



Analysing Urban Mobility Policy Measures: Learning from Paris

Melissa Joana Siegle

Dissertation written under the supervision of
Professor Pedro Parada

Dissertation submitted in partial fulfilment of requirements for the International MSc in Management with a Specialization in Strategy and Consulting, at the Universidade Católica Portuguesa, 31.05.2024.

Abstract

Urban mobility is a crucial aspect of contemporary urban planning, particularly in the context of accelerating urbanisation and mounting environmental challenges. This thesis examines urban mobility policies in Paris, with a focus on the identification and ranking of the most beneficial policy measures. Through a mixed-methods approach that integrates qualitative and quantitative data, this research identifies various urban mobility policies and evaluates them based on their impact, cost, time, acceptability, and transferability.

By interviewing 13 experts in urban mobility a total of 16 policy measures are disclosed. These measures are then ranked based on their potential to improve urban mobility in Paris, providing policymakers with actionable insights for decision-making. The findings show that higher taxes on internal combustion engine vehicles (ICEVs), free parking for electric vehicles (EVs), and the implementation of mobile applications for public transit are the most beneficial measures for improving urban mobility in Paris. The study also emphasises the importance of integrating multiple policy measures to achieve a comprehensive and effective urban mobility strategy.

Keywords: urban mobility, policy measures, Paris, sustainable transport, mixed methods research

Title: Analysing Urban Mobility Policy Measures: Learning from Paris

Author: Melissa Joana Siegle

Resumo

A mobilidade urbana é um aspeto crucial do planeamento urbano contemporâneo, particularmente no contexto da aceleração da urbanização e dos crescentes desafios ambientais. Esta tese examina as políticas de mobilidade urbana em Paris, com foco na identificação e classificação das medidas políticas mais benéficas. Através de uma abordagem de métodos mistos que integram dados qualitativos e quantitativos, esta investigação identifica várias políticas de mobilidade urbana e avalia-as com base em critérios como o impacto, o custo, o planeamento, a aceitabilidade e a não transferibilidade.

Através de entrevistas a 13 peritos em mobilidade urbana, é revelado um total de 16 medidas políticas. Estas medidas são depois classificadas com base no seu potencial para melhorar a mobilidade urbana em Paris, fornecendo aos decisores políticos informações accionáveis para a tomada de decisões. Os resultados mostram que o aumento dos impostos sobre os veículos com motor de combustão interna (ICEV), o estacionamento gratuito para veículos eléctricos (EV) e a implementação de aplicações móveis para os transportes públicos são as medidas mais benéficas para melhorar a mobilidade urbana em Paris. O estudo sublinha igualmente a importância da integração de múltiplas medidas políticas para alcançar uma estratégia de mobilidade urbana abrangente e eficaz.

Palavras-chave: mobilidade urbana, medidas políticas, Paris, transportes sustentáveis, investigação com métodos mistos

Título: Análise das medidas de política de mobilidade urbana: Aprender com Paris

Autor: Melissa Joana Siegle

Acknowledgements

The completion of my dissertation marks the culmination of my master's program at the Católica Lisbon School of Business and Economics. Over the past two years, this experience has been a transformative period in my life, enabling me to deepen my academic education, face new challenges, learn a new language and culture, and form strong friendships. Over the past four semesters, I have had the privilege of engaging in interactive learning, participating in consulting projects, and attending career sessions that have significantly contributed to my academic and personal growth.

I extend my heartfelt gratitude to all the professors, staff, and fellow students at Católica who have made this journey so memorable. To my thesis advisor Pedro Parada: I owe a special debt of gratitude for your support and mentorship throughout the entire dissertation process. I thank you for your willingness to respond to my questions, as well as for the impactful insights you have provided.

Furthermore, I would like to express my profound gratitude to my 13 interview partners. Your time and input were crucial for the success of my research. The sharing of your valuable experiences and the engagement in insightful interviews enabled me to gain a deeper understanding of urban mobility in Paris.

Finally, I wish to extend my heartfelt gratitude to my parents for their support throughout my academic career. Additionally, I am deeply thankful to my partner for his encouragement and constant support. Lastly, I am immensely grateful to all my friends, whose constant support and ability to keep me in good spirits have been invaluable throughout this endeavour.

Table of Contents

- ABSTRACT II**
- RESUMO..... III**
- ACKNOWLEDGEMENTSIV**
- TABLE OF CONTENTS V**
- LIST OF FIGURESVII**
- LIST OF TABLES.....VIII**
- LIST OF ABBREVIATIONS..... IX**
- 1 INTRODUCTION 10**
- 2 LITERATURE REVIEW 12**
 - 2.1 URBANISATION AND URBAN MOBILITY 12
 - 2.2 SUSTAINABLE TRANSPORTATION MODELS 13
 - 2.2.1 *Public transport*..... 13
 - 2.2.2 *Car-sharing*..... 15
 - 2.2.3 *Bicycle* 16
 - 2.2.4 *Technological innovations in transport*..... 17
 - 2.3 URBAN MOBILITY POLICY MEASURES 19
 - 2.3.1 *Definition of urban mobility policy measures* 19
 - 2.3.2 *Example urban mobility policy measures*..... 19
- 3 METHODOLOGY 21**
 - 3.1 RESEARCH DESIGN 21
 - 3.2 DATA COLLECTION AND DATA SAMPLING 21
 - 3.2.1 *Semi-structured interviews* 22
 - 3.2.2 *Ranking matrix*..... 25
- 4 RESULTS..... 28**
 - 4.1 QUALITATIVE ANALYSIS 28
 - 4.1.1 *Financial measures* 28
 - 4.1.2 *Regulatory measures* 28
 - 4.1.3 *Convenience and accessibility measures*..... 30
 - 4.1.4 *Social and community measures*..... 31
 - 4.1.5 *Technological measures*..... 33
 - 4.2 SUMMARY..... 34
 - 4.3 QUANTITATIVE ANALYSIS 35

5	DISCUSSION AND IMPLICATIONS	37
5.1	FINANCIAL MEASURES.....	37
5.2	REGULATORY MEASURES	37
5.3	CONVENIENCE AND ACCESSIBILITY MEASURES	38
5.4	SOCIAL AND COMMUNITY MEASURES.....	38
5.5	TECHNOLOGICAL MEASURES	38
6	CONCLUSION	40
7	LIMITATIONS AND FURTHER RESEARCH.....	41
	LIST OF REFERENCES.....	43
	APPENDICES	50
	APPENDIX A: INTERVIEW PARTICIPANTS	50
	APPENDIX B: INTERVIEW QUESTIONS	52
	APPENDIX C: EXAMPLE EXPERT INTERVIEW TRANSCRIPT.....	54
	APPENDIX D: THEMATIC ANALYSIS OF THE INTERVIEWS BASED ON GIOIA ET AL., 2013	70
	APPENDIX E: RANKING SYSTEM OF URBAN MOBILITY POLICY MEASURES IN PARIS.....	80

List of Figures

Figure 1: Share of the world's population living in cities by 2050 (UN Habitat, 2022).....	12
Figure 2: Comparison of efficiency of buses vs. cars (Ortúzar, 2019)	14
Figure 3: Sankey-Diagram of the interviewee selection process	23
Figure 4: Categorisation of policy measures for promoting sustainable transport	34
Figure 5: Distribution of measured scores	35
Figure 6: Variability in expert assessments of measures	41

List of Tables

Table 1: Evaluation results.....	35
----------------------------------	----

List of abbreviations

AV	Autonomous Vehicle
BEV	Battery Electric Vehicle
EU	European Union
EV	Electric Vehicle
GDP	Gross Domestic Product
ICEV	Internal Combustion Engine Vehicle
ITS	Intelligent transportation systems
MaaS	Mobility as a Service
NGO	Non-Governmental Organization
RER	Réseau Express Régional
SUV	Sport Utility Vehicle
TLZ	Traffic Limitation Zone
UN	United Nations
ZTL	Zone à Trafic Limité (Limited Traffic Zone)

1 Introduction

Urbanisation represents one of the most profound trends of the 21st century, reshaping landscapes, economies, and societies. With cities worldwide continuing to expand, one critical need for sustainable urban development becomes their transportation scheme. Policymakers have started to increasingly acknowledge the intricate relationship between sustainable urbanisation and public transport policies, underscoring the latter's pivotal role in steering cities towards a desirable future.

But even today cities still struggle with the complexity of this task and the challenges to implement tangible measures. For example, congestion is still an ubiquitous problem in metropolises all over the world, that has not only detrimental effects on the physical and mental health of citizens but also causes enormous economic damages by using up valuable time and resources. Additionally, there are hard to measure and often unknown economic effects at play like for example a vast disparity between the societal cost of various transport modes. While cars have been exemplarily calculated as costing society 0,159€/km (equals 0.22€/km inflation adjusted from 2008 to 2024), riding a bike can save society 0.164€/km (0.22€ in 2024) due to less pollution and increased health benefits (Gössling & Choi, 2015). It is therefore crucial to examine how the integration of public transport policies can contribute to making cities more sustainable while simultaneously resulting in an efficient urban environment.

Paris recently won the Sustainable Transport Award in April of 2023 (Institute for Transportation & Development Policy, 2024), having implemented a range of policies that have significantly altered its urban landscape. This is why Paris can be considered an inspiration for mobility investments and policies in other cities. This year in 2024, the city will take another step into the global spotlight when hosting the Olympic Summer Games and uses this to further expand its vision to improve its roads and transport systems (Institute for Transportation and Development Policy, 2024). With this momentum, Paris offers a rare opportunity to act as role model for researchers and other cities to analyse the implemented measures. To replicate Paris' success in other cities it is necessary to find the best and most recommendable measures and this study thus investigates the following research question:

What can cities learn from Paris' urban mobility transformation?

By answering this question, the research aims to provide actionable recommendations for policymakers to tackle the mentioned urban mobility challenges and improve economic, social and environmental stability.

In the following second chapter of this study, a comprehensive literature review on sustainable transportation models and urban mobility policy measures is presented, with the aim of enhancing these models related to the research question. It commences with an examination of the evolution of urbanisation, and subsequently, an analysis of sustainable transportation models. Various types of sustainable transportation models are discussed in detail, with a thorough exploration of their associated benefits and challenges. *Chapter three* explains the research methodology, offering clarity on data collection, sampling strategy, and interview protocol, as well as the ranking matrix. It also explains the chosen research method. The data collected is subjected to an analysis through the systematic Gioia method (Gioia et al., 2013), employing content analysis to provide a thorough understanding of the results obtained from 13 expert interviews. These results then form the basis for the quantitative part of the research, as it was used to identify 16 policy measures, which were then rated by the experts based on five criteria. *The fourth chapter* presents the interview and ranking matrix results, followed by a discussion that connects insights with the revised literature. In conclusion, the research also identifies potential limitations, managerial relevance, theoretical contributions, and directions for future research.

2 Literature review

This literature review analyses a mix of research articles, policy reports, and case studies that address the challenges and solutions in creating sustainable urban transportation. The primary areas of focus include sustainable transportation models and urban mobility policy measures that can enhance these models. This review brings together recent findings and global initiatives to suggest effective ways of managing the increasing need for urban transport while ensuring economic, environmental, and social sustainability. The aim is to provide a clear understanding of the current state and future possibilities of urban mobility.

2.1 Urbanisation and urban mobility

Urbanisation is a global trend that has led to a significant increase in the proportion of the population living in urban areas. This development has been going on for over 60 years and is said to continue well into the future with 70% of the world’s population projected to live in cities by 2050 (see Figure 1, UN Habitat, 2022). At the same time the population of the world's largest cities also continues to grow (UN DESA, 2018), indicating ever increasing density of the population and creating various challenges to keep these ecosystems functioning well.

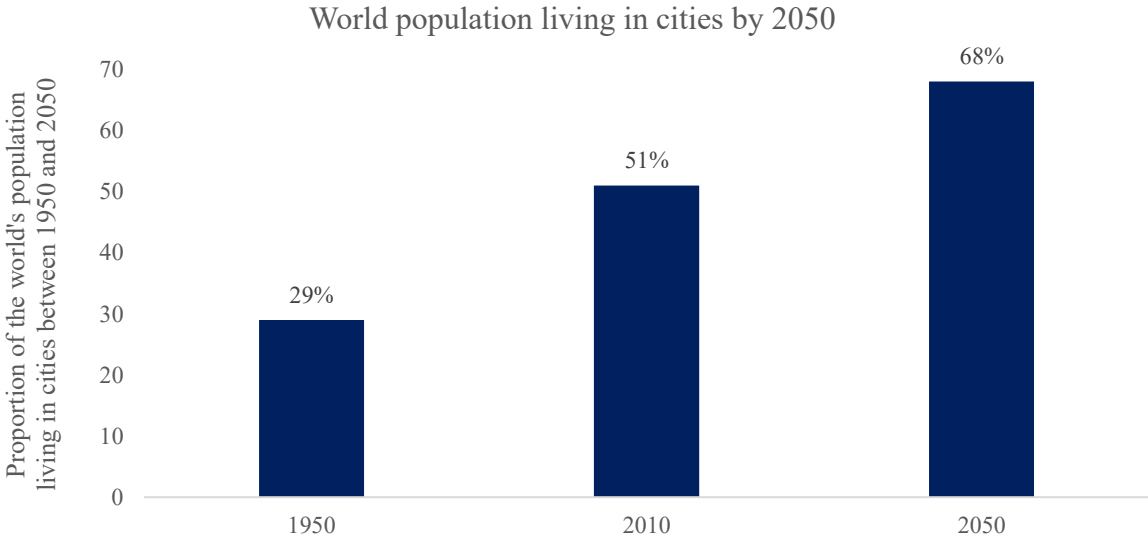


Figure 1: Share of the world’s population living in cities by 2050 (UN Habitat, 2022)

With this, the mobility of people and goods within cities is obviously becoming increasingly important. According to a forecast from (Arthur D. Little, 2018), global demand for inner-city mobility is set to rise to 48.4 trillion passenger-kilometres by 2050. In 2010, the figure was 25.8 trillion passenger-kilometres, while global demand for inner-city freight transport services is expected to rise to 28.5 trillion tonne-kilometres, up from just under ten trillion tonne-

kilometres in 2010 (Arthur D. Little, 2018). Existing transport systems are increasingly reaching their limits, with traffic jams on the roads of the world's metropolises already causing serious problems to major economies each year. In 2022, London ranked as the world's most congested city, with enormous implications on GDP as drivers spend an average of 156 hours stuck in traffic throughout the year (INRIX, 2023).

Urban areas are also confronted with transport-related air pollution, noise, occupation of public space by traffic, and increased morbidity and mortality rates caused by traffic accidents and pollution (Bosetti, 2013). These have an immense impact on economic, environmental, and social issues, the so-called triple bottom line (Litman T., 2019), highlighting the urgent need for sustainable transport solutions.

2.2 Sustainable transportation models

In order to address urbanisation and the resulting increased demand for urban mobility solutions, this chapter looks at different aspects that are critical for the improvement of sustainable urban transport systems.

When looking at sustainable transportation models, four models can be described: public transport, car-sharing, bicycle and technological innovations in public transit. In the following these models with its effectiveness and efficiency will be explained.

2.2.1 Public transport

Public transit, which encompasses services such as buses, trains, and ferries, is a fundamental component of sustainable urban mobility, offering significant economic, environmental, and social benefits. Public transit systems enhance urban mobility by providing efficient, reliable, and accessible transportation options. Efficiency is a crucial factor, as public transit systems can move a large number of people using less road space and energy than private cars (Chapman, 2007). A popular visualisation to make this fact instantaneously obvious is to show the used road space taken up by cars and the much smaller space necessary for the same number of occupants in public busses. One such visualisation is shown in Figure 2 with several cars parked on a city street on the left and a single bus shown on the right that is capable of transporting the same number of people (Ortúzar, 2019).



Figure 2: Comparison of efficiency of buses vs. cars (Ortúzar, 2019)

Economically the transition from private vehicle ownership to public transit can result in savings of approximately \$3000 (equals \$6000 inflation adjusted from 1996 to 2024) annually in vehicle ownership costs (Litman, T. 1996). Furthermore, public transit systems can generate substantial economic benefits by reducing the overall costs of congestion, which can amount to billions of dollars annually. For instance, traffic congestion in the EU costs approximately 130 billion euros annually, which represents approximately 1% of the entire GDP (European Court of Auditors, 2019). By mitigating these costs, public transit systems result in saving billions of dollars each year, thereby contributing to a more efficient and economically productive society.

In addition to affordability, accessibility is also a key factor (Department for Transport, 2007). Cities such as Paris are expanding their metro and bus networks with projects like the *Grand Paris Express*, which aims to provide access to rapid transit stations for 90% of the city's population by 2030 (Le Grand Paris Express, 2021). Such improved accessibility reduces transport chaos and enhances access to essential services and economic opportunities for diverse demographic groups (Altman J. and Hinkson M., 2007; Currie G. et al., 2007; Hurni, 2005; Johnson, 2011).

The convenience of public transit is defined by several factors, including reduced travel and waiting times, seamless transfers, and user-friendly services (Anderson et al., 2013). The implementation of integrated ticketing systems, such as London's Oyster card, has also

significantly improved user convenience by enabling smooth transfers between different transport modes (Transport for London, 2023).

2.2.2 Car-sharing

A car-sharing model represents an innovative approach to urban mobility that provides individuals with access to vehicles on an as-needed basis without the financial burden associated with vehicle ownership. Such services, which allow users to rent cars for a specified period, confer numerous advantages in economic, environmental, and social terms.

From a financial perspective, car-sharing can reduce the cost of transportation for individuals by eliminating expenses typically associated with vehicle ownership, including the purchase price, the cost of maintaining the vehicle, insurance, and parking (Rabbitt and Ghosh, 2016). A study conducted by Shaheen et al. (2019) revealed that participation in car-sharing programs can result in savings of between \$500 and \$3000 annually compared to ownership of a private vehicle. Furthermore, car-sharing optimises the utilisation of vehicles, as shared cars are used more frequently and efficiently than privately owned vehicles, which are usually not in use 90% of the time (Martin et al., 2010). From an environmental perspective, car-sharing contributes to reducing the number of vehicles on the road, which in turn decreases traffic congestion, lowers emissions, and diminishes the demand for parking spaces. For example, research has indicated that one shared car can replace up to 15 privately owned vehicles, significantly reducing urban congestion and freeing up valuable urban space for other uses (Firnkorner and Müller, 2012). Furthermore, car-sharing programs often include environmentally friendly vehicles, such as hybrids and electric cars, which further reduce the carbon footprint of urban transportation (T. Litman, 2006).

From a social perspective, car-sharing enhances mobility options, particularly for residents who may not be able to afford a private vehicle or who prefer not to own one. It provides a flexible and convenient alternative that supports the use of public transport, walking, and cycling (Department for Transport, 2007).

The integration of car-sharing with public transit enables cities to offer mobility solutions that cater to various needs and preferences, thereby enhancing the overall efficiency and sustainability of urban transport systems (Shaheen et al., 2019).

Remarkably, car sharing contributes to economic resilience by fostering a sharing economy, creating employment opportunities and promoting sustainable business practices (Martin et al.,

2010). Furthermore, it reduces the necessity for extensive urban infrastructure dedicated to parking, thereby enabling cities to reallocate these spaces for the development of parks, pedestrian areas, and other community-enhancing projects (Butz, 2023).

2.2.3 Bicycle

The prevalence of bicycle use in urban areas has been on the rise in recent years. This trend can be attributed to several factors, including the desire to contribute to local, national, and EU climate goals. However, it also reflects a growing citizen demand for cleaner air, safer and quieter streets, more multimodal travel options, and more liveable communities (ECF, 2023). To achieve these goals, it is essential to develop a robust bicycle infrastructure. This infrastructure must provide a safe and secure environment for cyclists, ensuring their safety and comfort. Consequently, urban areas must implement segregated cycle tracks, secure bicycle parking facilities, and measures that reduce the speed and volume of motor vehicles in order to create a more conducive environment for cyclists (Fiol et al., 2022).

Furthermore, governments may implement financial incentives for citizens with the objective of increasing the use of bicycles. One potential strategy is to provide employees with allowances in their salaries for every kilometre they cycle. Tax reductions may be implemented for bicycle leasing programs that facilitate the acquisition of bicycles that may be temporarily out of financial reach, such as electric cargo bicycles. Alternatively, cities may provide citizens with direct purchase incentives. For example, in France, the sale of electric bicycles (e-bikes) increased by twofold following the introduction of a government subsidy for their purchase (ECF, 2023).

Furthermore, the implementation of bicycle sharing systems represents a potential solution for citizens to use a bicycle. Bicycles are available at multiple docking stations throughout the city, increasing convenience and reducing overall travel costs. Empirical studies show that the annual savings for users of bicycle-sharing systems compared to the cost of owning a private car range from approximately \$1,500 to \$3,500 (Demaio, 2009; Fishman et al., 2013). Furthermore, the implementation of bicycle-sharing stations has been proven to contribute positively to urban economies by reducing traffic congestion, which in turn reduces the economic costs associated with delays and lost productivity. For example, the introduction of bicycle-sharing programs in cities such as New York led to 10% reduction in rush hour traffic congestion, thereby increasing the efficiency of urban transportation networks (Ricci, 2015). Furthermore, according to the United Nations (2011), the introduction of bicycle-sharing

programs has been shown to improve local economies by attracting tourists and strengthening a city's image as a progressive and environmentally friendly destination. To summarise, the integration of bicycle sharing into public transport aims to improve accessibility and efficiency, thereby facilitating the movement of users from transport hubs to their final destinations. The flexibility of bicycle sharing encourages more people to use public transport, thereby increasing ridership and improving the economic viability of these systems (Ricci, 2015; Pucher and Buehler, 2017).

2.2.4 Technological innovations in transport

Technological innovations in transport are revolutionising urban mobility and providing significant economic benefits. Advancements such as electric vehicles (EVs), autonomous vehicles (AVs), smart traffic management systems, mobility-as-a-service (MaaS) platforms, and mobile applications for public transit are transforming how people and goods move in cities. These innovations impact cost savings, efficiency, job creation, and overall economic growth (Qiao and Briceno-Garmendia, 2024).

Autonomous vehicles are expected to bring transformative economic benefits by reducing labour costs associated with driving, improving fuel efficiency through optimised driving patterns, and reducing traffic congestion. The deployment of AVs can lead to increased productivity as commuters can use travel time for work or leisure. A study estimates that widespread adoption of AVs would exceed \$800 billion of economic benefits in the United States in 2030 alone, stemming from reduced crashes, fuel savings, and increased productivity (McKinsey, 2019).

Smart traffic management systems for the road utilise real-time data and advanced algorithms to optimise traffic flow, reduce congestion, and enhance road safety. These systems can dynamically adjust traffic signals, provide real-time traffic updates to drivers, and manage incidents more effectively. The economic benefits include reduced travel time, lower fuel consumption, and decreased emissions. Furthermore, it could reduce travel times by up to 5%, resulting in substantial economic savings (Thorpe, 2015).

Mobility-as-a-service platforms integrate various modes of transport into a single accessible service, offering users seamless travel options that combine public transit, ridesharing, bicycle use, and car-sharing. MaaS platforms improve efficiency by optimising route planning and reducing the need for private vehicle ownership. This shift can lead to significant cost savings for users and reduce urban congestion. MaaS has the potential to save European cities up to 30€

billion annually by 2030 through reduced congestion, lower infrastructure costs, and increased use of public transit (European Commission, 2021).

Mobile applications for public transit have revolutionised how people navigate urban transport systems, offering significant economic benefits and enhancing overall efficiency and convenience. These applications provide real-time information on transit schedules, routes, and delays, enabling users to plan their journeys more effectively and reduce waiting times. Mobile transit applications can save commuters up to 20 minutes per day, translating to significant cost savings over time. By enhancing the user experience, mobile applications encourage more people to use public transit, leading to increased ridership. Higher ridership can improve the financial sustainability of transit systems and reduce the per-passenger cost of providing services (Bian et al., 2023).

All in all, these technological innovations drive economic growth and job creation. The EV industry, for instance, is expected to create 150,000 jobs in the US by 2030, particularly in sectors related to battery manufacturing, infrastructure development, and maintenance (Economic Policy Institute, 2021). Similarly, the implementation of smart traffic management systems, MaaS platforms, and mobile transit applications generates employment opportunities in technology development, data analysis, and service management (U.S. Department of Transportation, 2023).

Governments and municipalities play a crucial role in promoting EV adoption through incentives and policy support. Financial incentives, such as tax rebates, subsidies for EV purchases, and grants for charging infrastructure, make EVs more accessible and affordable for consumers. Policies that prioritise the development of charging networks and focus on emissions reductions further accelerate the transition to electric mobility (U.S. Department of Transportation, 2023). For example, Norway's aggressive EV policies, including tax exemptions and access to bus lanes, have led to EVs comprising over 82.4% of new car sales in 2023 (Norwegian Road Federation, 2023).

2.3 Urban mobility policy measures

As the sustainable transportation models in chapter 2.2 were discussed, this chapter deals with the urban policy measures which can support and enhance the models.

2.3.1 Definition of urban mobility policy measures

Urban mobility policy measures are strategies and actions devised by local governments and stakeholders to manage urban transportation systems. These measures aim to address pressing challenges such as traffic congestion, pollution, and accessibility, fostering sustainable and efficient mobility solutions (Brůhová Foltýnová et al., 2020). Key components include technical interventions like intelligent transportation systems (ITS), infrastructural developments such as expanded public transport networks and dedicated cycling lanes, as well as regulatory policies including emission controls and congestion charges (International Transport Forum, 2014). Additionally, soft measures, such as public awareness meetings and incentives for eco-friendly transportation options, play a crucial role (European Commission. Directorate General for Mobility and Transport., 2017).

Collectively, these initiatives aim to improve the quality of urban life by reducing environmental impacts, ensuring equitable access to transport, improving the efficiency and reliability of urban transport systems, and promoting economic growth. By promoting sustainable development, these efforts can attract businesses, create jobs and boost local economies. Improved transport infrastructure can lead to increased property values, reduced transport costs for residents, and increased productivity through more efficient commuting. Overall, the economic benefits complement the social and environmental benefits, making urban centres more liveable, resilient and prosperous (Brůhová Foltýnová et al., 2020; European Commission, 2023).

2.3.2 Example urban mobility policy measures

2.3.2.1 Higher taxes for ICEVs

Higher taxes on internal combustion engine vehicles (ICEVs) can have a significant impact on urban mobility by encouraging the adoption of electric vehicles (EVs) and reducing the environmental impact of transport. These taxes create financial disincentives to own and operate ICEVs, encouraging individuals and businesses to switch to EVs or alternative modes of transport such as public transport, cycling or walking (Energy Agency, 2024). A study by Yan (2018) conducted in Norway shows that higher taxes on ICEVs combined with EV purchase subsidies can significantly reduce the total cost of ownership of battery electric

vehicles (BEVs) compared to their ICEVs counterparts, thereby increasing BEV sales by about 3% for every 10% increase in tax incentives. However, the effectiveness of these taxes depends on the availability of supporting infrastructure, such as EV charging stations, and complementary policies, such as subsidies and investments in public transport. In addition, higher taxes on ICEVs can generate significant revenues that can be reinvested in improving public transport and expanding EV infrastructure (U.S. Department of Transportation, 2023).

2.3.2.2 Free parking for EVs

To further shift usage from ICEVs to EVs, discounted or free parking permits can be used as an incentive to encourage the purchase of EVs (ClimateWorks Centre, 2018). These parking incentives can significantly reduce the overall cost of owning an EV and increase its attractiveness compared to conventional vehicles. For example, in cities where parking fees represent a significant share of monthly expenses for car owners, providing free or discounted parking for EVs can act as a strong financial incentive. In addition, preferential parking spaces, such as those closer to building entrances or in more secure areas, can offer added convenience and appeal to potential EV buyers. A study by the ICCT (2017) found that such non-monetary incentives, including free parking, have played a crucial role in boosting EV sales in regions such as California and Norway. Furthermore, cities like Oslo have successfully implemented free parking for EVs, which has contributed to a significant increase in EV adoption (Figenbaum, 2017).

2.3.2.3 Mobile applications for public transit

To improve the transit experience, real-time transit information systems are used to encourage people to use alternatives to the private car. Lu et al. (2018) have shown that real-time information has a significant impact on how users perceive transit wait times. Not only are passengers more willing to wait for transit, but they also perceive their wait times to be shorter and the service itself to be more reliable. It is not only the perception of waiting time that users benefit from this system, but it also makes transit feel safer (Ferris et al., 2010; Gooze, 2013). In addition, the information provided allows people to make more informed transport decisions (Hickman and Wilson, 1995; Maclean and Dailey, 2002). All of these views have changed attitudes towards transit use (Ferris et al., 2010), resulting in increased ridership and mode share (Brakewood and Watkins, 2018; Ferris et al., 2010; Tang and Thakuriah, 2011).

3 Methodology

This chapter describes the theoretical framework for the data acquisition and how interviews with subject experts can be used to collect and process data.

3.1 Research design

To answer the research question of this study, a mixed methods approach was used to evaluate beneficial policy measures in Paris. This approach integrates both qualitative and quantitative research methods to facilitate a more profound and comprehensive comprehension of complex phenomena, thereby enhancing the reliability of research outcomes and conclusions for readers (Adu et al., 2022).

Qualitative data was collected through semi-structured interviews with experts in urban mobility, environmental policy and sustainable transport. The findings from these interviews informed the development of the quantitative component, which enabled the evaluation of individual policy measures. This dual approach allows for detailed comparisons and actionable recommendations.

By leveraging the strengths of both qualitative and quantitative data, this methodology offers a nuanced and scientific analysis to an often highly opinionated topic.

3.2 Data collection and data sampling

The empirical research in this thesis is based on qualitative interviews. An interview consists of a series of questions that can be used as a method of data collection. In empirical social research, a distinction is made between two extremes – “fully standardised interviews” and “non-standardised interviews”. The “fully standardised interviews” is subject to quantitative social research, while the “non-standardised interviews” is assigned to the area of qualitative social research. In addition to these two extreme types, the “partially standardised interviews” is often used in research. This method is located between the “semi-standardised interview” and the “non-standardised interview” and belongs to the qualitative area of empirical social research. The precise location of the semi-standardised interview is determined by the level of standardisation employed. This may vary from a relatively robust standardisation to a more minimalistic approach, which may be characterised by a less defined structure and less rigorous adherence to the standardised format (Tausendpfund, 2020).

3.2.1 Semi-structured interviews

3.2.1.1 Type of methodology and objective

The aim of the qualitative analysis is to analyse policy measures of urban mobility in Paris based on interviews with urban mobility experts such as policymakers, researchers, and NGOs. The data collection was carried out using a “partially structured survey” and the interviews were conducted online. To increase the applicability of the results, Mayring considers it particularly important that a basis of trust is established between the interviewer and the interviewee so that the interviewees can talk as freely as possible about their impressions and experiences. After all, "they themselves are initially the experts on their own meanings" (p. 66). However, the focus of the interview is a specific problem, which the interviewer introduces at the beginning, and which accompanies the conversation (through different topics). The questions are structured by the interviewer, who has prepared a 'partially structured interview guide' outlining the questions and topics of the interview. Most of the questions in the guide are supposed to be open-ended and narrative, without suggesting answers (Mayring, 2016). The semi-structured interview is intended to help guide the interviewee back to the core issue in the event of a digression but keeps the discussion open as to not limit the observable space and be able to find previously unknown or unexpected results.

3.2.1.2 Selection of interviewees

In this study, expert knowledge on urban mobility strategies in Paris needed to be collected. For this the heterogeneous perspectives of a total of 13 experts - five women and eight men – were considered. This group is made up of experts such as policymakers, researchers and representatives of NGOs.

The experts are chosen based on Schütz and Sprondel's definition of experts, according to which they possess complex, integrated, professionally applicable knowledge that enables them to shape fields of action for other actors in a meaningful and structuring way (Bogner, 2014).

The methodology for contacting potential interviewees included several channels: personal contact, professional networks such as LinkedIn, and direct contact by email. The recruitment results varied significantly between the different methods. The results of the individual contact methods are analysed in more detail in the following. Three interview partners were found through personal contact. 70 experts were contacted via LinkedIn, eleven of whom responded, and one interview was ultimately conducted. This corresponds to a response rate of around 15.7% and a success rate of 1.4% in relation to the original number of contacts. Due to this low

success rate, more e-mail contacts were used in parallel. A total of 112 people were contacted by email, nine of whom initially responded, which corresponds to a response and success rate of 8%.

A Sankey-Diagram is shown in Figure 3 illustrating the selection process and the response numbers. More detailed descriptions of the individual interviewees with for example their credentials can be found in Appendix A.

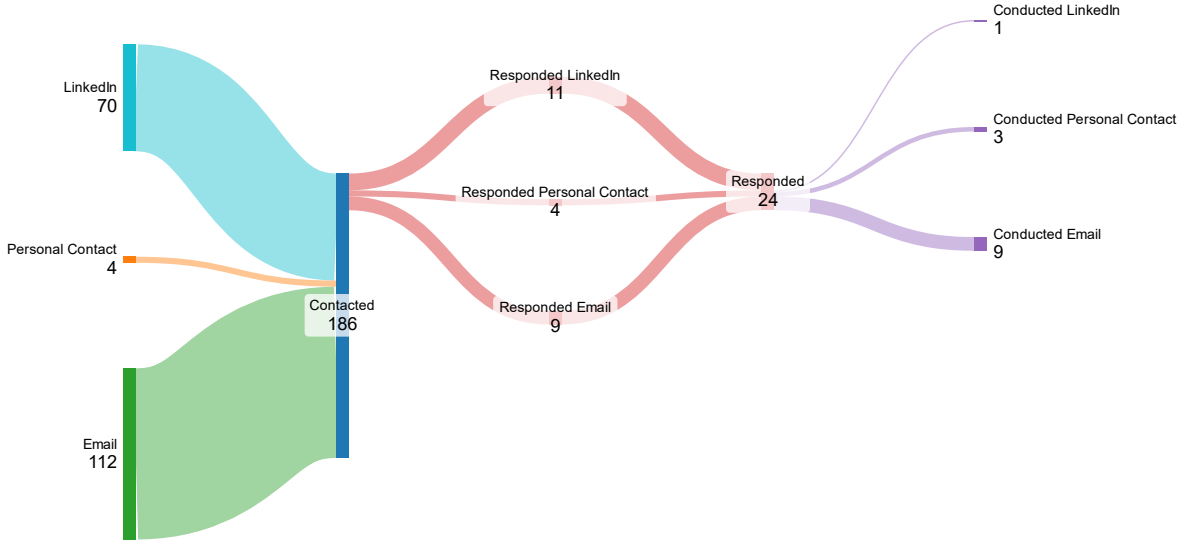


Figure 3: Sankey-Diagram of the interviewee selection process

A gender-balanced selection of the interviewees emphasises the social science rigour of the study and further enables a balanced understanding of the different perspectives within urban mobility strategies. This methodological approach ensures a broad data basis that makes it possible to analyse the field of urban mobility in depth.

In accordance with the principles of confidentiality and in consideration of the interviewees’ wishes, the names of the individuals participating in the study have been obfuscated. Their respective organisations, positions, and years of experience are disclosed in Appendix A.

3.2.1.3 Structure of the interview guideline

This chapter describes the design and structure of the interview guide. The interview was prepared and conducted according to Mayring's principle (Mayring, 2016). This involved five steps: Problem analysis (1), guideline conception (2), pilot phase (3), conducting the interview (4) and recording (5).

To focus the interview on the research question, the results of the literature analysis in chapter 2 were used to develop the guideline. The resulting questions are structured around key areas such as Reasons for Urban Mobility Strategies, Effectiveness of Current Strategies, Future Planning and Strategy Development, Learning from Others and Stakeholder Management.

Before the interviews begin, each interviewee is warmly welcomed and given a detailed introduction to the study, its background, and the research objective. Furthermore, each interviewee is given an overview of the structure of the interview and is reassured that the interview would be anonymous but recorded. Before the actual questions is asked, the interviewees are asked to briefly explain their position and their company as well as the years of experience in their field of urban mobility.

After the short introduction, the interviewer introduces the first question which captures the quantitative assessment of the level of satisfaction of the current urban mobility status in Paris, complemented by qualitative data. This section allows the interviewee to share his or her thoughts and then suggest improvements.

The introductory question is followed by the "Reason for Urban Mobility Strategies" section, which explores the goals and motivations behind the mobility strategies. Respondents are given the opportunity to reveal the strategic considerations of urban planning and give their views on the objectives and usefulness of the strategies.

The third section "Effectiveness of Current Strategies" dives into specific urban mobility strategies and goes into more depth by requiring the respondent's expertise. The interviewees evaluate which measures are most effective and which obstacles make implementation difficult.

Following this, the interview guide in the chapter "Future Planning and Strategic Development" aims to motivate the interviewees to express their opinions and expectations regarding future mobility in the context of technology trends, best practices, and new solution approaches.

Subsequently, the aim of the chapter "Learning from Others" is to gain insights by comparing with other cities to find out which strategies could be promising, and which adaptations are needed for an effective implementation in Paris.

In the next chapter, "Stakeholder Management", the aim is to discuss the interactions and management of different interest groups in urban planning. Methods for harmonising divergent interests and the role of stakeholder feedback in decision-making processes are examined.

Finally, the interview guide ends with an opportunity for the participant to raise any final thoughts and important points not discussed to ensure that all relevant aspects are covered. This ensures comprehensive data collection and deep insights into the topic of urban mobility.

The interview ends by politely thanking the interviewee for their time and valuable information.

For a detailed list of the questions to be asked during the interview, please refer to Appendix B.

3.2.1.4 Data analysis

The analysis follows the Gioia methodology, which involves collecting data through interviews, observations, and relevant documents, guided by the research questions and objectives. This interpretive research approach aims to link the interview data to the theoretical framework developed in chapter 2 of the literature review.

The process begins with extracting the most important findings from the transcripts, transferring them to the first-order concept while retaining the original wording of the interviewees. This informant-based information gathering helps identify similarities and differences in perceptions and perspectives.

During second-order analysis, the researcher interprets and categorises these first-order codes to form more abstract, researcher-generated themes. These themes reveal patterns in the data and align them with theoretical constructs. In this study, 16 second-order themes were identified, representing different policy measures that emerged from the interviews.

Finally, these themes are consolidated into aggregate dimensions, summarising the essence of the themes into a coherent theoretical narrative.

3.2.2 Ranking matrix

To systematically assess and compare the effectiveness of the various policies identified in the interviews, a comprehensive methodology has been used. Introducing several rateable criteria for each of the policies ensures an objective and thorough assessment in this analysis. The experts were tasked with evaluating the list of policy measures according to these criteria.

For the identification of the evaluation criteria the aim was to formulate a set of five criteria to keep the evaluation manageable and not use up too much of the experts' time. Based on the findings of the expert consultations, the following five evaluation criteria were selected, and the set deemed adequate to generate meaningful results:

- **Impact:** Measures the overall effectiveness of the policy in achieving its intended environmental and social outcomes. This includes reducing emissions, improving public health and enhancing urban liveability.
- **Cost:** Assesses the financial implications of implementing the policy, including both initial investment and ongoing operating costs. This criterion helps to understand the economic feasibility of each measure.
- **Time:** Assesses the time required to implement the policy and achieve tangible results. This includes the time from planning to full implementation and realisation of benefits.
- **Acceptance:** Considers the level of public and political support for the policy. This includes the likelihood of public approval, stakeholder buy-in and potential resistance.
- **Transferability:** Assesses the ease with which the policy can be adapted and implemented in different contexts and regions. This criterion is important for understanding the scalability and replicability of successful measures.

In order to effectively compare and evaluate the policies against these criteria, a systematic approach is required. Therefore, the researcher developed a scoring system that quantifies each criterion and allows for a comprehensive and objective assessment of each policy measure. For this each criterion score (s_c) is evaluated based on a pre-defined five-point Likert scale (Likert, 1932). This approach ensures a structured evaluation, allowing for a comparison and ranking of policy measures. The scoring range from 1 to 5 was defined with clear definitions for each score to guarantee no erroneous rating by the experts. The definitions were:

- **Impact:** 1 (no measurable effect) to 5 (highest impact)
- **Cost:** 1 (expensive) to 5 (cheap)
- **Time:** 1 (long implementation duration) to 5 (short implementation duration)
- **Acceptance:** 1 (strong resistance) to 5 (immediate acceptance by the population)
- **Transferability:** 1 (very specific to Paris) to 5 (can be easily realised in other cities)

To be able to rank the identified policy measures the formula then looks like the following:

$$r_m = \sum_{c=1}^n s_c$$

With

- r_m being the overall score for the policy measure
- n being the number of available criteria (in this case 5)
- s_c being the average score for criterion c considering all experts

By calculating r_m for all measures, the researcher is able to rank the policy measures and provide informed recommendations.

4 Results

Considering all 13 interviews, the qualitative analysis reveals a number of key insights and emerging themes from the collected data. Accordingly, the beneficial urban mobility policies for Paris could be organised into five aggregated dimensions. These dimensions include the aspects financial, regulatory, comfort and accessibility, social and community, and technological policies. This chapter thus highlights and organises various issues and considerations relevant to discussing beneficial urban mobility policies for Paris.

See Appendix D for the detailed thematic analysis of the interviews, based on Gioia et al., (2013).

4.1 Qualitative analysis

4.1.1 Financial measures

When discussing financial measures, expert KR highlighted the potential for higher taxes on ICE vehicles. Expert AN posited that "Paris has introduced new taxes on cars to reduce pollution. The tax on high-emission vehicles is €40,000. This includes a tax on CO₂ emissions and a tax on vehicle weight." underscoring the necessity of combining punitive measures with financial support to effectively drive the mobility transition. To reduce the daily operational costs for EV owners, expert AC proposed that the overall costs of ownership should be made more attractive by providing financial incentives such as free parking. Expert TG stated that the measures have already been implemented in Paris six or seven years ago in order to encourage people to switch to EVs. Another financial incentive mentioned by expert AN is the provision of free charging stations. She explained that people are concerned not only about the costs of switching to EVs but also about the availability of charging infrastructure. She emphasised the necessity of ensuring that EV owners have access to cost-free charging infrastructure, which could reduce the range of concerns and promote longer-distance travel, thereby further supporting the widespread adoption of electric vehicles.

4.1.2 Regulatory measures

Of the thirteen experts who were interviewed, twelve discussed the potential impact of regulatory measures. When the experts were queried about the low emission zone, their responses were not uniform. Experts PJ and TR primarily regarded the measure as an effective means of reducing emissions, yet they also emphasised the necessity for reform. Expert TR posited that the low emission zone solely addresses exhaust emissions, with non-exhaust emissions remaining unconsidered within this measure. He explained that the fine particles

generated by tyres and brakes are not accounted for in this measure. Expert PJ believed that the low emission zone is inadequate for addressing emissions and that further measures are necessary. She and expert AC proposed the introduction of a traffic-limited zone (TLZ) in Paris. The implementation of this measure is already scheduled to commence following the conclusion of the Olympic Games in October. In the designated zones, individuals are prohibited from entering or traversing the area unless they have a specific purpose. She additionally observed that this would represent a significant expansion of the low emission zone. One of the key challenges associated with this measure was the lack of control, as highlighted by experts TG, KR, DN and CN. Despite the implementation of the measure, the government did not provide municipalities with an automatic control system. Expert DN posited that he could still travel to Paris with his old vehicle, which is no longer permitted in the low-emission zone. However, due to the lack of control, he had never received a fine. Expert TG proposed that the government should provide every municipality with the necessary tools, such as cameras, to automatically read the ID of cars in order to enforce the law.

Another regulatory measure mentioned by five experts is the parking restrictions. When asked about the implementation of higher parking fees for SUVs in Paris, the experts responded that it was a well-considered measure to "stop losing public [...] space" and to set an incentive for the public and car companies to reconsider their strategy and stop building big cars. Expert FG additionally noted that, regardless of whether the car is electric, people should be aware of the problems that are coming with the rise of having big cars. Even large electric vehicles consume a considerable amount of energy, and the automobile manufacturers are responsible for a significant portion of the energy used in the production of these vehicles. The implementation of higher parking fees for SUVs serves as an incentive for individuals to utilise smaller vehicles, particularly in urban settings, where the environmental impact of large vehicles is particularly pronounced. In order to implement the strategy as successfully as possible, it is essential that it is well thought out and that all people are taken into account as stated of expert AC. Those who do not have an alternative to using a large vehicle for physical reasons should not be affected by higher parking fees when entering the city.

Finally, experts CN, AN and CB proposed the lowering of the speed limit as a potential measure. Expert CN stated that in Paris, the speed limit was reduced from 50 km/h to 30 km/h, covering 90% of the streets of Paris. Expert CB also emphasised the importance of limiting the speed limit in specific streets, for example streets in front of a school, in order to protect children.

4.1.3 Convenience and accessibility measures

When discussing the topic of convenience and accessibility measures, each expert was able to contribute to the discussion. In particular, the experts highlighted the importance of developing infrastructure for cycling and walking. Expert CN began by emphasising the importance of mobility as a universal right. To meet this demand, he suggested prioritising active mobility, such as walking and cycling, followed by shared mobility systems, such as bicycle and car sharing. Expert RB additionally proposed that this could be achieved by reallocating space from cars to bicycles, thereby enhancing the perception of safety on the streets. He also highlighted the effectiveness of bicycle parking lots as a measure. Paris, for instance, has implemented two to four bicycle parking locations at every cross-section of the city, significantly improving the bicycling experience. Expert CB noted that the global pandemic in 2019 accelerated the implementation of additional cycling lanes, which were initially conceived as provisional measures. Many of these have since become permanent fixtures. She emphasised the importance of promptly adapting to changes. Expert AC and CB highlighted that ongoing urban renewal and road renovation projects over the past ten years have reduced space for car traffic, thereby increasing space and quality for walking and cycling. Expert AC also mentioned a school programme designed to teach children how to ride a bicycle in urban environments, with the intention of familiarising them with this mode of transportation from an early age. Expert AC and DN mentioned that the implementation of this measure has led to the observation that the proportion of cyclists in Paris is approximately three times greater than that of motorised vehicle users. To put it another way, one in five trips within Paris is by bicycle.

Additionally, the experts mentioned an increased perception of safety as a measure. The cycling infrastructure in Paris has developed, and there has been a shift towards bicycles. Expert CN discussed the conflicts on the streets, noting that cyclists often collide with pedestrians. The streets should be redesigned to create a continuous and safe network for cyclists to ride their bicycles safely to work. As expert AC noted, although the streets of Paris have been improved and cyclists have a significant presence, there are still a considerable number of cars on the streets and a lack of awareness among the public regarding the negative impact of these vehicles on road safety. This led to parents being reluctant to allow their children to walk or cycle, perceiving the streets to be unsafe. Expert FG highlighted that the majority of road injuries are caused by cars and trucks. He proposed that road safety should be given a higher priority.

Another measure implemented is the improvement of the quality of service of the metro system. Expert CN, DN, FH and RB are not satisfied with the current situation of the public

transportation system. Expert FH and DN perceived a need for improvement in the quality of service, as FH stated that “the metro and RER (...) suffer from breakdowns and frequent service stoppages”. DN additionally highlighted that the trains are often late, or incidents completely disrupt the journeys of the people. Furthermore, expert RB not only expressed concern about the overcrowding of the metro during the day, which impedes the journey, but also about the frequency of the trains. He stated that there are instances where there is only one train every hour, which makes it challenging for individuals to navigate the system. Expert DN and FH proposed that to enhance the quality of service for public transportation, it is essential to prioritise factors such as punctuality, regularity, real-time information in the event of incidents, property maintenance, and cleanliness within the transport system. Consequently, expert FH emphasised the utilisation of the equipment and software tools that his company supplies, with the objective of reducing the operating costs of the transport network.

Finally, the development of the carpooling infrastructure is significant to some experts. Expert CN stated that there should be a possibility for people to have shared cars, which could be a good alternative to the private car. To make this more attractive to people, Paris provided 1,000 parking spaces in the city for shared cars in the streets. Expert TR emphasised that in order to encourage the population to switch to cleaner forms of transportation, it is necessary to reduce the space allocated to cars and promote greener forms of transportation, such as shared mobility. Expert TG proposed the implementation of higher parking fees for SUVs as a means of encouraging individuals to reflect on their transportation choices. They should consider whether they truly require their own vehicle for urban travel or whether shared vehicles would be a more sustainable option. This represents a further step in the transition from private vehicle ownership to shared mobility. Expert TR pointed out that the shared mobility also favours the reduction of cars in the city providing more space to other users such as bicycles, scooters, pedestrian, buses, or even parking spaces for shared mobility.

4.1.4 Social and community measures

Six out of thirteen experts were engaged in a discussion about social and community measures. In order to gain public acceptance for these measures, the experts highlighted the importance of efficient communication and transparency with the public. According to Expert PJ, one of the most critical aspects of these meetings was the distinction of dialogue and communication. Effective dialogue is crucial but requires time to be impactful. In the context of today's world, characterised by the fast pace of social media and the demand for rapid change, it is vital to communicate to the public that meaningful and adaptable projects cannot be rushed. It is

essential to ensure that the public understands that these projects require time to develop properly and achieve long-term success. Although attempts are made to get the public on board, expert FG emphasised that the meetings should be used to discuss how the project will be carried out, not the general objectives, "and that is very important to differentiate". Another significant challenge is engaging everyone in the public. Expert PJ highlighted that it is particularly difficult to reach people who are angry or unhappy with the urban project. Democracy necessitates the consideration of all opinions, yet the objective is to construct a project that addresses public interests rather than attempting to satisfy all stakeholders. This requires the role of the expert to explain the choices made in the project, which may not align with the simple addition of all opinions. This approach ensures that the project is in the best interest of the public as a whole. It is of the utmost importance to create public support and aspiration for the project if it is to be a success. Expert PJ highlighted the need for a cultural shift where public support becomes self-sustaining through strategic communication and engagement. Once the public has an understanding and positive perception of an idea, they are more likely to become active participants. This creates a virtuous cycle of support and involvement, making the project more resilient and widely accepted. Within this process, the level of explanation is of high value since people are becoming more and more experts as they inform themselves and engage in dialogue with others. They appear to be more hesitant towards decisions. Expert CB asserted that transparency is a crucial aspect of engaging with the public and informing them of the current plan, as this can help to prevent the spread of misinformation. It is also important to communicate the benefits of the project to the public, such as financial assistance to convert their ICEVs to EVs. Furthermore, she emphasised the significance of media communication, including the website and campaigns.

Another measure which expert FG and PJ mentioned is the strong political support and leadership. According to Expert PJ, strong political support and leadership involve taking bold actions, even at personal and political risk. Anne Hidalgo, the Mayor of Paris chose to confront car companies violating European laws, despite uncertainties about voter support. She highlighted the importance of coherence and the utilisation of power effectively, even if it may endanger re-election. This aligns with the mayor's values and campaign promises, demonstrating political courage. The 2020 election resulted in a clear mandate for the city of Paris to become more bicycle-friendly, including the reduction of parking spaces. This mandate was openly communicated and supported by voters. Expert FG emphasised that this clear

mandate allows elected officials to proceed confidently with their agenda, maintaining transparency and commitment to promises, regardless of opposition.

Finally, the significant support of NGOs was highlighted by expert AC, DN, AN, and FG. In summary, the experts stated that the support of NGOs is crucial in addressing social, economic, and environmental issues. Expert AC noted that many board members see cycling as a solution to these problems, and thus, NGOs play a significant role in bringing about these solutions. Expert DN emphasised the importance of these associations, highlighting their pivotal role in transforming urban infrastructure. In the process of developing bicycle infrastructure, as Expert AN explained, NGOs were consulted to prioritise needs within budget constraints, demonstrating their significant input in decision-making. These associations not only provide guidance but also help explain and justify necessary measures to the public, such as pollution reduction efforts. Expert FG illustrated how NGOs, like the large nonprofit organization for bicycles in Paris, are involved in every project, offering critical feedback and suggestions for improvement. Furthermore, the development of the express bicycle network in the region, as described by Expert DN, was significantly influenced by the persistent advocacy and pressure from bicycle associations, ultimately leading to regional financing. This collective effort serves to illustrate the indispensable role of NGOs in driving and supporting urban and regional development projects.

4.1.5 Technological measures

The experts identified technological innovations as a critical factor in the advancement of urban mobility. One of the measures expert CB and FH highlighted was the smart ticketing system. CB mentioned a national initiative aimed at creating a unified ticket that can be used across all public transport networks. This ticket is not fixed price but is based on usage and the tariffs set by the respective transportation authorities. This system is designed to simplify travel for passengers, eliminating the confusion of different ticketing systems and making cross-network travel seamless. Furthermore, Expert FH emphasised the advantages of the data generated by this smart ticketing system. This data has been instrumental in optimising routes and schedules, resulting in enhanced service and reduced wait times for passengers. Overall, the smart ticketing system not only improves convenience for travellers but also enhances the efficiency and effectiveness of public transportation services.

The other measure is the implementation of mobile applications for public transportation which play a significant role in enhancing the convenience and efficiency of transportation in Paris.

According to Expert KR, there are several applications available that guide users on the most optimal routes to take, whether they are utilising public transportation or the bicycle-sharing system in Paris. These applications also indicate the nearest available bicycles, making it straightforward to rent and return them. Furthermore, map applications provide information on travel times for various modes of transport, including walking and cycling. These features have been widely accepted by the public. Expert CL added that there are increasing numbers of applications designed to help users find safer, less polluted, and quieter paths for walking and cycling, thereby promoting healthier and more sustainable travel options. These applications collectively contribute to a more integrated and user-friendly public transportation system.

4.2 Summary

In summary, the researcher identified 16 policy measures categorised into Financial, Regulatory, Convenience and Accessibility, Social and Community, and Technological measures (see Figure 4). Each category plays a crucial role in promoting sustainable transport options, improving urban transport efficiency, and achieving environmental and social benefits.

Policy Categories & Measures				
Financial	Regulatory	Convenience and Accessibility	Social and Community	Technological
Higher taxes for ICEVs	Low emission zone	Development of cycling and walking infrastructure	Public awareness meetings	Smart ticketing systems
Free parking for EVs	Parking restrictions	Metro system with more frequent trains, more lanes, nightly service	Strong political support and leadership	Mobile applications for public transit
Free charging stations for EVs	Lowering speed limits	Increased safety perception	Effective communication and transparency	
		Development of carpooling infrastructure	Strong support of NGOs	

Figure 4: Categorisation of policy measures for promoting sustainable transport

4.3 Quantitative analysis

Following the explanations in chapter 3.3.1, this section contains the experts' assessment of the 16 measures shown in chapter 4.2 according to the criteria of impact, cost, time, acceptability and transferability. Table 1 shows the aggregated scores and the conversion into % with a maximum of $5 * 5 = 25$ corresponding to 100%. For a more comprehensive view, please refer to Appendix E.

Table 1: Evaluation results

	Average IMPACT	Average COST	Average TIME	Average ACCEPTANCE	Average TRANSFERABILITY	SCORE	in %
Financial							
Higher Taxes for ICE	2,8	5	3,6	1,8	4,8	18	72,0
Free parking fees for Evs	1,8	3,2	3,6	3,4	3,6	15,6	62,4
Free charging stations for Evs	1,8	1,6	2	3,6	3,6	12,6	50,4
Regulatory							
Low emission zone	3,4	3,2	2,4	2,2	3,2	14,4	57,6
Parking restrictions	3	3	2,4	2,2	3,6	14,2	56,8
Lowering speed limits	3,8	1,6	0,8	2,8	3,4	12,4	49,6
Convenience & Accessibility							
Development of Cycling and Walking Infrastructure	3	3	1,2	3,6	3	13,8	55,2
Metro system with more frequent trains, lanes and night	1,8	2,4	2	3	3,2	12,4	49,6
Increased safety perception	1,8	2,6	2	3,6	3,8	13,8	55,2
Development of Carpooling Infrastructure	3,6	2,8	1,2	2,8	3,4	13,8	55,2
Social & Community							
Public Awareness Meetings	3	3	1,6	2,6	3,2	13,4	53,6
Strong political support and leadership	2,2	1,8	1,8	3	3	11,8	47,2
Effective Communication and Transparency	2,2	2	2,2	3,6	3,6	13,6	54,4
Strong support of NGOs	3	3	1,6	2,6	3,2	13,4	53,6
Technological							
Smart Ticketing Systems	2,2	1,8	1,8	3	3	11,8	47,2
Mobile Apps for Public Transit	1,8	3,2	3,6	3,4	3,6	15,6	62,4

By means of a histogram (see Figure 5), three measures can be singled out by their high scores. These form the Top3 of identified policy measures in Paris and are considered to being the most important results for further analysis.

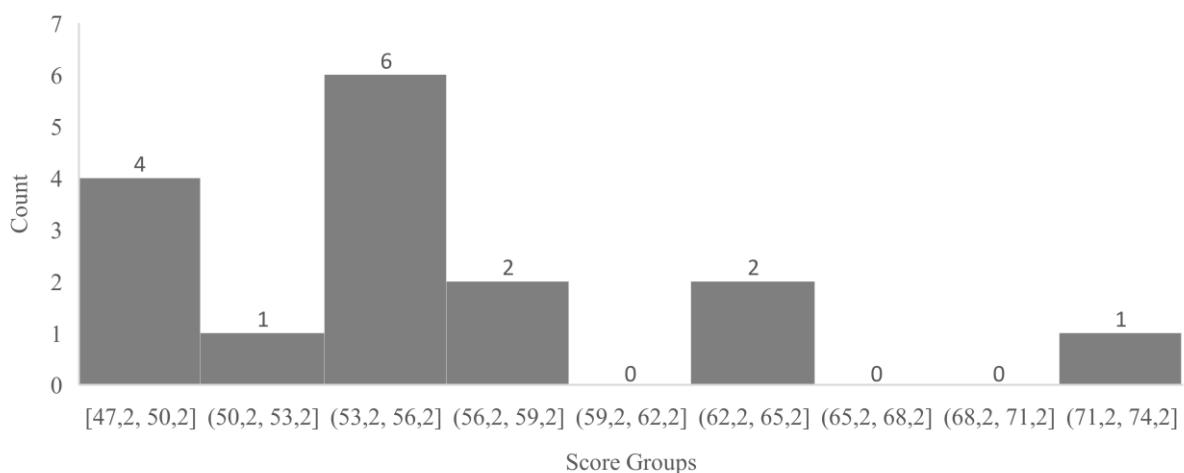


Figure 5: Distribution of measured scores

The three most beneficial measures are:

1. Higher Taxes for ICE (Score: 18, Percentage: 72%)

This measure has been awarded the highest score, primarily due to its substantial impact on reducing emissions and discouraging the use of ICEs. The very low cost to implement also offsets the moderate public acceptance and makes this an exceptional policy measure. It is especially effective as it directly targets the root cause of high emissions by incentivising a shift towards cleaner alternatives.

2. Free Parking for EVs (Score: 15.6, Percentage: 62%)

The implementation of free parking for electric vehicles (EVs) has emerged as a highly effective measure, balancing moderate costs with high public acceptance and transferability. This initiative encourages the adoption of EVs by reducing operational costs for users and thus promoting cleaner transportation options. The ease of implementation across various regions further enhances its attractiveness.

3. Mobile Applications for Public Transit (Score: 15.6, Percentage: 62%)

The development of mobile applications for public transit also scores highly due to the relatively low implementation costs and high level of public acceptance. The implementation of these applications has the potential to enhance the convenience and efficiency of public transportation, thereby encouraging a greater number of individuals to utilise these services in preference to private vehicles. The high transferability of this measure enables it to be applied in a variety of urban settings, thereby enhancing its overall usefulness.

5 Discussion and implications

This chapter compares the results of the expert interviews and the ranking matrix with the existing literature and provides academic contributions and implications related to urban mobility policies. Given the purpose of this research was to identify learnings from Paris, the study seeks to bridge theoretical concepts with practicable implications that can be implemented.

5.1 Financial measures

Regarding the Financial measures, this study found out that the higher taxes on ICEVs was the most beneficial urban mobility policy measure in Paris. This measure was also emphasised by expert KR to create taxes for ICEVs to encourage individuals and businesses to switch to EVs or alternative modes of transport. The provision of financial incentives such as free parking for EVs mentioned by the interviewed experts also aligns with global best practices as the literature shows that a \$100 monthly increase in parking costs can have the same effect on EV purchases as an \$11,500 increase in the vehicle's purchase price (Guerra & Daziano, 2020). Furthermore, the literature and research findings are in line with the need of financial sanctions and incentives in order to tackle the urban mobility demand.

5.2 Regulatory measures

The findings on regulatory measures, such as LEZ demonstrate their effectiveness but also highlight the need for enhancement. While existing literature acknowledges the positive impact of LEZs on reducing emissions (Urban Access Regulations in Europe, 2023), expert assessments have identified significant practical implementation obstacles. In practice, challenges reported include the lack of control and the need for a more comprehensive approach that addresses both exhaust and non-exhaust emissions. This highlights a gap in current research, emphasising the necessity for more robust enforcement mechanisms and broader regulatory frameworks. Experts underlined the need for enhancements, such as automated control systems to improve compliance and effectiveness. Following the identification of a discrepancy in the literature with regard to LEZs, there is a consensus between the literature and the expert interviews with regard to parking restrictions. According to Byrne et al. (2021), parking restrictions favour the acquisition of urban space, which is also confirmed by expert FG and TG.

5.3 Convenience and accessibility measures

This study largely confirms existing literature on the role of convenience and accessibility measures. Prior research has identified that to make people use public transportation or active modes of transportation, an improvement of the bicycle and pedestrian infrastructure is needed which also results in reallocation of urban space (Pucher and Buehler, 2017; Ricci, 2015). This interview series shows that the fast implementation of bicycle lanes during the COVID-19 pandemic has a potential for adaptive and responsive urban planning which is consistent with the literature recommending flexible and responsive infrastructure development (Fishman et al., 2013). However, this study shows that although the theoretical benefits are frequently discussed in the literature, there are still significant challenges in practical implementation and public acceptance. Public transportation improvements such as punctuality, regularity, and real-time information directly address common problems identified in urban transportation systems (Anderson et al., 2013). Prioritising safety and developing ride-sharing infrastructure will also help improve convenience and accessibility of the urban mobility ecosystem. The results of this study complement the existing literature by providing empirical evidence on the importance of the improvement of service quality and integration of different transportation modes.

5.4 Social and community measures

The effective communication and public participation in the implementation of urban mobility policies play an important role. Yet these measures are often partly illuminated in the existing literature, which tends to focus on economic and environmental aspects. Based on the evidence collected, this study highlights the crucial role of social and community actions in achieving public support and acceptance. Effective communication, transparency and active public participation are essential for the success of urban mobility projects. Another aspect which the study points out is the impact of political leadership and the strong support of NGOs. The Paris case illustrates how these measures can drive meaningful change, highlighting the importance of building social trust and fostering community ownership of mobility initiatives. Contributing to the literature this study found that communication and public engagement play a crucial role in order to successfully implement urban mobility policy measures.

5.5 Technological measures

Technological innovations, such as smart ticketing systems and mobile applications for public transit, were identified as highly effective in enhancing convenience and efficiency. This is consistent with global trends towards the digitalisation of urban mobility systems, which

improve user experience and increase public transit ridership (Bian et al., 2023). This study supports the existing literature by providing empirical evidence of the effectiveness of these technologies in Paris. However, it also emphasises the necessity for continuous updates and user feedback mechanisms to maintain their effectiveness, a point that is often overlooked in existing studies. The development of such technologies supports the integration of various modes of transportation, develop a more seamless and user-friendly urban mobility network. This highlights the necessity for cities to invest in technological infrastructure and ensure that it remains adaptable and responsive to user needs.

Given the complexity of urban mobility policy measures and their impact, time, cost, acceptance and transferability, this research provides a ranking of urban mobility policy measures that are most suitable for Paris and can be transferred to other cities. This ranking should help policymakers in decision making to improve urban mobility.

1. Higher taxes for ICEVs
2. Free parking for EVs
3. Mobile applications for public transit
4. Low emission zone
5. Parking restrictions
6. Development of cycling and walking infrastructure
7. Increased safety perception
8. Development of carpooling infrastructure
9. Effective communication and transparency
10. Public awareness meetings
11. Strong support of NGOs
12. Free charging stations for EVs
13. Lowering speed limits
14. Metro system with more frequent trains, lanes and nightly service
15. Strong political support and leadership
16. Smart ticketing systems

As the expert highlighted, it is crucial for policymakers to avoid focusing on a single measure, as the effectiveness of urban mobility is contingent upon the integration of multiple measures.

6 Conclusion

To address the growing demand for urban mobility and its implementation, this study provides a stepping stone for a better understanding of urban mobility policies, specifically with consideration of the learnings from Paris. While the existing literature provides valuable insights into urban mobility policies in various cities around the world, there is a gap that this study seeks to fill by developing a ranking system of the most beneficial urban mobility policies based on a successful model city with observations from Paris as a role model.

The thematic analysis of 13 semi-structured interviews identifies 16 policy measures that have been proven to be critical for urban mobility in Paris: Higher taxes for ICEVs, free parking for EVs, mobile applications for public transport, low emission zones, parking restrictions, development of cycling and walking infrastructure, increased safety perception, development of carpooling infrastructure, effective communication and transparency, public awareness meetings, strong support from NGOs, free charging for EVs, reduction of speed limits, metro system with more frequent trains, lanes and night services, strong political support and leadership, and smart ticketing systems. Comparisons with existing literature reveal both alignment and new perspectives, highlighting the complexity of urban mobility policies. The results of the 13 interviews are complemented by a ranking system.

The chosen methodology combines qualitative and quantitative approaches to offer a nuanced and scientific analysis to an often highly opinionated topic. The qualitative analysis demonstrates that while regulatory measures, such as low emission zones, are effective, they frequently encounter implementation obstacles, including the absence of control systems. Additionally, the study underscores the significance of effective communication and public participation. Such engagement has been instrumental in fostering social trust and facilitating the implementation of mobility concepts. The quantitative results, entails the identification of the top three urban mobility policies for Paris. The imposition of higher taxes on ICEVs was identified as the most beneficial urban mobility policy measure, given its capacity to significantly reduce emissions and encourage the transition towards EVs. The low implementation cost, coupled with its high impact, renders it a highly recommended measure. The second beneficial measure identified was free parking for EVs, as it is a crucial financial incentive to support the shift to EVs. In addition, the third beneficial measure is the implementation of mobile applications for public transport, which positively contributes to the user's perception of the efficiency and convenience of public transportation.

7 Limitations and further research

Social research based on qualitative methods such as interviews has inherent scientific limitations for the objective analysis of the data. Every analysis based on expert opinions is limited by the different assessments made by each person and suffers from a limited number of available people. This also allows for the introduction of some form of bias that highly depends on the interviewee selection. Bias can lead to vastly different scoring between experts and would typically be needed to be corrected for. An example approach can be to include additional weighting factors for each expert depending on their level of expertise. However, as there is no data available that such differing weightings could be based on, this thesis assumes identical levels of expertise between experts.

To check for the level of consensus between the experts in this evaluation, a boxplot graph was used that visualises the distribution of scores between the experts. Narrow boxes would indicate a large consensus, while spread out boxes indicate disagreement in the scoring. For easier visualisation a single category (Impact) was arbitrarily chosen to exemplarily represent such a distribution. It can be seen in Figure 6 that there is considerable variability in the scores for each of the measures. For example, the experts' scores vary heavily for the impact of low emission zones where it was simultaneously given the lowest and highest score by two experts. Such high variability may affect the reliability of the calculated overall scores and rankings and needs to be kept in mind when interpreting the data. For future research it is therefore recommended to include a much wider range of experts to be consulted, with which a more comprehensive and consensus-based assessment can be expected.

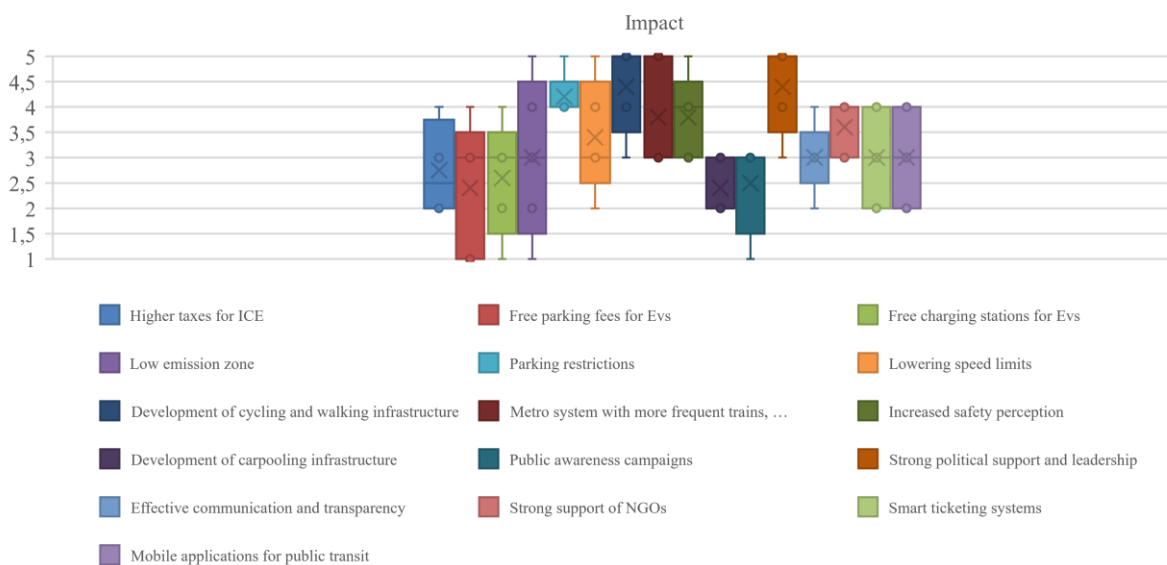


Figure 6: Variability in expert assessments of measures

Furthermore, the study identifies 16 subsections supportive for urban mobility policy measures. However, delving into each subsection in greater detail would enrich the analysis and contribute to a more nuanced understanding. Each subsection is worth further investigation, potentially leading to refined insights and an enhanced framework.

To improve the analysis and be able to rank the identified policy measures according to a single, overall representative score, additional relative weightings can be introduced. This allows for adjustments when using the raw evaluation results in other circumstances like for example in different cities and varying cultural settings. It can be assumed that depending on the context not all scores are supposed to be weighted equally, with for example “cost” being considered more important than “acceptance” or vice versa. To accommodate for this, a solution can be using additional weighting factors that are multiplied with each of the individual scores to calculate the overall score for each policy measure. The final formula would look the following:

$$r_m = \sum_{c=1}^n s_c * w_c$$

With

- r_m being the overall score for the policy measure
- n being the number of available criteria (in this case 5)
- s_c being the average score for criterion covering all experts
- w_c being the relative weight for criterion c

Additionally, although, the study considers EVs as a good sustainable alternative to conventional ICEVs, it is important to note that they are not just advantageous but also come with their own set of problems and drawbacks. Firstly, they are usually very heavy and thus require additional energy which is wasted on moving the car instead of the passenger. From an environmental perspective the recycling processes for EV batteries also remain underdeveloped. The current methods for recycling lithium-ion batteries, which are in most cases used in EVs, are not yet efficient or widely used, leading to potential challenges due to improper disposal (Pražanová et al., 2024). Additionally, the large-scale transition to EVs requires a good infrastructure for energy consumption. Many regions lack the necessary charging facilities and may struggle to handle the increased demand for electricity. Addressing these issues is highly significant in order to realise all environmental benefits of electric vehicle in the future (Zheng et al., 2023).

List of references

- Adu, J., Owusu, M. F., Martin-Yeboah, E., Pino Gavidia, L. A., & Gyamfi, S. (2022). A discussion of some controversies in mixed methods research for emerging researchers. *Methodological Innovations*, 15(3), 321–330. <https://doi.org/10.1177/20597991221123398>
- Altman J., & Hinkson M. (2007). Mobility and Modernity in Arnhem Land: The Social Universe of Kuninjku Trucks. *Journal of Material Culture*.
- Anderson, R., Condry, B., Findlay, N., Brage-Ardao, R., & Li, H. (2013). *Measuring and Valuing Convenience and Service Quality A review of global practices and challenges from mass transit operators and railway industries the public transport sector*.
- Arthur D. Little. (2018, March 15). *Prognostiziertes Aufkommen von urbanen Mobilitätsleistungen weltweit in den Jahren 2010 bis 2050 (in Billionen Personenkilometern)*. <https://de-statista-com.eaccess.tum.edu/statistik/daten/studie/1084696/umfrage/prognose-der-nachfrage-nach-urbanen-mobilitaetsleistungen-weltweit/>
- Bian, J., Li, W., & Lee, C. (2023). Current practices and emerging trends of transit apps for fixed-route bus services in the US. *Journal of Public Transportation*, 25. <https://doi.org/10.1016/j.jpubtr.2023.100052>
- Bogner, A. (2014). *Interviews mit Experten. Eine praxisorientierte Einführung*. Springer.
- Bosetti, S. , B. F. H. , D. B. C. , J. R. , K. P. , M. P. , S. A. , S. D. ,. (2013). *Policy recommendations for EU sustainable mobility concepts based on CIVITAS experience Deliverable title Policy recommendations for EU sustainable mobility concepts based on CIVITAS experience Dissemination level*.
- Brakewood, C., & Watkins, K. (2018). A literature review of the passenger benefits of real-time transit information . *Transport Reviews*.
- Brůhová Foltýnová, H., Vejchodská, E., Rybová, K., & Květoň, V. (2020). Sustainable urban mobility: One definition, different stakeholders' opinions. *Transportation Research Part D: Transport and Environment*, 87. <https://doi.org/10.1016/j.trd.2020.102465>

- Butz, C. (2023). Mindful Mobility. In *Mindful Mobility*. Springer Fachmedien Wiesbaden. <https://doi.org/10.1007/978-3-658-41429-0>
- Byrne, L., Bach, V., & Finkbeiner, M. (2021). Urban transport assessment of emissions and resource demand of climate protection scenarios. *Cleaner Environmental Systems*, 2. <https://doi.org/10.1016/j.cesys.2021.100019>
- Chapman, L. (2007). Transport and climate change: a review. *Journal of Transport Geography*, 15(5), 354–367. <https://doi.org/10.1016/j.jtrangeo.2006.11.008>
- ClimateWorks Centre. (2018). *The state of electric vehicles in Australia ClimateWorks*.
- Currie G., Stanley J., & Stanley J. (Eds.). (2007). No Way To Go: Transport and social disadvantage in Australian Communities,. *Monash University EPress, Melbourne, Australia*.
- Demaio, P. (2009). *Bike-sharing: History, Impacts, Models of Provision, and Future*.
- Department for Transport. (2007). Transport Trends. *Department for Transport*.
- ECF. (2023). *Cycling and the EU Urban Mobility Framework*.
- Economic Policy Institute. (2021, September 22). *The shift to all-electric vehicles could create over 150,000 jobs by 2030—if policymakers make smart investments to secure U.S. leadership in the auto sector*. <https://www.epi.org/press/the-shift-to-all-electric-vehicles-could-create-over-150000-jobs-by-2030-if-policymakers-make-smart-investments-to-secure-u-s-leadership-in-the-auto-sector/>
- Energy Agency, I. (2024). *Global EV Outlook 2024 Moving towards increased affordability*. www.iea.org
- European Commission. (2021). *Putting European transport on track for the future*.
- European Commission. (2023). *SUMP Guidelines and Decision Makers Summary*. https://urban-mobility-observatory.transport.ec.europa.eu/sustainable-urban-mobility-plans/sump-guidelines-and-decision-makers-summary_en
- European Commission. Directorate General for Mobility and Transport. (2017). *European urban mobility : policy context*.

- European Court of Auditors. (2019). *Urban mobility in the EU Audit preview*.
- Ferris, B., Watkins, K., & Borning, A. (2010). *OneBusAway: results from providing real-time arrival information for public transit*. Association for Computing Machinery.
- Figenbaum, E. (2017). Perspectives on Norway's supercharged electric vehicle policy. *Environmental Innovation and Societal Transitions*, 25, 14–34. <https://doi.org/10.1016/j.eist.2016.11.002>
- Fiol, O., Freemark, Y., & Su, Y. (2022, February 2). *Why US Cities Are Investing in Safer, More-Connected Cycling Infrastructure*. Urban Institute.
- Firnborn, J., & Müller, M. (2012). Selling Mobility instead of Cars: New Business Strategies of Automakers and the Impact on Private Vehicle Holding. *Business Strategy and the Environment*, 21(4), 264–280. <https://doi.org/10.1002/bse.738>
- Fishman, E., Washington, S., & Haworth, N. (2013). Bike Share: A Synthesis of the Literature. In *Transport Reviews* (Vol. 33, Issue 2, pp. 148–165). <https://doi.org/10.1080/01441647.2013.775612>
- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, 16(1), 15–31. <https://doi.org/10.1177/1094428112452151>
- Gooze, A. (2013). Benefits of Real-Time Transit Information and Impacts of Data Accuracy on Rider Experience. *Journal of the Transportation Research Board*.
- Gössling, S., & Choi, A. S. (2015). Transport transitions in Copenhagen: Comparing the cost of cars and bicycles. *Ecological Economics*, 113, 106–113. <https://doi.org/10.1016/j.ecolecon.2015.03.006>
- Guerra, E., & Daziano, R. (2020, January 28). *EV Adoption and the Price of Parking*. Kleinman Center for Energy Policy . <https://kleinmanenergy.upenn.edu/research/publications/ev-adoption-and-the-price-of-parking/>
- Hickman, M. D., & Wilson, N. H. M. (1995). *Passenger travel time and path choice implications of real-time transit information*.

- Hurni, A. (2005). Transport and social exclusion in Western Sydney. *Transporting the Future: Transport in a Changing Environment: Conference Proceedings of the 28th Australasian Transport Research Forum*.
- ICCT. (2017). *ICCT Annual Report 2017 final*.
- INRIX. (2023, January 9). *Stauauffälligste Ballungsräume weltweit im Jahr 2022 (nach Zeitverlust pro Jahr)*. Statista. <https://de-statista-com.eaccess.tum.edu/statistik/daten/studie/970465/umfrage/stauauffaelligste-ballungsraeume-weltweit/>
- Institute for Transportation & Development Policy. (2024, April 2). *2023 STA Winner Paris, France Presents a Bold Vision for its Historic Streets*. <https://itdp.org/2024/04/02/2023-sta-paris-france-presents-a-bold-vision-for-historic-streets/>
- International Transport Forum. (2014). *Valuing Convenience in Public Transport*. www.internationaltransportforum.org/jtrc/DiscussionPapers/jtrcpapers.html
- Johnson, V. (2011). *An exploration of the relationship between transport to arts and cultural activities and social exclusion*.
- Le Grand Paris Express. (2021). *Activité 2021 Mot du directoire et du conseil de surveillance*.
- Likert, R. (1932). *A technique for the measurement of attitudes of psychology*.
- Litman, T. (2006). Changing Travel Demand: Implications for Transport Planning. In *ITE Journal* (Vol. 76, Issue 9). www.vtpi.org/Info@vtpi.org
- Litman T. (2019). Well measured: Developing Indicators for Sustainable and Liveable transport planning. *Victoria Transport Policy Institute*.
- Litman, T. A. (1996). *Evaluating Public Transit Benefits and Costs*. www.vtpi.org
- Lu, H., Burge, P., Heywood, C., Sheldon, R., Lee, P., Barber, K., & Phillips, A. (2018). The impact of real-time information on passengers' value of bus waiting time. *Transportation Research Procedia*, 31, 18–34. <https://doi.org/10.1016/j.trpro.2018.09.043>
- Maclean, S. D., & Dailey, D. J. (2002). *Measuring The Utility Of A Real-Time Transit Information System*. <http://buavieu.org>

- Martin, E., Shaheen, S., & Lidicker, J. (2010). Impact of carsharing on household vehicle holdings. *Transportation Research Record*, 2143, 150–158. <https://doi.org/10.3141/2143-19>
- Mayring, P. (2016). *Einführung in die qualitative Sozialforschung (2016): Eine Anleitung zu qualitativem Denken* (6th ed.). Beltz.
- McKinsey. (2019). *Trends transforming mobility's future*.
- Norwegian Road Federation. (2023, December 31). *Norwegian EV market*. <https://elbil.no/english/norwegian-ev-market/>
- Ortúzar, J. de D. (2019). Sustainable Urban Mobility: What Can Be Done to Achieve It? In *Journal of the Indian Institute of Science* (Vol. 99, Issue 4, pp. 683–693). Springer. <https://doi.org/10.1007/s41745-019-00130-y>
- Pražanová, A., Plachý, Z., Kočí, J., Fridrich, M., & Knap, V. (2024). Direct Recycling Technology for Spent Lithium-Ion Batteries: Limitations of Current Implementation. In *Batteries* (Vol. 10, Issue 3). Multidisciplinary Digital Publishing Institute (MDPI). <https://doi.org/10.3390/batteries10030081>
- Pucher, J., & Buehler, R. (2017). Cycling towards a more sustainable transport future. In *Transport Reviews* (Vol. 37, Issue 6, pp. 689–694). Routledge. <https://doi.org/10.1080/01441647.2017.1340234>
- Qiao, W., & Briceno-Garmendia, C. (2024). *Transformative Technologies in Transportation Global Report*. <http://creativecommons.org/licenses/by/3.0/igo>.
- Rabbitt, N., & Ghosh, B. (2016). Economic and environmental impacts of organised Car Sharing Services: A case study of Ireland. *Research in Transportation Economics*, 57, 3–12. <https://doi.org/10.1016/j.retrec.2016.10.001>
- Ricci, M. (2015). Bike sharing: A review of evidence on impacts and processes of implementation and operation. *Research in Transportation Business and Management*, 15, 28–38. <https://doi.org/10.1016/j.rtbm.2015.03.003>
- Shaheen, S., Cohen, A., Chan, N., & Bansal, A. (2019). Sharing strategies: Carsharing, shared micromobility (bikesharing and scooter sharing), transportation network companies, microtransit, and other innovative mobility modes. In *Transportation, Land Use, and*

- Environmental Planning* (pp. 237–262). Elsevier. <https://doi.org/10.1016/B978-0-12-815167-9.00013-X>
- Tang, L., & Thakuriah, P. (Vonu). (2011). *Will Psychological Effects of Real-Time Transit Information Systems Lead to Ridership Gain?*
- Tausendpfund, M. (2020). *Fortgeschrittene Analyseverfahren in den Sozialwissenschaften: Ein Überblick*. Springer.
- Thorpe, D. (2015, July 30). *How cities can benefit from intelligent transport systems*. World Economic Forum. <https://www.weforum.org/agenda/2015/07/how-cities-can-benefit-from-intelligent-transport-systems/>
- Transport for London. (2023, February 17). *Congestion Charge marks 20 years of keeping London moving sustainably*. <https://tfl.gov.uk/info-for/media/press-releases/2023/february/congestion-charge-marks-20-years-of-keeping-london-moving-sustainably>
- UN DESA. (2018, May 16). *Urbanisierungsgrad: Anteil der Stadtbewohner an der Gesamtbevölkerung in den Weltregionen von 1995 bis 2018*. Urbanisierungsgrad: Anteil der Stadtbewohner an der Gesamtbevölkerung in den Weltregionen von 1995 bis 2018
- UN Habitat. (2022). *Envisaging the Future of Cities*.
- Urban Access Regulations in Europe. (2023). *Impact of Low Emission Zones*. Urban Access Regulations in Europe. [https://urbanaccessregulations.eu/low-emission-zones-main/impact-of-low-emission-zones#:~:text=Low%20Emission%20Zones%20\(LEZs\)%20have,and%20lets%20us%20live%20longer.](https://urbanaccessregulations.eu/low-emission-zones-main/impact-of-low-emission-zones#:~:text=Low%20Emission%20Zones%20(LEZs)%20have,and%20lets%20us%20live%20longer.)
- U.S. Department of Transportation. (2023). *How Government Agencies Can Support the Electrification of Private Fleet Vehicles*. www.transportation.gov/Momentum
- Yan, S. (2018). The economic and environmental impacts of tax incentives for battery electric vehicles in Europe. *Energy Policy*, 123, 53–63. <https://doi.org/10.1016/j.enpol.2018.08.032>
- Zheng, P., Young, D., Yang, T., Xiao, Y., & Li, Z. (2023). Powering battery sustainability: a review of the recent progress and evolving challenges in

recycling lithium-ion batteries. *Frontiers in Sustainable Resource Management*,
2. <https://doi.org/10.3389/fsrma.2023.1127001>

Appendices

Appendix A: Interview participants

Interview Participants					
#	Identification	Position	Company	Company Type	Years of Experience
1	Expert AN	Deputy Chief of Staff Public health, environmental health, pollution control and risk reduction	City of Paris	Public	6 years
2	Expert RB	Member of the 8th Commission (Environment - Climate and Biodiversity - Cleanliness) and Deputy Mayor of 7 th district	City of Paris	Public	23 years
3	Expert TG	Head of the Mobility Agency	City of Paris	Public	4 years
4	Expert AC	Network coordination manager	Mieux se Deplacer a Bicyclette	NGO	4 years
5	Expert DN	Director of the Mobility and Transport Department	L'institut Paris Region	Public	30 years
6	Expert FG	Deputy to the Head of the Sustainable Agriculture and Food Office	Ministry of Ecology and Territory	Public	3 years
7	Expert PJ	Deputy Mayor of the 10 th district, Public spaces and works	City of Paris	Public	
8	Expert CN	Deputy Mayor of Paris in charge of transport,	City of Paris	Public	6 years

		mobility and public spaces			
9	Expert CL	Project manager (assessment of health impacts of urban renewal projects)	City of Paris	Public	7 years
10	Expert CB	Project manager for the AOM (Active Operations Management) action framework	Ministry of Infrastructure, Transport and Mobility France	Public	2 years
11	Expert FH	Customer Account Manager	EQUANS-Ineo Systrans – supplier of equipment and software for Help with Operations and Passenger Information (SAEIV) for transport networks	Private	25 years
12	Expert TR	Executive Director	Respire	NGO	2 ½ years
13	Expert KR	Coordinator of scientific projects in health and the environment	City of Paris	Public	7 years

Appendix B: Interview questions

I. Introduction

- Introduction
- Thanks for participation
- Introduction of the interviewer
- Overview of the structure of the interview
- Reference to anonymisation and use of the data
- Permission for digital recording
- Explanation of the aim and content of the research
- Clarification of open questions

Personal details

Name:

Position:

Company Type:

Years of Experience:

II. Questions

Introduction questions

1. Could you briefly describe your role and experience in urban planning and mobility?
2. How do you perceive the current state of urban mobility in Paris? On a scale of 1-10 (1=unsatisfied; 10=very satisfied). Why?

Reason for Urban Mobility Strategies

3. What are the reasons for urban mobility strategies?
4. What primary urban challenges are you aiming to address with Paris's mobility strategies?

Effectiveness of Current Strategies

5. What key strategies have been implemented in Paris to address your reasons mentioned previously, and how successful have they been? Name the reasons why they have been successful.
 - 5.1. Which strategies have rather been unsuccessful and why?
 - 5.2. Where is potential for improvement?
6. Can you share any specific metrics or outcomes that illustrate the impact of these strategies?

7. In your opinion, what are the most pressing factors that complicated the implementation of the strategies (e.g. political pressure, public acceptance, monetary issues etc.)? How do/did you deal with it?
8. In 2016, Paris introduced the low emission zones using the national air quality certificate Crit'Air. How effective do you think this strategy is in reducing particulate matter and improve human health?
9. Paris recently voted for higher parking fees for SUVs. Do you think this is the right approach to reduce carbon emissions?

Future Planning and Strategy Development

10. What are upcoming strategies for urban mobility in Paris?
11. What is the long-term goal for the city's transportation infrastructure and how do these plans align with it?
12. From your experience, how do you see emerging technologies (e.g. Mobility as a Service) shaping future mobility in Paris?
13. What do you think is the perfect urban mobility strategy in Paris? Give reasons.
14. What factors do you think need to be taken into account when successfully implementing urban mobility strategies?

Learning from Others

15. Have you looked at urban mobility strategies from other cities for inspiration? If so, which strategies do you find most promising and why?
16. What adaptations, if any, are needed to implement these strategies effectively in the context of Paris?

Stakeholder Management

17. How do you engage with stakeholders (e.g. urban planners, policymakers, public etc.) in the development and implementation of mobility strategies?
18. What challenges have you encountered in aligning the diverse interests of stakeholders and what are incentives that you can use?
19. Can you share a recent example where stakeholder input significantly influenced a mobility decision or policy?

Closing

20. What is in your opinion the most important next step to improve the environment and make Paris more liveable?
21. Is there anything else you would like to add that we haven't covered, which you feel is critical?

Appendix C: Example expert interview transcript

Speaker 1 (00:00):

Now. Yes, exactly. So, what I'm just missing about your personal details is the years of experience. Maybe you can just mention how many years do you have experience in urban planning, urban mobility, and also what is your current position? What are you doing in that position?

Speaker 2 (00:24):

So, I'm elected in Paris. So, I've been elected in the last election, the municipal city election. It was in the summer of spring 2020, so it has been a little four years, but I have been elected. In Paris we are elected in different districts called arrondissement, and I'm in the central district that captures the fourth first arrondissement, which are 100,000 inhabitants and place of most of the touristic place. You might know if you have been in Paris or even if you have not been. So, for years I'm a deputy mayor, so the mayor of Paris Central, the district put me in charge of the road, the mobility and the work site management.

So, it's not my job, it's like I am elected, but I have a job that is something else and I'm an agricultural engineer if you want to know. But as a job, before I was elected, so before 2020, I used to work for the state of France, the government in urban planning, but at a state level for not Paris but for another region in the northeast of Paris, which is the poorest territory in France. So, it was a lot of stakes about social housing and infrastructure, transport infrastructures, that kind of stuff. But it was like my job now it's not my job. It's like my elected mandate.

Speaker 1 (01:58):

Okay, perfect. So, you already have a lot of experience and yeah, I think you're a great expert in this field. So, let's start with the questions. Are you ready?

Speaker 2 (02:13):

We'll see that.

Speaker 1 (02:16):

Okay, so first question would be kind of a general question. How do you perceive the current state of urban mobility in Paris on a scale of one to 10? One meaning satisfied and 10 very satisfied and why?

Speaker 2 (02:34):

I would say six or seven because it's quite good and it's going better according to me, of course, and to my perspective, it means that we have less and less car journeys. We are more and more pedestrians and bicycles. The public transports, they are very high in Paris since a long time, but it's staying very high. So, I think we are not at the maximum that we can reach. We can still do more for pedestrian, for public transport and for bicycles and we can still lower the parts of the car, the car and the thermic car especially used, but we're in the good direction. So, six, seven, maybe next year it will be eight.

Speaker 1 (03:19):

Okay, that's already quite good, I think. Okay, perfect. Then we are coming to the next chapter, the reasons for urban mobility strategies. So now your opinion, what are the reasons for urban mobility strategies in your opinion?

Speaker 2 (03:43):

I can speak for Paris at least, and for big cities, especially of big cities, urban territories in Paris for example, the Mayor Anne Hidalgo, she put the stake of the air pollution at the very top of the priorities and that's from this air pollution problem that's quite important in Paris, it's very dense. That came the idea of green mobility, but that's from I would say the health issues. That's what, and then of course when you develop public transport, when you develop pedestrian and bicycle, of course you tackle other issue like climate change, like road safety. But it has come as a second incentive and I suppose that in many big city in Europe which has this air pollution program, it's something that people are very afraid of more and more because we are more concerned about what we eat, what we breathe, and maybe it's easier to take these topics when you're a citizen because it consent directly to you and your kids than global eye warming. That is something important, but maybe a bit far and that you can feel a bit fatalyst about it. For the air pollution, we know that we can improve and that it'll have a direct impact on the health of people living concretely directly in the city.

Speaker 1 (05:08):

Okay, so you would also say the primary urban challenge is air pollution that you are trying to tackle?

Speaker 2 (05:17):

For Paris it was the main idea and then I would add some more what carbon reducing climate change traffic. I would also put the road safety. We know that in Paris and you, same in many big cities, most of the injuries on the roads are caused by cars, trucks. So, the less trucks and cars you have, the less injured people you have by the road accident, and it take the basic state of quality of life. I have lived in Copenhagen for a while that's there that I started to bicycle in the city. I was just impressed by the quality of life that you have, even if you don't bicycle. But just because of this and because it's not many cars and quite clean air and green spaces and that's really the idea of offering even if you live in a very, very dense city. Paris is one of the densest Paris cities in the world, people have tiny flats very often even when they have kids. So, they have to get some space outside, and we need to give people green spaces, big pedestrian area so they can enjoy outside because inside it's very narrow.

Speaker 1 (06:29):

Okay, yeah, that's reasonable. Okay, then let's go to the effectiveness of the current strategies in Paris. Which strategies implemented in Paris do you believe have been most effective? And can you share any metrics or outcomes that illustrate their impact?

Speaker 2 (06:51):

Yeah, you're lucky because a few days ago a big study just came out. So, we have data - very fresh data. I would say the most effective was the bicycle, the bicycle revolution in Paris. It's quite incredible, the rhythm of it. We're not the biggest biking city in the world. Of course not. There is happen again, there is Amsterdam, there is even France, there is other more little city that are doing that are better in the share of the number of journeys done by bicycle. But for Paris we started 10 years ago, there was almost no bicycles at all in the city. It was like one or 2% of the movement of the daily journeys that was done only by bicycle and the data that was broadcast like last week, it shows that now we have 12% of every journey in Paris that are done by bicycle and it's three times more than the number of car journeys. So, in 10 years we have totally switched. Before it was 2% for bicycles and 12-14% for cars and 10 years later. It's the totally opposite. It is only 10 years. I think it's very impressive.

Speaker 1 (08:11):

Yeah, that's true. It's a great achievement. So yeah, I think that's really nice.

Speaker 2 (08:18):

I could send you the study if you wanted the chance.

Speaker 1 (08:19):

Yeah, please. Yeah, that would be nice. Okay. And I guess you're also part of implementing the strategies or creating the strategies. What would you say was a major challenge when implementing those strategies? For example, was there any financial issues or the public didn't accept the strategy and how did you deal with it?

Speaker 2 (08:47):

Well there are always financially issues because the budget is never limitless. But if it's your priority in a very big city like Paris, you can have the fund you need to do your politics. If you renounce doing something else, that's the choice you have to make. And we did a choice like this in Paris with millions of euros for the bicycle infrastructures for this only this year, 2024, we'll spend around 50 million euros for bicycles. So that's a choice and we'll spend 500 million for public transport. So that's a choice. That's a lot.

So that's important. Of course, not everyone is happy about it. Public transport, it's very historic in Paris. I think it was difficult 30, 40 years ago when it started, but now everyone, even people that have a car, they don't complain about the bus lanes and stuff. It's normal to have this and they understand that some people don't have a car and they have to take the bus so it's okay. But no, it's true that there is a peak of a war because the bicycle lanes are taking some places and as we don't want to reduce the bus lanes and we don't want to reduce the pedestrian area. Of course, in case by reducing the car place, we reduce both the parking lots, the parking industries and we reduce the number of lanes to circulate. So of course, some people are not happy about this, but I have to say that we have been elected in 2020 on a political agenda.

It was very, very clear about this. That's why we can do it very quickly and very strong in our political programme. That was said to every voter and then they choose which candidate they wanted. We said that we wanted to do our 100% bicycle city, meaning not that all the movement are done by bicycle, but that if with a bicycle you can go everywhere in a safe way. And we even added that for this we'll have to find some space and to reduce the parking lots and we said that we are ready to reduce half the number of parking places in all the city in only six years and people chose this.

Speaker 1 (11:12):

Okay, so the public acceptance think it is fair?

Speaker 2 (11:14):

Yeah, the majority team, it's democracy. So, I think we did the score, we did a 51%. So, it was not like a very big, victory, it was tiny, but the majority of people chose this and the other candidate that lose, some of them were not that much, but they were still in the idea that we should reduce the car. So, I think in Paris you have a quite big majority of citizen that don't have a car. In my district, in the central district for example, we have about three fourth of the population that do not have a car. Very, very big. And of course, people that do not have a car, they just don't want to get the pollution and the noise. They don't have an interest in keeping the parking lots and keeping the lanes. So, they vote in favour of that kind of program. And once the voters have a clear idea, the mandate for us elected people, it's very clear because it was written and then of course there is opposition on the process, but we are always saying, okay, but people voted for that, so let us work and maybe the next election you will try and if we lose at the next election, well the direction will be different. But for the six years of the mandates, that's the direction we are having and we're not slowing even if there is a position.

Speaker 1 (12:32):

Okay, great. It's really nice that the public is accepting this. So yeah, very nice. Okay then we are coming to the next question. Studies show that congestion pricing is one of the most efficient strategies to reduce pollution in cities. For what reason did Paris not implement this model yet?

Speaker 2 (13:18):

It has been proposed not by me or by the left parties, but it has been in the public debate and that's normal because London does it and it's quite efficient there. We don't have the same culture in France. We are maybe less liberal than this. And the market-based incentive, I am an economist too by pharmacy, so I like economic incentive-based tax, the rabbits. In the general population it is not very much accepted because there is the idea that everyone should pay quite the same and get the idea of public service and to sit to accept that the city will be accessible maybe more for the rich and less for the poor. Because at some point if you have to pay a fee, that's what happened. That's very not acceptable for most people. And you have to add that in Paris, it's a very diverse city, but Paris is like richer than the suburb. Even if in Paris you have

also poor neighbourhood but as a whole, Paris is richer and there is complaint and I understand why that if we do that to mean that the rich, they gather together and then they just kept the poor outside.

Speaker 1 (14:36):

Yeah, there's like a gap.

Speaker 2 (14:37):

That's not acceptable first. So, we prefer to have very equal solutions. When you reduce the number of parking lots, when you reduce the number of car lanes, it affects everyone. No matter your revenue, you will spend maybe more time in the traffic jams, but this is like social blind.

Speaker 1 (15:00):

That's true. So, you say it's more like a cultural thing?

Speaker 2 (15:05):

I think in France we are very not ready for that kind of device. Maybe 20 years or I don't know. Because for example, for the pollution issue, Paris is not the only city in France that is concerned about this. We have the zone that we not, for example, it's not only Paris, it's Paris plus the suburb that is around the region that is the most pollutive. And the idea is not to pay to enter, but it's the idea that when there is an air pollution peak on each car in Paris and in the suburb, you have a number one to five, one is the greenest in terms of less pollution emission and five is the oldest. And when there are some peaks, you cannot enter the city. If your car is 5, 4, 3 depending on the severity, that's a bit of social too issues because of course if you have an old car because you don't have the money to change, you are more likely to have a five or a four on your stamp. But it's not a direct fee. But even this is less than, it's not so much accepted. It is difficult. This topic is very difficult.

Speaker 1 (16:20):

Okay, that's the link to my next question. It's about the low emission zones which you just mentioned, the label. Some critics say that this abroad should not only address the NO2 pollution, but also industrial emissions and residential heating. What do you think how effective the strategy is in reducing air pollution?

Speaker 2 (16:50):

Yeah, it's true that the circulation, they're not the only source of pollution of air pollution. Well, in Paris, because it's very dense again and that we don't have many industrial plots anymore, very close, the traffic is the main source. So, it's quite rational to target the main source when you want to have an effective public policy. But it's true that it's not the only one and this low traffic zone or low emission zone, then tackle only parts, partially the issue of air pollution. We have other public policies that tackle the other. So, as I say, industrial is not much a problem around Paris but for other cities in France it is. But it's getting more tackled by the norms, the law that are getting higher and higher in the standards that we require from the factory to be and for the fuel, I don't know, house eating that consume a lot, there is a government program and city program for example, to replace the old boilers that work with gas or that work with not coal, what we call in French of fuel. It's like this liquid black liquid very dirty fossil fuel. I don't know the name in English and very old stuff. And there is incentives and subsidies to change this old to the new that are electric that are more modern and that helps to reduce the air pollution from the residential area. But it's true that it's complimentary to the car policy. But still in Paris, the car is the main parcel. We are not quite well so far from the topics.

Speaker 1 (18:42):

Okay. So, like you said, there's also some other strategies which cover actually the other emissions which are not covered by the low emission zone.

Speaker 2 (18:57):

Exactly. Yeah, the low emissions only are one tool, but it's only one. Yeah, that's not all points.

Speaker 1 (19:04):

Okay. Okay. Then we are coming to the next question. It's about the voting for higher parking fees for SUVs, which just recently has been done. And some critics say that not only the car size and the types should be considered for the policy because a smaller diesel or gas line car might emit more pollutants than a larger electrical SUV. What is your opinion on that? Do you think it's a good strategy?

Speaker 2 (19:35):

It should in this case because in our SUV fees for the parking, the weight that we take into consideration to impose this very big fee on the parking, it's not the same if you are electric or not. If you are electric, you can have a car that is two tons and it's after two tons that you have to pay. If you are thermic, it's one ton six. So, this is the difference to all lot because of course electric cars are heavier because of the battery. So that's these 400 kilograms, that's the margin that we want to put to make a difference between the two. And I have to add that today every electric car in Paris can park for free - all of them. So, there is already a very big difference between electric and DSL on thermic cars. And tomorrow, even with the new fee, still it'll be cheaper for electric SUV more than two tons. It'll be cheaper than for a thermic SUV. So, you still have the difference, but why it's not free for big SUV. First because the bigger the car is, the more it'll produce some air pollutants from the tyres and from the movement itself and that you cannot do anything even if you're electric. So that's the point. That's something we don't want electric cars to be like tanks because we will not have resolved the problem. And secondly, because this SUV fee is not only an air pollution problem that we want to address, it's only, it's also a road safety. And if you have an accident, no matter if you are electric or not, it's the weight of the car that counts in the damage you will create. So that's why we proposed and that was voted like this by the citizen, the student that wanted to participate, it was like seven or 8% of the population. It's not everyone. We didn't want to make it totally free for the biggest electric car. That's why.

Speaker 1 (21:46):

Okay. Are you also hoping to win some space out of that strategy?

Speaker 2 (21:52):

Exactly. That's the third. Yeah, that's the third. Maybe not win but stop losing it because I mean some cars cannot even fit in the parking lot. That's a problem. And we don't want this to increase again. So, this tax, we will not stop every SUV from answering in Paris. That's not the point. And the residents, the citizen of Paris, they won't have to pay the fee to park in their own neighbourhoods. But if they want to go in another neighbourhood, they'll have to pay. But in their own neighbourhood, they won't pay. Because if people already have SUV, we don't want the people that live in Paris don't want from the day to another to pay, I don't know, hundreds of euros every day. That's not possible because the fees are very, very high. I don't know if you have seen them. So, for people that live there, it's not possible. But many other cities in front will do the same. Lyon, which is the third biggest city in France has done before us actually

some months before, we hope that most of the big cities will do that. So, then the government will have to do something about the size of the vehicle because it's not acceptable that the car industry is making bigger and bigger and bigger cars, even if there is no need for that, just to make some more profits. So, we want to make a stop and as a city we cannot stop the car industry, but we can send some messages, very strong messages like this. Okay, we ask you to stop this, or you'll pay a lot, and no one will buy your car anymore.

Speaker 1 (23:38):

Yeah. Okay. Nice strategy. Okay, then I would say we are going to step to the next chapter. It's about the future. As we all know, the technologies are getting more and more important. And my question would be from your experience, how do you see emerging technologies shaping future mobility in Paris?

Speaker 2 (24:09):

Honestly, not much. We tried some experiments regarding logistics. We tried to put some logistic parking in the streets connected with different sensors to help the delivery man to know in advance if the place is free or not, things like this. It was a totally failure, a failure for different reason, but it didn't work. And the technology was not so much compatible and that this company that tried this did not work well. But there were many reasons, but it didn't work. So yeah, we are a bit disappointed about it. I'm not sure we'll try new ones recently in the next month because of this failure and honestly in the daily life, I don't see much except for the navigation applications. Of course it can be more and more accurate. And that's interesting to offer people to change the roads in direct data time. Yeah, that's interesting. But that's not us. I mean that people can buy if they want the applications or use Waze or Google Maps, I don't know. And they will get better and that's good, but that's not a job for us. And honestly, I don't believe too much in the autonomous cars, things like this. And I must say that we are more in Paris at least, we are more in a suburb approach like low tech. I mean the bicycle, it's enough.

Paris is quite small city compared to the population. You can cross Paris in half an hour with a bicycle. So why do you need something else? I mean then you have electric bicycles if you are old or if you have some hilly neighbourhood, electric cars, of course that's nice compared to thermic cars, but that's not like high technology stuff. And honestly, the biggest technology we have was the scooters and we banned them, not because they are technologic but because they made too many accidents, and it was a mess. The parking, it was a mess and stuff. So, we've

made a votation like with the SUVs and 90% of the voters said "ban them". So, I think we're not a very high-tech mobility city. I'm not sure we'll be.

Speaker 1 (26:54):

Have you heard about mobility as a service?

Speaker 2 (27:02):

A service where you don't buy a car, but you use it?

Speaker 1 (27:06):

No, it's like the approaches that you have one app which you can use for public transportation, bicycles, taxis et cetera.

Speaker 2 (27:16):

Yeah, an application for everything. To rent a bicycle, to rent a car, to rent, yeah. We have this, it's not Paris that is doing it, but I mean application applications like City Mapper that you have in Portugal too, I don't know how it is in Portugal, but in Paris it's very much integrated with every kind of transport. So, I'm opening it right now and you have the public bicycle, the private bicycle location, you have every public transport, and you can buy your ticket on it. You have E-scooters, not a scooter, but the motorcycles, you have taxi, you have everything on it. So, it already exists somehow. It's already a reality.

Speaker 1 (27:58):

So, you see Paris is into technology.

Speaker 2 (28:02):

Yeah, it is true. Yeah, it's true. But it's more like a user-friendly device. But I think we won't be in the tech vehicle technological vehicle. That's what I meant.

Speaker 1 (28:13):

For example, there has been a debate about if for the Olympic games we authorise helicopter taxi. And it has been banned.

Speaker 1 (28:29):

Very funny. Then coming to the next question, what do you think is Paris currently missing about urban mobility strategies when you think for example about Copenhagen or another city?

Speaker 2 (28:58):

Yeah, I think we're getting better and better, but we still have progress to make in the way we design and the infrastructures. I mean if we take a bicycle lane for example, that has been done like five or six years ago, it's completely different than the one we are doing now because we did mistakes and we learned and the way we designed very like how you design the crossroad, how you design, where you put light, I would say it's the green lights or not all that kind of stuff. It has changed in a good way, but we are not still at the end of the process. When you go, for example in the Netherlands, it's a bit crazy. When you're back you have zero question, you have nothing to think. Everything is very natural, and you just follow the flow and you arrived where you want with nothing. I mean you don't have to pay attention to anything because everything is so well designed that you're never in conflict with another car or a pedestrian or something. And we're not at this point yet in Paris. So, we have to improve this.

And then I think we have to improve also the respect of the rules of the circulation for all the kind of vehicles including bicycles and including pedestrian because Paris is a bit messy regarding this. Everyone is doing his own rules, and no one is much following the signs. And so, it makes injured people because of the accident. And even without speaking about this, it's not very pleasant to walk or to cycle or to drive in Paris because you always have random behaviour from everyone. And that's difficult because it's both cultural in Paris that's been like this since ever. But I think we have a pedagogy like sense civilisation and police need to address more. That's why we are increasing the number of the police Paris, Paris policemen that are in charge, many topics but not in charge of the road safety and that kind of stuff. And they're doing more and more controls even for bicycles because we need to make more peace in the city. So, it works altogether.

Speaker 1 (31:26):

Okay, yeah, that's a challenge. Infrastructure is always a huge topic and also it is always combined with financial issues.

Speaker 2 (31:38):

Yeah, honestly it is. But as I said before, the financial, we find it, we choose, it's a very big political agenda and we put the money we need. But then even with this, it doesn't mean that it's budget less, but it's not like this. But we put a lot of money, and we prefer to do maybe a little less project, but we have better quality. But still the engineer of the city of Paris, the technicians, the workers on the work sites directly, when they are creating the thing, they have to train, they have to be more trained to do better in the way they conceive the infrastructures.

Speaker 1 (34:18):

Alright, then I have another chapter about the stakeholder management. I guess you're in contact with a lot of stakeholders and they all have sometimes different interests. And my question would be what challenges do you have when you work with those stakeholders and how are you working with these and what are the incentives or methods that you use?

Speaker 2 (34:55):

We try to do a lot of consultation, consultation committees, all kind of stuff to implicate the citizens, the NGOs. We have for example a quite big nonprofit organisation for bicycle in Paris from bicycle militants by bicycle users. So, we make them ask their advice on every project that we have, and they can criticise, we can help us to better. We have also pedestrian NGO; we have lot of NGOS of course. We also have what we call the district council. It's like citizen council that are on not mandatory. It's like people that want to join this camp, everyone can. And then it's like a panel that we can ask the opinion on different kind of topics. Often there are more conservative than the normal population. You have a lot of retired people that have more time and for example, they're not the more bicycle friendly and often they have more cars than the average population.

So sometimes it's difficult because you hear a lot of criticism, and you have the impression that everyone is against the project in this kind of committee. And then when you come back to the real life and you ask random person, the picture is totally different. So, my job is to implicate, to do some pedagogy and to just explain why we are doing this. Try to understand and to take in account the alerts of people that disagree with us. But still sometimes and often they have things to add. They have added value because in the critics, even if the critics are not so nice at the point that you receive, when you try to understand the roots of the critics, sometimes you have some keys to make some projects better or to conciliate more different stakes. But I will have never at this point renounced to a project because of some stakeholders saying, no, we can

modify, we can adjust, we can delay at some point, but we are elected for a very, very clear agenda. And I consider that all the consultation that we do are necessary to make the project fit exactly the needs, the local needs.

The conclusion cannot be the opposite of the program we have been elected for by the old citizen of the old city. So, we are discussing the way of doing it, but not the aim, not the general targets. And that's very important I think to dissociate. And when I start a meeting to consult, to ask people the opinion about the project, I present the intention, the main aims of the project at the beginning. And I say, this is not negotiable. We want to improve the bicycle safety in this road. We can discuss how we reach that goal, but the goal itself is not negotiable. And that's how we do the difference.

Speaker 1 (38:18):

Yeah, yeah. Okay. Do you have an example in mind where the stakeholder impact significantly influences the decision or policy?

Speaker 2 (38:31):

Oh yeah. Well, in most projects we have evolution after the stakeholder's consultation phase, less or more but we have. We had a very big project in 2021, 2022. It was the change of the road, the circulation maps in Alf, my district, so in which is the Mairret it's a very old neighbourhood with very narrow streets and we had many, many too much traffic of cars and we wanted to change the censes of some roads to make the car prefer to go around the neighbourhoods but not through. And with the big consultation, it took us one year and a half, something like this with many, many meetings, many maps, workshops and stuff like this. And the first proposal that we had, sorry, we wanted to change 40 streets, 40 census. And at the end of the process, we only kept 20.

Because we understood that what we were proposing that was maybe perfect on the paper, on the plate, it was too much on one time. It would've created too many difficulties even for the neighbourhoods that have a car, and they should be able to still come in their parking lots, private parking and stuff like this. So, we found somehow a way between the situation that was not acceptable for us and what we would've dreamed of but was not acceptable for many people in the district. So, we changed half the projects. So, I think those are the project that changed the most in the four last years.

And I'm glad about it, even if sometime in some streets when I buy on them and say, that's a shame we haven't changed this because if they're so much better. But then I remember all the process and I think we have done well because then the new roadmaps, except some, you always have a handful of people that are not happy about it and the protest and stuff. But 99% of the population accepted it and I think it's because we did this process of renouncing in some parts of the project but keeping the same goal as all.

Speaker 1 (41:13):

Yeah, that's great. Nice. Okay, then we are coming to the last two questions. What is in your opinion, the most important next step to improve the environment and make Paris more liveable?

Speaker 2 (41:32):

We have continued. I haven't spoken a lot about trees and vegetation, green spaces in general, but that's the other very important policy that we have. We want and we plant a lot of new trees because we have to adapt the city to climate change. We think we'll have maybe four degrees in Paris more in 2050 and in summer we will have some temperature when you have a heatwave that is close to what you have today in Sahara.

And that's very questionable of how we will live in such a dense city with narrow floods if you have no air and no green spaces to just chill and literally chill. So, I think the bicycle revolution, it's not finished but it's on the way and I think nothing will stop it. Even if you lose the next election, the new candidate, he will not be able to say I destroyed the bicycle lanes. It has become so normal in the daily life. But the green space, it's very challenging because we are very dense. There is not much free space. And so, we are taking the car again, the car places to plant new trees.

But the trees are, it's good, but you have a lot of technical constraints. I don't know how to say it's difficult to plant a tree when you have the gas network or electric network that are in Paris. All the networks, all the key network like this electric phone, gas, everything is on the ground. So, you have not much place for the roots to grow. So, it's very difficult and that's very a big, big challenge because if we fail doing this, Paris will just at some point not be livable anymore. That's not what we want.

Speaker 1 (43:41):

Okay. Yeah, that's true. Okay, then last question, is there anything else you would like to add that we haven't covered, which you feel is critical in this topic?

Speaker 2 (43:59):

I don't know, but I didn't mention the school streets, which is a big priority for us. The idea is to make the streets where you have schools only for pedestrians and bicycles and to plant some trees when we can. So, it's really the idea that the kids should be totally protected from the car injuries that are possible, but also that they must have some space to play that they can play balls, or I don't know, in the streets that used to have cars on it. It's very popular program. There are around 200 street schools like this. It has been in place and for this, even the right conservative districts, they're doing it because everyone was very impressed with the first one that was put in the 2020 or a bit before. And everyone was impressed of the effects it has on the local communities. You create so much social links in this very sometime, very, very narrow streets.

(45:16):

But once they are totally open for kids, it creates a very total difference atmosphere, and it has a lot of positive bounds in different kind of stakes. So that's very important for us. The attention to kids. And we have the school streets or in the streets and in the school itself. In the, I would say it's the playground. We have a big program, what's called oasis, I don't know what in English. In English, in the desert Oasis playground where we do the same, it's already pedestrian because it's like the playground of the kids inside the school. But historically in Paris, all the playgrounds, they are in concrete, very mineral. And we are trying to plant trees to change the materials that are used to make it more permeable to rain. So, when it's very hot, the ground give some fresh air back and the kids are very protected from heat wave during the day when they're at school. And this focus on kids and schools, it's very much in, it's a line that we follow in many, many policies. For example, some streets, playgrounds are open on Sundays for everyone in the neighbourhood, so everyone can enjoy the fresh air that we have, and this school ask the central part of the neighbourhood and then we organise all the neighbourhood around the school. It's really something that we try to do. And it has concerned the state that we are talking about. It's not only for social reason, but also for climate change resilience and for road safety and air pollution.

Speaker 1 (47:08):

Okay. Yeah, that's great. I think it's very important, especially in cities to make this space because it's probably really hard for kids to find any space.

Speaker 2 (47:20):

It's difficult to grow up in Paris, I was in a suburb when I was little, so I had a garden and stuff, so this was different. In Paris, when you are with two or brothers and sisters in maybe 50 meters squares or 60 meters squares flat with a shared room and the only place you can go is the playground to live your life as a kid, that's just essential. That's necessary for the normal life. So, it's important that we do more playgrounds, better greener, and again, it's difficult to find places everywhere. You have occupation, you don't have free spaces in your city. It doesn't exist. So that's the challenge.

Speaker 1 (48:07):

Okay. Then I think we are done with the questions, and I also want to thank you again for your time and also your insights. It was really great. You always came to a point, which I really liked.

Speaker 2 (48:36):

No worries – my pleasure. Thank you for the meeting. Goodbye.

Speaker 1 (49:01):

Thank you very much again. Goodbye.

Appendix D: Thematic analysis of the interviews based on Gioia et al., 2013

Interview Findings		
First-Order Concepts - Direct Quotation	Second-Order Themes	Aggregate Dimensions
"Paris has introduced new taxes on cars to reduce pollution. The tax on high-emission vehicles is €40,000. This includes a tax on CO ₂ emissions and a tax on vehicle weight." (Expert KR)	Higher taxes for ICEVs	
"Providing financial incentives such as free parking and charging for EVs is crucial in reducing operational costs and making EVs more competitive with traditional vehicles." (Expert AC)	Free parking for EVs	
"In Paris you can park for free if you have an electric car. It was a policy that have been implemented six or seven years ago to foster the development of the electric car." (Expert TG)		
"I think a price incentive for example, for car parking is a good incentive. It's more basic, less sophisticated." (Expert TG)		
"Paris has over 800 charging stations for electric vehicles. This helps EV users charge their cars easily, reducing range anxiety and encouraging the adoption of electric vehicles." (Expert AN)	Free charging stations for EVs	
"Low emission zones are not very popular in the public opinion and it's very, very difficult to implement them even if we know that it could be efficient to tackle air pollution. And so, it's a difficult debate today. We may be lost, I would say the cultural battle about implementing these policies and people are preferring having the bad air quality instead of having restrictions of using their own car." (Expert CN)	Low emission zone	Regulatory
"And we are still waiting from the state that the gift to the municipalities the capacity to have an automatic control because it is not effective (...), we still not have that capacity as a municipality to implement an automatic control system for cars." (Expert CN)		
"And when I go to Paris with my old car, there is no control. The problem is that from the beginning, there is no control of the Crit'Air of the low emissions of Paris. So I had never got a fine penalty for Crit'Air for the low emission zone. So, it's not at all effective." (Expert DN)		
"And the idea is not to pay to enter, but it's the idea that when there is an air pollution peak on each car in Paris and in the suburb, you have a number one to five, one is the greenest in terms of less pollution		

<p>emission and five is the oldest. And when there are some peaks, you cannot enter the city. If your car is 5, 4, 3 depending on the severity, that's a bit of a social issue too because of course if you have an old car, you don't have the money to change, you are more likely to have a five or a four on your stamp. But it's not a direct fee. But even this is less than, it's not so much accepted. It is difficult." (Expert FG)</p>	
<p>"And a major reason is that one of the limits that were shown is that we don't have sufficient control to know if cars are having the vignette or not." (Expert KR)</p>	
<p>"But I really think [Crit'Air] is not sufficient enough and we have to go further." (Expert PJ)</p>	
<p>"So, what we try to do in Paris with the power we have is to introduce the ZTL, which is a traffic limited zone in the centre in Paris. And it's going to be effective after Olympic game in October 2024 (...) in this area, people cannot come and cross. They will have to come with a special purpose, but they cannot cross. So, it's going to be a very big step in Paris but going further after Crit'Air." (Expert PJ)</p>	
<p>"So, I think Crit'Air is a good thing, but not enough." (Expert PJ)</p>	
<p>"I'm just saying that it's too early, too early to say if [the low emission zone] is working because we know it's not first properly and I think we need more time to see the effect. But it's definitely, I mean, a good idea in the process at first, but it could be more effective if we've done a few modifications in the measure." (Expert TR)</p>	
<p>"And for example, about Crit'Air, I think the problem is that we only consider the pollution from exhaust emissions, and we don't see the non-exhaust emissions. So, for example, when it comes to fine particles coming from the tyres, the brakes, and relate to the weight of vehicles like SUVs, we don't really consider it with that measure. It's only about NO2. So, for example, that SUV, it's something that could be left out. I mean, it's not taken into consideration with the measure. So, it means that you can have a big SUV, a big recent one and you have a good Crit'Air. It doesn't make any sense." (Expert TR)</p>	
<p>"So, we should reform [Crit'Air]." (Expert TR)</p>	
<p>"(...) the government didn't give the tools to enforce the laws. That is to say it's impossible by now still now to have the cameras, to have automatic lecture of the automatic reading of the ID of the cars, which would make it, which is quite interesting to enforce the law because you can't enforce the law by stopping the cars in a stream of traffic and just show me which Crit'Air you have. So, we have a real problem</p>	

<p>today. We haven't got tools to enforce efficiently the low emission zone in France." (Expert TG)</p>		
<p>"So, I think it's not a great policy and I think the ZTL so it's limited traffic zones will be a better choice and will be a better choice because one of them is supposed to be implemented in Paris in the next months because it's not about the fact that your car is green or very, very polluting. It's about the fact that some zones will be free from transit trips, and you can go in them if you have something to do in them, but you can't go in them if you just to bypass the streets that are thought for that use." (Expert AC)</p>		
<p>"If the vehicle is used by people with disabilities, with the wheelchair for instance, of course you have issues to move and if you have a solution that works, you should not be punished by higher parking fees when going into the city." (Expert AC)</p>		
<p>"With the higher parking fees for SUVs we want to stop losing [the space] because I mean some cars cannot even fit in the parking lot. That's a problem. And we don't want this to increase again." (Expert FG)</p>		
<p>"For me, SUV first, I think it'll really limit the number of SUV we'll have in town rich people who have SUV, they can pay for the parking." (Expert JB)</p>		
<p>"I think it's the right approach at the local level because this is the only thing that they can do. So, it's a way to also send a message to car makers saying you have to do small cars, you have to do lighter car, and we can't keep going with that SUV trend" (Expert TR)</p>		
<p>"Because we can see that for 20 years the cars are getting bigger and bigger and that's a problem, that's a problem even if it is electric, it is a problem of energy use because if you have a big electric car, it consumes more electricity than small cars and you need more energy to build the cars. And at the same time when you are driving a car in the city, why do you need a SUV? And we say it's using more space on the street. So we were willing to rebalance the policy not only on the pollution use but also on the fact that those cars are using more energy and those cars are using more space by parking. And it's an incentive to say when you are using a car in a city, just use a small car, not a big car, especially when you are just one person in the car." (Expert TG)</p>	<p>Parking restrictions</p>	
<p>"I think price incentive for example, for car parking is a good incentive. It's more basic, less sophisticated." (Expert TG)</p>		

<p>"Because now it's the speed limit is mainly, I would say in 90% of the streets in Paris are 30 kilometres per hour and just 50 kilometres per hour in some streets, which are under the responsibility of the Paris department, for example, Chausee Elysee OR things like that." (Expert CN)</p>	<p>Lowering speed limits</p>	
<p>"For example, when we pass Paris at 30 kilometre per hour, we try to see if there is an impact in air pollution. I'm sure it is pretty low because we think it has a correlation between the end of the 50 kilometre per hour in Paris and the pollution especially at night." (Expert AN)</p>		<p>Development of cycling and walking infrastructure Convenience and Accessibility</p>
<p>"And also, about road and street measures, how you limit the speed, for instance in several streets and maybe there is a school in the street for example." (Expert CB)</p>		
<p>"We saw that during the covid crisis with more cycling lanes that have been designed temporarily and some now definitive. So, you have to adapt the vehicle situation." (Expert CB)</p>		
<p>"For more than 10 years now, urban renewal and road renovation projects have contributed to reduce the space dedicated to car traffic and to increase both space and quality for walking and/or cycling." (Expert CB)</p>		
<p>"About 1 000 km of cycle facilities exist in 2021" (Expert CB)</p>		
<p>"After 3 years, traffic gets better with a transfer of the vehicle towards other pathways." (Expert CL)</p>		
<p>"One way to ensure public acceptance for more cycling was to develop a bicycle sharing-system (including electric ones) and offer financial aids for purchasing bicycles." (Expert CL)</p>		
<p>"So, the fact is that we need to provide to all the users the ability of being mobile, but with a hierarchy in the policy, giving the priority to, I would say three aspects (...) Second, what we call active policy mobility meaning walking and cycling because it's also a health policy. And third, all the shared mobility. So, it can be bicycle sharing systems, it can be car sharing systems." (Expert CN)</p>		
<p>"So, I think what we need is to give the bicycles the space that the cars need now. And we have made a lot for that regarding parking lots. Essentially for bicycles. Now there is in every cross section in the city 2, 3, 4 locations for bicycles parking which is very important and that makes a lot to improve the way bicycling is now in Paris" (Expert RB)</p>		

<p>"Of course, the habits of Parisians shifted a lot and now we have the share of cycling, which is three times bigger in Paris. So, it's actually now we can say that one out of five trips inside of Paris is by bicycle." (Expert AC)</p>		
<p>"(..) you have two third of the space that is dedicated to cycling, but Sebastopol is even more crowded. So, I think it's of course a symbol of the shift in Paris." (Expert AC)</p>		
<p>"If we want to make a lot of people cycling in the next years, we pushed and it's being implemented right now a scholar programme to learn to kids how to ride the bicycle inside the city." (Expert AC)</p>		
<p>"We have a lot of problems with the metros and the trams because we don't have 100% of the offer of service, which is bought by the region and by the city. So, we have several problems of having not a strong offer, not at 100%." (Expert CN)</p>		
<p>"For public transportation, it's important to improve the quality of service, not the quantity. You have to distinguish quantity for example, more frequency, more infrastructure. Of course, there are a lot of investment to extend the metro lines, the tram way, lines and so on. But the quality of service is probably more important today. Punctuality, regularity, real time information in case of incidents, property, cleanness in the transport, you see quality and because there are a lot of investments to extend the lines (..) but people are not satisfied with the quality of service, not really satisfied. The train is late, incidents and this disturbs completely your journey, your travel, your daily travels." (Expert DN)</p>	<p style="text-align: center;">Metro system with more frequent trains, more lanes, nightly service</p>	
<p>"The Metro and RER also suffer from breakdowns and frequent service stoppages." (Expert FH)</p>		
<p>"To improve the quality and attractiveness of transport in Paris by addressing the quality of service provided to passengers (information, punctuality and regularity, safety) using the equipment and software tools that our company supplies to help reduce transport network operating costs." (Expert FH)</p>		
<p>"Main problem is a problem of public transportation. Of course we have done a lot of the investment, but in fact if you take the metro line 13, you are not able to take a metro from eight in the morning to nine in the evening because it is completely occupied." (Expert RB)</p>		
<p>"It's the frequency. Sometimes you have just a train every hour, so it is difficult for people to move (..). I think these are the two most important aspects." (Expert RB)</p>		

<p>"We have now conflicts between cyclists and pedestrian. So, we still need to improve the safety of the pedestrian." (Expert CN)</p>	<p>Increased safety perception</p>	
<p>"To reshape the streets and to have a continuous and safe network for cyclists to give the possibility to everyone to drive a bicycle safely to go to work." (Expert CN)</p>		
<p>"A lot of people still don't get that cars are bad for road safety too because of the space, the needs. While we have more efficient mode of transportation, there are a lot more children not only because they can collide with them in the streets, but also because when you have a car you tend to not let your children go on and also in the neighbourhood because you want to bring them from A to B by yourself and make sure that they get to the destination" (Expert AC)</p>		
<p>"I would also prioritise the road safety. We know that in Paris and in many other big cities, most of the injuries on the roads are caused by cars, trucks." (Expert FG)</p>		
<p>"And secondly, because this SUV fee is not only an air pollution problem that we want to address, but also about road safety." (Expert FG)</p>		
<p>"And also giving the possibility to people to have shared cars. We have also about 1000 parking spaces for shared cars in the streets. It can be also a good alternative to the private car." (Expert CN)</p>	<p>Development of carpooling infrastructure</p>	
<p>"So, the fact is that we need to provide to all the users the ability of being mobile, but with a hierarchy in the policy, giving the priority to, I would say three aspects (...) Second, what we call active policy mobility meaning walking and cycling because it's also a health policy. And third, all the shared mobility. So, it can be bicycle sharing systems, it can be car sharing systems." (Expert CN)</p>		
<p>"We are reducing the place of cars in the city and also we are giving more space to the other users of the public space. For example, bicycles, scooters, pedestrians, buses, shared mobility." (Expert TR)</p>		
<p>"If you want them to switch to something cleaner. It means that you have to reduce the place of cars, promote pedestrians, promote the bicycles, promote shared mobility, promote scooters, promote public transport. It's just that you have to offer options to the population." (Expert TR)</p>		
<p>"It's about the space use, but also about what kind of car should I use when I'm in Paris and should I use my own car, should I use a shared vehicle? That's a way to give an incentive to the people. Just think about what you're doing." (Expert TG)</p>		

<p>"It is the shift from the private owned cars to shared cars" (Expert TG)</p>		
<p>"If we want to make a lot of people cycling in the next years, we pushed, and it's being implemented right now a scholar programme to learn to kids how to ride the bicycle inside the city." (Expert AC)</p>		
<p>"I think the public transparency plays an important role in consulting with the people to discuss with the inhabitants, to inform them to make sure they understand what it is really and not some fake news. And also, what are the difference as systems and making put in place such as financial aid to change their vehicles and to have electrical vehicles the persons. So, there's a lot of communication to have on the website and some campaign about that." (Expert CB)</p>		
<p>"Democracy debates are very important. And we really organise many, many meetings. Meetings to know what people want and meeting to present them the project we design based on what they say." (Expert PJ)</p>		
<p>"Dialogue is important, but it's also the way you communicate and explain for example, that this dialogue needs time. Because very often people want change, and they want change like that. And we are in a period of our history where with the social media, everything is going faster and faster all the time. And when I take time to explain to people but works can't go this way. They have to go faster, but they can't go this fast because if you want a real quality of dialogue, if you want a project that is able to both be durable, they have disability to have meaning in the long time, and also a capacity to adapt, which is not that simple, to have both. We have to have a real dialogue which has a quality of dialogue. And this takes time. It takes time. It doesn't go in three months." (Expert PJ)</p>		
<p>"To touch everybody is very complicated because when people are angry or when they are unhappy of what you're doing, they're always going to find a way to tell you when they are, I don't know what I think about this project or when they're happy, it's harder to touch them, because I mean the opinion of someone who is happy is as important as the one who is unhappy. I mean, everybody has to have a voice and it's very hard to explain also that democracy is not just the addition of all the opinions it is more I need to hear your opinion and then I need to construct a project which is not going to make you all happy, which is going to try to answer what is the public interests? And it's not the addition of all of you. It's something which it's a</p>		

<p>choice. Then my role is to explain the choice, which is a little bit different." (Expert PJ)</p>	<p>Effective communication and transparency</p>	
<p>"(...)And what I really observed for four years now of mandate I'm elected is that people can accept something that they didn't want or partly accept it if you explain and the level of explanation is really important first, because people are more and more experts, they really read things when they're interested, they read, they inform themselves, they talk to each other and they're not just going to say, okay, okay, to whatever you say." (Expert PJ)</p>		
<p>"We are discussing the way of doing it, but not the aim, not the general targets. And that's very important I think to differentiate." (Expert FG)</p>		
<p>"I think it's to create public support and even more public aspiration to what we do. It's what we did with SUV. We worked a lot with the environmental association and Pedestrian Association and Disabled People Association. So, we influenced by the strategy the public mind. Once they like your idea, they play to be seated. So, it's a kind of a virtual circle. Like you put six tack, tack, tack and you find some people who are also some emitters of the information and the public will be with you. And at the end it's the kind of cultural and that's how we make it." (Expert PJ)</p>		
<p>"She decided as the mayor of Paris to attack car companies, that were not respecting laws at the European level, and she won (...) It was a political risk because attacking at a European level when you are going to be elected or not by Parisian, it might seem very, very far. So, you expose yourself, but you don't know if it's going to bring you any votes for the next election as a mayor. So you can say, okay, it's not my business, it's too far. We let the bigger one, and she decided to take that risk." (Expert PJ)</p>	<p>Strong political support and leadership</p>	
<p>"For me what is very important is that first being coherent and second, do what everything you can do at your level with the power you have. And she had this power, she was not obliged to use it, but she had this power and she decided to take it, which is for me, important when you're a political person to have the courage to try things, even when it might be dangerous for your re-election, but it's coherent with your values and what you defended in your programme." (Expert PJ)</p>		
<p>"I have to say that we have been elected in 2020 on a political agenda. It was very, very clear about this. That's why we can do it very quickly and very strong in our political programme. That was said to every</p>		

<p>voter and then they choose which candidate they wanted. We said that we wanted to do our 100% bicycle city, meaning not that all the movement are done by bicycle, but with a bicycle you can go everywhere in a safe way. And we even added that for this we'll have to find some space and to reduce the parking lots and we said that we are ready to reduce half the number of parking places in all the city in only six years and people chose this." (Expert FG)</p>		<p>Social and Community</p>
<p>"Once the voters have a clear idea, the mandate for us elected people is very clear because it was written and then of course there is opposition on the process, but we are always saying, okay, but people voted for that, so let us work and maybe the next election you will try and if we lose at the next election, well the direction will be different." (Expert FG)</p>		
<p>"We have a lot of members of the board who think that cycling is a solution regarding social and economic issues and inequalities. So, we have people working to bring solutions." (Expert AC)</p>		
<p>"So very, very important is the role of these associations." (Expert DN)</p>		
<p>"So, in the process of work we went to every mayor of arrondissement, and we asked for what you want in terms of bicycle infrastructure in your own arrondissement, so they make their list and after that we decided because, we have a limited budget and we have also other priorities, we decided to take some of the things they wanted to keep. And after we went to the bicycle association, and we were like what do you think is the most important in order to face the transformation?" (Expert AN)</p>		
<p>"Associations can be super helpful for us, but we never go far enough. So, they're always there to help us, and I think it's really good and really safe for the political practise. So, we try to say to them, hey guys, in this subject we will go with you as far as we can, but we cannot go further, for example, bicycle. But they have been super helpful to explain to people why we have to reduce our pollution, how we do it all over Paris. So, I think it's good to do this for us." (Expert AN)</p>	<p>Strong support of NGOs</p>	
<p>"We have for example a quite big nonprofit organisation for bicycles in Paris. So, we make them ask their advice on every project that we have, and they can criticise, and help us in what we can do better. We have also a pedestrian NGO, we have lot of NGOS of course." (Expert FG)</p>		

<p>"It is the development of the express bicycle network in the region. It was at first promoted by bicycle associations. Bicycle associations in the beginning, in 2015 when Valerie Pere won the regional elections, so she became the president of the region. She wasn't very fond of the bicycles, but then there was pressure of the associations. There are not so many associations of bicycles, of bicyclers in the region and in France they gathered to present express bicycle network to the region. And finally, 3, 4, 5 years later, the region accepted to finance this network." (Expert DN)</p>		
<p>"Also, there is some issue about the ticketing, and we have an initiative at the national level, it's just to have some kind of ticket that you can use in every public transport authority network. And it is not a single price, it is really just a ticket that you can use, and you pay regarding the use and tariff and the fair that the public transportation decide. It's how to make people travel more easier and just without a sense of there is a border and different system between each network." (Expert CB)</p>	<p>Smart ticketing system</p>	<p>Technological</p>
<p>"The data collected through our smart ticketing system has been invaluable in optimizing routes and schedules, leading to better service and shorter wait times for passengers." (Expert FH)</p>		
<p>"But in my opinion, if we want to use public transportation, you have several applications that will indicate the better way to go to one point to another to rent the bicycle in Paris, which is the sharing bicycle system we have in Paris. You have the applications as well, which will indicate where you have the nearest available one." (Expert KR)</p>	<p>Mobile applications for public transit</p>	
<p>"Yeah, I mean even on the maps app they always indicate what time you will take with public transportation by walking or by cycling. You have every means of transportation on the maps applications. And I think it's, in my opinion, already largely accepted if I can say so." (Expert KR)</p>		
<p>"To my understanding, there are more and more applications to help find new paths to walk or cycle in Paris that are less used by cars (with less noise, less pollutants and a higher safety)." (Expert CL)</p>		

Appendix E: Ranking system of urban mobility policy measures in Paris

Table 1: Result table showing the average scores per criteria and the resulting overall score. Evaluation was done using a 1 to 5 scheme with 1 corresponding to bad and 5 to very beneficial.

	Average IMPACT	Average COST	Average TIME	Average ACCEPTANCE	Average TRANSFERABILITY	SCORE	in %
Financial							
Higher taxes for ICEVs	2,8	5	3,6	1,8	4,8	18	72,0
Free parking for Evs	1,8	3,2	3,6	3,4	3,6	15,6	62,4
Free charging stations for Evs	1,8	1,6	2	3,6	3,6	12,6	50,4
Regulatory							
Low emission zone	3,4	3,2	2,4	2,2	3,2	14,4	57,6
Parking restrictions	3	3	2,4	2,2	3,6	14,2	56,8
Lowering speed limits	3,8	1,6	0,8	2,8	3,4	12,4	49,6
Convenience and Accessibility							
Development of cycling and walking infrastructure	3	3	1,2	3,6	3	13,8	55,2
Metro system with more frequent trains, lanes and nightly service	1,8	2,4	2	3	3,2	12,4	49,6
Increased safety perception	1,8	2,6	2	3,6	3,8	13,8	55,2
Development of carpooling infrastructure	3,6	2,8	1,2	2,8	3,4	13,8	55,2
Social and Community							
Public awareness meetings	3	3	1,6	2,6	3,2	13,4	53,6
Strong political support and leadership	2,2	1,8	1,8	3	3	11,8	47,2
Effective communication and transparency	2,2	2	2,2	3,6	3,6	13,6	54,4
Strong support of NGOs	3	3	1,6	2,6	3,2	13,4	53,6
Technological							
Smart ticketing systems	2,2	1,8	1,8	3	3	11,8	47,2
Mobile applications for public transit	1,8	3,2	3,6	3,4	3,6	15,6	62,4