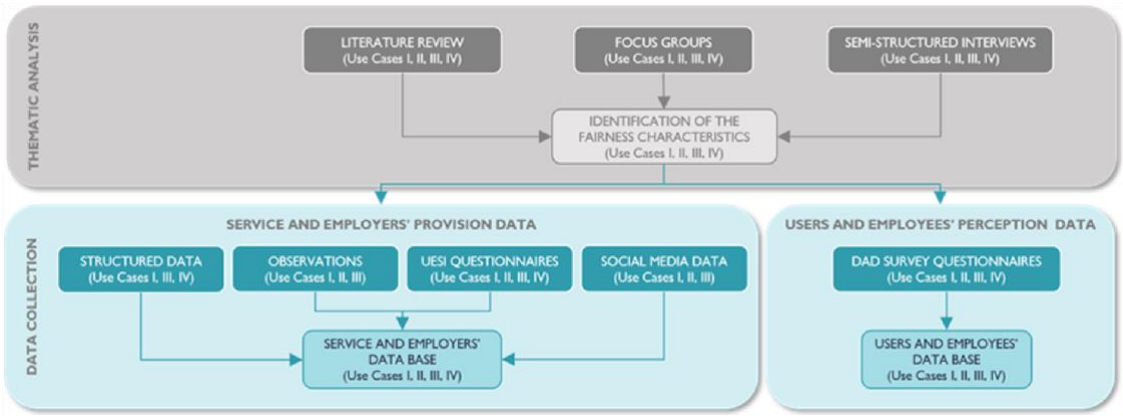

Figure 1: Overview of DIAMOND approach

Urban and mobility experts, transport authorities, computer and data scientists, mobility economists and social scientists from 8 European Countries (France, Italy, Ireland, Poland, Scotland, Serbia, Spain and the United Kingdom) have collaborated on work shown in Figure 1. This has focussed on four Use Cases: I: Public Transport Infrastructures (Railways); II: (Emotion in) Autonomous Passenger Car; III: Vehicle (Bike) Sharing Fleet Management; IV: Employment of Women in Rail Industry and Freight/CSR Protocols.

In each case study research was conducted to collect heterogeneous and disaggregated data about women's needs in the transport sector, as users and employees. The gathered data sets are divided into three main categories:

Thematic Analysis of all case studies of data derived from a Literature review; Focus group discussions and semi-structured interviews (Use Cases I, II, III and IV).

Service and Employers' Provision Data: Structured data regarding the operation of transport services (Use Cases I and III) and job holders of the sector (Use Case IV); Observations regarding relevant features of transportation settings (Use Cases I and III) and emotional responses to autonomous vehicles (Use Case II); Users and Employees' Satisfaction Index questionnaires regarding the opinion of the end-users of the services (Use Cases I, II and III) and job conditions and employability (Use Case IV); Social media data from Twitter regarding geospatial/time-based information and the opinion of the end-users of the services (Use
Cases I, II and III).

Users and Employees' Perception Data: DAD-Dynamic Argumentative Delphi survey questionnaires regarding the Fairness Characteristics (Use Cases I, II, III and IV).

The H2020 DIAMOND project was aimed at investigating the possibility to analyze digitally widespread open data sources as a valuable support of the activity of decision-makers by unveiling hidden mobility patterns and specific target-users' needs. The research was used to support the development of an interoperable and user-friendly toolbox for fairness, self-diagnosis and decision support in transport planning.

11.10-11.30 / 12.10-12.30 Presentation 42: Friday, 19th November 2021

Educational guidelines (TInnGO and DIAMOND)

Wafaa Saleh[1], Lazaros Tsampazis[2]
[1] Edinburgh Napier University -DIAMOND; [2]LEVER -TInnGO

Educational guidelines *(Wafaa Saleh- Edinburgh Napier University)*

Current transport systems inadequately address gendered differences in terms of the current infrastructure and the delivery of services, and that gender equity has not been realized. The findings from DIAMOND suggests that women as users of transport services for example are often concerned with availability, accessibility, safety, awareness, and cost. In relation to employability, women are concerned with their career development and flexible working opportunities.

To fill this knowledge gap, the Diamond project has developed curriculum design guidelines to provide a roadmap for adaptation of training and studies content in relation to new skills and opportunities in the transport system. The Guidelines will be distributed among the European training and educational centres. Their key aim is to develop a new level of curriculum design guidelines for educational institutions and future transport professionals to deliver excellence in education and close the gender gap in the transport sector. Essential to achieving the above stated objective is to design novel educational content to address the following items:

- How technologies should adapt to women needs
- How to match job opportunities with women motivations, talents and needs?
- How to design job characteristics and disseminate to attract women

- How to carry out HR processes to avoid bias and discrimination, and cover psychology aspects in the different stages of employment including getting into education, workforce, job recruitment, retention, progression in jobs, etc.
- Future skills needed for job positions
- How to design transport services to meet women's requirements and expectations, and improve their access to transport and jobs?

The Guidelines are targeted at EU Universities and training centres offering graduate and postgraduate studies, in-company and occupational training on Transport Technologies and Management. They show how to handle gender needs in transport planning, in service offerings, and how to tackle job opportunities in a fair way is generated based on the project outputs, in relation to:

- new skills identified in job transport
- new jobs and services opportunities
- women attitudes and talent towards new technologies, business models
- impact of women in Technology (adaptation of new technologies related to transport to women's needs; So this would be training for ICT, App, tech developers,

The expected outcome of the guidelines will be an increased readiness of transport systems and educational courses for gender inclusion based on a better understanding of women talents and motivations in job opportunities.

Educational short courses *(Lazaros Tsampazis-LEVER)*
As a one-stop shop to further the understanding and need for gender and diversity sensitive smart mobility, TinnGO have developed educational guidelines to summarise the current status of work in this and provide useful and actionable material to those unfamiliar with how to transform current practice. This material highlights, for example, the challenges in smart transport, issues in employment, usage of transport, education, representation, mobility data and women's requirements of transport.
The second aim of the educational guidelines is to provide measures and recommendations, so that inequality in transport can be tackled. The trainee is introduced to a range of methods and best practices and is given step by step guides on how to achieve equality in different parts of the transport ecosystem. Practical examples and case studies have been incorporated in the material so that creating lasting changes to existing policy, practice and operation, towards equality in transport, becomes a more understandable and easier process to follow.

11.30-11.50 / 12.30-12.50 Presentation 43: Friday, 19th November 2021

Citizen science

Sinead Ouillon
Coventry University, UK

Citizen science may be defined as social or community - based research conducted by members of the public with the support of professional researchers, for the benefit of citizens, scientists, and the community/society. People are experts on the communities from which they come from and the end users of any (transport) innovations. Therefore, they can play an important role in exploring deeper insights into barriers and challenges to everyday mobility. From a project perspective including local

communities means greater buy in, and active citizen involvement in design and delivery of project outputs.
Transport authorities and planners find citizen engagement hard, especially amongst the traditionally hard to reach groups. A fundamental concept within TinnGO was to develop differnt ways of getting the voice of diverse groups heard in transport. One way of doing this could be to engage them as citizen scientists, who are supported by professional staff and training materials. The training can build the skills of the citizens, which in turn builds capacity within communities that could go some way to sustaining the legacy of TinnGO and lead to the emergence of stronger voices and more powerful arguments that are based on local needs and lived experience.
Unfortunately the covid pandemic significantly reduced opportunities for hubs to develop citizen scientists to the level we would have hoped. Citizens have been engaged in all 10 TinnGO hubs in focus groups, co-design of mobility solutions street interviews, co-design of mobility solutions and walkability audits to provide insights into gender based mobility problems. However, we were not able to progress thisto a stage where citizens suggested transport issues they would like to look into, and work as a semi independent scientist.
To support the hubs work in creatign citizen scientists, as par tof their overall sustainability, Coventry's FabLab has created a training module which can be used to train future citizen scientists. These materials are aimed at individuals (such as local activists, user champions and NGOs) wishing to engage citizens in conducting social research related to gender smart mobility, in this case, but the approach can be adapted to other domains. The materials can be adapted by the trainers to incorporate a range of local contexts, a variety of methodologies and can be run over a period of one day to two months, depending on the purpose and experience of participants and resources available.
In terms of the wider aims of the TInnGO project, the use of citizen science contributes to the paradigm shift we believe is required in developing gender and diversity sensitive smart mobility, Here, transport is not something which is delivered to people, designed from the limited contextual knowledge of a remote group of experts. It is something which is developed for a purpose, and a specific context with the involvement of people it will most concern. Those with personal knowledge and experience of the city or suburb are the best placed to articulate those needs. Citizen science is a means of providing them with skills to gather information and present their arguments in a way in which planners may take notice (for example, the decision to house asylum seeking mothers, who have limited funds outside a city limits their ability to access healthcare, support, and general amenities).
Citizen Science can improve understanding of a more diverse range of communities lived experience and engages the general public in the process of discovery therefore, opening up science to the general public. For these reasons the EU Horizon 2020 programme, agencies such as, the European Citizen Science Association and research funders in member states have all implemented funding mechanisms and support, specifically aimed at engaging citizens in research in a more meaningful and equitable way.

11.50-12.10 / 12.50-13.10 Presentation 44: Friday, 19th November 2021

Co design for empathy and reducing barriers to inclusion

Andree Woodcock
Coventry University, UK

One of TInnGO's USPs relates to design-led engagement of diverse groups in transport futures, to understand their unmet needs, and to feed these insights into the project and wider stakeholders. Similar to citizen science, we aimed for a paradigm shift in transport system design, towards co-design by and with end users, using the process of design research and visual communication as a process of

engagement. As previously outlined our work in this area was impeded by Covid, which meant we could not work face to face 'in the wild' with any vulnerable users or be co-located in the hubs.
Nevertheless, we worked remotely for 18 months with undergraduate design interns to create Design Provocations (https://oip.transportgenderobservatory.eu/ideas-lab) based on ideas sent to us by a hub, or our own experience as female users of transport services. The Design Provocations are based on critique amongst the project team, inclusively designed around user journey touch points. Extensive conversations around design drawings, personas, market research and journey maps produced new insight, challenged the young designers and enabled them to develop transferable skills (i.e., empathy and systems design thinking), while our non-designers were able to think more creatively, outside the box and relate detailed personal experiences in exciting, interactive and nonthreatening discussions.
The early concepts are provided as design provocations, along with short textual commentaries on the Open innovation Platform to nudge people into commenting with further insights of mobility. Indicative of the works is: the Pinkorner which uses bus stops as platforms for social education and the Nurturepod, which provides temporary solace when infants need un-rushed care. In terms of moving forward, the design provocations remain on our OIP for others to develop, to stimulate wider discussion of the meaning and application of gender and diversity smart mobility and the use of design as a means of breaking down barriers.

Conclusions

Bringing the community together has the potential to increase realisation and accountability of any implemented community programs. This work has demonstrated a number of venues and efforts to facilitate this achievement. These include a number of innovative approaches and methodologies including data collection, sub population groups, methodological frameworks, educational curriculum as well as other conventional means.

Acknowledgements
The work was conducted as part of the EU funded, H2020 TInnGO project (grant number 824349) and H2020 DIAMOND project (grant No. 824326).

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Session XI: Inclusion for employability & entrepreneurship in transport

13.00-13.15 / 14.00-14.15 Presentation 45: Friday, 19th November 2021

Implementing organisational change for workplace diversity in transport organisations

Ann-Marie Nienaber[1], Andree Woodcock[2] and Kat Gut[2]
[1]Centre for Trust, Peace and Social Relations, Coventry University;
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Coventry, UK

Introduction

The transport sector is highly masculinised and lacking in diversity, with few women or those from ethnic groups rising to key positions. This creates a culture where the needs of marginalised groups

are not understood or considered. Evidence shows increasing workplace diversity is beneficial in improving decision making, performance and developing wider social awareness. Organisational changes across the Transport Business Ecosystem will help deliver the 2030 Agenda for Sustainable Development which requires consideration of women's role in the green economy, and sustainable development.

Providing a replicable methodology which encourages gender diversity in organizations is a significant challenge, which will have enormous impact on women as employees and transport users. In this paper, we share how we have applied key learnings from our work on organisational change in local authorities conducted in the in H2020 CIVITAS SUITS project (Nienaber et al, 2020) to transport organisations to foster behavioural change that transforms a masculine dominant organisational culture to a "gender-balanced" culture.

Method

A case study approach has been adopted to enable the exploration of change management and the context in which the change occurred, during intensive cooperation with the transport organisation Zeelo.

The theoretical approach is based on Kotter's structured Eight Stage Process (Kotter, 1996) for organisational change in combination with workshops driven by an engagement strategy for interaction and communication between the project team (UK TInnGO) and the organisation focusing on knowledge exchange for mutual benefit. This approach allowed to leverage the knowledge and capabilities of employees, which results in better performance as employees get in a better position to deal with uncertainty, variation and adaptation, and makes them more resilient towards changes on gender equality. Although Kotter's Eight Stage Process is one of the key models of change management, few real life case studies show implications for practice (e.g. Pollack & Pollack, 2015).

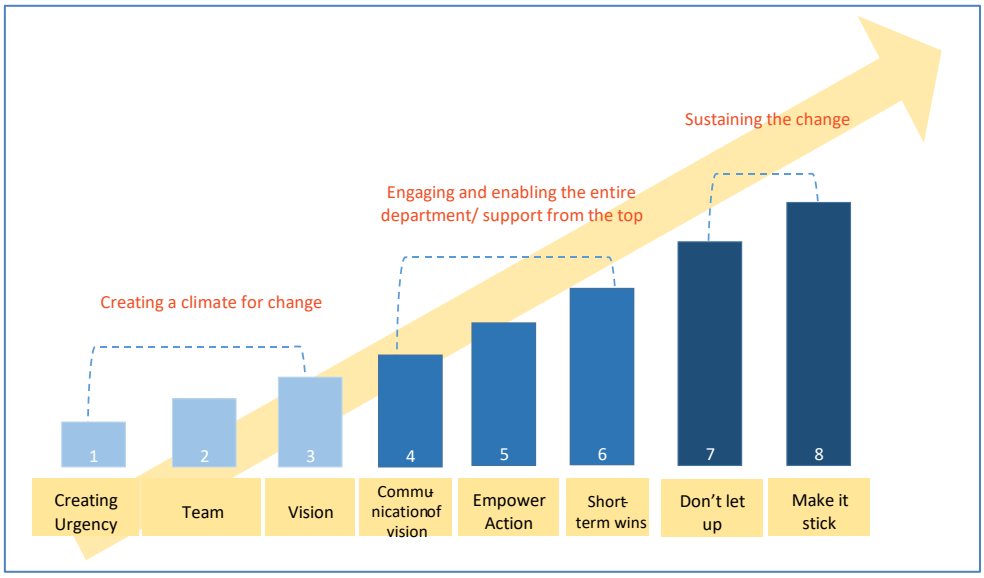

Figure 1. Organisational Change Process to increase workplace diversity

Results

Five clear guiding principles have been identified during the implementation process of organisational change. These are key for a successful organisational change in transport organisations.

1. Identify a key person - the change agent - who will be the driver for successful behavioral change in your organisation. A change agent should be knowledgeable, committed and well respected, with a clear route of communication through to senior management.
2. Support the change agent from the top and bottom in your organisation.
3. Communicate your vision organisation-wide if you want to become effective and resilient to change.
4. Celebrate little successes to keep your employees motivated to support the change over the long term.
5. Make change continual so that the organisation itself has the ability to be flexible and resilient.

Discussion/Conclusion

Implementing organisational change to increase workplace diversity is challenging, as the investments made are relatively high and thus, the majority of transport organisations try to postpone such changes. However, the impact of increasing workplace diversity is beneficial in improving decision making, performance and developing wider social awareness. Based on data from working with transport organisations in the TInnGO project, we are able to provide a replicable methodology which encourages gender diversity in transport organizations that make up the Transport Business Ecosystems (TBE), that has enormous impact on women as employees and transport users

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Acknowledgements

The data of this research was conducted during the TInnGO project—Transport Innovation Gender Observatory, grant agreement no 824349 – Horizon European projects.

13.15-13.30 / 14.15-14.30 Presentation 4**6**: Friday, 19th November 2021

Career and Women Entrepreneurship in the Transport Industry Across Europe

A. Isolda Constantin and A. Stefan Roseanu

Integral Consulting R&D, RO

Abstract

Background: Transport plays an essential part in the European Union economic growth and social development. In spite of its importance, the transports field is still one of the most gender segregated in economy. The sector is facing challenges regarding the low retention of women and drawing as many women as possible to the available jobs.

Methods: A mixed method approach was followed in this mainly phenomenological exploration of women's experiences in the transport sector. Each TInnGO hub conducted desk top research to provide a snapshot of gender equality in employment in transport.

The investigation of 57 female entrepreneurs or employed women, in different parts of the Transport Business Ecosystem (TBE), in 10 socially and economically divergent national contexts (United Kingdom, Germany, France, Sweden, Italy, Spain, Greece, Portugal, Romania, Baltic Countries), through a Pan European survey has provided a comprehensive perspective and a more nuanced understanding of labour market by outlining a general and comparative picture of the women working in TBE. In addition, 14 follow-up in-depth case studies were developed as 'motivational portraits' providing a clearer insight into the career path of influential women in transport. All these women stand for real role models to inspire further women to embrace a job in TBE.

Results: Exploration at an individual level has revealed that, along their career path and in business, the women in the TBE are still faced with institutional-, psychological- and personal barriers, the most frequently mentioned being: prejudices, skeptical and depreciative attitude, misogynist language and behaviour from men colleagues, partners, clients, suppliers etc. (particularly at the beginning of their activity) - 19%; gender discrimination at hiring, at the workplace and in career progress - 10%; internal bureaucracies related to maternity leave, motherhood and parenthood status, which slowed down / hindered their career progress - 7%; the prevailingly male working environment ('Being the only woman at the table'), was intimidating and non-welcoming - 6% reconciling professional- and family life - 4%. Although the results showed some variation across the countries, persistent themes emerged relevant to women's underrepresentation in transport. Women are mostly found in support and administrative services in the transport sector. Key factors which contribute to underrepresentation included misogynistic attitudes, male dominated hierarchies, recruitment bias, reluctance to acknowledge a woman's role and contributions, gender pay gap, male- dominated professional networks, the gender 'glass ceiling' still present in some companies, where career prospects and promotion are better for men than for women. All women cite the extra effort necessary to prove their value and abilities. With this fortitude and determination, the number of women in the industry is slowly increasing, and some countries have well developed frameworks for encouraging women into STEM careers, mentorships schemes and networks. Conclusions: The results indicate a number of ways in which entrepreneurial and business women in the transport sector can be supported and the actions to be taken to increase gender and diversity. These may be used to form gender and diversity action plans for organizations and policies.

13.30-13.45 / 14.30-14.45 Presentation 4**7**: Friday, 19th November 2021

Fostering gender balance inclusion from the transport employment perspective

Mireia Calvo Monteagudo and Margherita P. M. Colleoni
Albert Einstein street 1, Paterna, Valencia

Abstract

Introduction/background. Although many actions and measures are being applied to promote a gender balance in transport sector, the reality is that the sector is still male dominated. Spanish institutions put a great effort in fostering equal job opportunities for all the population segments, through the Spanish Royal DecreeLaw 6/2019 of 1 March 2019 with the introduction of a mandatory gender action plans for companies that exceed 50 employees.

Gender Action Plans pave the way towards the achievement of the gender balance inside transport companies. However, companies are still struggling in finding their way to turn legislation into reality. Although those plans have been already applied in public transport companies and big enterprises, the sector in Spain is highly fragmentated, thus lots of small companies are still far from including gender perspective in their DNA.

Methods. First of all, a deep analysis of the company processes is key to detect hidden gender and diversity harmful patterns. To assess the current situation in gender balance and evaluate which measures are potentially acceptable by transport companies a survey was launched to several entities. The main aim is to support companies in the promotion of gender balance, assess barriers and evaluate which are the measures most suitable for the employees.
The survey was answered by public and private companies, in both logistics and mobility sector trying to obtain a distributed sample in the transport field.

Results. Through the survey information related to how the COVID19 crisis had changed the transport sector, the main reasons why the employees started working in that field and their main motivations were detected. In addition, the survey gathered information on how work life balance is included or not in their daily job, analysing which are the best measures to pursue a gender balance situation, being a flexible time schedule one of the most popular. The main goal is that companies consider those measures to be included in the transport companies Gender Action plans.
Discussion/conclusions. Starting to bridge the gap working with the companies and establishing gender action plans based on the employees' needs. According to the presented study, a flexible schedule is one of the measures more accepted by the employees, but will this measure be compatible with logistics? Could all the measures be applied to all the branches of transport? The current situation is claiming new measures to make the transport sector more equal from a gender perspective by considering the vision and needs of the employees. This study aims at giving visibility to the employees in the transport sector and, by using the current actions like gender action plans in companies, it pursues the promotion of more inclusive measures in the transport and logistics fields.

13.45-14.00 / 14.45-15.00 Presentation 4**8**: Friday, 19th November 2021

Challenges and issues for women as employees in surface transport: a snapshot from the Diamond project findings

Mary Kinahan, Maria Chiara Leva and Yvonne Hail
[1]*Technological University Dublin, Lower Grangegorman, Dublin, Ireland*
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Abstract

Despite increasing technological advances in transport systems, and women's increasing participation in the labour market, there is considerable gender inequality regarding women's roles in the transport sector. Several studies have shown that there are differences between men and women in mobility behaviour and participation in transport-related jobs. In particular, there is marked gender segregation with the sector, with women employees typically placed in gendertypical positions, with 60% of female employees holding positions in the human resource department compared to only 3% of train drivers (European Commission, 2016). Several studies have shown that there are differences between men and women in mobility behaviour and participation in transport-related jobs. Nevertheless, most data and statistics in transport apply very simplistic categories, e.g. in terms of gender that is translated into binary male/female variables, but that lacks context such as age, class, ethnicity, disability, caring responsibilities etc. (European Commission, 2016).

Given recent technological advances and societal changes, there is an important shift in transport and mobility. This shift should be seen as an opportunity for remodelling transport systems to become more inclusive, safe and secure for women, from both the employment and service perspective. In order to seize this opportunity, a deep understanding of women's needs linked to their physical and psychosocial characteristics is required. Thus, the DIAMOND project aims to use such technological advances and innovations, to (i) analyse real-world scenarios where these gender inequality issues exist, and (ii) take concrete action, to create a fair and inclusive transport system.

The main aim of our research, as part of the broader DIAMOND project, is to examine women's employment in the transport sector by examining women's needs in terms of recruitment, retention, and promotion in railways, freight transport and logistics sectors.

Preliminary data on women's employment was gathered via focus groups in Dublin, Ireland. The focus groups, that included public transport employees and transport experts and industry representatives, were asked to discuss and assess the definition of fairness as an employee in the transport sector, fairness characteristics as well as transport employee's needs and barriers. Initial results indicate agreement with the working fairness definitions, as well as highlighting needs and barriers for employees.

Based on these piloting, an employee satisfaction survey was developed that examined a range of topics including employee's work community, job characteristics, company culture, safety and security, training, access to amenities (e.g., female facilities), adaptability, and job satisfaction. The survey was then translated into a variety of lanuguages and placed online by the DIAMOND research team to be accessed by the employees of three European rail service providers. Approximately 50 questions covered the following themes that were used to summaries the Fairness characteristics previously identified as part of the litterature reviews and initial focus groups

- Socio economic conditions – job segregation; demand factors; policy and legal
- Job Characteristics – HR policies recruitment, retention, promotion etc; training provision; safety and security; female facilities
- Personal circumstances – caring and family; economic deprivation; access to resources
- Individual characteristics – skills; adaptability; educational level/attainment; health status; demographic (age, ethnicity etc.)

Data was collected and analysed in a number public transport organisations that were willing to pilot it in Ireland, in Spain and in Poland. Further on line interviews with employees of the participant were used to identify critical areas and underpinning causal factors and or to identify possible improvement plans. While the data of the questionnaire is going to be analysed using factor and regression analysis to identify key drivers of user satisfaction or barrier to fairness in the workplace. This presentation

reports the key findings gathered during the scope of the project. Further details can be found on the Diamond Integrated
interdisciplinary analysis report (Deliverable 4.4) (Leva et al. 2021)

Acknowledgements
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Session XII: Gender equity in education and research for transport

13.00-13.15 / 14.00-14.15 Presentation 46: Friday, 19th November 2021

Gender and diversity in transport research in Europe

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Abstract
The paper explores gender and diversity in transport research. Despite recent initiatives to address gender gaps in STEM and support women in research, most research outputs and investigations are led by men. Taking a systems-oriented approach, using qualitative and desk-based research, the authors argue that gender and diversity bias in research is symptomatic of a wider malaise in the Transport Business Ecosystem (TBE). This not only effects women's research footprints but more importantly the direction of transport research.

Introduction
Transport and transport research have, for many decades, been dominated by STEM disciplines and approaches, which are traditionally fields dominated by men. Transport innovation has led to cheaper, faster, cleaner, more efficient, greener and safer vehicles and in some cases better infrastructure. However, until the advent of the new mobilities paradigm (Sheller and Urry, 2006), environmental. social and cultural concerns transport has focussed too narrowly on improving the movement of vehicles.
Smart mobility, with its zero vision targets (European Commission, 2021) requires new players, new ways of thinking and a more integrated approach to considering transport not only as part of a system of systems, but one which has negative economic, environmental, health and well-being consequences. Whilst technology innovation remains a key factor in meeting future challenges, it is now time to link transport to wider issues and open up new pattens of thinking. The gender gap in transport is only reducing slightly, with women forming, at best, under 27% of the workforce, and

mostly being confined to nonexecutive positions. The roots of Smart Mobility lie in the traditionally male-dominated STEM (Science, Technology, Engineering and Mathematics) subjects such as computing, engineering, manufacturing and planning. These have become associated with fractured and gender-biased Transport Business Ecosystems, that, if left unchecked, will impede the ability to deliver equitable transport. Women's participation, in particular in engineering, remains low in most European Union (EU) countries: in 2012, graduates in STEM-related subjects accounted for 12.6% of female graduates as compared to a share of 37.5% among male graduates (Caprile et al, 2015) While the contribution of those from diverse and ethnic backgrounds is largely ignored.

Despite evidence of the benefits of diversity, gender equality legislation, emphasis on inclusion of gender and diversity in transport calls, gender mainstreaming tools, and initiatives to recruit women into STEM, progress towards equality and diversity has been slower than expected. Both the transport industry and academia lack diversity, intersectional or interdisciplinary thinking in this wider sense. Current academics, research agendas and innovations work in, on or through projects and environments, guided by the values and research interests of, for the most part, older, white, middle class males. Given this and the culture it promotes, it is not surprising that progress towards greater diversity is slow. The resistance of this group to change not only impedes the career pathways of women, it also reduces the level of understanding of wider mobility needs because there is no tacit understanding or experience of diversity or broader societal needs. Failure to address gender and diversity in the research community, as the Smart Mobility industry is forming, creates barriers to understanding mobility patterns and changes which need to be made.

Key to such a paradigm shift is understanding the preparedness of different stakeholder groups to embrace increasing diversity. Such stakeholders may be local authorities, OEMs, transport providers, legislators and regulators. Preparedness may relate to the availability and willingness to use tools and methods, ability to change, capacity and workforce diversity.

This paper (based on Woodcock et.al, 2020) looks at gender and equality in the EU transport research sector, responsible for setting up and funding research strategies, implementing new transport measures and supporting new researchers. An examination of how it operates, who and what is funded shows the extent to which the transport research community has embraced the necessary changes in its constituency, to enable new ideas and new stakeholders to breakthrough and direct change.

Method

The research was undertaken by a desktop review of existing material related to women in research in general and in transport research in the EU in particular. This was supplemented by

- an analysis of publicly available datasets recently funded EU projects in the mobility sector and,
- an online survey to understand more about the gender dynamics in transport research environments to identify issues that create impediments to women's equal participation in the field.

Results

The collated results were summarised and mapped on to the Hexagon Spindle Model of educational Ergonomics (Benedyk et.al. and Woodcock et.al., 2009), as shown in Figure 1. This provides a rapid method of distributing the challenges faced by female researchers across organisational, contextual and personal sectors. Notably, many of these issues are the same ones faced by women in the transport industry, pointing to the influence of macro, social and cultural factors permeating the whole sector.

This clustering is a first step towards developing a gender and diversity action plan to ensure a more even playing field. The hexagon-spindle model also asserts that if one aspect of an environment is too problematic, a person, as an active agent will adapt their behaviour to avoid it. For example, to escape a 'laddish culture' in the department, a female academic may choose to work in a quiet place,

in another part of the university or from home; she may dress differently; where her work is undervalued, or a work life balance cannot be created she may seek employment elsewhere. All of these are very real experiences for female researchers. There are personal and professional costs associated with behaviours which challenge the status quo e.g. complaining about behaviour of male colleagues, being unavailable to work at certain time, or not undertaking service duties.

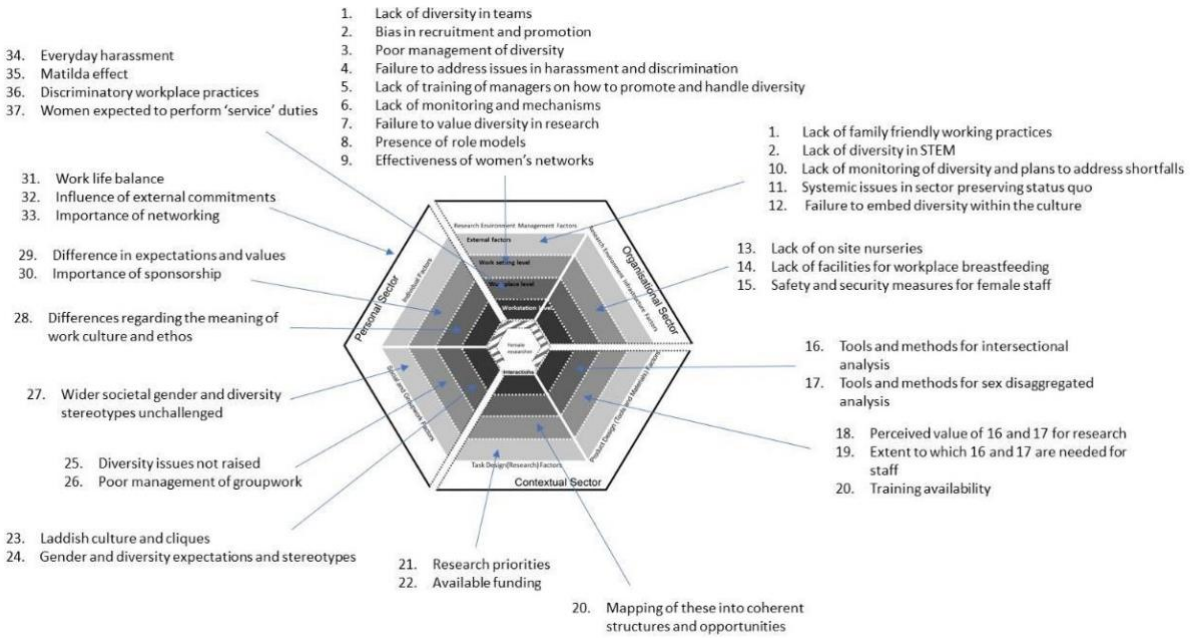

Figure 1: Overview of barriers to female researcher progression mapped on to the H-S spindle model.

Many of these issues are not 'job related' or about the design of the immediate work station but are clustered around the outer rings (external and work place setting), in the organizational sector, relating to the management of the research environment, the personal sector.

The findings accord with *(European Commission, 2020)* on the need for structural change in research institutions. Research centres are embedded in HEIs and staffed by those who have succeeded in that environment. They have a vested interest in maintaining the status quo, or systems may be so established that they are hard to turn around. The following recommendations are targeted at providing an inclusive research environment which is more conducive to (gender) diversity and can consolidate and speed up progress, and the level of influence women and those from more diverse groups can have on research and innovation.

Recommendations

In line with systemic design research approach which pervades much of TInnGO's work, we do not see quick or piecemeal fixes as necessarily appropriate in providing the paradigm shift needed. Transport research needs to be considered in the context in which it takes place, it can lead by example, but it must be supported by institutional changes. For example,

In Higher Education Institutions

- Transfer best practices to create an environment welcoming for women eg eliminating gender pay gap, understanding the female pipeline and progression, create mentorship programmes, reduce gender bias in recruitment, ensure inclusivity of all events, develop non prejudicial complaints procedures,
- Performa a Gender and Diversity Gap Analysis, develop an action plan and performance metrics

- Realign core objectives to develop a more holistic approach to cultural diversity (among both staff and students)
- Reduce disproportionate allocation of service duties

For research centres

- Reduce motherhood penalty
- Actively increase the research footprint of women
- Provide training for research managers on how to manage diverse teams and create zero tolerance environments to end discrimination, harassment, and gender bias (such as the Mathilda effect)
- Ensure all research projects generate, use and provide sex disaggregated data and intersectional analysis.
- Conduct a capability audit on research staff regarding their familiarization with sex disaggregated data 18 and intersectional analysis and develop training material specific research priorities of the centre.

For funding bodies

Provide additional training for staff and PIs to supplement the recommendations from, for example, the Gendered Innovations project, the existing Gender Toolkit and H2020 guidelines, relating to understanding the effects of diversity on research questions, methods, analysis and impact, reporting of intersectional activities, use of gender and diversity mainstreaming and using gender and diversity action plans to guide the research and staff development and team management.

In addition, funding bodies could

- require named and weighted sections on proposals and final reports relating to how gender and other differences have been considered and might have shaped research outcomes; understand the links between the diversity of the team and the research questions to funding success;
- provide training for evaluators on gender and diversity
- incentivise gender equitable research consortia
- record characteristics of research teams and make this available for analysis with greater transparency on award applicants
- analyse previous proposals to produce recommendations and guidelines on how diversity and intersectionality have been considered. Many person hours are spent in developing proposals, with most being unsuccessful. Nonetheless, this provides a rich data stream which could be more widely shared and analysed.
- Gender action plan for equality, diversity and inclusion (for example, Research Councils UK (RCUK) action plan 9 which focuses on leading by example through improved diversity in the research councils and review bodies, ensuring that workforce has the skills to act as ambassadors for equality, diversity and inclusion, challenging bias and raising awareness of impact of unintentional bias in RCUK systems, processes, behaviours and cultures; ensuring funding is not influenced by the gender of the applicant or by any other protected characteristics; providing 6 strong leadership to change the culture, practices and makeup of the research community).

Training opportunities

There is a need for a new qualification/level of competence for those wishing to lead research teams and projects. Gaining a postgraduate qualification indicates that the holder may have expertise in an innovative/interesting area. Subsequently, research management skills are 'picked up along the way' e.g. through mirroring behaviour of supervisors, attending ad hoc courses, learning by trial and error. Given the level of investment in research, the need for impact, wider diversity and, and the barriers (female) research staff face in fulfilling their potential, the final recommendation is the development

[9] https://www.ukri.org/files/legacy/skills/action-plan-edi-2016/

of an EU wide research competency framework, leading to a named qualification (based on a portfolio of practice) which would provide training and mentorship for those wishing to be research leaders. Specific areas could focus on sex, gender and intersectional analysis, management of diverse team and wider PI skills.

Conclusions

The EU research community has shown its commitment to improving gender equality. The transport and mobility calls stress the need to take into account gender related issues. This should be extended to considering wider diversity issues and further analyses could be made of previous projects to identify further activities and trends.

Unfortunately, our research has shown that top down approaches and best practices are reduced in their effectiveness by gender inequalities and lack of diversity which pervade the wider educational system, and STEM related research in particular. The paper has presented a series of recommendations on how this can be addressed, to improve the research culture for the next generation of female researchers.

Acknowledgements

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13.15-13.30 / 14.15-14.30 Presentation 4**9**: Friday, 19th November 2021

Experiences of gender and diversity in research teams working on transport related projects funded by EU

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Abstract

This study explores the experience of gender and diversity in research teams in transport and smart mobility related projects funded by the European Commission under Horizon 2020. An analysis of interviews with 14 Principal Investigators revealed that despite the growing awareness about gender and diversity inequalities in academia, bias against underrepresented groups exists. However, variation of experiences calls for intersectional lenses when assessing the problem. Findings reveal the need for changes in EU projects application process, implementation, delivery, and impact evaluation to address gender and diversity gaps.

Introduction

Several studies have revealed gender and diversity disparities in academic careers (Huang *et al*., 2020). Consequently, female researchers have smaller research footprints and are not as well represented as men among grant awardees and project leadership teams (Elsevier, 2020). Lack of gender balance, especially in leadership positions has been attributed to a variety of factors: bias in hiring, bias in promotion, gender differences in research collaboration (Van den Besselaar & Sandström, 2017), and educational barriers in STEM (science, technology, engineering and mathematics) fields (Charlesworth & Banaji, 2019). Despite the growing awareness about gender and diversity inequalities in academia, bias against underrepresented groups exists (Llorens, Anaïs et al., 2021). Bias is understood here as: an inclination or prejudice for or against one person or group, especially in a way considered to be unfair. This is especially relevant for transport and smart mobility related research, which are embedded in traditionally maledominated STEM subjects such as engineering, manufacturing and planning. As a result, smart mobility research teams do not represent the communities they cater for, which could impede delivery of equitable transport.

Thus, providing in-depth insight into dynamics of participation of those of different genders in smart mobility research projects is a significant step towards better understanding barriers and challenges on the journey to a more inclusive research ecosystem, which can deliver solutions and services that will address acute gendered problems of climate change, urbanisation, and sustainability in the context of growing social inequalities.

Methodology

This study explored experiences related to gender and diversity in research teams in transport and smart mobility related projects funded by the European Commission under Horizon 2020 Research and Innovation Framework Programme. Its aims were three-fold. Firstly, to identify experiences, attitudes and beliefs related to gender and diversity in the research work and outputs. Secondly, to understand barriers to gender and diversity mainstreaming. Thirdly, to identify needs for polices and support for research staff.

In total, 14 Principal Investigators were interviewed (3 males, 11 females). All interviews were carried out over zoom online, due to the global Covid19 pandemic. Thematic analysis informed data analysis.

Beyond gender

The analysis revealed that despite the growing awareness about gender and diversity inequalities in academia, bias against underrepresented groups exists in research teams and it extends to EU funded research projects. Data revealed that experiences of gender and diversity in research teams were determined by one`s social identities. Factors such as gender, age, nationality, professional status, ethnicity, disability and many more were affecting relationships within the consortium and the perceived sense of belonging. However, variation of experiences called for intersectional lenses when assessing the problem. There are different factors contributing to bias. Apart from female gender being frequently quoted as the implicit reason for biased treatment, age and nationality were also prevalent factors perpetuating prejudice:

> *For example, given this context now, due to my age [young], I was advised not to lead the proposal writing, not to lead the consortium. In general, there are some comments due to my age. [P6]*

> *It was a challenging role, especially because I was a woman and coming from Eastern Europe, but it turned out well. It was a tough time; I have to say it wasn't easy. [P4]*

Overall, experiences of participation in the research projects were determined by overlapping social identities, which often exacerbated existing power relations; e.g female gender and young age, or female gender and Eastern European background.

"… in the end it's up to the people working on the proposal"

Interviews evidenced that very little attention is paid to gender and diversity aspects in project implementation and delivery. Hence, it depends on the research team members involved to what extent they decide to work on gendered issues. Based on data from the interviews, it seems that gender and diversity aspects are not popular topics and are incorporated at the minimum level only due to requirement from the EU:

> *There's this paragraph that you always have to include in the proposals about gender diversity and gender equity, and it's not a big paragraph, it's very standard, so you normally copy it from somewhere else. But in the end it's up to the people working on the proposal to actually think of specific things that could impact the equity and the inclusiveness, so of the project activities and also of what you are preaching, because you're teaching cities how to do stuff about planning, about mobility planning, and you should tell them to do it differently. [P4]*

There was a general recognition of the role played by personal interests of the people involved in proposal development. Overall, it seemed that final proposals were heavily influenced by the interests and expertise of potential partners. Consequently, majority of interviewed Principal Investigator did not have gender and diversity equality agenda included in the proposal unless the project was concerned explicitly with gendered mobility or vulnerable transport users.

`I don't know if that's followed up and how it's assessed`

For many participants it remained unclear how gender and diversity dimensions in EU funded projects are assessed, how the diversity of their consortium is measured, and how does it relate to outcomes, outputs, impact, or equality goals. Moreover, many participants concluded there was no impact assessment specifically addressing gender and diversity issues in the project evaluation phase:

> *I don't think that it's much reflected in the measurement. It's difficult to say because there are so many different levels you can evaluate or you can measure, but, for example, gender competes with other issues, other social. [P1]*

> *Nobody measures how the gender balancing of consortium actually impacts the results of the project, and the output of the project. […] There's no measurement, everything you measure in terms of impact, you just measure the impact, nobody is actually considering… maybe if they relate and say, 'Yeah, but we have a gender balanced consortium, and these are the results,' so you can relate them. But nothing is really connecting back to how the consortium was being developed, and what the consortium looked like during the implementation phase. So no. [P4]*

> *I'm not aware that you monitor the quality or the content of the research addressing the sustainable goals and any equality. […] nowadays you have this box about gender and so on and how it's addressed but I don't know that's followed up and how it's assessed. There*

is always the possibility of white washing if you don't follow it up and I don't know how it's done. So I'm not saying that it's not done but I just don't know how. [P10]

This stance was echoed in majority of interviews: lack of measurements or vaguely communicated assessments of gender and diversity aspects were the main impediments to fully understanding what actions followed equality goals. Interviewees were referring to all stages of projects, starting with application process and putting call forwards, through implementation and delivery, to impact evaluation.

`…looking at the facts and the figures, that's a good start`

There was a general recognition of the importance of inclusivity at organisational level. Many participants stated that non-inclusive organisations cannot deliver quality projects related to transport, sustainability, and equality goals. Secondly, the research team make up and project representations set standards for partnering cities and transport sector services. However, it has been noted by many participants that impediments to female career development still exist and prevent women from equal participation in the field. Glass ceilings, the motherhood penalty, microaggressions, implicit bias - to just name a few. These issues could be investigated by continuous gender and diversity disaggregated data collection:

We could do this by reading the material, [laughs], that's how you do science, looking at the facts and the figures, that's a good start. [P10]

As stated above data informed action could advance work on gender and diversity at organisational and institutional level. One of the key recommendations from interviews was that organisations should commit to regular data collection on demographics of their employees and track their progress, grant applications, support given and career pathways in order to identify barriers in academic careers developments. Data should be gender and diversity disaggregated, looking at disparities between different groups (intersectional lenses taking into consideration: gender, ethnicity, age, disability, background and many more characteristics) by department, seniority and retention.

Discussion

If the research team makeup lacks inclusivity, the future of the smart mobility may replicate the same inequalities as the past. Transport and smart mobility related projects are still predominantly male-led, and guided by male interests. By impeding development and progress of diverse research team's leadership – we are losing potential solutions that could maximise innovation in transport, improve standards of lives, and tackle society's problems. Therefore, it is crucial to determine how we continue the work on more inclusive research ecosystem. Benefits of fostering diversity and inclusivity in academic research go beyond providing equal opportunities to everyone. Innovation and creativity thrives on diversity. Diverse teams bring more innovative ideas and different perspectives to the future services and products. Moreover, they create platform for collaboration and democratic problem solving by voicing different ideas, experiences, and perspectives. Science benefits from diversity as much as it benefits from different arguments and ideas. Therefore, allowing more inclusive research footprints can produce better outcomes, more arguments resulting in excellence of scientific advancement. Not only academic institution are losing by wasting talents and skills but also society loses as a whole. Smart mobility needs diverse research teams that will address acute problems of climate change, urbanisation, and sustainability in the context of growing social inequalities.

Recommendations

The gender and diversity gap in transport related EU projects needs to be addressed using a broad holistic approach. Only by challenging bias in education, academia, organisations, institutions, local authorities, and leadership can we advance work on equality goals. These areas are interconnected and illustrate how social inequalities permeate into all aspects of research projects and its outputs.

Gender and diversity data on research projects (objectives, teams make up, research footprints, impact) can drive actions on closing gender and diversity gap in international research community and inform policy at both EU and organisational level. Below Figure 1. Illustrates interlocking recommendations, which emerged from the findings, and represents interconnected actions, which can further work on gender and diversity in research projects funded by EU.

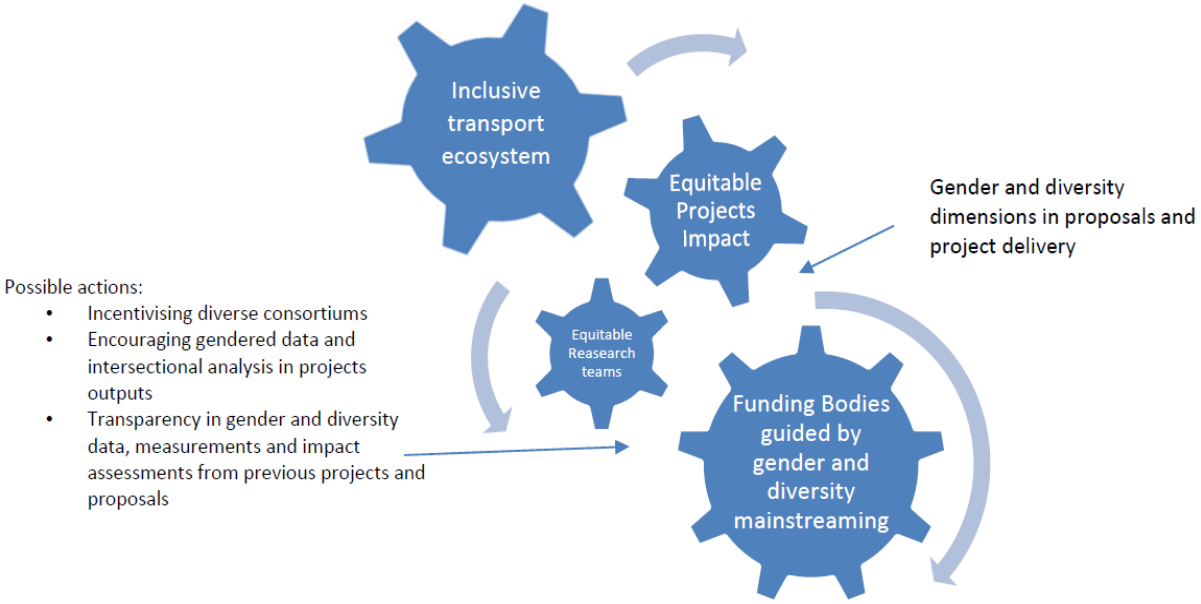

Figure 1. Gear of change. Recommendations for funding bodies

Each element is driven by tools and methods derived from gender and diversity mainstreaming. Thus, gender and diversity mainstreaming sits in the principal position and guides all actions, which are encouraged by main actor – funding body. Gender and diversity mainstreaming is a strategy to improve the quality of public services like transport, programmes and projects, ensuring a more efficient allocation of resources (Christensen et al., 2007). Better results mean increased well-being for both women and men, and the creation of a more socially just and sustainable society (Levin & Faith-Ell, 2019). The change does not happen in one direction, it is more of a mutual relationship between actions working both ways. Each consecutive action will have indirect implications on the transport system and finally on the society as a whole, which is the last gear in this mechanism leading to holistic change.

Acknowledgements

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13.30-13.45 / 14.30-14.45 Presentation **50**: Friday, 19th November 2021

Gender and equality aspects through the process of education and its impact on transport sector in Baltic states

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Abstract

The academic environment could take an important role for the mindset of the young people when deciding his or her future career preferences, especially in one-gender-dominated sectors as transport. Transport and mobility sectors are still facing the female underrepresentation, numerous strategies are being applied to solve this pattern. However, the mediume to address this problem lays in various levels of the personal formation. The aim of this article is to evaluate the hypothetical potential of academic sector to induce the greater interest of the youth (especially females) to choose transport related studies and to promote gender and equality in smart mobility. The core methods of the study are data analysis and quality interviews with the representatives of the 30 schools from Baltic states regarding challenges, incentives, and the variety of external influences for the youth to choose their career preferences with particular emphasis to transport field.

13.45-14.00 / 14.45-15.00 Presentation **51**: Friday, 19th November 2021

Building capacities on how to integrate a gender dimension in the content of scientific research and innovation: the GE Academy project experience

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Abstract

Through the Horizon 2020 and lately Horizon Europe programmes, the European Commission has affirmed and renovated its commitment towards gender equality in research (Gender equality in research and innovation, 2021). The inclusion of a gender dimension in the content of scientific research has been one of the three main ERA objectives set for gender equality in research (European Commission, 2012), and it falls under the umbrella of Horizon Europe's recommended thematic areas to be included in the Gender Equality Plans. The GE Academy project has been developed and funded

in this framework, with the aim of providing a high-quality capacity building programme on gender equality in R&I, to be disseminated in more than 15 European countries. The training program standards design took inspiration from feminist pedagogy principles and readapted them to the institutional change context (Sánchez-Casal and MacDonald, 2002, Mukhopadhyay and Wong, 2007; Ferguson, 2019). At the same time, also the PERFKTSI principles have constituted a guiding framework that helped to filter across a set of quality standards for gender training, and to transfer them towards transformative, non-hierarchical, experience-based learning. This work has been done studying different sources: reports from UN Women on quality in gender training, EIGE work, but also documentation and publications from different EU funded projects on gender training (QUING/Opera/GemTrEx /GenderStrat4Equality, etc). This has allowed embracing multiple interpretations of feminism while keeping consistency and focus by addressing the specific challenges of institutional transformation in research organisations. (GemTrEx, 2008; Ferguson and Forest, 2011; EIGE, 2016; GenderStrat4Equality, 2016; UN Women Training Centre, 2016)
Along with the GE Academy duration (Jan 2019 – Dec 2021) the capacity building program has been articulated and implemented using different training formats: in-person trainings, workshops, webinars, summer schools, DOCC (feminist alternative to MOOCs created by FemTechNet), roundtables, and train the trainers' sessions, and due to the covid-19 outbreak since mid2020 all formats have been moved online.
This presentation aims to reflect upon the experience of the GE Academy project, specifically on those training sessions focusing on integration of the sex and gender dimensions into research. In particular, learning objectives, approaches and methods of sessions held on a variety of disciplinary fields, will be presented and discussed, with peculiar attention to those with impact on urban planning, from mobility, to ICT, to climate and energy.
The presentation will also draw on data collected through the continuous monitoring of the capacity building programme' quality, to assess to what extent the sessions managed to increase participants' understanding of the relevance of including sex and gender variables in research.

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[i] Arguments for and against AV are summarized in (Litman 2021) These assumptions are echoed in many versions in strategic documents e.g. in Danish Climate Council: Known paths and new tracks to 70 per cent reduction | Klimarådet (klimaraadet.dk) 2020 and in Volvos promotion films.

[ii] Statistics have been collected from the YouTube channels from the companies January the 4th 2021 (Volvo 2021), the 31st of May 2021 (BMW 2021)