

# **Future of Urban Mobility in Europe**

Case City Analysis: Freiburg and Tampere



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This thesis explores the changes in urban mobility by looking at the impact of the targets to reduce greenhouse gas emissions set by the European Commission and the European Green Deal. The future changes in technologies and infrastructure needed to achieve those targets are then analyzed and explained.

To illustrate these changes more clearly and understandably, the cities of Freiburg im Breisgau and Tampere are used as examples. Furthermore, a survey has been conducted to determine people's perceptions of sustainable urban mobility in Europe.

The outcome of the qualitative and quantitative research has shown that people feel a lack of infrastructure and accessibility to sustainable urban mobility and that those issues are part of the main elements that are being tackled when a city becomes more sustainable.

Keywords Future changes in mobility, European Green Deal, European Union, Sustainable Urban Mobility

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## **Appendices**

Appendix 1 Survey questions

## 1 Introduction

In a rapidly changing environment where profit has often been put first, humans have developed bad habits and systems that need to be changed in order to offer the best possible future to the upcoming generations. The European Parliament has analysed the habits and systems which are the reason for the global environmental crisis and decided to come up with a plan to tackle those issues. This plan is called the European Green Deal which was mentioned by the European Parliament as being one of their biggest successes in recent history.

The European Green Deal was issued with the goal to reduce greenhouse gas emissions of EU Member States by 55% by 2030 and become climate neutral by 2050. To be able to meet those goals the European Green Deal will reshape the environment and some "everyday behaviour" humanity currently has will not exist in the future. (European Commission, 2021)

This thesis explains what future impacts the European Green Deal will have on urban mobility when trying to achieve its targets. The research will analyse how changes in mobility will affect people and their behaviour and what role the European Green Deal will play in those changes. What new technologies and infrastructure will be needed to achieve these targets and how do people perceive the present and future of sustainable urban mobility in Europe?

## **1.1 Background**

Back in 2012 among the 27 member states of the EU, the average amount of passenger cars per 1000 inhabitants was 490. Nine years later this number increased drastically reaching 567 cars per 1000 inhabitants in 2021. (Eurostat, 2023)

Not only has the number of passenger cars on the road increased but all kinds of transportation in general causing traffic jams, noise, accidents, and enormous amounts of greenhouse gases. In fact, 25% of Europe's overall greenhouse gas emissions are caused by traffic. (European Commission, n.d.-e)

In December 2019, the European Commission issued the European Green Deal, a comprehensive strategy to achieve net-zero greenhouse gas emissions by 2050 and make the EU climate neutral. The European Green Deal targets several different objectives which include the goal of transportation with zero greenhouse gas emissions in all of Europe. This concerns not only road and rail but also air and water transportation. The European Commission has therefore issued a sustainable and smart mobility strategy. This strategy is meant to transform transportation in Europe to become more sustainable, smart, and resilient. (European Commission, 2021) The European Commission will also guide the Member States on sustainable urban mobility planning and will provide financial support to implement this transformation (Directorate-General for Mobility and Transport, 2023). To monitor the use of financial support and to make the progress in achieving the goals set by the European Commission more visible they developed sustainable urban mobility indicator (SUMI). SUMI will help cities to compare themselves with similar cities and see how they perform. (European Commission, n.d.-d) Since the decision of the European Parliament, cities have had to change their mobility system to achieve the goal of zero greenhouse gas emissions in transportation. In this thesis, the author will take a look at the potential challenges in achieving the targets, including existing infrastructure, consumer behaviour, and political will.

## **1.2 Objectives of the research**

The purpose of this thesis is to get an overall perspective on the future of urban mobility aligned with the sustainability goals of the European Union and the European Green Deal. By laying out the possible future of urban mobility, this thesis shows the future challenges that

cities will be facing to reshape and renew the infrastructure and behaviours and implement new innovative technologies. A survey was conducted to get an up-to-date view of the topic. The purpose of the survey is to show the position of the people concerning sustainable urban mobility.

### **1.3 Research question**

To achieve the objective of this research paper, the following key question must be answered:

- How will the European Green Deal's targets for reducing greenhouse gas emissions impact urban mobility?

In order to answer the main research question, the following sub-questions were formulated from the circumstances of the initial situation:

- What new technologies and infrastructure will be needed to achieve these targets?
- What is people's perception of sustainable urban mobility in Europe?

### **1.4 Structure and methodology**

To keep the structure of this bachelor thesis clear, it has been divided into multiple chapters. In order to gather all the required information to properly answer the research questions, various research methodologies have been employed. The following paragraphs briefly summarize the content of each section and explain the methodology that has been involved within this section.

The introduction constitutes the first part of the research paper. In the beginning, the initial situation is described, and the relevance of the topic is addressed. The objective of this thesis is clearly defined and from this, the research questions are drawn. Furthermore, the delimitation of the topic, the structure of the work, and the used methodology are explained.

In the theoretical framework chapter, the reader is given basic general knowledge related to climate change. The purpose is to educate the reader and to refresh their knowledge on the problems of climate change. It is very important to the author that people are aware of the issues caused by climate change. To achieve this, a qualitative approach is conducted by analysing secondary data. After some research has been carried out, it has turned out that websites or literature related to climate issues were the best sources of information to explain this topic. (McCombes & George, 2023)

Following, the European Green Deal is discussed and explained. In the interest of the thesis, the relationship between the European Green Deal, transportation, and urban mobility is further analysed and specifically discussed. Measures, strategies, the expected results, and the influence of the European Commission are explained. For this part of the research paper, a descriptive method was used to explain qualitative, secondary data. The goal of this paragraph was to answer what, where, when, and how questions and give further knowledge to the reader. Therefore, using a descriptive approach to analyse and explain the characteristics of the European Green Deal seemed to be the most accurate choice. The analysed literature was mostly selected depending on how recent it was. (McCombes, 2022)

The methodology chapter starts by enumerating different challenges when planning strategies to achieve sustainable urban mobility. It continues by analysing two case studies of European cities with a clear sustainable urban mobility plan. After finding the successful case study of the German city, Freiburg im Breisgau (Freiburg), a less successful city that was similar in size had to be found with the aim of comparing them. However, all the undertaken research trying to find a European city that was struggling with the implementation of sustainable urban mobility ended vainly. The city of Tampere with a very well-documented sustainable urban mobility plan and known to be a leader in this matter was then found and decided to be the one that was going to be compared to Freiburg. However, even if both cities are successful there is a difference in the time of their success. The methodology part is based on comparing the researched qualitative, secondary data about both cities and their plan to reach sustainable urban mobility. (McCombes & George, 2023)

For the first part of the results chapter, the key findings of the previous research are summarized in a clear and concise manner. For the second part, a survey has been created



with the free tool Qualtrics to look at sustainable urban mobility from a human point of view. The questionnaire was freely created by the author and was conducted and distributed over a period of two weeks on multiple platforms (Facebook groups, Instagram and WhatsApp). The number of answers to the survey depended on the will of the people and therefore the sampling method of this survey is categorized as voluntary response sampling (McCombes, 2023). The inclusion criteria to be able to answer the survey was that the participant had to live in a city or region on the European Continent (Nikolopoulou, 2022). The questionnaire consisted of 26 questions. The form of those questions is multiple choice, Likert scale, and one text questions. The survey, therefore, qualifies as a quantitative research method.

Even if the survey has been distributed multiple times on many different platforms the result of the conducted survey has shown a clear difference when it comes to the age of the participants. Almost all the participants are millennials and therefore rank from 18 to 34 years. At this point, including the few answers of the other participants wouldn't have a significant impact on the result and was therefore ignored. This means that in addition to the use of voluntary response sampling, convenience sampling is used in the second step (McCombes, 2023). After excluding the participants that were over 34 years old the sample size reached exactly 100 participants. The survey as a research method was chosen because of its simplicity and the rapidly generated responses. The collected data is analyzed and synthesized by the author to reflect people's opinions on sustainable urban mobility. All the questions asked in the survey can be found in the appendix at the end of the research paper. (McCombes & George, 2023)

In the last part of the thesis, the main research question and sub-questions have been answered by using the acquired knowledge which is presented in the previous part of the thesis while also taking the results of the survey into account.

## **2 Theoretical framework**

### **2.1 Transportation**

Transportation refers to the movement of people, goods, or animals from one place to another. It involves the use of various modes of transportation, such as roads, railways, waterways, and airways, as well as the vehicles, vessels, or aircraft that transport people or

goods. Transportation is an essential aspect of modern society, facilitating trade, commerce, tourism, and social interactions. It has played a significant role in shaping the development of cities and regions, connecting people and communities across vast distances, and enabling the exchange of ideas, cultures, and technologies. A nation's or society's transportation infrastructure is frequently cited as an indicator of its level of development. (Britannica, 2022)

### **2.1.1 History of transportation in Europe**

Over the years, transportation has been essential to the economic and social growth of Europe. The Romans constructed a large network of roadways in ancient times that connected cities and facilitated trade throughout Europe. (Jasiński, 2022) Throughout the Medieval Ages, the only practical modes of transportation in Europe were ships and horse-drawn carts. Trade routes were formed along rivers and beaches, and the compass and other navigating tools were created. (Newman, 2012) Significant transportation improvements occurred throughout the Renaissance, including the creation of carriages and coaches for land travel and galleons and caravels for sea travel. Major developments in transportation were brought about by the Industrial Revolution. Transporting goods and people more swiftly and effectively was made possible in Europe because of the invention of steam-powered ships and railroads. Automobiles first appeared on European roadways in the late 19th and early 20th centuries. During the middle of the 20th century, many Europeans used vehicles as their main form of transportation. Air travel was revolutionized when airports and airplanes were developed in the early 20th century, enabling individuals to travel across great distances in a relatively short period. (Encyclopedia.com, n.d.) In general, the use of cars has changed substantially in recent years as worries about climate change and air pollution have grown. Many auto manufacturers now offer electric versions as a result of advancements in battery technology and the expansion of the infrastructure for charging electric vehicles, making them more practical and affordable. (Rodrigue, 2020)

## **2.2 Sustainability**

Meeting current requirements without compromising the capacity of future generations to meet their own needs is referred to as sustainability (United Nations, n.d.-b). It is about recognizing the limits of the planet, and its resources and how to act within those limits. This

means, implementing a circular economy to maximize efficiency and minimize waste. (European Environment Agency, 2023a) The concept of circularity is being implemented by more and more businesses, various industries, and entire governments. Also, a lot of individuals support the concept of sustainability and shape their life in that way. They do this by supporting sustainable businesses, products and therefore reducing their carbon footprint. An example would be to use public transportation and cycling instead of using a car running on fossil fuel.

Sustainability is a comprehensive strategy that acknowledges the interconnectedness of the social, economic, and environmental systems and aims to achieve harmony among these three aspects of sustainability as shown in Figure 1. (Allen, 2022)



Figure 1 Three Pillars of Sustainability (Getty Images, n.d.)

Environmental sustainability means using natural resources in a way so that they can regenerate and not degrade over time. This involves employing renewable energy sources, cutting back on waste and pollution, and conserving ecosystems. (Allen, 2022)

For social sustainability to succeed, it is necessary to establish an equitable, inclusive, and resilient society. This includes promoting human rights, lowering inequality, and making investments in social services, healthcare, and education. (Allen, 2022)

Developing a sustainable economy that promotes long-term growth and prosperity is necessary for economic sustainability. This entails promoting environmentally friendly business practices, making investments in infrastructure and innovation, and generating employment and financial prospects. (Allen, 2022)

## **2.3 Environmental issues**

### **2.3.1 Climate change**

The term "climate change" refers to the gradual change of global weather patterns and temperatures brought on by human activity, particularly the burning of fossil fuels, deforestation, and other commercial and agricultural practices that emit greenhouse gases into the atmosphere. These gases trap heat from the sun and raise Earth's temperature, which has a huge impact on the environment by causing sea levels to rise, natural disasters to occur more frequently and with greater intensity, changing precipitation patterns, and affecting ecosystems and biodiversity.

In many regions of the world, the effects of climate change are already being felt, including more frequent and severe heatwaves, droughts, floods, storms, and wildfires. These changes can have serious economic, social, and environmental consequences, affecting food security, water resources, infrastructure, public health, and biodiversity. (Greenpeace, 2022; Iberdrola, 2021)

### **2.3.2 Air and water pollution**

When harmful substances can be found in the air and water, whether it is tap water or water from the ocean it is considered polluted. This can have very bad effects on human health and the environment. Air pollution for example can have various negative impacts and cause respiratory diseases, cancer, or heart diseases. It can also affect the environment by disturbing ecosystems and contributing to climate change. In bigger cities, the pollution in the air which

is caused by cars can be seen and smelled. Water pollution has also its share of negative impacts on humans and the environment. People are getting sick by drinking contaminated water and aquatic life is getting harmed or even destroyed by pollution. (World Health Organization, 2019) When it comes to water pollution caused by transportation the pollution is less obvious but still very present. In urban areas, water often gets polluted because of car parks and transportation. Groundwater and floors are contaminated by oil and brake fluid, metal and rubber from tyres and brakes, exhaust fumes, detergents, and grease from cleaning vehicles. (NetRegs, n.d.) Maritime transport causes incredible amounts of pollution. Alone in the cruise ship business, the numbers are shocking. A premium cruise ship emits 10 times more CO<sub>2</sub> than all of Europe's cars combined. Further, cruise ships produce enormous amounts of grey water pollution, sewage pollution, chemical pollution, and many others. (Ahmed, 2022)

### **2.3.3 The energy transition and renewables**

The global switch from traditional fossil fuels like coal, oil, and gas to more environmentally friendly, renewable energy sources like solar, wind, hydropower, and geothermal is known as the energy transition. Renewable energy is generated from naturally replenishable resources that don't emit greenhouse gases or other pollutants. The transition is being driven by concerns about the effects of traditional energy sources on the environment, energy security, and climate change. To this day around 60% of global greenhouse gas emissions are due to energy. (Iberdrola, 2021)

### **2.3.4 Sustainable urban development and mobility**

At present, 55% of the world's population lives in urban areas; this percentage is expected to increase to 80% by 2050 (Venditti, 2022). The use of resources and space by a city to satisfy the needs of its citizens now without negatively affecting those needs in the future is known as sustainable urban development. This approach to urban growth seeks to minimize environmental harm while preserving as many of our resources as possible and, where feasible, switching to renewable resources. (Studysmarter, n.d.-b) Future metropolises will need to be built compact, reliable, secure, inclusive, ecologically, and energy-efficient. At the same time, they will also need to provide green spaces, parks, environmentally friendly

structures, and sustainable transportation options. (Iberdrola, 2021) Some advantages of sustainable urban development and mobility include less greenhouse gas emissions, better air quality, expanded accessibility to public transportation, and higher social and economic justice. (United Nations Department of Economic and Social Affairs, n.d.)

### **2.3.5 Extreme meteorological phenomena**

As a consequence of global warming, droughts, storms, and heat waves are becoming more common, intense, and destructive. The key to reducing the number of these catastrophes, adapting to them, and defending humanity from them is to keep temperatures stable, as has been advocated in negotiations at the highest level, as well as to improve the capacity to respond to climate emergencies. (Iberdrola, 2021) Consequently, by reducing the number of transportation methods that run on fossil fuel, producing greenhouse gas emissions the temperature of the earth would become more stable and the amount of extreme meteorological phenomena would decrease.

### **2.3.6 Overpopulation and waste management**

The United Nations projects a total of 8.5 billion people on our planet by 2030 (United Nations, n.d.-a). The increase in population results in an enormous amount of waste being produced by humanity. In a lot of countries, waste is not managed properly resulting in waste being stored in landfill sites over years without taking any action to dispose it of in a sustainable way. This mountain of waste decomposes over time and releases the harmful greenhouse gas methane. (Ijjasz-Vasquez et al., 2018) Some wealthy countries adopted some additional approach and make waste “someone else’s problem. Those countries ship parts of their waste to poorer countries to meet recycling and waste reduction targets set by their government. (Ritchie, 2022) Many nations are still forced to burn their solid waste due to overflowing landfills. This harmful practise has significant negative effects on the environment since it releases substantial quantities of carbon dioxide and hazardous compounds that harm air quality. (Quaik et al., 2017) To lessen the impact on health and the environment, one must significantly reduce the quantity of waste produced through prevention, reduction, reuse, and recycling as part of the circular economy. (Iberdrola, 2021)

## 2.4 European Green Deal

The fight against climate change and lowering greenhouse gas emissions are two issues that the European Union has long been dedicated to. The Paris Agreement, which the EU and other countries joined in 2015, set the goal of keeping global warming well below 2°C and extending attempts to keep it to 1.5°C above pre-industrial levels. (United Nations Climate Change, n.d.) The European Green Deal was unveiled by the European Commission as a new growth strategy for the EU on December 11, 2019. The European Green Deal is a comprehensive strategy to achieve net-zero greenhouse gas emissions by 2050 and make the EU climate neutral. The European Green Deal targets a number of different objectives which should contribute to achieving the following main goals (European Commission, 2021) :

- Climate neutrality by 2050
- Reducing greenhouse gas emissions by at least 55% by 2030  
(compared to 1990 levels)
- Generating 32% of the EU's energy from renewable sources by 2030
- Improving energy efficiency by at least 32.5% by 2030
- Planting 3 billion trees by 2030
- Supporting a just transition for workers and regions that are heavily reliant on fossil fuels

The European Green Deal is an extensive plan that covers many different areas, including (European Commission, 2021):

**Climate action:** On the 4<sup>th</sup> of March 2020, the European Commission proposed a new EU climate law to enshrine the goal of climate neutrality by 2050 which turned into force on June 2021. This law will revise and update the EU's emissions trading system and propose measures to reduce emissions from transport and buildings. (European Commission, 2020b)

**Circular economy:** On the 11<sup>th</sup> of March 2020, the European Commission proposed a new circular economy action plan to reduce waste and encourage the sustainable use of resources. (European Commission, 2020a)

**Biodiversity:** On the 20<sup>th</sup> of May 2020, the European Commission issued a new biodiversity strategy to protect and restore Europe's biodiversity and ecosystems. On the same day, the European Commission also introduced the Farm to Fork strategy to make food systems more sustainable. (European Commission, 2020d)

**Sustainable finance:** The European Commission also proposed new rules to promote sustainable finance and ensure that the financial sector contributes to the goals of the European Green Deal. (European Commission, 2021)

In conclusion, the European Green Deal is a comprehensive strategy to achieve carbon neutrality for the EU by 2050. It sets out several goals and covers many different areas, from climate action to circular economy, biodiversity, and sustainable finance. Since it was announced in December 2019, the EU has made some implementation-related moves, and it is anticipated that the European Green Deal will continue to be a major influence on EU policy for many years to come.

#### **2.4.1 Transport and the European Green Deal**

Overall 10 million people in the EU have work related to transportation. The transportation system in Europe is essential for businesses and for the global supply chain. However, this goes not without negative repercussions on people and nature by producing pollutant emissions, noise, road crashes, and traffic jams. Transportation represents 25% of the EU's total greenhouse gas emissions, a percentage that keeps increasing. The European Green Deal has various plans to adapt all kinds of transportation for the better, whether it is in the air, road rail, maritime or inland waterways. (European Commission, n.d.-e)

Since 80% of the world's population is set to live in urban areas by 2050 (Venditti, 2022) the infrastructure of cities' transportation systems must be reviewed and adapted to become safe, reliable, and sustainable. The European Parliament has therefore planned some strategies in relation to the European Green Deal to overcome those future challenges. (European Commission, n.d.-c)



The European Green Deal suggests policies to encourage the use of greener automobiles, like electric cars and low-emission buses. To achieve a notable reduction in emissions by 2030, the EU will update its CO2 emissions rules for automobiles and vans. The creation of a charging infrastructure for electric vehicles and the usage of alternative fuels like hydrogen will also receive help from the EU. (European Commission, n.d.-c)

It also aims to encourage environmentally friendly transportation options that lessen the use of automobiles and increase walking, cycling, and public transportation. The EU will support the creation of new and cutting-edge mobility options, like platforms that let users plan and reserve trips using various means of transportation and shared mobility services. (European Commission, n.d.-c)

The European Green Deal advocates spending money on environmentally friendly infrastructure to support clean and effective transportation. This involves spending money on infrastructure for active mobility, such as bike lanes and pedestrian routes, as well as public transportation infrastructure, such as rail networks and bus rapid transit systems. The development of smart mobility solutions, such as automated and connected transportation systems, which can improve traffic flow and lessen congestion, will also receive support from the EU. (European Commission, n.d.-c)

At the same time, it aims to encourage sustainable urban development that gives public transportation, biking, and walking a priority. This involves actions like making city centres more pedestrian-friendly, establishing parking restrictions, and enhancing public transportation options. The EU will aid in the creation of sustainable urban mobility strategies that promote the use of low-emission vehicles and integrate various modes of transportation. (European Commission, n.d.-c)

In particular for urban and suburban areas, the European Green Deal provides funding and assistance for sustainable transportation options. With a number of financial initiatives, including the Connecting Europe Facility (European Union key funding program to enhance growth, working places, and competitiveness through investment in infrastructure) (European Commission, n.d.-a) and the Horizon Europe (European Union key funding program for research and innovation) (European Commission, n.d.-b) research program, the EU will

support clean transportation innovations. The EU will also encourage the creation of partnerships for sustainable urban mobility that unite public entities, private companies, and civil society organizations to promote sustainable transportation solutions. (European Commission, n.d.-c)

In conclusion, the European Green Deal proposes a variety of ideas for reducing greenhouse gas emissions from the transportation industry and increasing sustainable transportation in urban and suburban areas. Along with funding and support for sustainable transportation options, the plan calls for investments in cleaner vehicles, environmentally friendly infrastructure, and urban design. It might revolutionize how people move across cities and suburbs and drastically lessen the negative environmental effect of the transportation industry if it is successfully implemented. (European Commission, n.d.-c)

## **2.5 Sustainable and Smart Mobility Strategy**

The European Commission has issued a sustainable and smart mobility strategy. This strategy is meant to transform transportation in Europe to become more sustainable, smart, and resilient. To reach the future goals for 2050 outlined by the European Green Deal, the improvement of the entire system will be driven by digitalization in an effort to make it seamless, more effective, and further reduce emissions. The European Commission wants nobody to be left behind as the transition to a greener, smarter, and more resilient mobility system happens. All people must have access to inexpensive mobility, rural and distant areas must remain connected, and European transportation must provide its employees with a favourable working environment and appealing employment opportunities. The strategy outlines targets that illustrate where the European Commission aims to go in 10 and 30 years. (European Commission, 2020c)

### **2.5.1 Benefits of such a strategy**

The reasons for such a strategy are the same as those mentioned in the European Green Deal. The negative consequences such as greenhouse gas emissions, air and water pollution, road crashes, congestion, noise, and biodiversity loss, affect the health and well-being of humans and nature. According to the European Commission, previous initiatives have not yet

addressed these costs effectively. In order to sustain the EU's leadership in the manufacture and provision of transportation equipment as well as to boost its level of international competitiveness, Europe must additionally use digitalization and automation to further raise standards of safety, security, efficiency, reliability, and comfort.

The strategy sets different milestones for 2030, 2035, and 2050 for all kinds of transportation modes. In the interest of the thesis, the author will only mention the milestones concerning decarbonizing road transportation. At least 30 million zero-emission vehicles will be on the road by 2030, together with 80,000 zero-emission lorries. By 2050, practically all automobiles, vans, buses, as well as new heavy-duty vehicles, will be zero-emission. The "polluter pays" and "user pays" principles must be rapidly applied to all forms of transportation. (European Commission, 2020c)

To achieve the objectives of sustainable mobility, sustainable alternatives must be made widely available. All transportation modes must become more sustainable and the right stimulus must be put in place to promote and make the transition faster. In addition to supporting the replacement of current fleets with low- and zero-emission vehicles, measures will include boosting the production, distribution, and use of renewable and low-carbon fuels in transportation. Additionally, a significant amount needs to be moved, along with an increase in the number of people using public transportation, active modes, and trains to commute. The European Commission wants to build a dense and wide network of infrastructure that makes recharging and refuelling all kinds of transportation modes easy and efficient and accessible. By 2025, 500 hydrogen stations and one million recharging stations should be built and in use across the EU. (European Commission, 2020c)

### **2.5.2 Urban mobility**

The population expects improvements in their towns and cities' air quality, noise from traffic, congestion, and road safety. The emergence of intermediate platforms has eased the transition in mobility in many cities toward shared and collaborative services (shared cars, bikes, ride-hailing, and other forms of micro-mobility), permitting a reduction in the number of vehicles in daily traffic. Cities are and should therefore remain at the forefront of the shift towards greater sustainability in mobility. The strategy calls for measures, such as a revision of the 2013 Urban Mobility Package, to make interurban and urban mobility healthier and

more sustainable. The European Commission intends to engage with cities and Member States to ensure that all large and medium-sized cities come up with and put in place their sustainable urban mobility plan by the year 2030. (European Commission, 2020c) It also strengthens its supportive measures for urban transportation with the Urban Mobility Package. This package is supposed to enhance the sharing of knowledge, highlight exemplary practices, and promote collaboration. Further, it will provide focused financial assistance and put more effort into research and innovation to provide answers to problems with urban mobility. (European Commission, n.d.-g)

In the near future, Europeans can expect the introduction and greater adoption of game-changing new transportation technology such as for example self-driving cars. The goal of the European Commission is to create a structure that will make it easier to create and use digital tools and systems. The objective is to facilitate testing and create a regulatory climate that is conducive to innovation, particularly in the area of artificial intelligence. (European Commission, 2020c)

To increase the effectiveness of the entire transportation system and to facilitate seamless multimodal movement, new technologies are required. Furthermore, through funding programs like Horizon Europe and the Connecting Europe Facility the European Commission is making significant investments in pre-deployment testing and study.

In addition to maintaining the EU's leadership in the manufacturing and service of transportation equipment, digitalization, and automation have a significant potential to further improve safety, security, reliability, and comfort while also enhancing global competitiveness through effective and resilient logistic chains. These initiatives will be centred on European values, ethical norms, equality, data protection, and privacy laws, and cybersecurity will be given top precedence. (European Commission, 2020c)

### **2.5.3 Support of the European Commission towards Member States**

A recommendation to assist Member States in supporting their towns and cities in reducing transportation emissions and enhancing urban mobility was approved by the European Commission on March 8, 2023. Support will be provided to the 430 largest towns along the Trans-European Transport Network (an essential tool for building multimodal, coordinated,

effective, and high-quality transportation infrastructure across the EU) (European Commission, n.d.-f) as they create their Sustainable Urban Mobility Plans (SUMPs).

The European Commission suggests establishing national initiatives to support the development and execution of urban mobility plans, which would be overseen by a special office. Along with technical know-how and financial assistance, help for cities should also include instructional materials, training programs, and capacity building. Sharing best practices will promote peer learning and networking between cities and villages. Additionally planned are coordinated campaigns to raise consciousness. The new Expert Group on Urban Mobility will collaborate with representatives from state program management offices, according to the European Commission (2023).

The recommendation updates the idea of SUMPs to incorporate the most recent policy advancements and strategies to decrease traffic fatalities in cities, combat climate change, and make use of new mobility services. It serves as a follow-up to the Commission's Urban Mobility Framework of 2021. (Directorate-General for Mobility and Transport, 2023)

#### **2.5.4 Sustainable Urban Mobility Indicators (SUMI)**

Cities and urban areas can use sustainable urban mobility indicators to pinpoint the advantages and disadvantages of their current transportation infrastructure and concentrate on areas that need development. It is crucial that this development of Sustainable Urban Mobility Plans (SUMPs) and the pursuit of EU policy objectives are documented for these accomplishments to be made public.

The indicator set by the European Commission and represented in Figure 2 consists of 13 core and 5 non-core indicators. Every indicator has a spreadsheet that can be completed and submitted by cities. (European Commission, n.d.-d)

| <b>Sustainable Urban Mobility Indicators</b>                      |   |
|---|---|
| <b>Core Indicators</b>  | <b>Definition</b>   |
| 1: Affordability of public transport for the poorest group        | Share of the poorest quartile of the population's household budget required to hold public transport (PT) passes (unlimited monthly travel or equivalent) in the urban area of residence. |
| 2: Accessibility of public transport for mobility-impaired groups | This indicator determines the accessibility of public transport services to persons with all kinds of reduced mobility.   |

|  |  |
|--|--|
| 3: Air pollutant emissions             | Air pollutant emissions of all passenger and freight transport modes in the urban area.  |
| 4: Noise hindrance                     | The adverse effect of noise caused by urban traffic on the population.   |
| 5: Road deaths                         | Road deaths by all transport accidents in the urban area yearly.   |
| 6: Access to mobility services         | Share of population with appropriate access to public transportation.  |
| 7: Greenhouse gas emissions            | Well-to-wheels (total energy required to produce and total greenhouse gas emitted when used) greenhouse gas emissions by all urban area passenger and freight transport modes.   |
| 8: Congestion and delays               | Delays in road traffic and public transport during peak hours compared to off-peak travel (private road traffic) and optimal public transport travel time (public transport).  |
| 9: Energy efficiency                   | Total energy use by urban transport per passenger-km and tonne-km (annual average over all modes).   |
| 10: Opportunity for Active Mobility    | Infrastructure for active mobility, namely walking and cycling.  |
| 11: Multimodal integration             | Any location where a traveller can move from one method of transportation to another with a minimum or fair amount of waiting is considered an interchange. The degree of multimodal integration increases with the number of modes present at an interchange. |
| 12: Satisfaction with public transport | The perceived satisfaction of using public transport.  |
| 13: Traffic safety active modes        | Fatalities of active modes users in traffic accidents in the city in relation to their exposure to traffic.  |
| <b>Non-core Indicators</b>             |  |
| 14: Quality of public spaces           | The perceived satisfaction of public spaces.   |
| 15: Urban functional diversity         | Functional diversity is the mixture of spatial functions in a space that creates close proximity of activities that are related to one another.  |
| 16: Commuting travel time              | The time it takes to travel by any method of transportation to and from work or a place of study.  |
| 17: Mobility space usage               | A measure of the amount of land that is used for both direct and indirect municipal transportation.  |
| 18: Security                           | The security of passengers and the perceived risk of crime in urban transportation.  |

Figure 2 Sustainable Urban Mobility Indicators (European Commission, n.d.-d)

One city's score can be compared to the average or median performance of other cities using the indicator data from multiple cities. This feature is intended to make it easier to establish

challenging but doable goals for each city, not to incite hostile comparisons. (European Commission, n.d.-d)

The Benchmarking Tool can also be used to display comparisons with cities with comparable populations in order to properly reflect the unique context circumstances of each city. The size of the underlying database and the representativeness of the benchmarking data increase as more cities send their indicator spreadsheet. (European Commission, n.d.-d)

### **3 Methodology**

#### **3.1 Potential challenges in achieving the European Green Deal targets**

A new type of collaboration between private and public organizations, across regional boundaries, and involving community members is necessary to shape an urban mobility future that will enhance the quality of life in cities, mitigate climate change, and create jobs to strengthen the European mobility sector. Municipalities and regions, businesses, start-ups, universities, and citizens must work together to co-create new solutions from concept to market scale if Europe wants to hasten the shift to sustainable mobility and liveable urban space. To realize all goals, several enablers, and crucial transformational areas are essential.

##### **3.1.1 Existing Infrastructure**

The current transportation system is one of the main obstacles to meet the goals. It can be challenging to switch to more environmentally friendly means of transportation because many urban areas have been designed with car-centered transportation systems in mind. This includes issues with the accessibility of infrastructure for refuelling and charging electric and hydrogen vehicles, as well as the availability of accessible and practical public transportation choices for everyone in a neighbourhood. (European Commission, 2019)

##### **3.1.2 Consumer Behaviour**

The goal of changing customer behaviour presents another difficulty. Many people are used to depending on their vehicles for transportation and might not be ready to transition to more

environmentally friendly, although potentially less convenient or comfortable, modes of transportation. Additionally, the general public may be still not enough aware of how transportation affects the environment and the advantages of more sustainable choices. (European Environment Agency, 2023b)

### **3.1.3 Political will and technological innovations**

Obviously, a significant amount of political will and backing from government leaders, as well as cooperation from different stakeholders, may be necessary to meet the goals. This covers the requirement for legislative and regulatory frameworks that encourage the use of more environmentally friendly modes of transportation, as well as funding and investment in the creation of new technologies and infrastructure. The European Green Deal and the SUMI work exactly in that direction.

## **3.2 Freiburg im Breisgau**

When it comes to sustainable cities in Europe, Freiburg im Breisgau (Freiburg) is always mentioned as one of the best examples of cities following and implementing a strategy to become more and more sustainable. Freiburg is a city located in the southwestern part of Germany. The city is known for the black forest, medieval architecture, and tourism. Since the early seventies, Freiburg decided to start developing its city in a sustainable way. The city aims to use only renewable energy by 2035 and as the European Green Deal mentions, it wants to become completely carbon neutral by 2050. Through all its achievements, the city has earned a new name and is now also known as the green city. (StudySmarter, n.d.-a)

### **3.2.1 Implementation of Sustainable Urban Mobility**

In the interest of the thesis, the author is taking a look at what the city has done when it comes to sustainable urban transportation. When going around the city people will notice that there are very few cars driving around and almost none in the city centre. To tackle air pollution the city officials wanted to reduce drastically the use of cars. Therefore they banned the use of cars in certain areas and reduced the speed limitation, increased prices for parking spaces, and reduced the number of parking spaces. They also stimulated the use of public



transportation and cycling. The city tried to make the use of cars as unattractive as possible so people would rather choose to use bikes, public transportation, or other sustainable transportation methods to go around. In the eighties, only 15% of the population of Freiburg was using bikes to go around the city. Now, 40 years later the statistics show that the amount of cyclist doubled and the number of drivers dropped from 39% to 21%. (StudySmarter, n.d.-a; Pieper, 2022)

15 minutes south of the city centre, Freiburg has built a “model district” which is known as Vauban. If one looks at Freiburg and how sustainable it is one can multiply this by ten and will get Vauban. It consists of 59 wooden houses which are all covered with solar panels. The amount of power generated by the houses is more than what they consume so the houses become “plus-energy”. This results in energy being sold back to the national energy grid. To make this area sustainable, parking spots are so expensive that the few cars one can find there are owned and shared by multiple people. Also, most of the streets are only for bikes and pedestrians. People do not need a car since every few minutes some kind of public transportation goes to the city centre. Although everything about Freiburg sounds very positive, some downsides became visible over time. Freiburg became the third city in Germany when it comes to rent prices and as a result, the mix of people that was initially in Vauban disappeared over time. (StudySmarter, n.d.-a; Pieper, 2022)

### **3.2.2 Result of analysis of Freiburg**

The city of Freiburg became very popular and important when it comes to discussions about sustainability and the future of cities. As a result of its transformation into an eco-city, Freiburg has earned a lot of benefits. The city became a tourist hotspot for people who want to do sustainable tourism. The city has brought a lot of benefits to its inhabitants and created a concept of how cities will be in the future. Not only Germany and Europe but the whole world can take Freiburg as an example to build the next generation of sustainable and eco-friendly cities. Thanks to Freiburg the world knows that building and transforming a city to become entirely sustainable is in fact doable. (StudySmarter, n.d.-a)

### 3.3 Tampere

Tampere is a city located approximately two hours north of the Finnish capital of Helsinki. Tampere is the third biggest city in Finland, and its population reached almost 250'000 in 2022 (Pernu, 2023). The city is known to be the “sauna capital of the world” with 55 public saunas in the region. Finnish sauna culture even became part of the UNESCO Intangible Cultural Heritage list. (Visittampere, n.d.) Tampere cherishes nature, protects the environment, and minimises emissions as a city of sustainable growth. Tampere’s sustainable urban mobility plan is strategic by addressing people's mobility requirements from the standpoint of a higher quality of life. Tampere follows a roadmap to become carbon neutral by 2030. (City of Tampere, 2022)

#### 3.3.1 Tampere’s Sustainable Urban Mobility Plan

In 2021, Tampere’s city board approved its Sustainable Urban Mobility Plan. This plan aims to affect people's mobility preferences, feelings of safety, equality, and sustainability.

Carbon neutrality as a goal for 2030 has a big impact on planning decisions. Public transportation, travel chains, and switching from one form of transportation to another must actively be encouraged in a carbon-neutral city. Therefore the city of Tampere wants to expand the tramway, the train traffic, and the service of regional busses. Further, the city wants to create travel chains and park-and-ride facilities. Reducing the speed in residential areas makes it safer for old and young. The residential areas become more comfortable and it promotes independent mobility for children. Tampere wants a sustainable and efficient transportation system that is reliable, safe, and accessible to everyone. According to Tampere’s sustainable urban mobility plan it wants to promote innovative mobility services, residential mobility hubs, and transportation hubs. Furthermore, the city wants to encourage mobility management initiatives and improve space for public transportation and active modes of transportation. Physical activities increase health and well-being and reduce the costs induced by a lack of physical activity. All of Tampere's citizens should have the chance to travel from one place to another. Daily mobility must be feasible with acceptable effort, in a reasonable time, and at reasonable expense, with a focus on sustainable means of transportation for everyone. The city calls this goal “mobility opportunities for all”. The negative effects of traffic on the environment are reduced by a transportation system that is

environmentally friendly by increasing air quality and reducing noise. Also, urban nature can be reached fast and easily. Environmental responsibility and health go hand in hand. (City of Tampere, 2022)

### **3.3.2 Result of analysis of Tampere**

Tampere's sustainable urban mobility plan is pretty recent (2019) and therefore no concrete results have been achieved yet or at least documented and shared with the public. However, the city of Tampere was the winner of the 10<sup>th</sup> Sustainable Urban Mobility Planning (SUMP) award during the "EuropeanMobilityWeek" in 2021. The "EuropeanMobilityWeek" is an annual event that gives cities and towns a chance to test out cutting-edge development strategies, promote new infrastructure and technology, and assess air quality. (Directorate-General for Mobility and Transport, 2022) For the city of Tampere, this award can be seen as an achievement and a confirmation that they are going in the right direction.

Tampere focused its SUMP on mobility management instead of focusing on investments. By using this multidisciplinary approach the city aims to have an impact on people's behaviour and choices when it comes to mobility. Their goal is to shape the urban environment in a way that the people of Tampere use sustainable transportation that is healthy, safe, active, and environmentally friendly. Investment still takes place by considering the most efficient measures to address various targets (active, equal, efficient, etc.) rather than evaluating the effects of actions from a single perspective. (Schmalholz, 2022)

### **3.4 Freiburg im Breisgau vs. Tampere**

Freiburg and Tampere both have clear goals to make urban mobility in their city more sustainable and can both be considered leaders in this subject. Both cities have developed their public transportation system and their tram and bus lines have large networks. Cycling and walking have been enhanced by creating specific road paths for both groups. Freiburg and Tampere both have reduced speed limits in the city to calm traffic, increase safety and reduce congestion. Both cities have been transforming their space and already score high when it comes to the "Sustainable Urban Mobility Indicators" mentioned earlier in the thesis. The biggest difference would be the degree of implementation to this day. While Freiburg started sustainable urban development already back in the seventies, Tampere only started the

sustainable movement in recent years. Because of this difference in time, the approaches of the cities regarding sustainability are different one from another. Freiburg has increased its emphasis on renewable energy and has put energy-efficient structures and solar power systems into place. Although Tampere has also launched renewable energy projects, it has prioritised projects relating to sustainable transportation (City of Tampere Group, 2022).

In conclusion, both Freiburg and Tampere are positive examples regarding sustainable urban mobility and have implemented numerous strategies to enhance sustainable transportation.

### **3.5 Helsinki's successful implementation of new technologies in urban transportation – Open Mobility as a Service (Open MaaS)**

The case of Helsinki addresses the earlier mentioned challenges of consumer behaviour and technological innovations encountered by cities when developing their urban mobility. In the capital of Finland, the Helsinki Regional Transport Authority (HSL) has been successful in implementing a new service. Through the analysis of this example, we can take a look at the impact new technologies can have on the transportation system of a city and how they can change people's behaviour when using public transportation. Mobility as a Service also called MaaS, combines many modes of transportation and services associated with transportation into a single, all-encompassing, and on-demand mobility service. Instead of requiring numerous tickets and payment transactions, MaaS provides end customers with the added benefit of accessing mobility through a single application. MaaS doesn't have to be only focused on public transportation but can also include walking, cycling, or even car sharing. (MaaS Alliance, n.d.)

Public transportation in Helsinki is managed by the Helsinki Regional Transport Authority (HSL). HSL enhances the development of innovative transportation services by removing obstacles to data access. By sharing all their data and working with other platforms, HSL and their partners can provide their customers with the best possible options when planning a journey. HSL has also its own mobile application in which customers can buy their transportation tickets. HSL promotes MaaS and includes in their mobile application several transportation options that are provided by other companies to make the journey as sustainable and efficient as possible. (European Commission, 2018) Furthermore, customers can also resell their tickets on the same app without having to pay any commission or fees to HSL (HSL, n.d.).

## 4 Results

### 4.1 Qualitative research

The research shows that when it comes to transportation, the European Green Deal is a plan with a multitude of measures on how to reduce greenhouse gas emissions from the transportation industry and enhance sustainable transportation in rural and urban areas. The plan doesn't only consist in promoting and supporting funding in sustainable transportation options but also investments in the production of greener vehicles and sustainable infrastructure.

The European Green Deal outlines many potential end goals. Those goals must then be attained via a variety of strategies and methods that are already put in place or will be in the future. Therefore the European Commission has issued a sustainable and smart mobility strategy to set long-term goals for 2030, 2035, and 2050. (European Commission, 2020c) The ability to assess and review progress at any time is another important part of these methods and strategies. SUMI is an example of a tool to follow evaluate and follow the progress of a city (European Commission, n.d.-d). This will guarantee that the ultimate goals' deadlines are met.

The European Commission strengthens its supportive measures for urban transportation with the Urban Mobility Package. This package is supposed to enhance the sharing of knowledge, highlight exemplary practices, and promote collaboration. Further, it will provide focused financial assistance and put more effort into research and innovation to provide answers to problems with urban mobility. Furthermore, the European Commission will provide support to the 430 largest towns along the Trans-European Transport Network when creating their sustainable urban mobility plan. Sustainable urban mobility indicators (SUMI) help cities to evaluate and identify the advantages and disadvantages of their current transportation system and concentrate on the areas that need improvement.

Research has shown that the challenges for achieving the urban mobility goals set by the European Green Deal can be divided into four categories. Existing infrastructure, consumer behaviour, political will, and technological innovation, whereby the latter strongly depends on

political will. The existing infrastructure has been built for a car-centered transportation system. Therefore the developing of new infrastructure to make practical public transportation more accessible can be very challenging. Further, people's behaviour plays a major role in the implementation of sustainable urban mobility. One of the reasons is that a lot of people are used to their personal cars and therefore making those people change their behaviour so they choose to use a more sustainable transportation method takes a lot of time. The European Green Deal provides financial support to create new technologies and infrastructure. However, political will and backing from government leaders, as well as cooperation from different stakeholders, is necessary to get everything up and running.

The first part of qualitative research relates to the main research questions and the first sub-question. By gathering all the qualitative literature about the European Green Deal, its goals, and the possible challenges one can deduct its impact on urban transportation, the required technologies, and infrastructures. When collecting data about the European Green Deal it can be quite challenging not to get lost in all the different documentation. The website of the European Commission is very transparent and therefore the available documentation about each theme seems to be endless. The number of different strategies and support provided by the European Commission becomes more every day. Therefore the author had to put some limitations by not explaining every measure package provided by the European Commission.

The case studies of the cities Freiburg and Tampere give an overview of the future of cities and the positive impact a sustainable approach can have on life quality. By presenting those two examples it is shown to the reader that by working together with an elaborated plan, sustainable urban mobility can be achieved. The search for cities with detailed documentation on the sustainable design of their urban mobility has proved to be problematic. The case study of Freiburg was found very quickly because of the city's leading role in sustainable urban development. However, when searching for a city that was facing difficulties with the implementation of sustainable urban development which also is similar in size, no literature could be found. The author is convinced that comparing a less successful city with Freiburg would have been more meaningful to the research paper. Especially when it comes to the possible challenges of implementing sustainable urban mobility. It turned out, however, that even though Tampere is a second positive example of the introduction of sustainable urban mobility, there are still important differences in both cases.

## 4.2 Quantitative research - Survey

To answer the second research sub-question the author decided to make a survey and ask people about their perception of urban mobility. 100 out of 114 participants were under the age of 35. The answers of the 14 people above 34 years were excluded from the analyses and therefore the survey can be considered as the point of view of millennials on urban transportation. Furthermore, the equal representation of both genders is guaranteed with a woman participation rate of 51%.

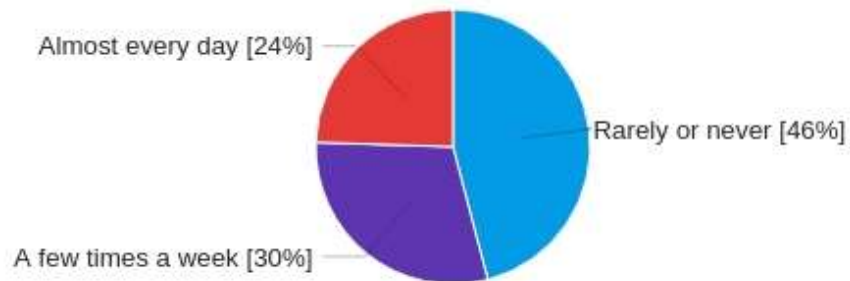


Figure 3 The frequency of public transportation use

Participants were asked how often they use public transportation like buses, trains, or subways to get around in their city or region. Figure 3 shows that 46% of participants stated using them rarely or almost never while 30% used them at least weekly. The remaining 24 % confirmed being daily users of public transportation methods. When asking about people's perception of the quality of mentioned public transportation in their city or region, 65% of people rated it from good to excellent while 17% stated the quality was fair and 15% even categorised it as poor.

Apart from the quality of public transportation, the survey wanted to find out how sustainable people perceived public transportation. 36% of participants stated that the available public transportation does not seem to be sustainable to them. The other 64% of the respondents

believed that it was at least somewhat sustainable. Overall, 19% of participants felt the local public transportation system was very sustainable.

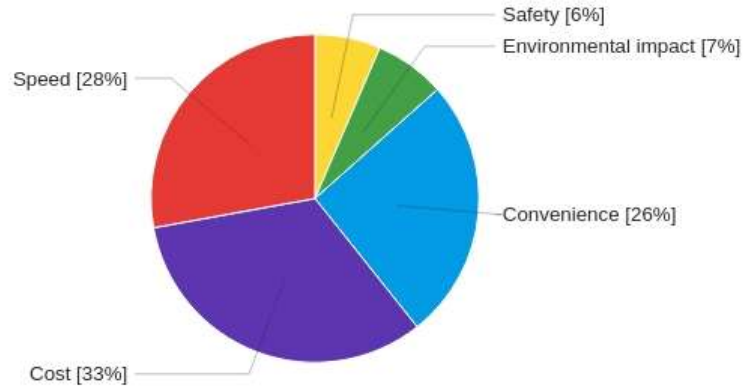


Figure 4 Considered factors when choosing a mode of transportation

Another purpose of the survey was to learn what factors people use to select their mode of transportation. For this, participants had the possibility to choose between multiple factors. As shown in Figure 4, the multiple-choice question consisted of the factors of speed, cost, convenience, environmental impact, and safety. Both, safety and the environmental aspect had very little influence on the participants when choosing their mode of transportation. On the other hand, the speed, convenience, and cost aspects scored almost identical. Especially when asking how important the cost aspects were for the participants when deciding which transportation mode to use, 57% of respondents stated this factor to be somewhat important to them and 30% considered it to be extremely important. This tendency continued when asking the participants about their perception of the price of public transportation in their own city or region. The option to choose the answer “too low” was not selected once. However, this was expected since prices are rarely viewed as “too low” by the consumer. 46% of respondents feel the prices to be “just right” as the other 53% feel the prices to be set too high. The aspect of the cost seems to be a very important factor when choosing the mode of transportation and a large number of people feel public transportation to be too expensive.



Are the cities and regions doing enough to develop sustainable transportation? Should they invest more in different sustainable transportation options like public transportation, bike-sharing programs, and pedestrian-friendly infrastructures? People think “yes”. The large majority of those surveyed want to see more involvement and effort by the city to develop sustainable transportation options. Only 22% of the people are already happy with the situation and don’t think that more needs to be done. According to the survey the number one improvement people want to see is the transportation options. People want expanded services and reduced fares. Furthermore, the participants think their region has a lack of bike lanes or overall cycling infrastructure and feel the accessibility to sustainable transportation methods must be improved. 40% of the respondents express occasionally facing challenges accessing public transportation in their region while 20% experience it to happen frequently.

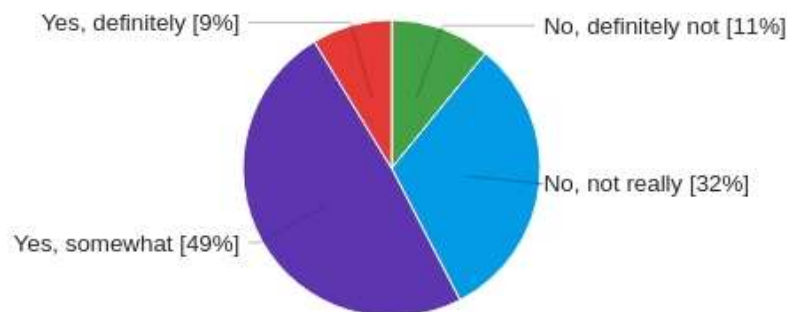


Figure 5 People’s willingness to pay more in taxes or fees to support sustainable urban mobility initiatives in their city or region

However, the enthusiasm vanishes when people are asked to financially participate in the development of sustainable transportation. Participants were asked if they would be willing to pay more taxes or support sustainable urban mobility initiatives in their respective regions. Figure 5 clearly shows some withholding. 43% of them answered with a clear “no” and 49% would only be willing to pay more to a certain degree. The money factor pervades throughout the entire survey, and despite the willingness to use sustainable transportation, people are not willing to participate financially.

Participants were asked about what they think are the biggest advantages of using sustainable transportation options. The survey shows a strong correlation between what the people perceive as advantages and what cities like Freiburg and Tampere are trying to improve. Reducing the carbon footprint and traffic congestion were both perceived as the main advantages of sustainable urban transportation followed by better air quality and enhanced physical health. Additionally the perception of the biggest barriers to using more sustainable modes of transport correlate with what Freiburg and Tampere try to improve. The limited availability of sustainable transportation and the lack of infrastructure is part of the top priorities for both parties.

When analysing the data, some limitations were found in the survey. The survey was based on people living in cities and also in rural areas mentioned as regions. This was especially reflected in the question regarding the use of personal vehicles. 41% of the participants declare using their personal car daily. Furthermore, the people who participated in the survey live in 13 different European countries. Depending on the level of development of the public transportation system in those 13 countries, people do not evaluate it the same way and the result becomes less meaningful to individual countries. By analysing only one or two countries this limitation could have been avoided. This survey, however, shows an overall perception of urban mobility in Europe and could become more significant by having a larger and equal number of participants from all European countries.

## **5 Conclusion**

The European Union is dedicated to fighting climate change and lowering greenhouse gas emissions. Therefore, in December 2019 the European Green Deal has been introduced by the European Commission to achieve net zero greenhouse gas emissions by 2050 and make Europe the first climate-neutral continent. Revolutionising transportation to become more sustainable and eliminate its accountability for 25% of Europe's total greenhouse gas emissions is one of the first issues that the European Commission wants to tackle. Transportation as known today will change and especially in urban areas where people need transportation to move around, the European Green Deal will have an important impact. With the support of the European Commission, countries and cities develop sustainable urban mobility plans (SUMP) to innovate urban mobility and reach the targets set by the European

Green Deal. Mobility becomes greener with more trains, trams, subways, and electric vehicles. Furthermore, active transportation methods are promoted with the development of bike lanes and the reduction of speed limits in urban areas. To reach those changes, cities are challenged with the implementation of new technologies and changes in infrastructure. Mobility as a service (MaaS) programs are implemented to interlink different providers of transportation methods to make the organization of journeys simpler, faster, and more sustainable. Cities have to reorganize their urban areas to make them suitable for new sustainable transportation methods.

People in general are willing to use sustainable transportation methods. However, a large part of the participants in the survey feels a lack of infrastructure and accessibility to sustainable urban mobility. Also, the cost of sustainable urban transportation methods seems to be problematic and people often find it too expensive. The positive side of these findings is that those are exactly the issues cities want to tackle. The case studies of Freiburg and Tampere reflect this perfectly.

In conclusion, this research paper shows that the European Green Deal will have a great impact on urban mobility and people's behaviour when using transportation methods. By developing a comprehensive SUMP, and implementing new technologies and infrastructures, the targets set by the European Commission should be reached and the will of the inhabitants of urban areas fulfilled. Besides providing knowledge to people that are interested in the future of mobility, this research can also be of interest to businesses. Knowing the challenges of sustainable urban mobility can be very valuable to investors and companies that want to (further) develop their business in urban mobility. Furthermore, knowing the extent of the support provided by the European Commission to countries and sustainable development gives companies an additional feeling of safety when developing new technologies and businesses connected to sustainable mobility. To be really of meaning for businesses, additional research and analysis of all strategies and measures packages of the European Commission would be required. As mentioned earlier in the thesis, the number of different strategies and support provided by the European Commission becomes more every day. The author had to put some limitations by not explaining every measure package provided by the European Commission and therefore couldn't dive into the company and investment aspect.

This thesis gives a simple overview of the future of urban mobility in Europe and could be deepened by analysing all the strategies and packages issued by the European Commission to help countries and cities. Furthermore, a survey over a longer period with an equal number of participants from different urban areas, of different European countries, would result in a great overview of the perception of urban mobility in all of Europe. This survey could help the European Commission by showing them how people really experience and see urban mobility in their own country additionally to how the government evaluates it.

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**Appendix 1: Survey questions**

What is your Gender?

- Female
- Male
- Non-binary
- Prefer not say

What is your age?

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

Country of residence (Only European Continent)

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How often do you use public transportation (e.g. bus, train, subway) to get around your city/region?

- Almost every day
- A few times a week
- Rarely or never

Have you ever used a bike-sharing program or rented a bike to get around your city/region?

- Yes, frequently
- Yes, occasionally
- No, never

How would you rate the quality of public transportation in your city/region?

- Excellent
- Good
- Fair
- Poor

How would you rate the overall sustainability of transportation options in your city/region?

- Very sustainable
- Somewhat sustainable
- Not very sustainable
- Not sustainable at all

Have you ever used a ride-sharing service (e.g. Uber, Lyft) to get around your city/region?

- Yes, frequently
- Yes, occasionally
- No, never

Have you ever used an electric scooter or other micro-mobility device (e.g. hoverboard, electric skateboard) to get around your city/region?

- Yes, frequently
- Yes, occasionally
- No, never

What factors do you consider when choosing a mode of transportation?

- Speed
- Cost
- Convenience
- Environmental impact
- Safety

How important is the cost of transportation when deciding which mode of transportation to use?

- Extremely important
- Somewhat important
- Not very important
- Not important at all

Do you think that the current prices of public transportation in your city/region are too high, just right, or too low?

- Too high
- Just right
- Too low

Do you think your city/region should invest more in sustainable transportation options like public transportation, bike-sharing programs, and pedestrian-friendly infrastructure?

- Yes, definitely
- Yes, somewhat
- No, not really
- No, definitely not

What do you think are the biggest barriers to using more sustainable modes of transportation in your city/region?

- Lack of infrastructure (e.g. bike lanes, pedestrian crossings)
- Limited availability or convenience of sustainable transportation options
- Safety concerns
- Lack of awareness or education about sustainable transportation options
- Other (please specify) \_\_\_\_\_

How important is it to you to reduce your carbon footprint when choosing a mode of transportation?

- Extremely important
- Somewhat important
- Not very important
- Not important at all



Would you be willing to pay more in taxes or fees to support sustainable urban mobility initiatives in your city/region?

- Yes, definitely
- Yes, somewhat
- No, not really
- No, definitely not

Have you ever participated in a community advocacy group or political campaign focused on promoting sustainable urban mobility?

- Yes, frequently
- Yes, occasionally
- No, never

What additional sustainable transportation options or improvements would you like to see in your city?

- More bike lanes or other cycling infrastructure
- Improved public transportation options (e.g. expanded service, reduced fares)
- More pedestrian-friendly infrastructure (e.g. improved sidewalks, pedestrian crossings)
- Improved access to sustainable transportation options in underserved neighborhoods
- Other (please specify) \_\_\_\_\_

What do you think are the biggest advantages of using sustainable transportation options in your city/region?

- Reduced traffic congestion
- Improved air quality
- Reduced carbon footprint
- Improved physical health
- Other (please specify) \_\_\_\_\_

Have you ever faced challenges accessing public transportation options in your city/region?

- Yes, frequently
- Yes, occasionally
- No, never

How would you rate the safety of sustainable transportation options (e.g. biking, walking) in your city/region?

- Very safe
- Somewhat safe
- Not very safe
- Not safe at all

How important is access to sustainable transportation options when choosing where to live or work?

- Extremely important
- Somewhat important
- Not very important
- Not important at all

How often do you use a personal car to get around your city/region?

- Almost every day
- A few times a week
- Rarely or never

How often do you take trips outside of your city or town?

- Almost every day
- A few times a week
- Rarely or never

How do you typically travel for longer trips outside of your city or town?

- Personal car
- Public transportation
- Plane
- Other (please specify) \_\_\_\_\_

Do you want to share any thoughts or point of view on the subject "Sustainable Urban Mobility"?

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