UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

CHANGING CONSUMER COMMUTING HABITS IN SLOVENIA THROUGH URBAN MOBILITY TRENDS

Ljubljana, May 2022 JULIJA PINTAR

AUTHORSHIP STATEMENT

The undersigned Julija Pintar, a student at the University of Ljubljana, School of Economics and Business, (hereafter: SEB LU), author of this written final work of studies with the title Changing consumer commuting habits in Slovenia through urban mobility trends, prepared under supervision of Prof. Vesna Žabkar, Ph.D.

D E C L A R E

1. this written final work of studies to be based on the results of my own research;

2. the printed form of this written final work of studies to be identical to its electronic form;

3. the text of this written final work of studies to be language-edited and technically in adherence with the SEB LU's Technical Guidelines for Written Works, which means that I cited and / or quoted works and opinions of other authors in this written final work of studies in accordance with the SEB LU's Technical Guidelines for Written Works;

4. to be aware of the fact that plagiarism (in written or graphical form) is a criminal offence and can be prosecuted in accordance with the Criminal Code of the Republic of Slovenia;

5. to be aware of the consequences a proven plagiarism charge based on the this written final work could have for my status at the SEB LU in accordance with the relevant SEB LU Rules;

6. to have obtained all the necessary permits to use the data and works of other authors which are (in written or graphical form) referred to in this written final work of studies and to have clearly marked them;

7. to have acted in accordance with ethical principles during the preparation of this written final work of studies and to have, where necessary, obtained permission of the Ethics Committee;

8. my consent to use the electronic form of this written final work of studies for the detection of content similarity with other written works, using similarity detection software that is connected with the SEB LU Study Information System;

9. to transfer to the University of Ljubljana free of charge, non-exclusively, geographically and time-wise unlimited the right of saving this written final work of studies in the electronic form, the right of its reproduction, as well as the right of making this written final work of studies available to the public on the World Wide Web via the Repository of the University of Ljubljana;

10. my consent to publication of my personal data that are included in this written final work of studies and in this declaration, when this written final work of studies is published.

Ljubljana, _____ Author's signature: _____

(Month in words / Day / Year,
e. g. June 1st, 2012

TABLE OF CONTENTS

INTRODUCTION **1**
1 URBAN MOBILITY **3**
1.1 Urban mobility trends **7**
1.1.1 E-mobility 9
1.1.2 Autonomous driving and connected vehicles 12
1.1.3 Shared mobility 13
1.1.4 Mobility as a Service 15
1.2 Urban mobility planning **16**
1.3 Urban mobility in Slovenia **20**
2 CONSUMER COMMUTING HABITS IN SLOVENIA **22**
2.1 Methodology **23**
2.2 Survey results of consumer commuting habits in Slovenia **24**
2.3 Suggestions for changing consumer commuting habits in Slovenia with future mobility trends **33**
2.4 Discussion on results **41**
2.4.1 Future mobility trends suggestions 43
2.4.2 Contributions and practical implications 46
2.4.3 Research limitations and directions 47
CONCLUSION **48**
REFERENCE LIST **51**
APPENDICES **57**

LIST OF FIGURES

Figure 1: 12 steps of revised sustainable urban mobility planning 19
Figure 2: Time spent for commuting to and from work [in minutes] 25
Figure 3: Selected mode of mobility of commuting by the use frequency 25
Figure 4: The importance of parameters for choosing the main mean of mobility 26
Figure 5: The likelihood of choosing different types of mobility the next years 30
Figure 6: Main motivators to change current commuting habits 31
Figure 7: The likelihood of the following scenario in the five following years 32

Figure 8: Attitude towards using a personal vehicle 32

LIST OF TABLES

Table 1: Share of travel purpose per person per day for urban mobility on all days (%) 6
Table 2: Overview of five main urban mobility trends 9
Table 3: 6 levels of autonomous driving 12
Table 4: Overview of main types of shared mobility 14
Table 5: Comparison between traditional transport planning and SUMPs 18
Table 6: Analysis of the importance of parameters for choosing the main mean of mobility by specific mean of mobility 27
Table 7: Analysis of the importance of the main obstacles for not choosing ridesharing (as a driver or as a passenger) more often 28
Table 8: Analysis of the importance of the main obstacles to not choosing public transportation more often 29
Table 9: Analysis of the importance of the main obstacles for not choosing cycling and walking more often 30
Table 10: Analysis of five clusters 33
Table 11: Suggestions of proposed future mobility trends for clusters based on survey results and secondary data analysis 43

LIST OF APPENDICES

Appendix 1: Executive Summary / Povzetek 1
Appendix 2: Survey questionnaire 4
Appendix 3: Cluster analysis 10
Appendix 4: Detailed analysis of specific clusters 13

INTRODUCTION

The following master's thesis focuses on the topic of urban mobility. It initially addresses the world's challenge of rapid urbanization and increased pressure on current infrastructure. As current mobility methods do not offer a sustainable solution for tackling this challenge, new mobility trends are being introduced. Hence, we present urban mobility trends of e-mobility, autonomous driving and connected vehicles, shared mobility, and mobility as a service, followed by a detailed overview of urban mobility planning of how those trends should be implemented to benefit different stakeholders. Last, urban mobility in Slovenia is presented with a thorough primary source analysis of an online survey demonstrating current consumer commuting habits in Slovenia and addressing the challenge of changing those habits with future mobility trends.

The master's thesis aims to introduce urban mobility trends that are used later when implicating suggestions to change current commuting habits in Slovenia with the tool of urban mobility planning. It thoroughly analyses the problem that urban mobility faces with rapid urbanization and changing consumer habits and preferences and tries to present a suitable solution to benefit different stakeholders, the environment, and general society with future mobility trends.

The master's thesis can be divided into two parts – a secondary source analysis titled "Urban mobility," which firstly introduces urban mobility in general and further discusses urban mobility trends, urban mobility planning, and urban mobility in Slovenia, as well as a primary analysis titled "Consumer commuting habits in Slovenia" that is built upon an online survey and later includes the chapters of methodology, survey results of consumer commuting habits in Slovenia, suggestions for changing consumer commuting habits in Slovenia with future mobility trends, and lastly, presents the discussion on obtained results.

The first part of the master's thesis begins with a content analysis of secondary sources to explain urban mobility, urban mobility trends, and urban mobility planning, all with a specific focus on urban mobility in Slovenia. Firstly, we present the importance of urban mobility emphasizing the growing trend of people living in urban areas and introducing the main challenge in urban mobility in Slovenia – everyday commuters to urban areas. Secondly, urban mobility trends are explained emphasizing changing current commuting habits. The last part of content analysis with secondary data focuses on urban mobility planning, its benefits, and strategies, which is a base for the second part of the master's thesis – an online survey. A short introduction to all main pillars – urban mobility, urban mobility trends, and urban mobility planning – is presented below.

Urban mobility represents different ways of moving around in the city areas divided into the collective (e.g. public transportation), individual, and freight transportation. It is growing in importance as the complexity, fast development, and growing urban population are making

it essential for city officials, companies, and individuals to react (Rodrigue, 2020a). In 2020, 56.0% of all 7.8 billion world population lives in urban areas with the leading 82.0% in North America (Statista, 2020a). Based on UN estimations, it is believed this percentage will grow by 2050 to 68.0% of 9.8 billion individuals (United Nations, 2018). This rising challenge of urbanization will, therefore, bring new threats and opportunities to urban mobility. In Slovenia, approximately 50.0% of citizens live in urban areas or town and city suburbs with the number stagnating over the recent years. The main challenge is, therefore, not the number of people living in urban areas but rather people commuting to the cities daily. In Slovenia, more than 90.0% of all citizens are commuting to cities creating a challenge for city infrastructure, quality of life, and sustainable policies (Šuklje Erjavec, Miklavčič, Rogelj, & Jerman, 2016).

Urban mobility trends, such as electrification, autonomy, and connectivity, followed by e-hailing (e.g. on-demand mobility), ridesharing, mobility as a service, and many others all share the same main feature – to consequently develop a holistic approach for a sustainable and commuter-friendly mobility solution. In the previous years, we saw the rise of electric vehicles (EVs), declining consumer preferences for privately owned cars, and new business models developed by leading mobility companies followed by a rapid shift in investments also in automotive manufacturers (Moller, Padhi, Pinner, & Tschiesner, McKinsey & Company, 2019). Urban mobility trends follow megatrends that have shifted consumer behavior to consider mobility as a service instead of a narrow product of transport that can get you from point A to point B. It is believed a new trend will enable no cars in the city centers, autonomous vehicles with embedded connectivity, and customized experience with fully sustainable and integrated experience (Kuzia, 2018). As Slovenia has one of the highest motorizations (523 registered vehicles per 1,000 citizens in 2015) in Europe, the urban mobility trends will have an even greater impact on the shift in consumer behavior in everyday mobility (Šuklje Erjavec, Miklavčič, Rogelj, & Jerman, 2016).

Urban mobility planning tackles the question of commuting to work, delivering services, offering public transportation, and so on. It is one of the main contributors to the general quality of the urban population affecting further economic growth, personal wellbeing, and connectivity (Federal Ministry for Economic Cooperation and Development (BMZ), D. f., & Germany, M.F., 2016). Together with the improved quality of life for people living in urban areas, urban mobility planning also affects the reduction of air pollution, health, and safety of people and improves traffic flow. Those benefits not only support the people living in cities but also companies that can gain urban accessibility with a bigger pool of candidates who now save more time in the traffic and attractiveness for consumers to visit brick and mortar stores. Urban mobility planning also provides equal opportunities for those of vulnerable groups and the economically disadvantaged. Hence, it also serves the government's purpose of political priorities with the involvement of different stakeholders, such as businesses and civil society in general (Rupprecht Consult – Forschung & Beratung GmbH, Colclough, & EUROCITIES, 2019).

After a detailed secondary source analysis of urban mobility, future mobility trends, urban mobility planning, and a thorough overview of the urban mobility situation in Slovenia, we continue the master's thesis with the second part – quantitative research of an online survey conducted to gain actual in-sight data of Slovenian commuting to urban areas to identify current struggles and challenges and determine possible solutions for the future. The consumer behavior analysis, together with the main drivers, motivators, pain points, and beliefs, consists of questions targeting their current mobility that is later used for cluster analysis to form strategies to change current commuting habits in Slovenia to increase the quality of life in urban areas, to benefit everyday commuters, companies in urban areas, city inhabitants and local authorities and, last, to help the environment.

The online survey focuses on four key research questions that will support further discussion:

- RQ1: What are the current commuting habits in Slovenia?
- RQ2: What are the main drivers when deciding on a current commuting habit?
- RQ3: What future urban mobility trends are Slovenian commuters most likely to accept in the future?
- RQ4: What kind of solutions would best suit commuters, companies, and governments when changing consumer commuting habits in Slovenia?

In the master's thesis, it is the purpose to determine the current consumer commuting habits in Slovenia – e.g. how individuals currently commute to work, what are the main drivers behind this decision, and what would motivate them to change. Aligned with previously explained future urban mobility trends, master's thesis purpose is to find the best strategies to change consumer commuting habits to achieve a sustainable environment and quality of life. Therefore, the analysis will not only benefit commuters themselves but also companies in the urban areas, governments, and city inhabitants.

1 URBAN MOBILITY

In 2020, 56.0% of all 7.8 billion world population lived in urban areas, with the top 82.0% in Northern America, 79% in Latin America and the Caribbean, and 75.0% in Europe. The lowest percentage of urbanization can be identified in Africa with 43.0% (Statista, 2020a). Based on United Nations' estimations, it is believed the percentage of people living in urban areas will grow to 68.0% of 9.8 billion individuals by 2050, which represents more than 6.6 billion individuals (United Nations, 2018).

Additionally, it is estimated that by the year 2100, 20 cities will have a population bigger than 35 million inhabitants with 10 of those cities' populations higher than 50 million and two cities (Lagos and Kinshasa) with more than 80 million inhabitants (Hoornweg & Pope, 2014). This rising challenge of urbanization will bring new threats and opportunities including but not limited to urban mobility.

Overall mobility can be divided into four categories – micro-mobility, urban mobility, short-haul travel, and long-haul travel categorized based on the average travel distance. Micro mobility is defined in the range of 0 km to 4 km and includes scooters, bikes, and other non-engine means of travel, hence including walking. The following three categories all involve using a private vehicle and public transport with the rise of new mobility possibilities. Urban mobility which has the main overlaps with the other categories includes traveling from 4 km to 20 km and varies from motorbikes to different types of car use – ride-hailing, vanpooling, car-sharing, autonomous cars, etc. Next, short-haul transport ranges from 20 km to 500 km and includes air taxis, car hire, car-pooling, buses, etc. Short-haul transportation is not included in urban mobility. However, it represents a primary means of transportation for commuting from rural (or suburban) areas to cities. Last, long-haul travel mainly includes air mobility (Dobravsky, 2019). In the following master's thesis, we shall focus on the definition of urban mobility which overlaps with micro-mobility and some aspects of short-haul transportation.

Urban mobility represents different ways of moving around in the city areas. It can further be split into the collective (including various modes of public transportation and new mobility types, such as car-sharing, etc.), individual (including the individual use of a private vehicle, cycling, walking, etc.), and freight transportation. The importance of urban strategical planning grows as the increasing urban population brings new challenges to urban areas making it essential for cities, companies, and individuals to react (Rodrigue, 2020a).

Urban mobility faces a significant challenge concerning the rise of private vehicle ownership, increasing demands for sustainable transport strategies, and better quality of life eliminating road connections, traffic accidents, and polluted air. As estimated for 2030, there will be more than 2 billion units of total ownership vehicles (Dargay, Gately, & Sommer, 2007) representing an increase from 2015 by more than 700 million vehicles, which means high pressure on urban mobility. Additionally, it is expected that vehicle sales will increase from 70 million a year in 2010 to 125 million by 2025 (Bouton, Mihov, Swarty, & Knaupfer, 2015).

Additionally, in 2014 estimates, car utilization in Europe represented approximately 8.6% of actual use – with 1.0% sitting in congestions, 1.6% looking for parking, and 6.0% driving. Hence, 91.4% of the time, a typical European car is parked without being in use. The average car in Europe also has five seats with moderate use of 1.5 people per trip (Ellen MacArthur Foundation, 2015).

As we could already witness in the past years, the urban infrastructure cannot bear such a high pressure of increased use of privately-owned vehicles. For example, in 2019[1], 381 of 416 cities across 57 countries had a traffic index higher than 15.0%, which means that every 30-minute trip was prolonged for at least 4.5 minutes. It is even more alarming that seven

[1] 2020 data is also available. Due to the COVID-19 pandemic, however, all data demonstrated a high deviation from previously reported numbers.

cities (Moscow, Mumbai, Bogota, Manila, Istanbul, Bangalore, and Kyiv) scored a traffic index higher than 50%, which means that for every 30-minute drive, they spent more than 15 minutes in traffic connection alone (TOMTOM, 2019).

Furthermore, congestions are very costly for cities and governmental budgets ranging from 2.0 to 4.0% of the nation's GDP, including wasted time or fuel measures, resulting in the loss of business opportunities and higher business costs for companies (Bouton, Mihov, Swarty, & Knaupfer, 2015). Based on WHO estimations, 7 million premature deaths in 2014 were also linked to air pollution where urban mobility and connections in urban areas play a significant factor (World Health Organization, 2014).

Witnessing urban mobility challenges (Rodrigue, 2020b) of traffic congestion and parking difficulties, longer commuting, public transportation inadequacy, problems for non-motorized transport, loss of public space, high infrastructure maintenance costs, environmental impacts and energy consumption, accidents and safety, land footprint, and freight distribution, countries are urged to act. For that purpose, the United States introduced Mobility Action Plans to help plan the future of mobility in urban areas (American Public Transportation Association, n.d.).

Similarly, European Union presented Sustainable Urban Mobility Plans (SUMPs), a strategic plan designed to satisfy the mobility needs of people and businesses to ensure a better quality of life. The mission of SUMPs is to solve transport-related challenges efficiently, offer transport to key destinations and services, improve safety and quality, reduce air and noise pollution, greenhouse gas emission, and energy consumption, improve the cost-effectiveness of mobility, and contribute to the overall quality of life. SUMPs are also intended to be followed in all European Union cities and towns including the ones in Slovenia (European Commission, n.d.).

Based on Urban Mobility Readiness Index[2], Singapore ranks highest with 74.1%, representing its prominent position in urban mobility with the best practices, infrastructure, and overall investments. Following Singapore, there are three European cities (London, Stockholm, and Amsterdam in the fifth place) and Hong Kong in the fourth place. (Statista, 2020b)

[2] Urban Mobility Readiness Index is a forward-looking study aiming to evaluate best practices in cities, therefore contributing to mobility development in other cities (Oliver Wyman Forum, 2020).

Table 1: Share of travel purpose per person per day for urban mobility on all days (%[3])

	Work (commuting)	*Professional/ business*	*Education*	*Shopping*	*Escorting*	*Leisure*	*Personal business*
Austria	**30.5**	6.1	4.3	10.2	6.0	19.0	21.9
Belgium	**27.7**	5.7	5.9	19.4	8.1	30.2	0.0
Croatia	**47.4**	0.5	5.0	7.9	0.9	27.3	10.8
Denmark	**28.1**	10.4	4.4	11.5	6.9	32.9	5.8
Germany	**27.2**	16.5	2.8	9.0	4.7	28.0	11.6
Greece	**44.3**	2.8	5.8	4.7	2.8	26.4	5.0
Italy	**30.5**	5.1	4.7	16.6	4.1	32.0	7.0
Latvia	**45.0**	1.0	4.5	11.8	6.3	21.8	9.0
Netherlands	**NA**	NA	NA	NA	NA	NA	NA
Poland	**46.5**	1.2	9.4	15.3	2.4	8.8	16.5
Portugal	**44.6**	2.9	6.8	12.7	9.3	9.0	12.8
Romania	**33.4**	1.5	0.4	23.4	0.7	9.6	27.8
Slovenia	**32.7**	**3.5**	**6.5**	**10.2**	**7.7**	**30.7**	**8.6**

Source: Eurostat (2021a)

When analyzing urban mobility, we should consider different travel intentions (see Table 1). For example, different purposes for mobility are work (e.g. commuting), professional/business, education, shopping, escorting, leisure, personal business, and others. Between 2013 and 2019, twelve EU member states (Belgium, Denmark, Germany, Greece, Croatia, Latvia, Netherlands, Austria, Poland, Portugal, Romania, and Slovenia) participated in a pilot project that analyzed the above intentions behind urban mobility. The results

[3] The percentages may not add up to 100% due to a small residual category Other/Unknown.

suggest that in eight of eleven[4] countries, the leading choice for urban mobility is commuting to work. In the other three countries (Belgium, Denmark, and Germany), the primary purpose of urban mobility is leisure. However, it is closely followed by commuting (Eurostat, 2021a).

Overall, when observing the distribution (see Table 1) of distance traveled per person per day by travel purpose for urban mobility on all days in percentage, we determine that time spent on commuting varies from 27.2% in Germany to 47.4% in Croatia. Most time spent in urban mobility for professional/business purposes is observed in Germany and the least in Latvia. The highest percentage for educating-purposed travel is observed in Poland (9.4%), with the lowest rate in Romania – 0.4%. Also, the lowest percentage for escorting intentions is for Romania (0.7%) whereas the highest percentage is identified in Belgium (8.1%). The highest rate for leisure is observed in Belgium (30.2%) and the lowest in Portugal (9.0%). Last, personal business is the purpose for urban mobility in Romania (27.8%) and the lowest in Greece (5.0%) (Eurostat, 2021a). We should, however, keep in mind that the intentions are also influenced by many factors, including but not limited to lifestyle, the geographical landscape of the country, and various cultural elements (Van Acker, Goodwin, & Witlox, 2016). As this master's thesis focuses on urban mobility in Slovenia where 32.7% of commuting to work represents the highest percentage of urban mobility intentions, we will mainly focus on commuting as a part of urban mobility.

Concerning the European Union, the highest percentage of people going to work by car can be observed in Nicosia (91.0%) followed by Riga, Valletta, and Luxemburg with approx. 67.0%. Concerning public transportation, the highest percentage in European capitals can be observed in Paris (80.0%) followed by Vienna and Prague. The highest satisfaction (95%) with public transportation use can be observed in Vienna as well. Most people bike to work in Copenhagen (58.0%), followed by Amsterdam and Ljubljana. The highest percentage of walking to work is again observed in Paris (52.0%), followed by Vienna and Athens (European Commission, 2015).

1.1 Urban mobility trends

One of the latest United Nations reports determined the five most essential megatrends – climate change, demographic shift (e.g. population aging), urbanization, the emergence of digital technologies, and inequalities (United Nations, 2020).

Furthermore, the European Commission identified three main pillars of megatrends – technological, socio-political, and environmental, as well as smart economy megatrends. Technological megatrends include automation, mass customization and servitization, integration of subjects and objects, a data-driven world, and cybersecurity and blockchain. Social-political megatrends include globalization and geopolitics together with demographic shifts. Last, environmental and smart economy megatrends include green and circular

[4] There is no data available for Netherlands for this indicator.

economy, urbanization and smart city, and smart mobility (Sirtori, Caputo, Colnot, Ardizzon, & Scalera, 2019).

When analyzing the correlation between determined megatrends from the European Commission and emerging industries, we observe a high correlation of mobility technology with megatrends automation, integration of subjects and objects, data-driven world, cybersecurity and blockchain, globalization and geopolitics, green and circular economy, urbanization and smart city, and smart mobility (Sirtori, Caputo, Colnot, Ardizzon, & Scalera, 2019).

Hence, urban mobility trends also follow megatrends that have created a shift in consumer behavior, considering mobility as a service instead of a narrow product of transport that can get you from point A to point B. New trends will enable no cars in the city centers, autonomous vehicles with embedded connectivity, and a fully sustainable integrated customized experience (Kuzia, 2018).

With the younger generation caring less about car brands and more about the overall experience, urban mobility shifted from owning a vehicle to the availability and flexibility of a ride itself. Many cities are now striving for a multimodal approach integrating different means of transportation to offer a complete experience of sustainable, efficient, and affordable mobility (Bubenzer-Paim, 2020).

Urban mobility trends, such as electrification, autonomy and connectivity, shared mobility (e.g. e-haling and ridesharing), mobility as a service, and many others mainly focus on solving the same challenge of trying to establish a holistic approach for a sustainable, customer-oriented mobility solution that will benefit not only the environment but also enable a higher quality of life in urban areas. So far, in the most developed countries, we have seen the rise of EVs, declining consumer preferences for privately owned cars, new business models developed by leading mobility companies in the field of shared mobility and mobility as a service, and more. A rapid shift followed those recent changes in investments and automotive manufacturers (Moller, Padhi, Pinner, & Tschiesner, 2019).

With new trends of shared mobility, autonomous driving, connectivity, Internet of Things (IoT), and vehicle electrification, the existing public transit, infrastructure, energy systems, and regulation are already adapting and will need to adjust further to keep up with the urban pressures and demands. For example, many cities worldwide are already adapting their public transportation systems by adding autonomous vehicles, offering fleet vehicles for sharing purposes, and using IoT to ensure the reliability and efficiency of the system in general. Additionally, infrastructure is adjusted with necessary improvements and a multimodal approach by promoting walking, biking, and other means of travel (Bouton, Hannon, Knaupfer, & Ramkumar, 2017).

Many technologies will be needed in the background to ensure the successful integration and implementation of mobility trends. Some of those technologies required are Machine-to-

Machine (M2M) to provide continuous connectivity with real-time measurements, networked computer-controlled systems for real-time data and advanced safety, real-time traffic information systems connected to driver services and vehicles, Software-as-a-Service (SaaS) to integrate location, information, and services, real-time machine learning, human-computer interaction, sensors, etc (Ceder, 2020).

Since 2010, most investments in the automotive industry went to e-hailing with more than $56.0 billion, which also represented a higher increase in the nine years from $0.2 to $11.4 billion. Scope of investments in e-hailing is followed by semiconductors ($38.0 billion), AV sensors and ADAS components ($30.0 billion), connectivity and infotainment ($21.0 billion), electric vehicles ($19.0 billion), and batteries ($14.0 billion). Total investments in the automotive industry from 2010 to 2019 accounted for $220 billion, representing an increase of $5.9 in 2010 to $39.5 in 2019 (Moller, Padhi, Pinner, & Tschiesner, 2019).

In the following analysis, we will focus on five main urban mobility trends with autonomous driving and connectivity of vehicles presented together; the literature also combines the explanation of both. Additionally, we will focus on e-mobility (e.g. electrification), shared mobility, and mobility as a service (MaaS). In Table 2 below, we first present a short overview of all.

Table 2: Overview of five main urban mobility trends

Urban mobility trend	*Definition*	*Urban mobility implications*	*Case study*
E-mobility	The use of electric alternatives to mobility (Scheffels & Stark, 2019).	Carbon-neutral way of moving in urban areas (Glotz-Richter & Lange, 2020).	Electric city fleet of buses and taxis, charging stations, e-bikes, e-scooters, and the promotion of walking and bicycling with needed infrastructure (Glotz-Richter & Lange, 2020). Charging infrastructure, electric vehicles subsidies, electric public transportation (LEMO - Learning E-Mobility, 2016).

(table continues)

(continued)

Urban mobility trend	*Definition*	*Urban mobility implications*	*Case study*
Autonomous driving and connected vehicles	Autonomous driving represents different stages of self-driving vehicles (Kirkland, 2019). Connectivity refers to the vehicle's ability to wireless connection to any other nearby devices (Wade, 2020).	Increase safety and efficiency by removing human factors and carve the path to sharing economy of car sharing (Lang, Herrmann, Hagenmaier, & Richter, 2020).	Introduction of robo-taxis and robo-shuttles (Moller, Padhi, Pinner, & Tschiesner, 2019) and autonomous drones that can deliver any product on demand (e.g. medical supplies) (Porter, 2020).
Shared mobility	Shared use of any vehicles for personal and business use follows the short-term access model on an as-needed basis (Shaheen, Cohen, & Zohdy, 2016).	Decrease in privately-owned cars, vehicle miles travelled, CO_2, mobility-related costs, increase in economic activity near shared-mobility stations (Shaheen & Cohen, 2018).	Increased mobility use and accessibility in unprivileged neighbourhoods with lower income (Brown, 2018).
Mobility as a Service (MaaS)	Mobility as a service combines various mobility modes to offer a multimodal experience of mobility (Jittrapirom et al., 2017).	Increase efficiency and overall customer experience and focus on public transportation, accessibility (Alexiou, 2021).	Moovel combines car-sharing, ride-hailing, and charging, blending various modes of mobility, such as bikes, e-scooters, and private and public transportation. (Halytska, 2019) Whim in Helsinki, Finland, enables users to plan, book, and pay for all public and private transportation modes within the city (Goodall, Dovey, Bornstein, & Bonthron, 2017).

Source: Own work

1.1.1 E-mobility

Electromobility, or more commonly used – e-mobility – is the use of electric (and hybrid) vehicles, not only limited to cars but also including other means of transport, such as bikes, scooters, trains, trucks, etc. The trend became more widely known with Toyota's launch of the Prius in 1997 and spread with the introduction of Tesla's electric vehicles in 2006 (Scheffels & Stark, 2019).

With the gas deficit and rising threat of carbon emissions, e-mobility has become one of the most important trends rising from the end of the 20th century, with growing importance until today. In the last years, e-mobility has witnessed an increase in the production of electric vehicles by different automotive companies and supporting infrastructure of charging stations. Another positive shift to electric cars is also a growing trend observed in the renewable energy sector with decreased prices (Kiser, Chiu, & Otto, 2018).

As a result, demand for electric vehicles is soaring, especially in China, followed by the United States and Europe. In 2019, sales of electric cars reached another peak, mainly in the European market. The rise in the demand in the European market was driven by new regulations set in European countries (for example, diesel bans in some German cities) and increased customer demand (Moller, Padhi, Pinner, & Tschiesner, 2019).

The main benefit of e-mobility is the adaption of carbon-neutral mobility. On the other hand, the main challenge in electric mobility is the energy, which is still mainly produced non-sustainable. The additional challenge still considered is the production of vehicle batteries and storage after its lifetime (Scheffels & Stark, 2019). However, based on Ipsos' research, the main barriers to the adoption of electric vehicles are the lack of supply of public charging stations and a limited driving range of electric cars (Kiser, Chiu, & Otto, 2018).

As many cities are experiencing polluted air, e-mobility represents an excellent opportunity for a carbon-neutral way of moving in urban areas, improving the air quality and the quality of people living in the cities (Glotz-Richter & Lange, 2020).

The effect of e-mobility on urban mobility can be identified in many different case studies. For example, in Barcelona's Electric Mobility Strategy 2018 – 2024, the goal is to use 80% of electric vehicles in the entire city fleet. The plan intends to be achieved using electric taxis, private cars, and motorcycles. Additionally, walking and biking lanes will be improved by promoting ridesharing and mobility as a service in promoting the use of electric bikes and scooters for rental (Glotz-Richter & Lange, 2020).

Many case studies can also be observed in Slovenia, with 26 charging stations across the entire highway cross in 2015, given subsidy for electric vehicle purchase on a governmental level, the transformation of public transportation in the city of Ljubljana to electric mobility, and many more (LEMO - Learning E-Mobility, 2016).

1.1.2 Autonomous driving and connected vehicles

Autonomous driving or self-driving cars represents different levels of the ability of a vehicle to function on its own. The levels are identified by SAE International, varying from stage 0, which demands complete driver control, to stage 5 where the vehicle can be self-driven in all conditions (Kirkland, 2019). For more details see Table 3.

Table 3: 6 levels of autonomous driving

L0	L1	L2	L3	L4	L5
No automation	Driver assistance	Partial automation	Conditional automation	High automation	Full automation
There is no automation technology in the vehicle with a driver entirely in charge of operating the movement.	There is at least one driver support system (e.g. steering, braking, acceleration assistance) with the driver still in charge of vehicle operation.	Advanced driving assistance systems (ADAS) may control specific functions of vehicle operations (e.g. steering, braking, acceleration).	With artificial intelligence (AI), driver assistance systems control specific situations. A person does not control a vehicle. However, one should be present. *Not yet in use, testing phase.*	A fully autonomous vehicle that does not require a driver limited to travel from point A to point B or a specific geographic area. *Not yet in use, testing phase.*	A fully autonomous vehicle that does not require a driver and can drive anywhere at any time. *Not yet in use, testing phase.*

Source: Choksey & Wardlaw (2021)

As the trend of autonomous vehicles was anticipated to peak in the last couple of years, stages 4 and 5 have not yet been delivered. However, it is expected that by 2040, 66.0% of total passenger-kilometers will be driven by autonomous vehicles (Moller, Padhi, Pinner, & Tschiesner, 2019).

To successfully reach autonomous driving, many developments of ADAS (Advanced Drives Assistance Systems) have been pursued to optimize safety, energy consumption, comfort, and overall mobility. Many innovations, such as speed regulation, obstacle collision avoidance, vehicle stability control, or lane-keeping are already part of most new vehicles (Gruyer et al., 2017).

Concerning autonomous driving, an important role is also taken by connectivity or connected cars. This vehicle can wirelessly connect to other nearby devices spreading from infotainment systems in the vehicle to communicate with other vehicles or city intersections. This Internet of Things (IoT) function enables mobility participants to constantly communicate with features, such as adaptive cruise control and automatic route planning based on real-time data to avoid connections or monitor traffic reports. As the primary purpose of connected cars is to enable safe mobility, another positive outcome is the improved user experience in driving (Wade, 2020).

Concerning urban mobility, autonomous driving and connectivity may bring new solutions for alternatives in the mobility mix. As most self-driving cars are anticipated to be publicly shared, autonomy will support the transition of urban areas to greener, more sustainable places carving the path to the sharing economy. Hence, traffic would be reduced, fewer parking spaces would be needed, and transportation would be accessible to unprivileged social groups. Additionally, removing the human factor would increase safety and efficiency in everyday commuting (Lang, Herrmann, Hagenmaier, & Richter, 2020).

Two case studies are emphasized – first, the introduction of robo-taxis and robo-shuttles which are considered to revolutionize urban mobility with carbon-free, affordable, and user-friendly features (Moller, Padhi, Pinner, & Tschiesner, 2019). The second example is the use of autonomous drones that can deliver any product on-demand without being stuck in traffic congestion. Fighting the COVID-19 pandemic, drones by line companies are already being used in the U.S, providing medical supplies to two hospitals in North Carolina (Porter, 2020).

1.1.3 Shared mobility

Shared mobility is a part of a new trend of global behavior – a shared economy or collaboration economy where consumer preferences shift from owning a particular product (e.g. car, apartment) to divert to minimalism and sharing different goods. Leading examples of sharing economy are shared mobility with Uber as the leading company, apartment lending with Airbnb, peer-to-peer lending with lower interest rates, reselling, coworking, and talent-sharing with the new wave of freelancing (Marr, 2016).

Deriving from the sharing economy, shared mobility is the shared use of any vehicles for personal and business use that follows the model of short-term access on an as-needed basis. Shared mobility includes different types, such as (for more detailed description of various types of shared mobility, see Table 4):

- vehicle sharing (e.g. carsharing and other types of vehicles sharing),
- ridesharing (e.g. carpooling),
- on-demand ride services (e.g. ride-hailing, ride sourcing),
- alternative transit services (e.g. microtransit and other means intended to substitute fixed-routes traffic) (Shaheen, Cohen, & Zohdy, 2016).

Table 4: Overview of main types of shared mobility

Carsharing	Carsharing is a short-term use of a car shifting from privately owned car to a more sustainable way of using a car by fleet provider or private person renting his or her car. First carsharing was already introduced in 1948 in Switzerland's with the aim of economic reason but has highly developed in the following years with additional strive for a more environmental and social impact. In the last years, leading manufacturing automotive companies also embarked on a new business model of carsharing, offering their fleet to be used by individuals (Ferrero, Perboli, Rosano, & Vesco, 2018). Currently, the main player in carsharing sector is Zipcar present in nearly 500 cities with more than one million members and more than 12.000 vehicles (Zipcar, 2021).
Carpooling/ridesharing	Carpooling or ridesharing represents a type of mobility with a shared ride of two or more people traveling in together in one vehicle, which means a person offering a ride and one or more passengers joining for a ride (Bachmann, Hanimann, Artho, & Jonas, 2018).
Ride-hailing	Ride-hailing is a specific type of ride sharing where an individual can hail and pay for a ride by a platform from a professional or part-time driver through smart phone application. The alternative developed world-wide in 2009 with the introduction of Uber (Clewlow & Mishra, 2017). Today, the main company in ride-haling is Uber which is present in more than 10.000 cities across 71 countries (Dean, 2021).
Ride sourcing	Ride sourcing offers a similar service to ride-haling, only that in this case, private car owners drive their own vehicles (e.g. not professional, or part-time driver) to provide for-hire rides for others joining for a ride (Zha, Yin, & Yang, 2016).
Microtransit	Microtransit is a shared transportation (usually private, but also a possibility of public transportation) with dynamic routes and scheduling to ensure efficiency and on-demand rides, usually with minibuses or small shuttles (Mayaud, Ward, & Andrews, 2021). The main companies in the sectors are Via, Bird, and Chariot (University of Oregon, 2020).

Source: Own source

In 2021 global shared mobility market size accounted for approx. $150 billion whereas it is forecasted that the total revenue will increase to approx. $1.200 billion until 2028 (Statista, 2021). Based on McKinsey's research in 2017, 63.0% of respondents intended to increase ride-hailing use in the following two years and 67.0% planned to increase the use of car-sharing (Grosse-Ophoff, Hausler, Heineke, & Moller, 2017).

Asia is anticipated to be the largest market for shared mobility in the following years with China and India taking the lead. The rapid growth of shared mobility will also influence car producers with lower sales growth in the next 5-10 years with a CAGR of 3.0 – 4.0% (FutureBridge, 2020).

It is analysed that shared mobility has many positive, mainly evolving around environmental, social, and transportation-related impacts. Environmental impact can be identified with a significant decrease in the use of privately-owned vehicles and vehicle miles travelled. It is estimated that roundtrip car sharing can reduce greenhouse gas emissions by 34.0–41.0% per year for one household. A decrease of 27.0–34.0% vehicle miles travelled per year for one household is identified. Economic impacts can be seen in cost-saving and increased economic activity in new shared-mobility stations. Analysing the US household, monthly savings per member after joining car sharing of $154 – 535 are observed. Last, social impacts are determined by increased accessibility of mobility, for example, in remote urban areas or for people with disabilities. It additionally increases efficiency for users. One roundtrip carsharing vehicle may also replace 9-13 privately owned cars, increase the use of used cars, increase the use of alternative transportation modes, such as walking and biking, and create greater environmental awareness (Shaheen & Cohen, 2018).

We emphasize one case study selecting from many. In Los Angeles, ride-hailing services like Uber and Lyft increased mobile use and accessibility for minority groups in unprivileged neighborhoods with lower-income. Like public transportation, taxis and other means of mobility do generally not cover those areas in urban areas. Due to crime rates, lower transport rates, and relatively low car ownership, ride-hailing services created a new opportunity for mobility in these areas. The study also suggests that low-income areas made more trips with those services than those in the middle higher-income class (Brown, 2018).

1.1.4 Mobility as a Service

In many ways, complementary to the mobility mentioned above trends, mobility as a service (commonly used MaaS) combines various mobility modes to offer the multimodal experience of mobility. Mobility modes are usually combined in a smartphone application in a bundle (e.g. integrated, multimodal approach) including other complementary services, such as planning, payments, reservation, etc. One of the most significant factors is integrating various mobility options on one interface, hence emphasizing the importance of the internet (Jittrapirom et al., 2017).

Mobility as a service is typically presented through a monthly subscription package where the user can decide between various mobility types based on the different criteria (e.g. efficiency, timeline, and pricing). It is sometimes even rereferred to as a “Netflix” of mobility. A specific mobility model is selected based on the user’s needs and follows the logic of pay-as-you-go pre/post-pay. An essential feature of mobility as a service is also the personalization of multimodality, which means the adaptation of mobility services based on

customers' preferences. Hence, bundles are tailored to specific needs and are heterogeneous to subscribers benefiting both users and providers. This common benefit is called collaborative customization or personalization (Jittrapirom et al., 2017).

Another vital feature of mobility as a service is mobility without owning a car. This is possible due to the offer of different approaches on one platform e.g. carsharing to public transportation or biking. Hence, mobility as a service indicates a more sustainable way of moving around. Additionally, mobility as a service introduces a more efficient way of traveling and promotes cost-efficiency (Utriainen & Pollanen, 2018).

The advantages of mobility as a service can also be identified as an efficient way of mobility with a decrease in the number of cars, promoting shared, and public transportation. Therefore, it reduces traffic congestion and pollution and reclaims space previously lost to parking and roads. For vehicle owners, it represents an opportunity to recover asset costs with one of the forms of shared mobility. It also focuses on public transportation, which is usually reflected in the decrease in overall mobility costs (Segal, 2020).

Furthermore, it represents accessibility to different users varying from people commuting from rural areas to urban areas, people from underprivileged neighborhoods, disabled people, etc. This is possible due to the personalization and customization of mobility modes and with accessible data via an integrated app (Alexiou, 2021).

Two case studies are introduced. The first one is a start-up, Moovel, a part of BMW Group and Daimler AG, combining car-sharing, ride-hailing, parking management, and charging, blending various modes of mobility, such as bikes, e-scooters, and private and public transportation. (Halytska, 2019) Payment is also offered, with additional personalization of rewards, loyalty tools, and rider engagement tools (Moovel, n.d.).

The second case study refers to using an app called Whim in Helsinki, Finland, which enables users to plan, book, and pay for all modes of public and private transportation within the city. With a selection of a destination, various modes of transportation are given, which means that one mode or combination comes from point A to point B. Users can decide on a subscription package or pay-as-they-go (Goodall, Dovey, Bornstein, & Bonthron, 2017). In late 2018, Whim had more than 70,000 registrants. Analysis showed that app users ride public transportation more often, use a three-larger pool of multimodal approaches, and bike more, hence solving the first-and-last-mile challenge (Whipact, 2019).

1.2 Urban mobility planning

Urban mobility planning or, more specifically in European Union, sustainable urban mobility planning (SUMPs) represents different phases of strategic planning aiming to satisfy the mobility need of various stakeholders (e.g. residents, commuters, and businesses) in urban areas to deliver a higher quality of life. In short, SUMPs strategically tackle the

efficiency of urban transport complexity. Additionally, it consists of existing planning practices and includes integration, participation, and evaluation principles (Oyofo, 2019).

The concept of SUMPs has been gradually developed since 2005, with the first Urban Mobility Package in 2013 that included the idea for the first time. However, as the need for urban mobility dramatically shifted in the last decade, an updated version of the SUMPs followed in 2019 (Rupprecht Consult – Forschung & Beratung GmbH, 2019).

The main benefits of the SUMPs include the reduction of CO_2 levels, affecting residents' health and well-being, additional increase in health and safety with the focus on biking and walking instead of driving with a personal vehicle, improved traffic flow, increasing the public affection for living in urban areas and expanding the liveability in cities, increasing the efficiency of various means of transportation (e.g. public transport), etc. (Rupprecht Consult – Forschung & Beratung GmbH, 2019).

Compared to traditional transport planning, SUMPs focus on people instead of traffic, which means a great emphasis is given to the involvement of different stakeholders in policy decisions. Cooperation between governmental and private stakeholders is also needed to implement SUMPs successfully. Traditional planning focuses on traffic capacities whereas SUMPs object to delivering accessibility and higher quality of life for people. Furthermore, SUMPs include integrated modes of traffic and do not only focus on infrastructure but also include a deep understanding of the market, regulations, information, and promotion of different services. Its strategy is long-termed and consists of all functional urban areas, not only administrative regions (Oyofo, 2019). A more detailed comparison between traditional transport planning and SUMPs can be observed below in Table 5.

SUMPs consist of 4 phases and 12 steps (see Figure 1) starting with the preparation and analysis phase which includes setting up working structures, determining a planning framework, and analyzing the current mobility situation in the area. The second phase, strategy development, further includes building and assisting (with different stakeholders) with different scenarios developing a vision and objective with the same stakeholders in mind, and setting indicators and targets to be measured in the following phases. The third phase focuses on measure planning and consists of selecting measure packages with stakeholders agreeing on actions and responsibilities and preparing for adoption and financing. The last, the fourth phase of implementation and monitoring includes managing implementation, monitoring, adaptation, communication with the stakeholders, and a final review of the lesson learned (Rupprecht Consult - Forschung & Beratung GmbH, 2019)

Table 5: Comparison between traditional transport planning and SUMPs

Traditional transport planning	**Sustainable urban mobility planning (SUMPs)**
Focus on traffic.	Focus on people.
Primary objectives: traffic flow capacity and speed.	Primary objectives: accessibility and quality of life, as well as sustainability, economic viability, social equity, health, and environmental quality.
Modal-focussed.	Balanced development of all relevant transport modes and shift towards cleaner and more sustainable transport modes.
Infrastructure focus.	Integrated set of actions to achieve cost-effective solutions.
Sectorial planning document.	Sectorial planning document that is consistent and complementary to related policy areas (such as land use and spatial planning, social services, health, enforcement and policing, etc.).
Short- and medium-term delivery plan.	Short- and medium-term delivery plans embedded in a long-term vision and strategy.
Related to an administrative area.	Related to a functioning area based on travel-to-work patterns.
The domain of traffic engineers.	Interdisciplinary planning teams.
Planning by experts.	Planning with the involvement of stakeholders using a transparent and participatory approach.
Limited impact assessment.	Regular monitoring and evaluation of impacts to inform a structured learning and improvement process.

Source: Wefering, Rupprecht, Bührmann, & Böhler-Baedeker (2014)

Figure 1: 12 steps of revised sustainable urban mobility planning

Source: Rupprecht Consult - Forschung & Beratung GmbH (2019)

When analyzing the previously mentioned Urban Mobility Readiness Index, Stockholm was a leading city in 2021. The top 10 cities also included Helsinki, Amsterdam, Berlin, London, Munich, and Zurich as representatives with the highest rankings (Oliver Wyman, 2021).

Additionally, when identifying the main actors in SUMPs, similar cities (including some additional, for example, Barcelona and Vienna) are emphasized. Hence, we can observe the correlation between mobility planning and high urban mobility readiness in those cities. For instance, Stockholm already introduced Stockholm urban mobility strategy in 2021 and is still recognized as one of the pioneers in urban vehicle access regulations. In their mobility strategy, the city focuses on reducing car congestion by 30% by 2030 introducing various steps. Those steps included investment in public transportation and cycling, increasing parking charges, promoting car-sharing, encouraging fewer car journeys by using online technologies (e.g. video conferencing), and stimulating purchases of electric vehicles (Twisse, 2019). Like Stockholm, other highest-ranked cities also have a well-defined SUMP with clear goals and actions.

1.3 Urban mobility in Slovenia

In Slovenia, from the year 2009 to 2019, approximately half of the citizens lived in urban areas or towns and city suburbs with a slowly increasing percentage from 52.4% in 2009 to 54.8% in 2019 (Plecher, 2020). As many countries face rapid urbanization, Slovenia projects a slight discrepancy with suburbanization instead of urbanization (Ministry of the Environment and Spatial Planning RS, 2020).

An essential aspect of Slovenian mobility is the low population density in 81.0% of municipalities and dispersion. Only two cities – Ljubljana and Maribor – have high population density (Statistični Urad RS, 2011). Hence, many people commute to urban areas for job requirements. More than 90.0% of all citizens commute to cities in Slovenia creating a challenge for city infrastructure, quality of life, and sustainable policies (Ministry of the Environment and Spatial Planning RS, 2020).

Based on 2019 research by Eurostat, an estimate of 12.0% of people do not spend any time commuting to work. 60.0% spend from 1 to 29 minutes, 22.0% from 30 to 59 minutes, and approx. 6.0% more than 60 minutes. Compared to the EU-27 average, Slovenia ranks at the top with the percentage of people without any commuting time. Additionally, the average commuting time in Slovenia is 23 minutes which is below the European Union's average of 25 minutes (Eurostat, 2020).

When analyzing current urban mobility trends, we identify that in 2018 86.4% of passenger transport was done by passenger cars above the European average of 83.3%. In Slovenia, 1.8% of routes were done by train (EU average 8.0%) and 11.8% by motor coaches, buses, and trolleybuses (EU average 8.7%). To identify the change in time series, we observe relatively stable use of personal cars, a slow decline in train use, and a slow increase in motor

coaches, buses, and trolleybuses (Eurostat, 2021b). Additionally, Slovenia is known for its high percentage of motorization with 566 cars per 1.000 inhabitants in 2019 (Eurostat, 2021c).

To identify the main patterns of urban mobility and commuting in Slovenia, we analyze Ljubljana Urban Region[5] (LUR) with the highest population density in Slovenia and the highest percentage of daily commuters. It is estimated that more than 120.000 people commute to the City of Ljubljana every day, which almost doubles the whole population of the City of Ljubljana. This increase is represented by nearly half of commuters from other municipalities within LUR while the bigger half of the commuters come from other municipalities in Slovenia (Regional Development Agency of the Ljubljana, 2018).

LUR residents make 60.0% of all trips by car. The percentage is also high for short journeys (e.g. approximately 30.0% for travel below 1 kilometer, about 55.0% for journeys 1-2 kilometers, and a growing percentage for any next kilometer added). 45.0% of commuting to the City of Ljubljana happens within the area, 25.0% from the LUR area to the City of Ljubljana, and 30.0% from other Slovenian municipalities. 84.3% of those trips are made by car, 14.6% by public transportation, 0.8% by walking, and 0.3% by bicycle (Klemenčič, Lep, Mesarec, & Žnuderl, 2014).

Based on the 2019[6] Ljubljana Traffic Index ranking, we observed 26.0%, which means that for every 30-minute trip, the traffic jams prolonged the journey for at least 7.8 minutes. Driving in a rush, drivers lost 15 minutes per 30-minute tip in the morning and 18 minutes per 30 minutes trip in the evening representing a loss of 33 minutes per day. This represents 124 hours lost in rush hours per year, which means five days and 4 hours (TOMTOM, 2020).

With the main commuting paths to urban areas of Ljubljana, one of the main challenges include planning the future of mobility in the area. To secure more sustainable mobility, the main challenges are the creation of integrated and balanced planning of multimodal approaches focusing on safe and quality walking paths, increasing biking as a way of daily commuting, comprehensive parking management, adapting to new technologies in mobility (e.g. EVs), and efficient management of pre-existing infrastructure (Šuklje Erjavec, Miklavčič, Rogelj, & Jerman, 2016).

The main challenges in LUR are defined as the underutilized potential of cycling and intramodality at a regional level, the inefficiency of public transportation and the need for its reorganization, traffic congestion during peak hours as a result of excessive car use in daily commuting, enormous loads of freight transport on populated areas and the absence of sustainable logistics in urban center, and uncoordinated and incoherent functioning of the

[5] 26 municipalities in central Slovenia with the main municipality of the City of Ljubljana.

[6] 2020 data is also available. Due to the COVID-19 pandemic, however, all data demonstrated a high deviation from previously reported numbers.

administration and sectors (as well as the lack of public participation) with the mission of regional level planning (Klemenčič, Lep, Mesarec, & Žnuderl, 2014).

With SUMPs measurements taken in the City of Ljubljana, firstly 2007 with "Vision Ljubljana 2025", adjusted in 2012 with "Sustainable Urban Mobility Plan of the City of Ljubljana," and upgraded in 2017, city officials anticipated the use of private cars of 55.0%, 26.0% of walking and biking, and 19.0% of bike use. For 2020, their vision was to decrease car use to 34.0%, increase biking and walking to 34.0%, and use public transportation to 33.0%. (City of Ljubljana, 2017)

As the latest measures have not been made on a scientific level recently, this master's thesis will focus on the current mobility habits of commuters to urban areas (mainly the City of Ljubljana) and try to anticipate possible solutions for the mentioned challenges with future mobility trends.

2 CONSUMER COMMUTING HABITS IN SLOVENIA

The second chapter includes the in-depth survey analysis (see Appendix 2) that focuses on researching current commuting trends in Slovenia and the likelihood of change in the future with mobility trends. The quantitative research of an online survey demonstrates insight into consumer commuting habits in Slovenia and further identifies the struggles and challenges to determine possible solutions for the future. Based on survey results, we additionally built on recognizing different clusters and how those clusters could be influenced in the future to shift the current mobility type.

The survey aims to determine the current consumer commuting habits in Slovenia – e.g. how individuals currently commute to work, the main drivers behind this decision, and what would motivate them to change. Aligned with previously explained future urban mobility trends, the purpose is to find the best strategies to change consumer commuting habits to achieve a sustainable environment and quality of life. Therefore, the analysis not only benefits commuters themselves but also companies in the urban areas, governments, and city inhabitants.

The consumer behavior analysis, together with the main drivers, motivators, pain points, and beliefs, consists of questions targeting their current mobility. It is later used to form different strategies to change current commuting habits in Slovenia to increase the quality of life in urban areas, to benefit everyday commuters, companies in urban areas, city inhabitants, and local authorities, and to help the environment.

The following research aims to answer four vital fundamental questions:

- RQ1: What are the current commuting habits in Slovenia?
- RQ2: What are the main drivers of a current commuting habit?

- RQ3: What future urban mobility trends are Slovenian commuters most likely to accept?
- RQ4: What solutions would best suit commuters, companies, and governments when changing consumer commuting habits in Slovenia?

Four key research questions are later discussed in the following chapters, the first three in the chapter 2.2 Survey results of consumer commuting habits in Slovenia, while the fourth research question is thoroughly analyzed in chapters 2.3 Suggestions for changing consumer commuting habits in Slovenia with future mobility trends and 2.4.1 Future mobility trends suggestions.

2.1 Methodology

The online survey was conducted in the Slovenian language by the Slovenian portal 1ka, with the survey title "Vsakodnevna vožnja na delo" (Eng. everyday commuting). The survey was open for three months, from November 9, 2021, to February 9, 2022. The survey consisted of 21 mandatory questions, and it took 6 min 33 sec on average to be completed.

The following analysis is based on a convenience sample where individual responses were gathered through various online channels (e.g. direct e-mail sharing, Facebook, and LinkedIn). The survey was mainly shared with a family member and friends that were also asked to share the survey with their contacts. Additionally, the online survey was shared within a mobility company AV Living Lab where employees also shared it with their contacts.

The representativity of the sample is further analyzed with the main demographics. For analyzing the difference between the convenience sample and general representative sample, we mainly compared the data on the location of living because this parameter is one of the most important ones (together with the location of work) for the following analysis of commuting from "where" to work.

The questionnaire can be divided into three separate subcategories – current commuting habits, possible implications in changing current commuting habits with future mobility trends, and demographics. Most questions were designed. Therefore, we could later form a quantitative analysis with mainly continuous variables and also included different variables with Likert-type scale (1 – 7 scale).

The questions were all backed by different scientific sources used from sources that already tried to determine some commuting trends in Slovenia, mainly from:

- Klemenčič, Lep, Mesarec, & Žnuderl, 2014,
- Plevnik, Mladenovič, Balant, Koblar, & Kukovec, 2019,
- Plevnik, Mladenovič, Balant & Ružič, 2012.

We gathered 525 responses where 242[7] were marked as invalid and 283 as valid. However, of 283 valid responses, 202 were finished fully while 81 were completed only partially. We decided only to use valid responses for the following analysis including both fully and partially finished (see chapter 2.2). For a more detailed analysis that includes a cluster analysis (see chapter 2.3), we also decided to use valid responses including fully and partially finished. As not all responses included defying parameters, however, the sample size was automatically reduced to 243.

To know more about our sample for further interpretation, the demographics of the sample are the following. We identified 38.0% of respondents as male and 62.0% as female of 187 respondents to the question about gender. Additionally, the average age of respondents (n = 187) is 33.3 years (σ = 9.3). With 187 valid answers, 0.5% of the respondents finished elementary school, 19.8% secondary school, 7.0% higher school/training programme, 42.2% undergraduate studies, 28.3% master's studied, and 2.1% Ph.D. studies.

Again, with 187 valid answers, we identified that 31.6% of the respondents live in a village (up to 3,000 inhabitants), 9.6% in a small town (between 3,000 and 5,000 inhabitants), 19.3% in a town (between 5,000 and 10,000 inhabitants) and 39.6% in a city (with more than 10,000 inhabitants). Comparing the sample to data of the entire Slovene population obtained from the Statistical Office of the Republic of Slovenia (SURS), we identify quite some differences. For example, a representative sample of the whole population should include 55.7% samples from a village (up to 3,000 inhabitants), 6.0% from a small town (between 3,000 and 5,000 inhabitants), 7.0% from a town (between 5,000 and 10,000 inhabitants) and 31.2% from cities (more than 10,000 inhabitants) (Razpotnik, 2020). Hence, we observe our sample size is too low for village and town inhabitants and too high for inhabitants of small towns and cities.

Last question regarding the average household monthly income included 0.5% of respondents with less than 400 EUR per month, 1.1% 400–800 EUR, 9.1% 800–1,200 EUR, 13.4%, 1,200–1,600, 15.0% 1,600–2,000 EUR, 9.1% 2,000–2,400 EUR, 14.4% 2,400–2,800 EUR, 12.3% 2,800–3,200 EUR, and 17.1% with more than 3,200 EUR per month. 8.0% of the respondents did not want to answer.

2.2 Survey results of consumer commuting habits in Slovenia

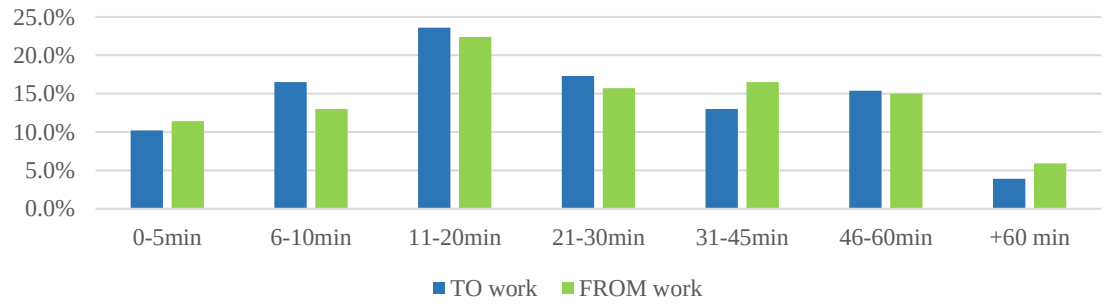
In the online survey, we initially analyzed the location of an individual's workplace. With a sample size of 254, we determined more than half – 56.7% – of our respondents work in a city (with more than 10,000 inhabitants) whereas 16.5% work in a village (up to 3,000 inhabitants), 10.2% in a small town (from 3,000 to 5,000 inhabitants), and 16.5% in a town (from 5,000 to 10,000 inhabitants).

[7] Click on a survey or survey introductory speech only.

We further observe most respondents – 24.8% – commute to work approx. 0 to 3 kilometers per day in one way. 20.1% commute 4 to 10 kilometers per day, 17.3% 11 to 20 kilometers, 22.4% 21 to 30 kilometers, and 15 – 4% more than 30 kilometers per day. The following questions touched on the time spent commuting to and from work.

As seen in Figure 2, we observe that most respondents commute 11 to 20 minutes to and from work. As for the shortest routes, commuting to work takes longer than from work. The longest commuting of more than 60 minutes takes longer from work than to work.

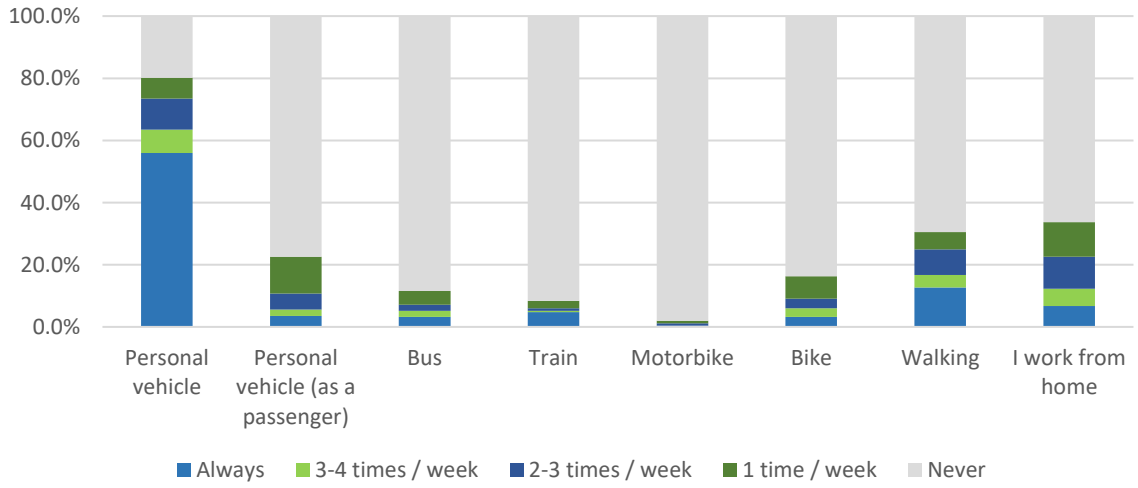
Figure 2: Time spent for commuting to and from work [in minutes]



Source: Own work

As observed in Figure 3, a thorough analysis of the first research question – RQ1 – focusing on current commuting habits in Slovenia finds that most respondents use a personal vehicle most frequently, with 56.0% of them using a personal vehicle every day. On the other hand, 19.8% of all respondents never use a personal vehicle.

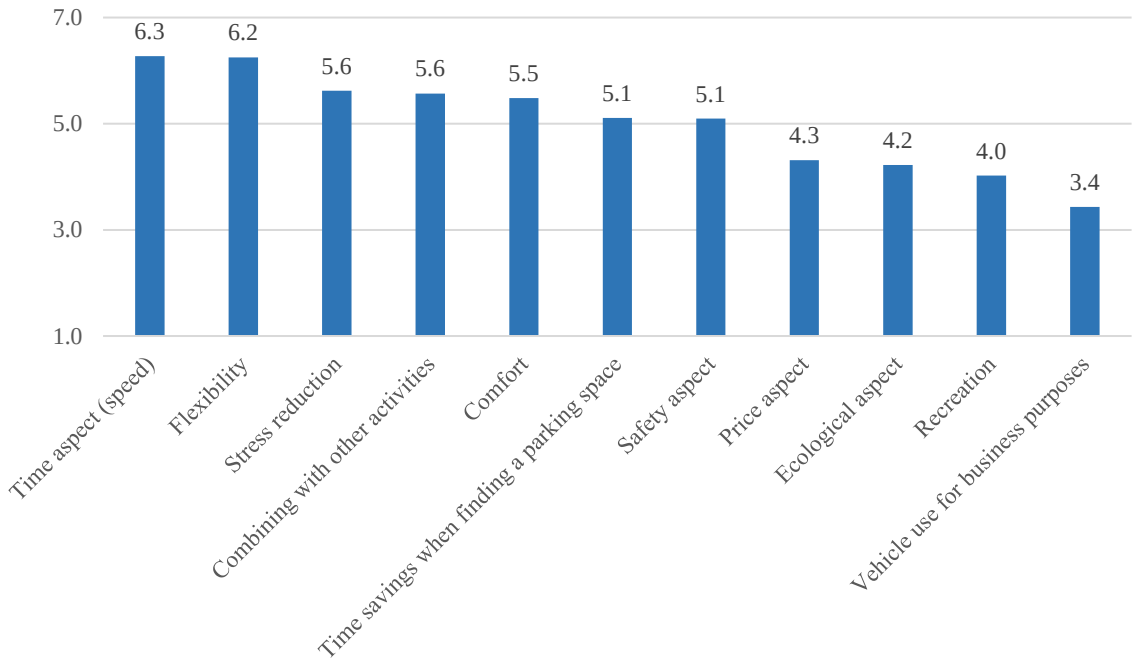
Figure 3: Selected mode of mobility of commuting by the use frequency



Source: Own work

When analyzing the second research question – RQ2 – of the main drivers for choosing the main commuting habit, we can observe in Figure 4 that the most crucial aspect is speed (6.3, σ = 1.4), followed by flexibility (6.2, σ = 1.2) and stress reduction (5.6, σ = 1.5). The least important reasons are the use of the vehicle for business purposes as well (3.4, σ = 2.2) and recreation (4.0, σ = 1.9).

Figure 4: The importance of parameters for choosing the main mean of mobility



Source: Own work

To analyze the second research question even more thoroughly (see Table 6), respondents who mostly use personal vehicles aspire for flexibility (6.4), time aspect (6.3) and combining the drive with other activities (5.8). On the other hand, the most negligible value is the use of the vehicle for business purposes (3.6) and recreation (3.8). For users of a personal vehicle as a passenger, the essential parameter is the time aspect (6.3), followed by comfort (5.9) and stress reduction (5.8). In contrast, the least important is the use of the vehicle for business purposes (3.5) and ecological aspects (4.0).

Respondents that most frequently use buses mainly value the time aspect (6.0), followed by flexibility (5.6) and price aspect (5.5). The most negligible value is the use of the vehicle for business purposes (3.1) and recreation (4.0). Like frequent bus users, the regular train users also value the time aspect (6.2) mainly. However, they are followed by times savings when finding a parking space (5.6), price aspect (5.5), and safety aspect (5.5). It is also the least important for them to use the vehicle for business purposes (2.3). Recreation (4.3) follows.

Frequent cyclist mostly value time aspect (6.0), followed by time savings when finding a parking space (5.9), flexibility (5.8), and recreation (5.8). They least value vehicle use for

business purposes (3.3) and comfort (4.5). Analyzing the answers from most frequent walkers, they mainly value the time aspect (6.0), flexibility (5.9), and stress reduction (5.7). Like frequent cyclists, they least value vehicles used for business purposes (3.3) and price (4.4).

Lastly, people who often work from home mainly value time aspects (6.6), flexibility (6.5), and comfort (5.8). For them, the least important parameters are the use of the vehicle for business purposes (2.8) and recreation (4.2). For more details see Table 6.

Table 6: Analysis of the importance of parameters for choosing the main mean of mobility by specific mean of mobility

	Personal vehicle	Personal vehicle (as a passenger)	Bus	Train	Bike	Walking	I work from home
Price aspect	4.0 σ = 2.1	4.2 σ = 2.5	**5.5** σ = 1.1	**5.5** σ = 1.6	4.6 σ = 2.1	4.4 σ = 1.9	4.6 σ = 2.0
Time aspect (speed)	6.3 σ = 1.4	6.3 σ = 1.0	6.0 σ = 1.3	6.2 σ = 1.7	6.0 σ = 1.5	6.0 σ = 1.3	**6.6** σ = 0.8
Ecological aspect	4.0 σ = 1.7	4.0 σ = 1.9	4.4 σ = 1.7	**5.4** σ = 1.9	5.2 σ = 1.6	5.0 σ = 1.5	4.3 σ = 1.6
Safety aspect	5.2 σ = 1.8	5.5 σ = 1.2	5.2 σ = 1.5	5.5 σ = 1.8	5.0 σ = 1.6	**5.6** σ = 1.6	5.3 σ = 1.3
Comfort	5.7 σ = 1.6	**5.9** σ = 1.3	4.8 σ = 1.3	5.3 σ = 1.7	4.5 σ = 1.6	5.3 σ = 1.5	5.8 σ = 1.4
Flexibility	**6.4** σ = 1.1	5.7 σ = 1.2	5.6 σ = 1.3	4.9 σ = 1.6	5.8 σ = 1.5	5.9 σ = 1.2	6.5 σ = 0.7
Stress reduction	5.7 σ = 1.5	**5.8** σ = 1.0	4.8 σ = 1.8	5.4 σ = 1.9	5.4 σ = 1.5	5.7 σ = 1.5	5.6 σ = 1.5
Time savings when finding a parking space	4.9 σ = 2.1	4.8 σ = 2.1	5.2 σ = 1.8	5.6 σ = 1.5	**5.9** σ = 1.5	5.4 σ = 1.7	5.0 σ = 1.9
Combining with other activities	**5.8** σ = 1.6	5.5 σ = 1.3	4.8 σ = 1.8	4.8 σ = 1.7	5.2 σ = 1.6	5.3 σ = 1.4	5.3 σ = 1.9
Recreation	3.8 σ = 1.9	4.8 σ = 1.6	4.0 σ = 1.9	4.3 σ = 1.7	**5.8** σ = 1.4	4.8 σ = 1.4	4.2 σ = 1.7
Vehicle use for business purposes	**3.6** σ = 2.3	3.5 σ = 2.3	3.1 σ = 1.4	2.3 σ = 1.9	3.3 σ = 2.6	3.3 σ = 2.0	2.8 σ = 1.9

Source: Own work

When further analyzing the reasoning behind why respondents do not choose a specific mean of mobility (see Table 7), we again identified different parameters that were rated on the

Likert-type scale. The main reasons for not selecting the option of ridesharing for drivers are the issue of organization and time management (5.1) and (in)flexibility (5.1), followed by not knowing anyone who rides on the same route (4.9). On the other hand, the least significant reason is problems with cost-sharing (2.9) and hygienic reasons (3.2).

When asking for an opposite side of ridesharing (i.e. as a passenger), the main reasons for not choosing these options are the same – starting with (in)flexibility (5.5), followed by organization and time management (5.2), and not knowing anyone who rides on the same route (4.9). The same parameters also rank the lowest – problems with cost-sharing (2.9) and hygienic reasons (3.2).

Table 7: Analysis of the importance of the main obstacles for not choosing ridesharing (as a driver or as a passenger) more often

	Ridesharing (as a driver)	Ridesharing (as a passenger)
(In)flexibility	**5.1** σ = 1.9	**5.5** σ = 1.8
Hygienic reasons	3.2 σ = 1.9	3.2 σ = 1.8
I prefer to drive alone	4.0 σ = 2.1	4.0 σ = 2.2
Problems with costs sharing	2.9 σ = 1.7	2.9 σ = 1.7
Organization and time management	**5.1** σ = 1.8	5.2 σ = 1.8
I use my vehicle for transporting family members	3.8 σ = 2.2	NA
I do not know anyone who rides on the same route	4.9 σ = 1.9	4.9 σ = 2.1
Safety concerns (e.g. in the event of an accident)	3.9 σ = 2.0	3.8 σ = 2.0

Source: Own work

The main reason why respondents do not choose public transportation more often (see Table 8) is the lack of suitable connections (6.0), followed by excessive time consumption (5.9) and (in)flexibility (5.8). Contrary, they find minor importance in not knowing the lines and timetables (3.0) and hygienic reasons (3.6).

Table 8: Analysis of the importance of the main obstacles to not choosing public transportation more often

	Public transportation
Inappropriate distance	5.1 σ = 2.1
Excessive time consumption	5.9 σ = 1.8
Lack of suitable connections	**6.0** σ = 1.7
Price too high	4.0 σ = 2.1
Low quality of service	4.5 σ = 1.9
(In)flexibility	5.8 σ = 1.7
Hygienic reasons	3.6 σ = 1.8
I do not know the lines and timetables	3.0 σ = 2.1

Source: Own work

Lastly, we analyzed the main reasons to not opt for cycling or walking to and from work (see Table 9) more often. The main reason for not using a bike more often is unpredictable weather (5.4), followed by inappropriate distance (5.3) and excessive time consumption (5.3). On the other hand, the least important reasons are a lack of route information (2.8) and not owning a bike (3.0).

Similar can be observed for not walking more, but in a different order with the main reasoning of excessive time consumption (5.9), followed by inappropriate distance (5.8) and unpredictable weather (4.5). The least important reasons are a lack of route information (2.4) and health reasons/physical form (2.9).

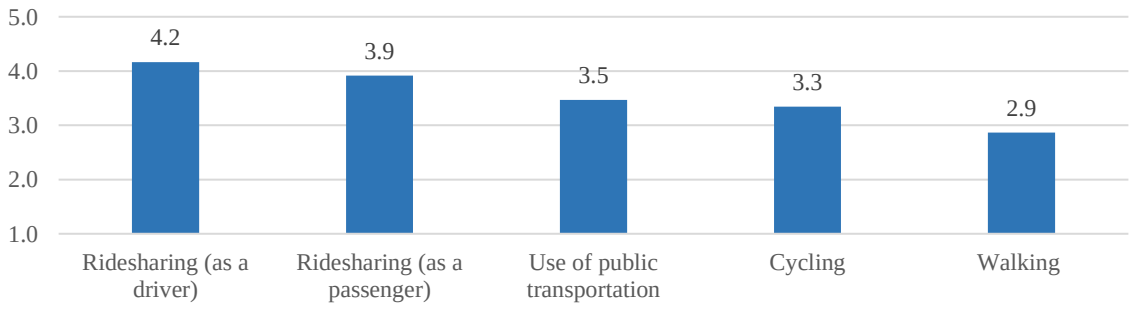
Table 9: Analysis of the importance of the main obstacles for not choosing cycling and walking more often

	Cycling	Walking
Inappropriate distance	5.3 σ = 2.2	5.8 σ = 1.9
Excessive time consumption	5.3 σ = 2.1	**5.9** σ = 1.9
Lack of adequate infrastructure	5.0 σ = 2.1	NA
Hygienic reasons (no possibility to shower/change clothes)	4.7 σ = 2.3	3.9 σ = 2.4
I do not have a bike	3.0 σ = 2.2	NA
I am worried about my bike being stolen	3.3 σ = 2.0	NA
Lack of route information	2.8 σ = 2.1	2.4 σ = 1.9
Unpredictable weather	**5.4** σ = 1.8	4.5 σ = 2.2
Health reasons/physical form	3.2 σ = 2.1	2.9 σ = 2.1

Source: Own work

After analyzing current commuting trends, we shifted our focus to try and determine the future mobility habits when commuting to and from work. In Figure 5, when asked what the likelihood is of choosing different types of mobility for commuting in the following years, the respondents are most likely to offer ridesharing as a driver (4.2, σ = 1.9), followed by ridesharing as a passenger (3.9, σ = 1.9), and the use of public transportation (3.5, σ = 2.1). In contrast, they are least likely to walk (2.9, σ = 2.3) or cycle (3.3, σ = 2.3) to work.

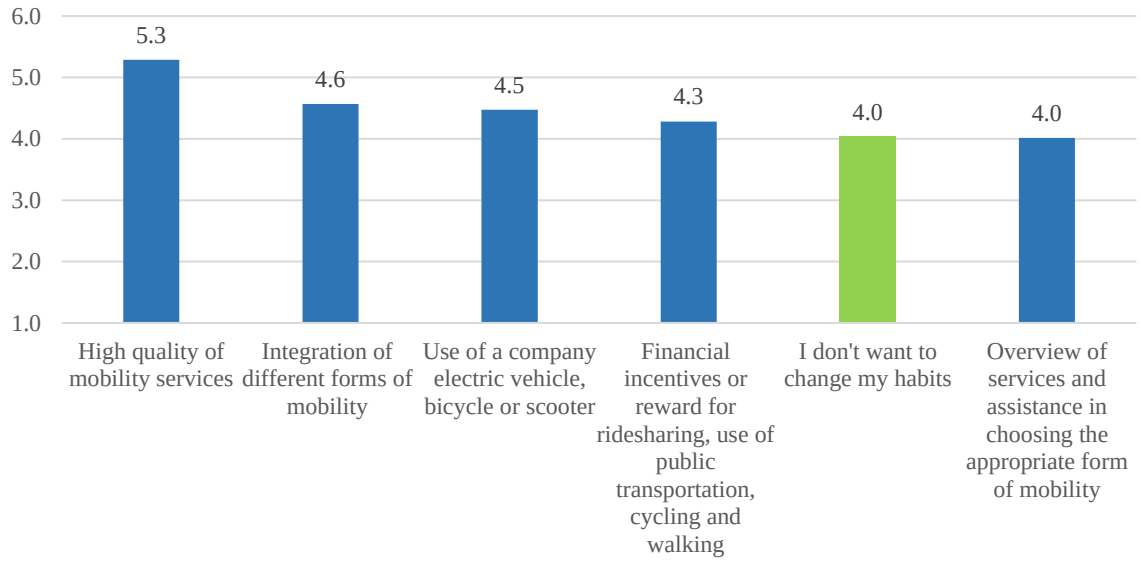
Figure 5: The likelihood of choosing different types of mobility the next years



Source: Own work

The primary motivator for a change in current commuting habits is a high quality of mobility services (5.3, σ = 1.9). A significant gap is followed by the integration of different forms of mobility (e.g. integration of public transportation using bicycles through one application (4.6, σ = 2.0) and the use of company electric vehicles, bikes, or scooters (4.5, σ = 2.3)). The most negligible impact of a change would be brought by an overview of services and assistance in choosing the appropriate form of mobility (4.0, σ = 1.9). Additionally, an average of 4.0 (σ = 2.1) people answered they do not want to change their habits. For more details see Figure 6.

Figure 6: Main motivators to change current commuting habits

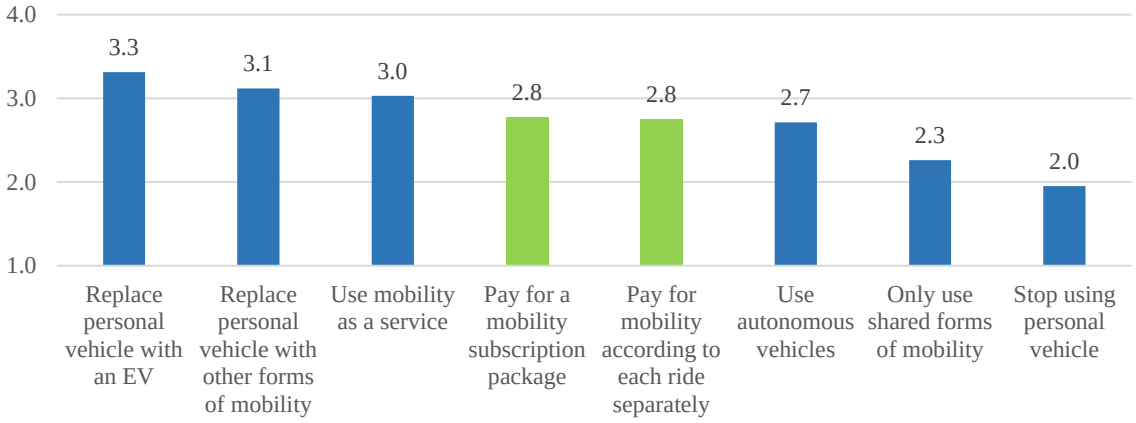


Source: Own work

The following analysis focused on the third research question – RQ3 – that examined what future mobility trends would be most likely accepted by the Slovenian commuters in the future. As observed in Figure 7, respondents demonstrate a low likelihood of changing the future commuting behavior to different given scenarios, as none of the schemes ranks higher than the Likert-type average of 4.0. However, they are most likely to change their current vehicle for an electric one, including hybrid or hydrogen (3.3, σ = 2.0). The second highest likelihood is observed in replacing their current personal vehicle with other forms of mobility, such as ridesharing, public transportation, cycling, and walking (3.1, σ = 1.9), which is followed by using mobility as a service, i.e., the integration of all types of mobility in one application (3.0, σ = 1.8). They find it least likely to stop using their vehicle (2.0, σ = 1.4) and only use shared forms of mobility (2.3, σ = 1.5).

When asked about the future business model of mobility, the respondents also answered hesitantly about both options, but with the same opposition for both paying with a mobility subscription package and paying according to each ride separately (2.8, σ = 1.7).

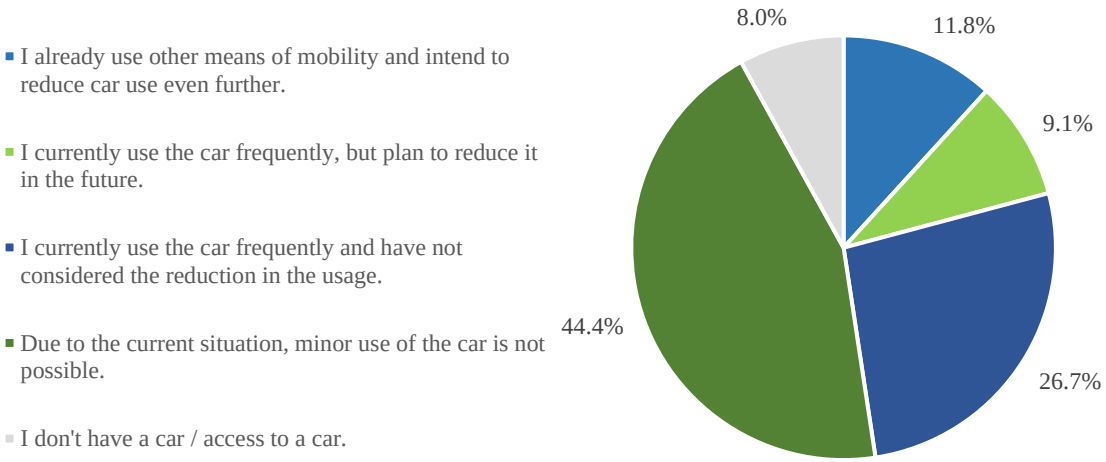
Figure 7: The likelihood of the following scenario in the five following years



Source: Own work

As initially observed, the respondents most often use personal vehicles to commute to and from work. Additionally, a high tendency not to change their current habits and not to switch from their existing car is observed. Hence, we further identified individuals' attitudes towards using a personal vehicle. In Figure 8, we see 44.4% cannot or will not use the vehicle less in the future due to their current situation. Also, 26.7% currently use the car frequently and have not considered reducing their use in the following years. Combined, the leaning against shifting away from private car ownership, in this case, the results in 71.1% of all respondents. On a positive note, 11.8% of respondents already use other mobility modes to commute to and from work and intend to reduce private vehicle use even further.

Figure 8: Attitude towards using a personal vehicle



Source: Own work

2.3 Suggestions for changing consumer commuting habits in Slovenia with future mobility trends

Of our survey sample, we developed a cluster analysis using SPSS to create different personas and prepare suggestions for changing consumer commuting habits in Slovenia with future mobility trends based on the results. The following analysis later combined with previously gained knowledge of secondary sources and primary analysis of the online survey contributed to analyzing the fourth (the last) research question – RQ4 – of what solutions would best suit commuters, companies, and governments when changing consumer commuting habits in Slovenia.

For the basis of the analysis, we decided to use the question Q7 – Rate the importance of the following parameters for choosing the MAIN mean of mobility (1 – not very important, 4 – neutral, 7 – very important). Of 11 variables in the question, we further decided to use the ones with the highest standard deviation, hence using the following parameters:

- a vehicle used for business purposes,
- price aspect,
- time savings when finding a parking space,
- recreation,
- safety aspect,
- combining with other activities, and
- ecological aspect.

The hierarchical cluster analysis first suggested that five would be an optimal number of clusters, which was later confirmed with K-mean analysis (non-hierarchical cluster analysis). See Appendix 3. The following Table 10 represents a summary of five clusters with the main characteristics.

Table 10: Analysis of five clusters

	Cluster 1 – Diversified (28.8%)	*Cluster 2 – Car lovers (27.2%)*	*Cluster 3 – Status quo (15.6%)*	*Cluster 4 - Opportunists (10.7%)*	*Cluster 5 – Opinionated alternative (17.7%)*
Gender	Female	Female, male	Female, male	Male	Female
Average age	33.1	33.0	32.4	35.5	33.8
Education	Undergraduate studies	Undergraduate studies	Highest school/training program, Master's studies	Elementary school, secondary school	Undergraduate studies, Ph.D. studies

(table continues)

(continued)

	Cluster 1 – Diversified (28.8%)	*Cluster 2 – Car lovers (27.2%)*	*Cluster 3 – Status quo (15.6%)*	*Cluster 4 - Opportunists (10.7%)*	*Cluster 5 – Opinionated alternative (17.7%)*
Average monthly income	2,080.0 EUR	2,471.1 EUR	2,124.1 EUR	2,285.7 EUR	1,740.7 EUR
Location of residence	City	City	Village	City	Village, small town
Work location	City	Small town	Village	City	Town
Km to work	11-20, 21-30	More than 30	21-30	4-10	0-3
Time to/from work	11-20 min, 46-60 min/same from work	6-10 min, 11-20 min /same from work	31-45 min, more than 60 min/31-45 from work	11-20 min/same from work + more than 60 min	0-5 min, 21-30 min/same from work
Mobility means frequency – personal vehicle	2-3 times per week personal vehicle	Everyday personal vehicle	3-4 times, 1 time per week personal vehicle	Highest everyday personal vehicle	The lowest use of personal vehicle
Attitude towards the personal vehicle	The highest not having a car	Due to the current situation, minor use is not possible	Highest current user, plan to reduce it/have not considered the reduction	Due to the current situation, minor use is not possible	The highest already using other means of mobility
Mobility means frequency – alternatives	• The highest everyday train • The highest everyday motorbike • The highest everyday bike • The highest work from home	• The highest everyday personal vehicle (as a passenger) • The lowest train • The highest everyday walking	• The lowest motorbike • The lowest walking	• The lowest use of a personal vehicle (as a passenger) • The lowest bus	• The lowest work from home

(table continues)

(continued)

	Cluster 1 – Diversified (28.8%)	*Cluster 2 – Car lovers (27.2%)*	*Cluster 3 – Status quo (15.6%)*	*Cluster 4 - Opportunists (10.7%)*	*Cluster 5 – Opinionated alternative (17.7%)*
Importance NOT RIDESHARING (as a driver)	(In)-flexibility	Organization and time management	• Organi-zation and time management • I do not know anyone who rides on the same route	(In)-flexibility	(In)-flexibility
Importance NOT RIDESHARING (as a passenger)	(In)flexibility	(In)flexibility	I do not know anyone who rides on the same route	(In)flexibility	(In)flexibility
Importance NOT PUBLIC TRANSPORT.	A lack of suitable connections	Excessive time consumption	(In)flexibility	Low quality of service	A lack of suitable connections
Importance NOT CYCLING	Unpredictable weather	Excessive time consumption, unpredictable weather	Excessive time consumption	Excessive time consumption, unpredictable weather	A lack of adequate infrastructure
Importance NOT WALKING	Excessive time consumption	Excessive time consumption	Excessive time consumption	Inappropriate distance	Excessive time consumption
Likelihood of choosing mobility types	Ridesharing (as a passenger), public transportation, cycling	Ridesharing (as a driver)	Ridesharing (as a passenger)	Ridesharing (as a driver), walking	Ridesharing (as a driver), ridesharing (as a passenger)
Likelihood of future mobility trends	Mobility as a Service	Electric vehicle	Electric vehicle	Electric vehicle	Vehicle replacement for other means of mobility
Motivators for change	High-quality mobility services	High-quality mobility services	Do not want to change habits	Financial incentives, do not want to change habits	High-quality mobility services

Source: Own work

Cluster 1 – Diversified (28.8%)

Cluster 1 could also be named "diversified". Of the analyzed parameters for cluster analysis, it ranks highest for the importance of timesaving when finding a parking space and combining the means of mobility with other activities. On the other hand, it ranks lowest on vehicle use for business purposes.

The primary demographics indicate a mainly female sample, with an average age slightly higher than the entire sample, but still in the middle when compared to the other four clusters. The highest percentage of the finished level of education was analyzed for undergraduate studies with an average monthly income of 2,080.00 EUR making it the second least wealthy cluster. Most respondents live in a city. In all those characterizing, cluster one does not represent any extreme, not maximum or minimum. However, the most significant difference compared to other clusters is that 72.9% of samples in this cluster work in a city, which is higher than the second-highest result by 19.1 percentage points. In cluster 1, the distance to work is 11 to 30 km, which usually takes from 11 to 20 or 46 to 60 minutes to commute to or from work.

As we already observed in the previous section, like all other clusters, the main mobility means is a personal vehicle where a car is used 2 to 3 times per week. On the other hand, of all clusters, they have the highest percentage (12.7%) of not having a car or access to a vehicle. However, cluster 1 also ranks highest with everyday train, motorbike, bike use, or the number of days working from home, hence making it the most diversified cluster with the most alternatives already used instead of a personal vehicle or a substitute.

When asked about the main reasons for not using specific means of travel, they mainly focus on (in)flexibility and similar issues that arise with other means of travel. For ridesharing (both as a driver or as a passenger), cluster 1 directly indicates (in)flexibility of the use. Cluster 1 also ranks highest compared to other clusters (tied with clusters 2, 4, and 5) for the parameter of not knowing anyone who rides on the same route. The main reason for not using public transportation more often is the lack of suitable connections. On the other hand, the main reason behind not cycling to work is unpredictable weather (tied with cluster 5). They additionally do not opt for walking due to excessive time consumption, which is highly connected to the average 11 to 30 kilometers route to work.

They are most likely to use public transportation in the following years where cluster 1 ranks highest compared to other clusters. Additionally, they are highly likely to use ridesharing services (as a passenger) or opt for cycling where they again rank the highest compared to other clusters. Additionally, they would most likely use mobility as a service solution (e.g. integration of all types of mobility on one application). The primary motivator to change their current mobility habits is the high quality of mobility services. However, they also rank (together with cluster 2) highest for not wanting to change the existing practices.

Due to significant diversification of mobility means, not currently having access to a personal vehicle, and willingness to change current mobility habits, cluster 1 represents a great potential to be targeted with future mobility trends. With suggestions focusing on enhancing the use of alternative means of mobility, together with mobility as a service and high quality of service in general, we propose different targeting options for this cluster that focus on mobility as a service and shared mobility. The detailed suggestions are discussed in the discussion section.

Cluster 2 – Car lovers (27.2%)

Cluster 2 could also be known as "car lovers". When observing the parameters used for cluster analysis, cluster 2 ranks high on the importance of the safety aspect. In contrast, it does not find significance in the price aspect of mobility services.

Cluster 2 has a similar share of both females and males. The average age of this sample size is 33.0 years which is the second-lowest average age and is below the average age of the entire sample. Most individuals finished with undergraduate studies. The average monthly income is 2,471.1 EUR, making it the wealthiest cluster of all five. Most representatives live in the city. However, it ranks highest for working in a small town. Additionally, compared to other clusters, they have the highest number of kilometers to work – more than 30 km. Surprisingly, they mainly spend 6 to 20 minutes to or from work.

They are everyday personal car users with the highest emphasis that they cannot opt for minor car use due to the current situation. Additionally, cluster 2 ranks the most elevated of all clusters for using a personal vehicle as a passenger where 6.1% use it daily while 15.2% use it once per week. Cluster 2 also ranks lowest in train use. However, they have the highest percentage every day and three to four times per week walking to work.

The main reason for not offering ridesharing services as a driver is organization and time management. They also rank highest compared to other clusters for preferring to drive alone and not knowing anyone who rides the same route (tied with clusters 1, 4, and 5). The main reasoning behind not using ridesharing as a passenger is (in)flexibility. However, they again rank highest at preferring to drive alone and not knowing anyone who rides on the same route. They do not use public transportation due to excessive time consumption and rank highest in the parameter of (in)flexibility (tied with cluster 5). Similarly, cluster 2 does not cycle or walk to work more often due to excessive time consumption and additionally ranks highest for the reasons behind not cycling to work for hygienic reasons (not having a possibility to shower or change clothes at work), a lack of route information and health reasons/physical form.

As they already demonstrate the highest use of ridesharing as a driver, it comes as no surprise they are most likely to continue offering this mobility alternative in the future. To change current mobility habits, they aspire for a high quality of mobility services. Tied with cluster 1, however, they demonstrate the highest resistance to change. Connected to ranking highest

at not wanting to change current mobility habits, they will still opt for using a personal vehicle in the following five years, but having an open mind to replacing it with an electric car.

In contrast to cluster 1, cluster 2 is delighted with its current mobility modes and will continue to use personal vehicles also in the future. Hence, the suggestion is a bit limited to minor changes in the use of the car. However, this does not mean that future mobility trends cannot support this slight shift for this cluster. Cluster 2 could be targeted with enhancement on offering ridesharing services and opt for an electric vehicle, hence still focusing on their cars with a modern mobility touch. The detailed suggestions are discussed in the discussion section.

Cluster 3 – Status quo (15.6%)

Cluster 3 could also be identified as "status quo". With the analyzed parameters for cluster analysis, they rank high on the importance of safety aspect and the lowest of parameters of importance on time savings when finding a parking space and combining current mobility mode with other activities and recreation.

Like cluster 2, cluster 3 also has a similar distribution of females and males. The average is 32.4 years, the lowest age in all clusters. On the other hand, they stand out with the highest percentage of the finished level of education being the highest school or training program and master's studies. Their average monthly income is 2,124.1 EUR, which puts this cluster in the middle of all clusters in the wealth category. Compared to other clusters, they significantly stand out (44.8%) with their location of residence being a village. Similarly, cluster 3 also ranks highest with the village being their work location. They have 21 to 30 kilometers to work, which usually takes 31 to 45 minutes or more than 60 minutes to work (highest compared to other clusters) and 31 to 45 from work.

They also mainly use personal vehicles for everyday commuting. It is the highest rank for three to four times per week use of a car and one time per week use of the car, leaving room for some other substitutes of a personal vehicle. Additionally, they rank highest with the frequent use of a vehicle but plan to reduce it in the future and with the frequency of use. However, they do not consider the reduction which creates a paradoxical situation. Cluster 3 does not rank highest in any alternative everyday use. However, they rank highest for three to four times bus use and one per week train use, cycling or walking. They also demonstrate the lowest use of a motorbike or walking of all clusters.

The main reasons for not using ridesharing as a driver are organization and time management and not knowing anyone who rides on the same route. Similarly, not knowing anyone who commutes on the same route is the main reason for not opting in for ridesharing as a passenger. The main reason for not using public transportation more often is (in)flexibility whereas they listed excessive time consumption for not cycling or walking to work. They demonstrate the highest importance compared to other clusters in none of the parameters.

Cluster 3 is mainly likely to use ridesharing services as a passenger in the future. However, they do not want to change their current mobility habits, with the lowest scores for most motivators. Still, they would most likely see themselves replacing their vehicle with an electric one in the following years.

Like cluster 2, cluster 3 is not very keen on changes, ranking lowest on most motivators for a change. Hence, the targeting is minimal, with only focus of all mobility trends shifting toward electrification of a personal vehicle. The detailed suggestions are discussed in the discussion section.

Cluster 4 – Opportunists (10.7%)

Cluster 4 could also be named "opportunists". On parameters used for cluster analysis, cluster 4 ranks high on the importance of combining the current mobility modes with other activities and using the vehicle for business purposes. On the other hand, they rank lowest on the importance of price, ecological, and safety aspects.

Cluster 4 is the only predominant male cluster. The average age of this cluster is 35.5 years, making it the oldest cluster. Additionally, cluster 4 has the lowest finished level of education with elementary school and secondary school. Their average monthly income is 2,285.7 EUR, hence making it the second wealthiest cluster of them all. Of all clusters, most people (50.0%) live in cities where most of them also work. They normally have 4 to 10 kilometers commuting to work, which takes 11 to 20 minutes to and from work. Interestingly, they also score highest on needing more than 60 minutes from work.

With 76.9%, this cluster dominates in everyday use of a personal vehicle, with 17.8 percentage points highest than the second-highest score for the daily use. Additionally, they rank highest in the variable of not being able to limit car use due to the current situation. Cluster 4 exceeds all clusters, never using the personal vehicle as a passenger and bus use. However, compared to other clusters, they have the highest score for everyday bus use with 3.8%, and the highest three to four times per week working from home.

The main reason behind not offering ridesharing services to others as a driver is (in)flexibility. Additionally, they also rank the highest compared to other clusters with organization and time management and not knowing anyone who rides on the same route (tied with clusters 1, 2, and 5). Similarly, the main reason for not using ridesharing as a passenger is (in)flexibility. Another maximum can again be observed in organization and time management. They feel most strongly about not using public transportation due to the low quality of service. The main reasons for not cycling to work are excessive time consumption and unpredictable weather whereas inappropriate distance is the main consequence why they do not walk to work more often.

Cluster 4 demonstrates the highest likelihood of using ridesharing as a passenger. However, they additionally rank highest with the walking alternative, which is suitable due to the

commuting length to work. They also believe the highest likelihood in the next five years' scenario is the replacement of the current vehicle for an electric one. The primary motivator for the change for this cluster would be financial incentives or rewards for ridesharing, using public transportation, cycling, and walking, or the use of electric vehicles, bicycles, or scooters. However, they also rank relatively high on not wanting to change current habits.

With the dominant current use of personal vehicles but with high interest in different motivators for a change, cluster 4 represents an excellent opportunity for targeting, especially from the company side. By offering various financial incentives or using a company electric vehicle or other mobility means, they would most likely be willing to change their current mobility habits. Therefore, suggestions for future mobility trends focus on electrification with a pinch of shared mobility and mobility as a service. The detailed suggestions are discussed in the discussion section.

Cluster 5 – Opinionated alternative (17.7%)

Another name for cluster 5 could also be "opinionated alternative". They rank high on most analyzed parameters of the cluster analysis with the only maximum not seen in the importance of vehicles used for business purposes.

With 83.3%, cluster 5 is highly dominated by the female population. The average age is 33.8 years, with the highest level of education combining maximums undergraduate and Ph.D. studies. On the other hand, compared to other clusters, they have the lowest average monthly income of 1,740.70 EUR. Most individuals live in a village or small town and work in towns. Compared to other clusters, they have the shortest length of zero to three kilometers to work. Hence it is not surprising they rank highest in needing zero to five minutes to and from work. They additionally rank highest on 21 to 30 minutes to and from work.

Of all clusters, most individuals in cluster 5 (32.6%) never use a personal vehicle to commute to work. Consequently, 20.0% of individuals already answered they already use other mobility means and intend to reduce car use even further in the future. They rank highest on using a bus one time a week, using a train two to three times a week, biking to work three to four or two to four times a week, and two to three times walking. However, they rank highest on never working from home.

Cluster 5 is highly opinionated, ranking high on most parameters. The main reason for not using ridesharing as a driver is (in)flexibility. However, they also rank highest compared to other clusters in hygienic reasons, problems with cost-sharing, using the vehicle for transporting family members, not knowing anyone who rides on the same route (tied with clusters 1, 2, and 4) and safety concerns. Similarly, the main reason for not using ridesharing services as a passenger is (in)flexibility with the highest ranking of hygienic reasons, problems with cost-sharing, and safety concerns. The lack of suitable connections is not opting more for public transportation. However, compared to other clusters, cluster 5 also gives the highest importance on inappropriate distance, excessive time consumption, too

high price, (in)flexibility (tied with cluster 2), hygienic reasons, and not knowing the lines and timetables. They do not cycle to work due to a lack of adequate infrastructure. Again, they rank highest in parameters of inappropriate distance, excessive time consumption, not having a bike, worrying about bikes being stolen, and unpredictable weather (tied with cluster 1). The main reason for not walking to work is excessive time consumption. However, they rank highest in all parameters compared to other clusters.

In the following years, they are most likely to opt for ridesharing, both as a driver and passenger, where they rank highest compared to other clusters. For the future, they demonstrate the highest optimism with the highest ranks in most parameters with the highest likelihood of replacing personal vehicles with other forms of mobility (e.g. ridesharing, public transportation, walking, and cycling) in the next five years. The primary motivator would be a high quality of service followed by ranking highest in all other parameters (excluding not wanting to change current habits).

Of all clusters, this one would be the easiest to persuade as they are already opting for alternative mobility modes. However, we should still be careful of their high preferences for different parameters guaranteeing high quality of service and other benefits that arise with those alternatives. Therefore, the focus would be on mobility as a service and shared mobility. The detailed suggestions are discussed in the discussion section.

2.4 Discussion on results

With a rapidly growing population and additional pressures in the future on urban areas, a different view on the area of mobility is needed. Instead of building new infrastructure and producing more and more personal vehicles, alternative trends are arising, offering substitutes for private vehicle ownership. The main trends mobility is currently facing are electrification of vehicles, autonomous driving and connected cars, shared mobility, and mobility as a service.

The pressure on current infrastructure and a need for consumer mobility habits can also be observed in Slovenia. With 37.7% (Van Acker, Goodwin, & Witlox, 2016) time driving spent commuting, driving to and from work represents one of the main aspects to be further analyzed and critically discussed. Together with data we gathered from secondary sources and data gathered from an online survey, we compare the results and further discuss the opportunities for changing the future of mobility with new trends, hence improving the livelihood of different stakeholders in Slovenia.

The proposed suggestions for a defined clusters present different solutions of future mobility trends follow the logic of sustainable urban mobility planning. Like SUMPs, the following discussion strategically tackles the efficiency of urban transport complexity, offers a brief introduction of the existing planning practices, and introduces proposed actions.

Based on previous analysis, 90.0% of all citizens in Slovenia commute to urban areas for job requirements, which represents a challenge to city infrastructure, quality of life, and sustainable policies (Ministry of the Environment and Spatial Planning RS, 2020). The online survey demonstrated a similar result with 16.5% working in a village, whereas the other 83.5% working in urban areas – 56.7% in cities, 10.2% in small towns, and 16.5% in towns. Secondary data also revealed that 60.0% of people spend 1 to 29 minutes working whereas the average commuting time is 23 minutes (Eurostat, 2020). The online survey confirms this finding with a slight discrepancy where 67.6% need from 0 to 30 minutes to commute to work and 62.5% from work. On the other hand, the average time to commute to work is 25.5 minutes whereas the average time to commute from work is 26.9 minutes making both results higher than the EU average of 25 minutes (Eurostat, 2020).

As observed in an online survey conducted for this master's thesis, the preferred way of commuting to and from work is a personal vehicle with 80.2% using the personal vehicle at least once per week and 56.0% using it daily. Secondary statistical data, however, suggests an even higher number of personal vehicle users with 86.4% of transportation done by personal car making it above the EU average of 83.3% (Eurostat, 2021b). The following data hence supported the research of the first research question – RQ1 – of what the current commuting habits in Slovenia are, with both primary and secondary data demonstrating a high preference for the use of a personal vehicle.

With the main essential parameters for choosing the main mean of mobility which are speed, flexibility, and stress reduction, the question of decreasing personal vehicle use arises urging us to understand future mobility trends better and propose them to commuters in the best suitable way. The following analysis answered the second research question of this master's thesis – RQ2 – with the main drivers of current commuting habits. To build further, we determine the highest likelihood to opt for different modes of mobility which are ridesharing (as a driver and as a passenger) and public transportation use. However, we also observed the LUR incentives for multimodal approaches focusing on qualitative walking and biking paths (Šuklje Erjavec, Miklavčič, Rogelj, & Jerman, 2016), most minor possible outcomes of increased walking, and cycling to work in our sample.

The proposed suggestions for specific clusters follow the analysis made for the total sample size that highlights the importance of motivators as high-quality mobility services integrating different forms of mobility and using electric alternatives. Additionally, when considering future mobility trends, the highest likelihood was observed, which indicated the replacement of a personal vehicle for an EV (e.g. electrification), replacement of the personal vehicle with other forms of mobility (e.g. shared mobility, mobility as a service), and direct use of mobility as a service. As already observed in the general analysis of the online survey, the trend of autonomous vehicles is still least likely to be accepted by our sample. This latest analysis hence answered the third research question – RQ3 – on what future urban mobility trends would be most likely accepted by Slovenian commuters.

2.4.1 Future mobility trends suggestions

Table 11 represents an overview of proposed suggestions for targeting each specific cluster focusing on finding the best possibility to change current mobility habits with future mobility trends, hence offering a more efficient and sustainable way of commuting. It presents an answer to the last research question – RQ4 – of what solutions would best suit different stakeholders (mainly individual users with later consideration of companies and governments as well) when changing consumer commuting habits in Slovenia.

Table 11: Suggestions of proposed future mobility trends for clusters based on survey results and secondary data analysis

	Cluster 1 – Diversified (28.8%)	*Cluster 2 – Car lovers (27.2%)*	*Cluster 3 – Status quo (15.6%)*	*Cluster 4 - Opportunists (10.7%)*	*Cluster 5 – Opinionated alternative (17.7%)*
Likelihood of choosing mobility types	Ridesharing (as a passenger), public transport., cycling	Ridesharing (as a driver)	Ridesharing (as a passenger)	Ridesharing (as a driver) and walking	Ridesharing (as a driver, as a passenger)
Likelihood of future mobility trends	Mobility as a Service	Electric vehicle	Electric vehicle	Electric vehicle	Vehicle replacement for other means of mobility
Motivators for change	High-quality mobility services	High-quality mobility services	Do not want to change habits	Financial incentives and not want to change habits	High-quality mobility services
Proposed future mobility trends	**Mobility as a service, shared mobility**	**E-mobility and shared mobility + autono-mous and connected vehicles in the future**	**E-mobility and shared mobility**	**E-mobility, shared mobility, and mobility as a service**	**Mobility as a service and shared mobility**

Source: Own work

Cluster 1 – Diversified (28.8%)

Cluster 1 is already the most diversified cluster of all five when it comes to using different modes of mobility and using substitutes for personal vehicles weekly. As they rank highest in the likelihood of using public transportation in the future, together with other mobility alternatives, such as ridesharing or cycling, we could target this specific cluster with future mobility trend of mobility as a service combining different modes of transportation into one integrated platform offering a multimodal experience of mobility for the end-users (Jittrapirom et al., 2017). It also tackles the challenge of high-quality mobility services by integrating all different alternatives, making the user experience more cost-efficient and highly satisfying (Utriainen & Pollanen, 2018).

Because of reasoning for not opting for alternative transportation use more often, they mainly specify various (in)flexibility aspects that cannot be directly targeted (e.g. lack of suitable connections for public transportation, unpredictable weather for cycling, and excessive time consumption for walking). What could be targeted, however, is the reasoning behind not using ridesharing services more often where they indicate the importance of not knowing anyone who rides on the same route. Additionally, as they are highly likely to use ridesharing services as a passenger in the future, the suggestions for cluster 1 also focus on shared mobility offering the users different types of shared services (e.g. carsharing, ridesharing, carpooling, etc.). With shared mobility, users are shown environmentally and socially friendly impacts (Shaheen & Cohen, 2018).

Cluster 2 – Car lovers (27.2%)

Cluster 2 is the keenest on everyday personal vehicle use with the lowest opportunity of changing this trend due to current situations. However, even though they also highly emphasize (in)flexibility for not opting for alternative modes of transportation more often, some parameters could also be addressed directly by future mobility trends.

As they are most likely to opt for ridesharing as a driver in the future and their main reason for not offering it more often is the organization and time management, together with not knowing anyone who rides on the same route, a shared mobility platform could be introduced combining all stakeholders (ridesharing drivers and passengers) in one platform, hence making the organization of the ride easier. A good example is Slovenia where prevozi.org offers a platform introducing the demand and supply side of the rides (prevozi.org, n.d.). Similar mobility as a service solution would offer cluster 2 a high-quality mobility service they aspire to have.

As cluster 2 is still delighted with their current mobile use and strives to continue using personal vehicles in the future, however, it comes as no surprise that the highest likelihood for a change based on future mobility trends is the electrification of their current automobile. Hence, cluster 2 could also be targeted to increase buying of electric vehicles, which could be done with different governmental (e.g. grants or subsidies for electric vehicle purchases)

or company (e.g. use of company electric vehicle also in the afternoon) incentives. As e-mobility highly affects carbon neutrality, it also tackles the challenge of air quality and the general quality of people living in the city. Electrification of vehicles for cluster 2 would also indicate the highest quality of mobility services in general (Glotz-Richter & Lange, 2020).

Additionally, even if they do not rank highest on the consideration of using connected and autonomous vehicles in the future, this would also be a suitable option for users because it combines their admiration of personal vehicle use with high-quality mobility service offering optimization of safety, energy consumption, and comfort aspects (Gruyer et al., 2017). As this trend is probably the most futuristic of them all, however, there is still a long way for it to be widely adopted by the public.

Cluster 3 – Status quo (15.6%)

Like cluster 2, cluster 3 prefers using a personal vehicle. However, it uses more alternative mobility means on specific days, such as public transportation, cycling, or walking. The main reasons for not using ridesharing as a driver and as a passenger are organization and time management and not knowing anyone who rides on the same route. Hence, we suggest a similar suggestion as already introduced before – an efficient shared mobility platform, combining drivers and passengers in an integrated application that effectively coordinates ride organization and time management.

However, cluster 3 also ranks highest on not wanting to change their current mobility habits and with very limited motivators for the change. As they rated the highest likelihood of using e-mobility in the future, we suggest replacing current vehicles with electric cars enabling carbon-neutral mobility (Scheffels & Stark, 2019).

Cluster 4 – Opportunists (10.7%)

Cluster 4 dominates extremely in everyday use of personal vehicles with an additional highest score of not being able to limit the current car use due to the current situation. When analyzing the results of not using mobility alternatives more often, most reasons revolve around (in)flexibility of use, except for high scores of issues with organization and time management and not knowing anyone who rides on the same route for ridesharing. Additionally, as they are most likely to choose ridesharing options as a driver, we suggest the future mobility trend of shared mobility be the best alternative for them.

As they also indicated a high likelihood of walking to and from work, we suggest the implication of mobility as a service where all mobility services are combined into one multimodal experience (Jittrapirom et al., 2017). Of all mobility trends in the future, however, they would still prefer to switch their current vehicle to electric vehicle making it possible to change their everyday habits with electrification.

Cluster 4 is the only cluster that could be influenced by financial incentives with all already mentioned future mobility trends potentially playing an important role. Examples of the use would be different financial incentives for the use of shared mobility and mobility as a service directly from the company (e.g. financing public transportation tickets or free use of the company's bikes, rewards for ridesharing to work, etc.) or from the government (e.g. unrestricted access for public transportation, tax reduction on various costs related to commuting, etc.). Another financial incentive could also be implemented in electrification with government subsidies or the company's free parking or free use of corporate electric vehicles.

Cluster 5 – Opinionated alternative (17.7%)

Cluster 5 stands out with no use of personal vehicles where 20.0% already use other means of mobility and intend to reduce car use even further. As they are highly opinionated and value many different parameters, the proposed suggestions focus on offering a high-quality mobility service.

They are most likely to offer ridesharing services as a driver and use them as a passenger in the future. As they ranked highest on parameters of (in)flexibility, hygienic reasons, problems with cost-sharing, operating a vehicle for transporting family members, not knowing anyone who rides on the same rate, and safety concerns compared to other clusters, the solutions of shared mobility should be of specific high quality focusing not only on joining demand and supply but also offering high user experience of the service (e.g. customer support, additional plugins for costs sharing, route organization, safety guarantees with insurance companies, etc.).

As they strive to replace the personal vehicle with other means of mobility in the future, we further suggest the future mobility trend as a service combining various mobility modes into a single integrated platform. Following various reasons for currently not using other mobility alternatives, we conclude that again the service of mobility as a service should be of high-quality offering not only a wide range of different services but enhanced user experience with integrated activities (e.g. price discounts for using various mobility modes, lines and timetables notifications, best route suggestions, best possibilities as to where is the safest to lock the bike, weather forecast, etc.). With the high emphasis on the quality of the service, cluster 5 is for sure the best candidate to opt for alternative mobility modes.

2.4.2 Contributions and practical implications

The main contribution of the master's thesis is a detailed overview of urban mobility in Slovenia through secondary data and a comprehensive primary analysis of an online survey that allowed us to compare the data and create further assumptions about current mobility commuting habits in Slovenia critically. The study of an online survey and preparation of cluster analysis combined with previously gained knowledge on future mobility trends

contributed to different suggestions for targeting various groups of individuals, hence changing their current commuting habits with more efficient and sustainable mobility alternatives.

Therefore, the contributions are mainly focused on a better understanding of an essential topic of current mobility habits in Slovenia that might help decision-makers (governmental authorities and companies) and individuals adapt their practices and opt for alternative mobility modes. Contributions can also be observed in the sense of practical implication through the eyes of different stakeholders.

Government authorities can consider the findings for a set of regulations and incentives imposition, such as tax reduction for electric vehicles, different grants, subsidies for using alternative modes of mobility, and so on. Additionally, it supports the decision-making process of what infrastructure or digitalization project is needed in the future (e.g. building a network of electric charging stations, integrated application for shared mobility, etc.).

Similarly, the practical implications for companies also support internal decision-making with a better understanding of where to shift the focus of changing future mobility habits. It helps companies decide on different incentives inside companies, from working from home to implementing various mobility alternatives (e.g. making it possible for employees to use electric company vehicles in the afternoon or on weekends for a specific cost, offering subsidized public transportation tickets, etc.).

Lastly, individuals may consider this master's thesis to understand mobility trends in the market better, their benefits, and the growing trends that might assure them some safety if they option of using a personal vehicle. Additionally, it lights a new perspective on time spent in traffic and offers various case studies of possible changes in future commuting habits.

2.4.3 Research limitations and directions for future research

The master's thesis should be read with some research limitations that mainly focus on the online survey. Firstly, we should consider the adaptation of the survey sample that is currently more of a convenience sample rather than a representative sample. Even though the diversification in sample size was of high importance, we should still consider that the study was performed on a convenience sample and that a completely random sampling with individuals from different regions in Slovenia and various backgrounds (age, finished education, available monthly income, having children or not, etc.) would be better suited to represent a thorough and detailed overview of current commuting habits in Slovenia. This would allow a more comprehensive cluster analysis with potentially more heterogeneous groups.

As already discussed in the previous chapter, we observe a high percentage of female answers (62.0%), which is not aligned with the demographics in Slovenia in general. As the location of living is one of the most important parameters for this analysis (together with the location of work), we could also observe that the percentage of people living in villages, small towns, towns, and cities varies between our sample size and general population in Slovenia. Hence, the direction for the following research should focus on following the logic of random sampling with a genuine distribution of the whole population.

The master's thesis still gives insight and an overview of current mobility commuting habits in Slovenia and offers a great comparison to previous sources already made in that field. However, the director for future research should focus on a broader sample reach with more diversified individuals, hence truly making this analysis country-based rather than convenience-based.

CONCLUSION

With rapid urbanization that will increase the pressure on urban areas from 56.0% of the world population living in cities in 2020 (Statista, 2020a) to 68.0% by 2050 (United Nations, 2018), the quality of living in urban areas is facing many challenges in the future. One of the critical challenges is urban mobility, which is thoroughly discussed in the master's thesis and represents different ways of moving around in the city areas (Rodrigue, 2020a).

As the current infrastructure cannot support the increasing trend of urbanization and with additional pressure with the yearly increase of private vehicle ownership, urban mobility faces a significant challenge that demands more sustainable strategies focusing on increased living quality in urban areas (Bouton, Mihov, Swarty, & Knaupfer, 2015). Hence, various future mobility trends are now emerging with the support of technological, environmental, and smart economy megatrends (Sirtori, Caputo, Colnot, Ardizzon, & Scalera, 2019). With the additional shift in consumer preferences for a shared economy and the consideration for the environment, new trends are now rapidly being supported by individuals, companies, and governments (Kuzia, 2018).

This master's thesis introduces four main urban mobility trends:

- E-mobility or electrification – using electric alternatives to mobility (Scheffels & Stark, 2019).
- Autonomous driving and connected vehicles – different stages of self-driving cars (Kirkland, 2019) and vehicle's ability to wireless connection to other nearby devices (Wade, 2020).
- Shared mobility – the shared use of any vehicle (Shaheen, Cohen, & Zohdy, Shared Mobility – Current Practices and Guiding Principles, 2016).

- Mobility as a service – integrating various mobility modes into one platform (Jittrapirom et al., 2017).

The above trends focus on providing a holistic approach for a sustainable, customer-oriented mobility solution that will benefit the environment and society (Moller, Padhi, Pinner, & Tschiesner, 2019).

With the rise of new mobility trends, a better understating of its successful implementation is needed. Hence, European Union introduced a Sustainable urban mobility planning (SUMPs) tool that offers different phases of strategic planning to satisfy the mobility need of various stakeholders (Oyofo, 2019). It focuses on reducing emissions in the air and considers a higher quality of life for people living in cities or commuting to urban areas, therefore increasing the liveability in the cities in general (Rupprecht Consult - Forschung & Beratung GmbH, 2019).

As Slovenia is a part of the European Union, it also follows the idea of sustainable urban mobility planning with an additional focus on tackling specific challenges it faces. Slovenia's challenge is less rapid urbanization (54.8% in 2019 (Plecher, 2020)). However, cities face enormous pressure with everyday commuting. In Slovenia, more than 90.0% of all employees commute to or from city areas creating a challenge for the infrastructure, quality of life, and sustainable policies (Ministry of the Environment and Spatial Planning RS, 2020).

Additional pressure is given with the high use of personal vehicles with 86.4% of individuals in 2018 using them daily (Eurostat, 2021b). The increased use of private cars represents a tremendous challenge for cities. The struggle can mainly be observed in the capital city of Ljubljana where 120,000 people commute to and from work every day (Regional Development Agency of the Ljubljana, 2018). The increased pressure on existing infrastructure prolongs every 30-minutes trip by 15 minutes in the morning and 18 minutes in the evening representing a loss of 33 minutes per day spent in traffic (TOMTOM, 2020).

Based on previously described challenges, we focused on analyzing current mobility trends in Slovenia. We tried to determine the best possible scenarios of future mobility trends that would enable a higher quality of living in urban areas. Hence, we prepared an online survey that focused on researching current commuting trends in Slovenia and prepared suggestions for commuting change in the future. The online survey answered four main research questions about current commuting habits in Slovenia, primary drivers of current commuting habits, the likelihood of acceptance of future mobility trends, and the suitability of solutions for commuters.

Our online survey determined that 83.5% of individuals work in urban areas (e.g. cities, towns, and small towns) and confirmed the previous findings that Slovenians indeed prefer private vehicles with 56.0% using them every day. The main reasons for opting for their

current mode of mobility are time aspect (speed) followed by flexibility and stress reduction. In the future years, Slovenian commuters are mainly likely to choose ridesharing options (both as a driver or passenger). The primary motivator to change their current mobility habits would be a high quality of mobility services followed by integrating different forms of mobility and company electric vehicles, bicycles, or scooters.

When further analyzing the likelihood of adapting future mobility trends in the next five years, they are most likely to replace their vehicle with an electric one followed by replacing personal vehicles with other forms of mobility or mobility as a service. However, almost half answered that minor use of the car is not possible due to the current situation.

The master's thesis later focused on providing suggestions for changing consumer commuting habits in Slovenia with future mobility trends for different groups (clusters). Five clusters are introduced – Diversified, Car lovers, Status quo, Opportunists, and Opinionated alternative, each given a specific suggestion based on the detailed analysis.

For cluster 1 (Diversified), we suggested future mobility trends as a service. We shared mobility as they strive for a high quality of mobility services and are most likely to opt for ridesharing (as a passenger), public transportation, and cycling. As the name "Car lovers" already suggests for cluster 2, they strongly prefer the use of the privately-owned car and would only choose the option of ridesharing as a driver in the future. Hence, we suggest the shift of their current vehicle to an electric one and propose a bold idea for the use of the autonomous and connected car in the further future. For cluster 3 (Status quo), we also suggest e-mobility and add the proposition of shared mobility because they would opt for ridesharing as passengers. Cluster 4 (Opportunists) is the only cluster motivated by financial incentives. Hence, we propose the idea of e-mobility, shared mobility, and mobility as a service where financial incentives are possible to be integrated with the solutions. Last, cluster 5 (Opinionated alternative) already used the most alternative modes of mobility, proposed mobility as a service, and shared mobility.

The mentioned suggestions may benefit individuals and other stakeholders, such as companies and governments. With a comprehensive analysis, readers can now understand urban mobility and possible implications for changing current commuting habits in Slovenia with future mobility trends making the commute more efficient and sustainable.

The master's thesis concludes with a positive thought that a detailed overview of urban mobility was introduced focusing on current commuting habits in Slovenia and how those could be changed in the future with new mobility trends. As many companies and governmental authorities are already trying to change urban mobility to a more sustainable and environmentally friendly society that benefits, this document presents an initial thought of what could be the possible implications for the future.

REFERENCE LIST

1. Alexiou, G. (2021, May 23). *'Mobility As A Service' Concept Promises To Revolutionize Transport Accessibility.* Retrieved May 5, 2022 from https://www.forbes.com/sites/gusalexiou/2021/05/23/mobility-as-a-service-concept-promises-to-revolutionize-transport-accessibility/?sh=ad9e81a7fe6c
2. American Public Transportation Association. (n.d.). *Mobility Action Plans.* Retrieved May 5, 2022 from https://www.apta.com/research-technical-resources/mobility-innovation-hub/mobility-action-plans/
3. Bachmann, F., Hanimann, A., Artho, J., & Jonas, K. (2018). *What drives people to carpool? Explaining carpooling intention from the perspectives of carpooling passengers and drivers. Transportation Research Part F: Traffic Psychology and Behaviour, 59*(Part A), 260–268.
4. Bouton, S., Hannon, E., Knaupfer, S., & Ramkumar, S. (2017, June 20). *The future(s) of mobility: How cities can benefit.* Retrieved May 5, 2022 from https://www.mckinsey.com/business-functions/sustainability/our-insights/the-futures-of-mobility-how-cities-can-benefit
5. Bouton, S., Mihov, I., Swarty, S., & Knaupfer, S. (2015, September). *Urban mobility at a tipping point.* Retrieved May 5, 2022 from http://worldmobilityleadershipforum.com/wp-content/uploads/2016/04/urban_mobility_at_tipping_point_final.pdf
6. Brown, A. E. (2018). *Ridehail Revolution: Ridehail Travel and Equity in Los Angeles.* UCLA Electronic Theses and Dissertations. Retrieved May 5, 2022 from https://www.ucits.org/research-project/2017-14/
7. Bubenzer-Paim, A. (2020, May 18). *The Future Of Urban Mobility.* Retrieved May 5, 2022 from https://www.forbes.com/sites/forbestechcouncil/2020/05/18/the-future-of-urban-mobility/?sh=1e0b3293362b
8. Ceder, A. (2020). *Urban mobility and public transport: future perspectives and review. International Journal of Urban Sciences, 25*(2), 1-25.
9. Choksey, J. S., & Wardlaw, C. (2021, May 5). *Levels of Autonomous Driving, Explained.* Retrieved May 5, 2022 from https://www.jdpower.com/cars/shopping-guides/levels-of-autonomous-driving-explained
10. City of Ljubljana. (2017). *Celostna prometna strategija.* Retrieved May 5, 2022 from https://www.ljubljana.si/sl/moja-ljubljana/promet-in-mobilnost/celostna-prometna-strategija/
11. Clewlow, R., & Mishra, G. (2017). *Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States.* Institute of Transportation Studies, University of California: Davis.
12. Dargay, J., Gately, D., & Sommer, M. (2007). Vehicle Ownership and Income Growth, Worldwide: 1960-2030. *The Energy Journal, 8*(4), 143-170.
13. Dean, B. (2021, March 23). *Uber Statistics 2021: How Many People Ride with Uber?* Retrieved May 5, 2022 from https://backlinko.com/uber-users

14. Dobravsky, L. (2019, October 10). *The New Transportation Leaderboard.* Retrieved May 5, 2022 from https://tnmt.com/new-transportation-leaderboard/
15. Ellen MacArthur Foundation. (2015). *Growth within: A circular economy vision for a competitive Europe.* Ellen MacArthur Foundation: Deutsche Post Foundation, McKinsey Center for Business and Environment.
16. European Commission. (2015). *EU cities on the move.* Retrieved May 5, 2022 from https://ec.europa.eu/eurostat/documents/10186/8230403/Mobility_EU_capitals.pdf
17. European Commission. (n.d.). Sustainable Urban Mobility Plans (SUMPs) and Cycling. Retrieved May 5, 2022 from https://ec.europa.eu/transport/themes/urban/guidance-cycling-projects-eu/policy-development-and-evaluation-tools/sumps-and-cycling_en
18. Eurostat. (2020, October 21). *Majority commuted less than 30 minutes in 2019.* Retrieved May 5, 2022 from https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20201021-2
19. Eurostat. (2021a, February). *Passenger mobility statistics.* Retrieved May 5, 2022 from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Passenger_mobility_statistics#Mobility_data_for_12_Member_States_with_different_characteristics
20. Eurostat. (2021b, Februar 8). *Modal split of passenger transport.* Retrieved May 5, 2022 from https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do
21. Eurostat. (2021c, April 22). *Passenger cars per 1 000 inhabitants.* Retrieved May 5, 2022 from https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do
22. Federal Ministry for Economic Cooperation and Development (BMZ), D. f., & Germany, M.F. (2016). *Urban Mobility - Strategies for Liveable Cities.* Berlin: BMZ.
23. Ferrero, F., Perboli, G., Rosano, M., & Vesco, A. (2018). *Car-sharing services: An annotated review. Sustainable Cities and Society, 37,* 501-518.
24. FutureBridge. (2020, April 3). *Shared Mobility–Changing the Landscape of Automotive Industry.* Retrieved May 5, 2022 from //www.futurebridge.com/industry/perspectives-mobility/shared-mobility-changing-the-landscape-of-automotive-industry/
25. Glotz-Richter, M., & Lange, B. (2020). *Electric mobility in Sustainable Urban Mobility Planning (SUMP).* Green Charge 2020: Civitas, European Union.
26. Goodall, W., Dovey, T., Bornstein, J., & Bonthron, B. (2017). *The rise of mobility as a service. Deloitte Review, 20,* 1-20.
27. Grosse-Ophoff, A., Hausler, S., Heineke, K., & Moller, T. (2017, April 18). *How shared mobility will change the automotive industry.* Retrieved May 5, 2022 from https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/how-shared-mobility-will-change-the-automotive-industry
28. Gruyer, D., Magnier, V., Hamdi, K., Claussmann, L., Orfila, O., & Rakotonirainy, A. (2017). *Perception, information processing and modeling: Critical stages for autonomous driving applications. Annual Reviews in Control, 44* (Sup C), 323-341.

29. Halytska, M. (2019, September 18). *7 Best Mobility As A Service Startups that will make you join the market right away.* Retrieved May 5, 2022 from https://stfalcon.com/en/blog/post/mobility-as-a-service-startups
30. Hoornweg, D., & Pope, K. (2014). *Socioeconomic Pathways and Regional.* University of Toronto: Global Cities Institute.
31. Jittrapirom, P., Caiati, V., Feneri, A.-M., Ebrahimigharehbaghi, S., Alonso-Gonzalez, M., & Narayan, J. (2017). *Mobility as a Service: A Critical Review of Definitions, Assessments of Schemes, and Key Challenges. Urban Planning, 2*(2), 13-25.
32. Kirkland, G. (2019, July 26). *What are the Levels of Autonomy for Self-Driving Vehicles?* Retrieved May 5, 2022 from https://www.roboticsbusinessreview.com/unmanned/unmanned-ground/what-are-the-levels-of-autonomy-for-self-driving-vehicles/
33. Kiser, J., Chiu, J., & Otto, P. (2018, July). *The Future of Mobility - Electrification.* Retrieved May 5, 2022 from https://www.ipsos.com/sites/default/files/ct/publication/documents/2018-07/The_Future_of_Mobility-Electrification-2018.pdf
34. Klemenčič, M., Lep, M., Mesarec, B., & Žnuderl, B. (2014). *Potovalne navade prebivalcev v Mestni občini Ljubljana in Ljubljanski urbani regiji.* Ljubljana: Mestna občina Ljubljana.
35. Kuzia, M. (2018). *New urban mobility model in sharing economy context.* Opatija: Conference: Interdisciplinary management research XIV.
36. Lang, N., Herrmann, A., Hagenmaier, M., & Richter, M. (2020, July 8). *Can Self-Driving Cars Stop the Urban Mobility Meltdown?* Retrieved May 5, 2022 from https://www.bcg.com/publications/2020/how-autonomous-vehicles-can-benefit-urban-mobility
37. LEMO - Learning E-Mobility. (2016, May). *Electric mobility case study for Slovenia.* Retrieved May 5, 2022 from https://www.lemo-project.eu/wp-content/uploads/2016/05/Electric-mobility-case-study-for-Slovenia.pdf
38. Marr, B. (2016, October 21). *The Sharing Economy - What It Is, Examples, And How Big Data, Platforms And Algorithms Fuel It.* Retrieved May 5, 2022 from https://www.forbes.com/sites/bernardmarr/2016/10/21/the-sharing-economy-what-it-is-examples-and-how-big-data-platforms-and-algorithms-fuel/?sh=705929837c5a
39. Mayaud, J., Ward, F., & Andrews, J. (2021). *Microtransit Has the Potential to Flip Transit on Its Head. Transportation Research Record: Journal of the Transportation Research Board, 2675*(11), 77-88.
40. Ministry of the Environment and Spatial Planning RS. (2020, May 7). *Mesta in urbana območja v Sloveniji.* Retrieved May 5, 2022 from //www.gov.si/teme/mesta-in-urbana-obmocja-v-sloveniji/
41. Moller, T., Padhi, A., Pinner, D., & Tschiesner, A. (2019, December 19). *The future of mobility is at our doorstep.* Retrieved May 5, 2022 from

https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-future-of-mobility-is-at-our-doorstep#
42. Moovel. (n.d.). *We Help Transit Agencies Acquire, Retain and Delight Riders.* Retrieved May 5, 2022 from https://www.moovelus.com/
43. Oliver Wyman. (2021, November 1). *Stockholm tops 2021 urban mobility readiness index with significant investment in electric vehicles and public transit infrastructure.* Retrieved May 5, 2022 from https://www.oliverwyman.com/media-center/2021/nov/stockholm-tops-2021-urban-mobility-readiness-index-with-significant-investment-in-electric-vehicles-and-public-transit-infrastructure.html
44. Oliver Wyman Forum. (2020). *The Urban Mobility Readiness*. Retrieved May 5, 2022 from https://www.oliverwyman.fr/content/dam/oliver-wyman/europe/france/fr/Publications/20200930%20Index%202020%20Summary.pdf
45. Oyofo, A. (2019, November 28). *What is a Sustainable Urban Mobility Plan?* Retrieved May 5, 2022 from https://www.eltis.org/mobility-plans/11-what-sustainable-urban-mobility-plan#:~:text=1%20Policy%20context.%20Sustainable%20Urban%20Mobility%20Planning%20is,better%20quality%20of%20...%203%20Eight%20principles.%20
46. Plecher, H. (2020, November 3). *Slovenia: Urbanization from 2009 to 2019.* Retrieved May 5, 2022 from https://www.statista.com/statistics/455925/urbanization-in-slovenia/
47. Plevnik, A., Mladenovič, L., Balant, M., & Ružič, L. (2012). *Mobilnostni načrt Ekonomske Fakulete.* Ljubljana: Republika Slovenija, Ministrstvo za promet.
48. Plevnik, A., Mladenovič, L., Balant, M., Koblar, S., & Kukovec, M. (2019). *Uvrstite mobilnost med strateške priložnosti - Nacionalne smernice za pripravo Mobilnostnih načrtov za ustanove.* Ljubljana: Republika Slovenija, Ministrstvo za infrastrukturo.
49. Porter, J. (2020, May 27). *Zipline's drones are delivering medical supplies and PPE in North Carolina.* Retrieved May 5, 2022 from https://www.theverge.com/2020/5/27/21270351/zipline-drones-novant-health-medical-center-hospital-supplies-ppe
50. prevozi.org. (n.d.). *prevozi.org.* Retrieved May 5, 2022 from https://prevoz.org/
51. Razpotnik, B. (2020, January 1). *On 1 January 2020, 2,095,861 residents of Slovenia lived in 5,978 settlements; 57 settlements were unpopulated.* Retrieved May 5, 2022 from https://www.stat.si/StatWeb/en/News/Index/8857
52. Regional Development Agency of the Ljubljana. (2018). *Sustainable urban mobility plan of ljubljana urban region.* Ljubljana: Regional Development Agency of the Ljubljana.
53. Rodrigue, J.-P. (2020a). *The Geography of Transport Systems.* New York: Routledge.
54. Rodrigue, J.-P. (2020b). *Urban Transportation.* New York: Routledge.

55. Rupprecht Consult - Forschung & Beratung GmbH. (2019). *Guidelines for Developing and Implementing Sustainable Urban Mobility Plan - Second Edition.* Cologne: European Comission.
56. Scheffels, G., & Stark, A. (2019, March 28). *Electromobility: Definition, Vehicles and Future.* Retrieved May 5, 2022 from https://www.spotlightmetal.com/electromobility-definition-vehicles-and-future-a-810482/?cmp=go-ta-art-trf-SLM_Allg_DSA-20201118&gclid=Cj0KCQiA0rSABhDlARIsAJtjfCdiK6obpRMIpP_RrQWuzmvkwv1iaLUUOK5VJGyP22bV72irC2yeu-QaAqMmEALw_wcB
57. Segal, E. (2020, April 2). *Why Mobility as a Service Is the Future of Transportation.* Retrieved May 5, 2022 from https://developer.ibm.com/recipes/tutorials/why-mobility-as-a-service-is-the-future-of-transportation/#r_step3
58. Shaheen, S., & Cohen, A. (2018). *Impacts of Shared Mobility.* University of California, Berkeley: ITS Berkeley Policy Briefs.
59. Shaheen, S., Cohen, A., & Zohdy, I. (2016). *Shared Mobility - Current Practices and Guiding Principles.* Washington: U.S. Department of Transportation - Federal Highway Administration.
60. Sirtori, E., Caputo, A., Colnot, L., Ardizzon, F., & Scalera, D. (2019). *European Cluster and Industrial Transformation Trends Report, European Observatory for Clusters and Industrial Change.* Luxemburg: European Commision.
61. Statista. (2020a, July). *Degree of urbanization (percentage of urban population in total population) by continent in 2020.* Retrieved May 5, 2022 from https://www.statista.com/statistics/270860/urbanization-by-continent/
62. Statista. (2020b). *Leading cities in the Urban Mobility Readiness Index 2020.* Retrieved May 5, 2022 from https://www.statista.com/statistics/1181805/leading-urban-mobility-readiness-cities/
63. Statista. (2021, April). *Global shared mobility market size forecast from 2021 to 2028, by region.* Retrieved May 5, 2022 from https://www.statista.com/statistics/1229470/shared-mobility-market-size-worldwide-by-region/
64. Statistični Urad RS. (2011). *Prostorske tipologije – Razmejitev mestnih in podeželskih območij*. Ljubljana: Statistični Urad RS.
65. Šuklje Erjavec, I., Miklavčič, T., Rogelj, A., & Jerman, Z. (2016, september). *Nacionalno poročilo o urbanem razvoju - habitat ii.* Retrieved May 5, 2022 from https://www.gov.si/assets/ministrstva/MOP/Publikacije/c2b947f73c/porocilo_urbani_razvoj_HabitatIII.pdf
66. TOMTOM. (2019). *Traffic Index 2019.* Retrieved May 5, 2022 from https://www.tomtom.com/en_gb/traffic-index/ranking/
67. TOMTOM. (2020). *Ljubljana traffic.* Retrieved May 5, 2022 from https://www.tomtom.com/en_gb/traffic-index/ljubljana-traffic/
68. Twisse, F. (2019, March 19). *Stockholm: Achieving sustainable mobility using urban vehicle access regulations.* Retrieved May 5, 2022 from

https://www.eltis.org/discover/case-studies/stockholm-achieving-sustainable-mobility-using-urban-vehicle-access
69. United Nations. (2018, May). *68% of the world population projected to live in urban areas by 2050, says UN*. Retrieved May 5, 2022 from https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html
70. United Nations. (2020, September). *Report of the UN Economist Network for the UN 75th Anniversary - Shaping the Trends of Our Time.* n.d.: United nations.
71. University of Oregon. (2020). *Microtransit.* Retrieved May 5, 2022 from //www.urbanismnext.org/technologies/microtransit
72. Utriainen, R., & Pollanen, M. (2018). *Review on mobility as a service in scientific publications. Research in Transportation Business & Management, 27*(0), 15-23.
73. Van Acker, V., Goodwin, P., & Witlox, F. (2016). *Key research themes on travel behavior, lifestyle. International Journal of Sustainable Transportation, 10*(1), 25-32.
74. Wade, N. (2020, June 17). *What Is Connected Vehicle Technology and What Are the Use Cases?* Retrieved May 5, 2022 from https://www.digi.com/blog/post/what-is-connected-vehicle-technology-and-use-cases
75. Wefering, F., Rupprecht, S., Bührmann, S., & Böhler-Baedeker, S. (2014). *Guidelines: Developing and Implementing a Sustainable Urban Mobility Plan.* Brussels: European Platform on Sustainable Urban Mobility Plans.
76. Whipact. (2019). *WHIMPACT - Insights from the world's first Mobility-as-a-Service (MaaS) system.* Helsinki: Whimpact.
77. World Health Organization. (2014, March 25). *7 million premature deaths annually linked to air pollution.* Retrieved May 5, 2022 from https://www.who.int/mediacentre/news/releases/2014/air-pollution/en/
78. Zha, L., Yin, Y., & Yang, H. (2016). *Economic analysis of ride-sourcing markets. Transportation Research Part C: Emerging Technologies, 71*, 249-266.
79. Zipcar. (2021). *Zipcar overview.* Retrieved May 5, 2022 from https://www.zipcar.com/press/overview

APPENDICES

Appendix 1: Executive Summary / Povzetek

Magistrsko delo »Spreminjanje navad vsakodnevne vožnje na delo v Sloveniji z urbanimi mobilnostnimi trendi« se osredotoča na temo urbane mobilnosti. Na začetku obravnava globalni izziv hitre globalizacije, ki povzroča velik pritisk na obstoječo infrastrukturo. Ker trenutni načini mobilnosti ne ponujajo trajnostne rešitve za reševanje tega izziva, se uvajajo novi trendi. Zato v naslednjem delu magistrske naloge predstavimo trende urbane mobilnosti: e-mobilnost, avtonomna vožnja in povezana vozila, deljena mobilnost in mobilnost kot storitev, čemur sledi podroben pregled učinkovitega načrtovanja in implementacije urbane mobilnosti. Magistrsko delo se konča s temeljito analizo spletne ankete, ki prikazuje trenutne navade vsakodnevne vožnje na delo v Sloveniji in obravnava izziv spreminjanja teh navad z novimi urbanimi trendi mobilnosti.

V nadaljevanju je predstavljen kratek uvod v tri glavne stebre magistrskega dela – urbana mobilnost, urbani mobilnostni trendi in načrtovanje urbane mobilnosti.

Urbana mobilnost predstavlja različne načine premikanja po mestnih območjih, ki se delijo na kolektivni (npr. javni prevoz), individualni in tovorni promet. Pomen urbane mobilnosti skozi leta zaradi kompleksnosti, hitrega razvoja in naraščajočega števila mestnega prebivalstva narašča. (Rodrigue, The Geography of Transport Systems, 2020). Leta 2020 bo 56.0 % od vseh 7,8 milijarde svetovnega prebivalstva živelo v urbanih območjih (Statista, 2020). Na podlagi ocen Združenih Narodov naj bi se ta odstotek do leta 2050 povečal na 68.0 % od 9,8 milijarde posameznikov (ZN, 2018). Ta naraščajoči izziv urbanizacije bo zato prinesel nove grožnje in priložnosti za mobilnost v mestih. To velja tudi za Slovenijo, kjer približno 50 % državljanov živi v urbanih območjih, več kot 90 % vseh državljanov pa se vozi na delo v mesta, kar predstavlja izziv za mestno infrastrukturo, kakovost življenja in trajnostno politiko. (Šuklje Erjavec, Miklavčič, Rogelj in Jerman, 2016)

Urbani mobilnostni trendi, kot so elektrifikacija, avtonomna in povezana vozila, deljena mobilnost in mobilnost kot storitev, sledijo istemu cilju razvoja celostnega pristopa za trajnostno, potnikom prijazno rešitev (Moller, Padhi, Pinner in Tschiesner, McKinsey & Company, 2019). Trendi urbane mobilnosti sledijo megatrendom, zaradi katerih se je vedenje potrošnikov spremenilo tako, da mobilnost namesto kot pot s točke A do točke B obravnavajo kot celostno storitev (Kuzia, 2018). Ker ima Slovenija eno najvišjih motorizacij (523 registriranih vozil na 1.000 prebivalcev leta 2015) v Evropi, bodo urbani mobilnostni trendi še bolj vplivali na spremembo vedenja potrošnikov pri vsakodnevni mobilnosti kot marsikje drugje. (Šuklje Erjavec, Miklavčič, Rogelj in Jerman, 2016)

Načrtovanje urbane mobilnosti se ukvarja z vprašanjem prevoza na delo, zagotavljanjem različnih mobilnostnih storitev, ponudbo javnega prevoza itd. Je eden glavnih dejavnikov, ki prispevajo k splošni kakovosti življenja mestnega prebivalstva in vplivajo na nadaljnjo gospodarsko rast, osebno blaginjo in povezanost državljanov (Zvezno ministrstvo za gospodarsko sodelovanje in razvoj (BMZ), D. f., & Germany, M. F., 2016). Načrtovanje

mobilnosti v mestih skupaj z izboljšanjem kakovosti življenja prebivalcev mest vpliva tudi na zmanjšanje onesnaženosti zraka, izboljšanje zdravja in varnosti ljudi ter pretočnosti prometa (Rupprecht Consult - Forschung & Beratung GmbH, Colclough, & EUROCITIES, 2019).

Po podrobni analizi sekundarnih virov magistrsko delo ponuja kvantitativno raziskavo spletne ankete, ki je bila izvedena z namenom pridobitve dejanskih podatkov o vsakodnevni vožnji Slovencev na delo z namenom ugotovitve trenutnih težav in izzivov ter določitve možnih rešitev v prihodnje. Spletna anketa se osredotoča na štiri ključna raziskovalna vprašanja, ki nam bodo v pomoč pri nadaljnji razpravi:

- *RQ1: Kakšne so trenutne potovalne navade v Sloveniji?*
- *RQ2: Kateri so glavni dejavniki pri odločanju za trenutne potovalne navade na delo?*
- *RQ3: Katere urbane mobilnostne trende bodo slovenski vozači na delo najverjetneje sprejeli v prihodnosti?*
- *RQ4: Katere rešitve bi najbolj ustrezale potnikom, podjetjem in vladam pri spreminjanju potrošniških potovalnih navad v Sloveniji?*

Na podlagi spletne ankete smo ugotovili, da 83,5 % posameznikov dela v urbanih območjih in potrdili prejšnje ugotovitve, da Slovenci resnično najraje uporabljajo osebna vozila, saj jih 56,0 % to sredstvo uporablja vsak dan. Glavni razlogi za izbiro trenutnega načina mobilnosti so časovni vidik (hitrost), sledita fleksibilnost in zmanjšanje stresa. V prihodnjih letih bodo slovenski potniki kot alternativo najraje sprejeli možnost souporabe vozil (kot vozniki ali kot potniki). Glavni motivator za spremembo njihovih trenutnih mobilnostnih navad bi bila visoka kakovost mobilnostnih storitev, sledila bi integracija različnih oblik mobilnosti in uporaba službenih električnih vozil, koles ali skirojev.

Pri nadaljnji analizi verjetnosti prilagoditve na urbane mobilnostne trende v naslednjih petih letih bodo svoja osebna vozila najverjetneje zamenjali z električnimi, sledila bi zamenjava osebnih vozil z drugimi oblikami mobilnosti ali uporaba mobilnosti kot storitve. Skoraj polovica pa jih je odgovorila, da zaradi trenutnih razmer manjša uporaba avtomobila ni mogoča.

Magistrsko delo se v nadaljevanju osredotoči na podajanje predlogov za spremembo potovalnih navad potrošnikov v Sloveniji z urbanimi mobilnostnimi trendi za različne skupine posameznikov.

Za prvo skupino, ki dajejo velik pomen na visoko kvaliteto storitev, predlagamo uporabo mobilnosti kot storitve in deljeno mobilnost. V prihodnjih letih se bodo namreč najverjetneje odločali za souporabo prevoza (kot potniki), uporabo javnega prevoza in kolesarjenje. Za drugo skupino posameznikov, ki močno preferirajo uporabo osebnega vozila, predlagamo zamenjavo njihovega trenutnega vozila z električnim na srednji rok, v nadaljnji prihodnosti

pa še dodatno uporabo avtonomnih in povezanih vozil. Tudi za tretjo skupino posameznikov predlagamo trend e-mobilnosti in dodajamo predlog deljene mobilnosti, saj bi se na podlagi pridobljenih podatkov prav tako odločili za souporabo vozil kot potniki. Skupini štiri, ki je edina lahko motivirana s finančnimi spodbudami, predlagamo idejo o e-mobilnosti, deljeni mobilnosti in mobilnosti kot storitvi, kjer je mogoče v rešitve vključiti različne finančne spodbude. Skupini pet, ki trenutno že uporablja največ alternativnih načinov mobilnosti, predlagamo mobilnost kot storitev in deljeno mobilnost.

Omenjeni predlogi lahko koristijo ne le posameznikom, temveč tudi drugim zainteresiranim stranem, kot so podjetja in vlade. S celovito analizo lahko bralci zdaj razumejo mobilnost v mestih in možne posledice za spreminjanje trenutnih navad na poti na delo v Sloveniji s prihodnjimi trendi mobilnosti, s čimer bo pot na delo učinkovitejša in bolj trajnostna.

Appendix 2: Survey questionnaire

Table 1: Online survey questionnaire in English (translation) and Slovene (original)

English translation	*Slovenian (original)*
Greetings, I am Julija Pintar, a student of the Faculty of Economics - IMB program, and I am currently writing a master's thesis "CHANGING CONSUMER COMMUTING HABITS IN SLOVENIA THROUGH URBAN MOBILITY TRENDS". I am asking you to help analyse gain a deeper understanding of current commuting habits. The survey is intended for all employees who spend their time commuting to and from work. All answers are anonymous and will only be used to analyse the questionnaire that is part of the master's thesis. Thank you very much in advance for your answers in your time.	Lepo pozdravljeni, Sem Julija Pintar, študentka Ekonomske fakultete – IMB programa, in trenutno pišem magistrsko nalogo »Spreminjanje navad vsakodnevne vožnje na delo v Sloveniji z urbanimi mobilnostnimi trendi«. Na vas se obračam s prošnjo pri pomoči analize trenutnih potovalnih navad. Anketa je namenjena vsem zaposlenim, ki porabljate svoj čas za pot na in z dela. Vsi odgovori so anonimni in se bodo uporabili le za namen analize vprašalnika, ki je del magistrske naloge. Vnaprej se vam najlepše zahvaljujem za vaše odgovore in vaš čas.
Q2: Are you currently employed (incl. Student work, part-time work and volunteer work)? • Yes • No* **If the answer is no, the survey is finished.*	Q1: Ali ste zaposleni (vključno študentsko delo, priložnostna dela in prostovoljna dela)? • Da • Ne* **Če je odgovor Ne, sledi konec ankete.*
Q3: Location of your workplace: • Village (up to 3000 inhabitants) • Small town (between 3000 and 5000 inhabitants) • Town (between 5000 and 10000 inhabitants) • City (more than 10000 inhabitants)	Q2: Lokacija vašega delovnega mesta: • Vas (do 3000 prebivalcev) • Manjše mesto (med 3000 in 5000 prebivalcev) • Srednje veliko mesto (med 5000 in 10000 prebivalcev) • Večje mesto (več kot 10000 prebivalcev)
Q4: How many kilometres does the commute to and from work include (one-way calculation, if needed use Google maps)? • 0 - 3 km • 4 - 10 km • 11 - 20 km • 21 - 30 km • More than 30 km	Q3: Koliko kilometrov vključuje pot od vašega doma do delovnega mesta (izračun v ENO SMER, namig – uporaba Google maps)? • 0 - 3 km • 4 - 10 km • 11 - 20 km • 21 - 30 km • Več kot 30 km

Q4: How long do you commute TO work take? • 0 - 5 min • 6 - 10 min • 11 - 20 min • 21 - 30 min • 31 - 45 min • 46 - 60 min • More than 60 min	Q4: Koliko časa porabite za pot NA delovno mesto? • 0 - 5 min • 6 - 10 min • 11 - 20 min • 21 - 30 min • 31 - 45 min • 46 - 60 min • Več kot 60 min
Q5: How long do you commute FROM work take? • 0 - 5 min • 6 - 10 min • 11 - 20 min • 21 - 30 min • 31 - 45 min • 46 - 60 min • More than 60 min	Q5: Koliko časa porabite za pot Z delovnega mesta? • 0 - 5 min • 6 - 10 min • 11 - 20 min • 21 - 30 min • 31 - 45 min • 46 - 60 min • Več kot 60 min
Q6: How often do you use the following means of mobility (always / 5 times per week, 3-4 times per week, 2-3 times per week, 1 time per week, never)? • Personal vehicle • Personal vehicle (as a passenger) • Bus • Train • Motorbike • Bike, e-bike, scooter, e-scooter, roller-skates, roller • Walking • I work from home	Q6: Kako pogosto uporabljate naslednje potovalne načine (vedno / 5x tedensko, 3-4x tedensko, 2-3x tedensko, 1x tedensko, nikoli)? • Osebno vozilo • Osebno vozilo (kot sopotnik) • Avtobus • Vlak • Motor • Kolo, e-kolo, skiro, e-skiro, rolerji, rolka • Hoja • Delam od doma
Q7: Rate the importance of the following parameters for choosing the MAIN mean of mobility (1 – very not important, 4 – neutral, 7 – very important). • Price aspect • Time aspect (speed) • Ecological aspect • Safety aspect • Comfort • Flexibility • Stress reduction • Time savings when finding a parking space • Combining with other activities (e.g., kindergarten, shopping) • Recreation • Vehicle use for business purposes	Q7: Ocenite pomembnost naslednjih razlogov za uporabo PREVLADUJOČEGA načina potovanja (1 – sploh ni pomembno, 4 – niti ni pomembno, niti je pomembno, 7 – zelo je pomembno). • Cenovni vidik • Časovni vidik (hitrost) • Ekološki vidik • Varnostni vidik • Udobje • Fleksibilnost • Zmanjšanje stresa • Časovni prihranek pri iskanju parkirišča • Združitev z ostalimi obveznostmi (npr. obisk trgovine, vrtca) • Rekreacija • Uporaba vozila še za službene namene

Q8: Rate the importance of the main obstacle for not choosing RIDESHARING / AS A DRIVER to and from work more often (driving family members are not included) (1 – very v not important, 4 – neutral, 7 – very important). • (In)flexibility • Hygienic reasons • I prefer to drive alone • Problems with costs sharing • Organization and time management • I use my vehicle for transporting family members • I don't know anyone who rides on the same route • Safety concerns (e.g., in the event of an accident)	Q8: Ocenite pomembnost glavnih ovir, da se večkrat ne odločite za PREVOZ SOPOTNIKOV (prevoz družinskih članov ni vključen) (1 – sploh ni pomembno, 4 – niti ni pomembno, niti je pomembno, 7 – zelo je pomembno). • (Ne)fleksibilnost • Higienski razlogi • Najraje se vozim sam/a • Problem pri delitvi stroškov • Organizacija prevozov in čas skupinske vožnje • Vozilo uporabljam za prevoz družinskih članov • Ne poznam nikogar, ki se vozi na isti relaciji • Varnostni pomisleki (npr. v primeru nezgode)
Q9: Rate the importance of the main obstacle for not choosing RIDESHARING / AS A PASSENGER to and from work more often (1 – very v not important, 4 – neutral, 7 – very important). • (In)flexibility • Hygienic reasons • I prefer to drive alone • Problems with costs sharing • Organization and time management • I don't know anyone who rides on the same route • Safety concerns (e.g., in the event of an accident)	Q9: Ocenite pomembnost glavnih ovir, da se večkrat ne odločite za SOPOTNIŠTVO na delovno mesto (1 – sploh ni pomembno, 4 – niti ni pomembno, niti je pomembno, 7 – zelo je pomembno). • (Ne)fleksibilnost • Higienski razlogi • Najraje se vozim sam/a • Problem pri delitvi stroškov • Organizacija prevozov in časa skupinske vožnje • Ne poznam nikogar, ki se vozi na isti relaciji • Varnostni pomisleki (npr. v primeru nezgode)
Q10: Rate the importance of the main obstacle for not choosing PUBLIC TRANSPORTATION to and from work more often (1 – very v not important, 4 – neutral, 7 – very important). • Inappropriate distance • Excessive time consumption • Lack of suitable connections • Price too high • Low quality of service • (In)flexibility • Hygienic reasons • I do not know the lines and timetables	Q10: Ocenite pomembnost glavnih ovir, da se večkrat ne odločite za uporabo JAVNEGA POTNIŠKEGA PROMETA na delovno mesto (1 – sploh ni pomembno, 4 – niti ni pomembno, niti je pomembno, 7 – zelo je pomembno). • Neprimerna razdalja • Prevelika poraba časa • Pomankanje primernih povezav • Previsoka cena • Nizka kakovost storitve • (Ne)fleksibilnost • Higienski razlogi • Ne poznam linij in voznih redov

Q11: Rate the importance of the main obstacle for not choosing CYCLING to and from work more often (incl. e-bike, scooter, e-scooter, roller-skates, roller) (1 – very v not important, 4 – neutral, 7 – very important). • Inappropriate distance • Excessive time consumption • Lack of adequate infrastructure • Hygienic reasons (no possibility to shower / change clothes) • I don't have a bike • I'm worried about my bike being stolen • Lack of route information • Unpredictable weather • Health reasons / physical form	Q11: Ocenite pomembnost glavnih ovir, da se večkrat ne odločite za KOLESARJENJE (vključuje uporabo koles, e-koles, skirojev, e-skirojev, rolerjev in rolk) na delovno mesto (1 – sploh ni pomembno, 4 – niti ni pomembno, niti je pomembno, 7 – zelo je pomembno). • Neprimerna razdalja • Prevelika poraba časa • Pomankanje primerne infrastrukture • Higienski razlogi (ni možnosti za prhanje / preoblačenje) • Nimam kolesa • Skrbi me, da bi mi kolo ukradli • Pomanjkanje informacij o poteh • Nepredvidljivo vreme • Zdravstveni razlogi / kondicija
Q12: Rate the importance of the main obstacle for not choosing WALKING to and from work more often (1 – very v not important, 4 – neutral, 7 – very important). • Inappropriate distance • Excessive time consumption • Hygienic reasons (no possibility to shower / change clothes) • Lack of route information • Unpredictable weather • Health reasons / physical form	Q12: Ocenite pomembnost glavnih ovir, da se večkrat ne odločite za HOJO na delovno mesto (1 – sploh ni pomembno, 4 – niti ni pomembno, niti je pomembno, 7 – zelo je pomembno). • Neprimerna razdalja • Prevelika poraba časa • Higienski razlogi (ni možnosti za prhanje / preoblačenje) • Pomanjkanje informacij o poteh • Nepredvidljivo vreme • Zdravstveni razlogi / kondicija
Q13: Rate the likelihood of choosing the following types of mobility to and from work in the next years (1 – very not likely, 4 – neutral, 7 – very likely). • Ridesharing as a driver • Ridesharing as a passenger • Use of public transportation • Cycling • Walking	Q13: Ocenite verjetnost uporabe spodaj zapisanih oblik mobilnosti za na in z dela v prihodnjih letih (1 – sploh ni verjetno, 4 – niti ni verjetno, niti je verjetno, 7 – zelo je verjetno). • Nudenje sopotništva drugim • Vožnja kot sopotnik • Uporaba javnega potniškega prometa • Kolesarjenje • Hoja

Q14: Rate the importance of motivators for the change in current commuting habits (1 – very not important, 4 – neutral, 7 – very important). • Financial incentives or reward for ridesharing, use of public transportation, cycling and walking • Use of a company electric vehicle, bicycle or scooter • High quality of mobility services • Integration of different forms of mobility (e.g., integration of public transport using bicycles through one application) • Overview of services and assistance in choosing the appropriate form of mobility • I don't want to change my habits	Q14: Ocenite pomembnost motivatorjev za spremembo trenutnih mobilnostnih navad (1 – sploh ni pomembno, 4 – niti ni pomembno, niti je pomembno, 7 – zelo je pomembno). • Finančna vzpodbuda oz. nagrada za vožnjo s sopotniki, sopotništvo, uporabo javnega potniškega prometa, kolesarjenje in hojo • Uporaba službenega električnega vozila, kolesa ali skiroja • Kvalitetnejša ponudba samih storitev • Integriranost različnih oblik mobilnosti (npr. integriranost javnega prevoza z uporabo koles preko ene aplikacije) • Pregled storitev in pomoč pri izbiri primerne oblike mobilnosti • Navad ne želim spreminjati
Q15: Rate the likelihood of the following scenarios (1 – very not likely, 4 – neutral, 7 – very likely). • Over the next five years, I will be replacing my current vehicle with an electric one (including hybrid and hydrogen powered vehicles) • Over the next five years, I will replace my car with other forms of mobility (ridesharing, public transport, cycling, walking) • Over the next five years, I will use autonomous vehicles to transport from point A to point B • Over the next five years, I will only use shared forms of mobility (example Avant2Go) • Over the next five years, I will stop using my personal vehicle • Over the next five years, I will use mobility as a service (integration of all types of mobility in one application) • Over the next five years, I will pay for a mobility subscription package that includes all mobility options • Over the next five years, I will pay for mobility according to each ride separately	Q15: Ocenite verjetnost naslednjih situacij (1 – sploh ni verjetno, 4 – niti ni verjetno, niti je verjetno, 7 – zelo je verjetno). • V naslednjih petih letih bom zamenjal/a trenutno vozilo za električno (vklj. tudi hibrid in vozila na vodikov pogon) • V naslednjih petih letih bom osebno vozilo zamenjal/a z drugimi oblikami mobilnosti (sopotništvo, javni prevoz, kolesarjenje, hoja) • V naslednjih petih letih bom uporabljal/a avtonomna vozila za prevoz s točke A na točko B • V naslednjih petih letih bom uporabljal/a le deljene oblike uporabe osebnega vozila (primer Avant2Go) • V naslednjih petih letih ne bom več uporabljal/a svojega osebnega avtomobila • V naslednjih petih letih bom uporabljal/a mobilnost kot storitev (integracija vseh vrst mobilnosti v eni aplikaciji) • V naslednjih petih letih bom za mobilnost plačeval/a naročniški paket, ki bo vključeval vse opcije mobilnosti • V naslednjih petih letih bom mobilnost plačeval/a glede na vsako vožnjo posebej

Q16: Choose the statement that best describes your attitude towards using a personal vehicle. • I don't have a car / access to a car. • I already use other means of mobility and intend to reduce car use even further. • I currently use the car frequently, but plan to reduce it in the future. • I currently use the car frequently and have not considered the reduction in the usage. • Due to the current situation, minor use of the car is not possible.	Q16: Izberite trditev, ki najbolje opiše vaše razmerje do uporabe osebnega vozila. • Nimam avtomobila / dostopa do avtomobila. • Uporabljam druge prometne načine in nameravam uporabo avtomobila zmanjšati. • Trenutno uporabljam avtomobil pogosto, a nameravam uporabo v prihodnje zmanjšati. • Trenutno uporabljam avtomobil za večino poti. O zmanjševanju uporabe avtomobila sem že razmišljal/a. • Zaradi trenutnih razmer manjša uporaba avtomobila ni mogoča.
Q17: Gender. • Female • Male • Other	Q17: Spol. • Ženski • Moški • Drugo
Q18: Year of birth. _____	Q18: Letnica rojstva. _____
Q19: Al. • Primary school • High school • Higher school /Training programme • Undergraduate studies • Master's studies • PhD studies	Q19: Dokončana stopnja izobrazbe. • Osnovna šola • Srednja šola • Višja šola • Dodiplomski študij • Magistrski študij • Doktorski študij
Q20: Location of residence. • Village (up to 3000 inhabitants) • Small town (between 3000 and 5000 inhabitants) • Town (between 5000 and 10000 inhabitants) • City (more than 10000 inhabitants)	Q20: Lokacija bivanja. • Vas (do 3000 prebivalcev) • Manjše mesto (med 3000 in 5000 prebivalcev) • Srednje veliko mesto (med 5000 in 10000 prebivalcev) • Večje mesto (več kot 10000 prebivalcev)
Q21: What is the average monthly net income of your household? • Up to and including € 400 • 400 - 800 € • 800 - 1200 € • 1200 - 1600 € • 1600 - 2000 € • 2000 - 2400 € • 2400 - 2800 € • 2800 - 3200 € • More than € 3,200 • I don't want to answer	Q21: Kolikšen je povprečen neto mesečni dohodek vašega gospodinjstva? • Do vključno 400 € • 400 - 800 € • 800 - 1200 € • 1200 - 1600 € • 1600 - 2000 € • 2000 - 2400 € • 2400 - 2800 € • 2800 - 3200 € • Več kot 3200 € • Ne želim odgovoriti

You have answered all the questions. Thank you!	Odgovorili ste na vsa vprašanja v tej anketi. Hvala za sodelovanje.

Source: Own source

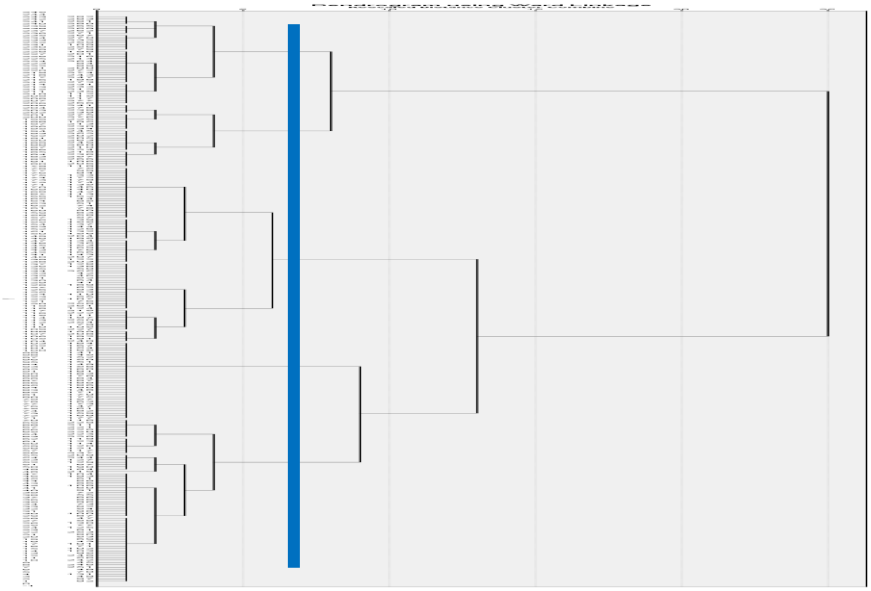
Appendix 3: Cluster analysis

Figure 1: Agglomeration Schedule of hierarchical cluster analysis

232	44	122	2549.656	217	225	238	No.of clusters	Absolute change	Relative change
233	41	79	2658.605	221	224	238	10	108.95	4.10%
234	43	67	2768.682	229	222	237	9	110.08	3.98%
235	106	195	2932.885	227	223	239	8	164.20	5.60%
236	84	109	3117.268	228	231	239	7	184.38	5.91%
237	43	114	3305.427	234	230	240	6	188.16	5.69%
238	41	44	3563.186	233	232	241	**5**	**257.76**	**7.23%**
239	84	106	3907.976	236	235	242	4	344.79	8.82%
240	43	141	4304.450	237	218	241	3	396.47	9.21%
241	41	43	4893.735	238	240	242	2	589.28	12.04%
242	41	84	6096.428	241	239	0	1		
								Avg. relative change:	**6.95%**

Source: Online survey, n = 243

Figure 2: Dendrogram using Ward Linkage



Source: Online survey, n = 243

Figure 3: ANOVA analysis of K-means analysis (non-hierarchical cluster analysis)

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
Importance MAIN: price aspect	90.222	4	2.594	238	34.783	.000
Importance MAIN: ecological aspect	67.436	4	1.640	238	41.126	.000
Importance MAIN: safety aspect	82.292	4	1.872	238	43.948	.000
Importance MAIN: time savings when finding a parking space	108.664	4	1.994	238	54.497	.000
Importance MAIN: combining with other activities	53.131	4	2.114	238	25.134	.000
Importance MAIN: recreation	90.168	4	2.152	238	41.896	.000
Importance MAIN: vehicle use for business purposes	203.399	4	1.563	238	130.121	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Source: Online survey, n = 243

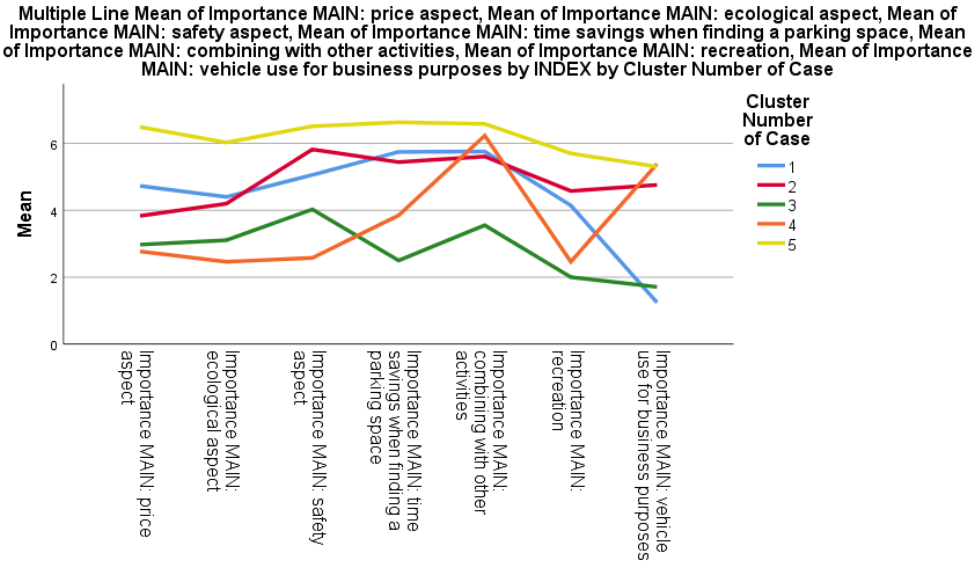
Figure 4: Number of cases in each cluster of K-means analysis (non-hierarchical cluster analysis)

Number of Cases in each Cluster

Cluster	1	70.000
	2	66.000
	3	38.000
	4	26.000
	5	43.000
Valid		243.000
Missing		40.000

Source: Online survey, n = 243

Figure 5: G-Graph of K-means analysis (non-hierarchical cluster analysis)



Source: Online survey, n = 243

Appendix 4: Detailed analysis of specific clusters

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Work location	Village: 10.0 % Small town: 7.1 % Town: 10.0 % **City: 72.9 %**	Village: 19.7 % **Small town: 15.2 %** Town: 15.2 % City: 49.9 %	**Village: 21.1 %** Small town: 7.9 % Town: 21.1 % City: 50.0 %	Village: 15.4 % Small town: 11.5 % Town: 19.2 % City: 53.8 %	Village: 16.3 % Small town: 9.3 % **Town: 27.9 %** City: 46.5 %
Km to work	0-3: 20.0 % 4-10: 20.0 % **11-20: 21.4 %** 21-30: 28.6 % More than 30: 10.0 %	0-3: 25.8 % 4-10: 18.2 % 11-20: 18.2 % 21-30: 16.7 % **More than 30: 21.2 %**	0-3: 23.7 % 4-10: 15.8 % 11-20: 15.8 % **21-30: 28.9 %** More than 30: 15.8 %	0-3: 26.9 % **4-10: 30.8 %** 11-20: 11.5 % 21-30: 15.4 % More than 30: 15.4 %	**0-3: 32.6 %** 4-10: 14.0 % 11-20: 16.3 % 21-30: 18.6 % More than 30: 18.6 %
Time to work	0-5 min: 7.1 % 6-10 min: 10.0 % **11-20 min: 28.6 %** 21-30 min: 18.6 % 31-45 min: 10.0 % **46-60 min: 22.9 %** More than 60 min: 2.9 %	0-5 min: 10.6 % **6-10 min: 21.2 %** 11-20 min: 22.7 % 21-30 min: 18.2 % 31-45 min: 10.6 % 46-60 min: 12.1 % More than 60 min: 4.5 %	0-5 min: 10.5 % 6-10 min: 21.1 % 11-20 min: 13.2 % 21-30 min: 13.2 % **31-45 min: 23.7 %** 46-60 min: 13.2 % **More than 60 min: 5.3 %**	0-5 min: 11-5 % 6-10 min: 19.2 % 11-20 min: 26.9 % 21-30 min: 15.4 % 31-45 min: 15.4 % 46-60 min: 7.7 % More than 60 min: 3.8 %	**0-5 min: 14.0 %** 6-10 min: 11.6 % 11-20 min: 23.3 % **21-30 min: 20.9 %** 31-45 min: 9.3 % 46-60 min: 16.3 % More than 60 min: 4.7 %
Time from work	0-5 min: 7.1 % 6-10 min: 11.4 % 11-20 min: 22.9 % 21-30 min: 17.1 % 31-45 min: 14.3 % **46-60 min: 22.9 %** More than 60 min: 4.3 %	0-5 min: 12.1 % **6-10 min: 16.7 %** 11-20 min: 22.7 % 21-30 min: 15.2 % 31-45 min: 13.6 % 46-60 min: 12.1 % More than 60 min: 7.6 %	0-5 min: 13.2 % 6-10 min: 13.2 % 11-20 min: 15.8 % 21-30 min: 10.5 % **31-45 min: 31.6 %** 46-60 min: 10.5 % More than 60 min: 5.3 %	0-5 min: 11.5 % 6-10 min: 15.4 % **11-20 min: 30.8 %** 21-30 min: 11.5 % 31-45 min: 19.2 % 46-60 min: 0.0 % **More than 60 min: 11.5 %**	**0-5 min: 16.3 %** 6-10 min: 7.0 % 11-20 min: 18.6 % **21-30 min: 20.9 %** 31-45 min: 11.6 % 46-60 min: 20.9 % More than 60 min: 4.7 %

Frequency: personal vehicle	Always / 5 times per week: 50.0 % 3-4 times per week: 7.1 % **2-3 times per week: 18.6 %** 1 time per week: 7.1 % never: 17.1 %	Always / 5 times per week: 59.1 % 3-4 times per week: 9.1 % 2-3 times per week: 6.1 % 1 time per week: 9.1 % never: 16.7 %	Always / 5 times per week: 55.3 % **3-4 times per week: 10.5 %** 2-3 times per week: 5.3 % **1 time per week: 10.5 %** never: 18.4 %	**Always / 5 times per week: 76.9 %** 3-4 times per week: 0.0 % 2-3 times per week: 3.8 % 1 time per week: 3.8 % never: 15.4 %	Always / 5 times per week: 44.2 % 3-4 times per week: 9.3 % 2-3 times per week: 11.6 % 1 time per week: 2.3 % **never: 32.6 %**
Frequency: personal vehicle (as a passenger)	Always / 5 times per week: 2.9 % 3-4 times per week: 1.4 % **2-3 times per week: 7.1 %** 1 time per week: 11.4 % never: 77.1 %	**Always / 5 times per week: 6.1 %** 3-4 times per week: 1.5 % 2-3 times per week: 6.1 % **1 time per week: 15.2 %** never: 71.2 %	Always / 5 times per week: 2.6 % 3-4 times per week: 2.6 % 2-3 times per week: 2.6 % 1 time per week: 10.5 % never: 81.6 %	Always / 5 times per week: 0.0 % **3-4 times per week: 3.8 %** 2-3 times per week: 0.0 % 1 time per week: 7.7 % **never: 88.5 %**	Always / 5 times per week: 2.3 % 3-4 times per week: 2.3 % 2-3 times per week: 7.0 % 1 time per week: 14.0 % never: 74.4 %
Frequency: bus	Always / 5 times per week: 2.9 % 3-4 times per week: 1.4 % **2-3 times per week: 4.3 %** 1 time per week: 5.7 % never: 85.7 %	Always / 5 times per week: 3.0 % 3-4 times per week: 1.5 % 2-3 times per week: 1.5 % 1 time per week: 4.5 % never: 89.4 %	Always / 5 times per week: 2.6 % **3-4 times per week: 2.6 %** 2-3 times per week: 0.0 % 1 time per week: 2.6 % never: 92.1 %	**Always / 5 times per week: 3.8 %** 3-4 times per week: 0.0 % 2-3 times per week: 0.0 % 1 time per week: 0.0 % **never: 96.2 %**	Always / 5 times per week: 2.3 % 3-4 times per week: 2.3 % 2-3 times per week: 2.3 % **1 time per week: 7.0 %** never: 86.0 %
Frequency: train	**Always / 5 times per week: 8.6 %** **3-4 times per week: 1.4 %** 2-3 times per week: 0.0 % 1 time per week: 4.3 % never: 85.7 %	Always / 5 times per week: 0.0 % 3-4 times per week: 0.0 % 2-3 times per week: 1.5 % 1 time per week: 0.0 % **never: 98.5 %**	Always / 5 times per week: 5.3 % 3-4 times per week: 0.0 % 2-3 times per week: 0.0 % **1 time per week: 5.3 %** never: 89.5 %	Always / 5 times per week: 3.8 % 3-4 times per week: 0.0 % 2-3 times per week: 0.0 % 1 time per week: 0.0 % never: 96.2 %	Always / 5 times per week: 7.0 % 3-4 times per week: 0.0 % **2-3 times per week: 2.3 %** 1 time per week: 2.3 % never: 88.4 %

Frequency: motorbike	**Always / 5 times per week: 1.4 %** 3-4 times per week: 0.0 % 2-3 times per week: 0.0 % 1 time per week: 0.0 % never: 98.6 %	Always / 5 times per week: 0.0 % 3-4 times per week: 0.0 % 2-3 times per week: 0.0 % 1 time per week: 1.5 % never: 98.5 %	Always / 5 times per week: 0.0 % 3-4 times per week: 0.0 % 2-3 times per week: 0.0 % 1 time per week: 0.0 % never: 100.0 %	Always / 5 times per week: 0.0 % 3-4 times per week: 0.0 % **2-3 times per week: 3.8 %** **1 time per week: 3.8 %** never: 92.3 %	Always / 5 times per week: 0.0 % 3-4 times per week: 0.0 % 2-3 times per week: 2.3 % 1 time per week: 0.0 % never: 97.7 %
Frequency: bike	**Always / 5 times per week: 8.6 %** 3-4 times per week: 2.9 % 2-3 times per week: 0.0 % 1 time per week: 1.4 % **never: 87.1 %**	Always / 5 times per week: 0.0 % 3-4 times per week: 3.0 % 2-3 times per week: 3.0 % 1 time per week: 12.1 % never: 81.8 %	Always / 5 times per week: 0.0 % 3-4 times per week: 0.0 % 2-3 times per week: 2.6 % **1 time per week: 15.8 %** never: 81.6 %	Always / 5 times per week: 0.0 % 3-4 times per week: 0.0 % 2-3 times per week: 3.8 % 1 time per week: 11.5 % never: 84.6 %	Always / 5 times per week: 4.7 % **3-4 times per week: 7.0 %** **2-3 times per week: 9.3 %** 1 time per week: 0.0 % never: 79.1 %
Frequency: walking	Always / 5 times per week: 15.7 % 3-4 times per week: 1.4 % 2-3 times per week: 8.6 % 1 time per week: 0.0 % never: 74.3 %	**Always / 5 times per week: 16.7 %** **3-4 times per week: 7.6 %** 2-3 times per week: 6.1 % 1 time per week: 7.6 % never: 62.1 %	Always / 5 times per week: 5.3 % 3-4 times per week: 2.6 % 2-3 times per week: 5.3 % **1 time per week: 10.5 %** **never: 76.3 %**	Always / 5 times per week: 7.7 % 3-4 times per week: 3.8 % 2-3 times per week: 7.7 % 1 time per week: 7.7 % never: 73.1 %	Always / 5 times per week: 11.6 % 3-4 times per week: 4.7 % **2-3 times per week: 16.3 %** 1 time per week: 4.7 % never: 62.8 %
Frequency: work from home	**Always / 5 times per week: 10.0 %** 3-4 times per week: 5.7 % **2-3 times per week: 14.3 %** 1 time per week: 10.0 % never: 60.0 %	Always / 5 times per week: 9.1 % 3-4 times per week: 1.5 % 2-3 times per week: 13.6 % 1 time per week: 10.6 % never: 65.2 %	Always / 5 times per week: 0.0 % 3-4 times per week: 10.5 % 2-3 times per week: 2.6 % **1 time per week: 18.4 %** never: 68.4 %	Always / 5 times per week: 3.8 % **3-4 times per week: 11.5 %** 2-3 times per week: 7.7 % 1 time per week: 11.5 % never: 65.4 %	Always / 5 times per week: 7.0 % 3-4 times per week: 4.7 % 2-3 times per week: 7.0 % 1 time per week: 9.3 % **never: 72.1 %**
Importance NOT RIDESHARING (as a driver)	(In)flexibility: 5.3 Hygienic reasons: 3.3 I prefer to drive alone: 4.1 Problems with costs	(In)flexibility: 5.1 Hygienic reasons: 3.6 **I prefer to drive alone: 4.3**	(In)flexibility: 4.2 Hygienic reasons: 2.1 I prefer to drive alone: 3.6 Problems with costs	(In)flexibility: 5.5 Hygienic reasons: 2.7 I prefer to drive alone: 3.7 Problems with costs	**(In)flexibility: 5.6** **Hygienic reasons: 4.2** I prefer to drive alone: 4.1 **Problems with costs**

	sharing: 2.9 Organization and time management: 5.1 I use my vehicle for transporting family members: 3.6 **I don't know anyone who rides on the same route: 5.0** Safety concerns (e.g., in the event of an accident): 3.9	Problems with costs sharing: 3.3 Organization and time management: 5.3 I use my vehicle for transporting family members: 4.2 **I don't know anyone who rides on the same route: 5.0** Safety concerns (e.g., in the event of an accident): 4.2	sharing: 1.8 Organization and time management: 4.7 I use my vehicle for transporting family members: 2.7 I don't know anyone who rides on the same route: 4.7 Safety concerns (e.g., in the event of an accident): 3.1	sharing: 2.2 **Organization and time management: 5.4** I use my vehicle for transporting family members: 3.4 **I don't know anyone who rides on the same route: 5.0** Safety concerns (e.g., in the event of an accident): 2.9	**sharing: 3.7** Organization and time management: 5.2 **I use my vehicle for transporting family members: 4.7** **I don't know anyone who rides on the same route: 5.0** **Safety concerns (e.g., in the event of an accident): 5.0**
Importance NOT RIDESHARING (as a passenger)	(In)flexibility: 5.6 Hygienic reasons: 3.2 I prefer to drive alone: 4.0 Problems with costs sharing: 2.7 Organization and time management: 5.2 I don't know anyone who rides on the same route: 4.8 Safety concerns (e.g., in the event of an accident): 3.5	**(In)flexibility: 5.8** Hygienic reasons: 3.7 **I prefer to drive alone: 4.3** Problems with costs sharing: 3.6 Organization and time management: 5.2 **I don't know anyone who rides on the same route: 5.1** Safety concerns (e.g., in the event of an accident): 4.2	(In)flexibility: 4.7 Hygienic reasons: 2.3 I prefer to drive alone: 3.5 Problems with costs sharing: 2.0 Organization and time management: 4.8 I don't know anyone who rides on the same route: 4.9 Safety concerns (e.g., in the event of an accident): 3.2	**(In)flexibility: 5.8** Hygienic reasons: 2.6 I prefer to drive alone: 4.0 Problems with costs sharing: 2.2 **Organization and time management: 5.5** I don't know anyone who rides on the same route: 4.4 Safety concerns (e.g., in the event of an accident): 2.8	(In)flexibility: 5.7 **Hygienic reasons: 4.0** I prefer to drive alone: 4.2 **Problems with costs sharing: 3.7** Organization and time management: 5.4 I don't know anyone who rides on the same route: 5.0 **Safety concerns (e.g., in the event of an accident): 4.9**

Importance NOT PUBLIC TRANSPORTATION	Inappropriate distance: 4.8 Excessive time consumption: 5.8 Lack of suitable connections: 6.2 Price too high: 4.0 Low quality of service: 4.3 (In)flexibility: 5.7 Hygienic reasons: 3.2 I do not know the lines and timetables: 2.7	Inappropriate distance: 5.5 Excessive time consumption: 6.1 Lack of suitable connections: 5.9 Price too high: 4.0 Low quality of service: 4.8 **(In)flexibility: 5.9** Hygienic reasons: 4.1 I do not know the lines and timetables: 3.3	Inappropriate distance: 4.3 Excessive time consumption: 5.1 Lack of suitable connections: 5.3 Price too high: 3.8 Low quality of service: 3.9 (In)flexibility: 5.4 Hygienic reasons: 2.8 I do not know the lines and timetables: 2.1	Inappropriate distance: 5.2 Excessive time consumption: 6.0 Lack of suitable connections: 6.0 Price too high: 3.8 **Low quality of service: 6.3** (In)flexibility: 3.2 Hygienic reasons: 3.2 I do not know the lines and timetables: 3.4	**Inappropriate distance: 5.7** **Excessive time consumption: 6.3** **Lack of suitable connections: 6.5** **Price too high: 4.7** Low quality of service: 5.0 **(In)flexibility: 5.9** **Hygienic reasons: 4.3** **I do not know the lines and timetables: 3.7**
Importance NOT CYCLING	Inappropriate distance: 5.4 Excessive time consumption: 5.2 Lack of adequate infrastructure: 4.9 Hygienic reasons (no possibility to shower / change clothes): 4.7 I don't have a bike: 2.6 I'm worried about my bike being stolen: 3.0 Lack of route information: 2.4 **Unpredictable weather: 5.7** Health reasons / physical form: 3.0	Inappropriate distance: 5.4 Excessive time consumption: 5.5 Lack of adequate infrastructure: 5.3 **Hygienic reasons (no possibility to shower / change clothes): 5.2** I don't have a bike: 3.3 I'm worried about my bike being stolen: 3.9 **Lack of route information: 3.4** Unpredictable weather: 5.5 **Health reasons / physical form: 3.7**	Inappropriate distance: 4.6 Excessive time consumption: 4.8 Lack of adequate infrastructure: 4.2 Hygienic reasons (no possibility to shower / change clothes): 3.8 I don't have a bike: 2.6 I'm worried about my bike being stolen: 2.4 Lack of route information: 2.5 Unpredictable weather: 4.4 Health reasons / physical form: 2.8	Inappropriate distance: 5.2 Excessive time consumption: 5.0 Lack of adequate infrastructure: 4.3 Hygienic reasons (no possibility to shower / change clothes): 4.6 I don't have a bike: 2.9 I'm worried about my bike being stolen: 2.9 Lack of route information: 2.1 Unpredictable weather: 5.0 Health reasons / physical form: 3.0	**Inappropriate distance: 5.6** **Excessive time consumption: 5.7** **Lack of adequate infrastructure: 5.8** Hygienic reasons (no possibility to shower / change clothes): 4.8 **I don't have a bike: 3.7** **I'm worried about my bike being stolen: 4.2** Lack of route information: 3.3 **Unpredictable weather: 5.7** Health reasons / physical form: 3.4
Importance NOT WALKING	Inappropriate distance: 5.9 Excessive time consumption: 6.0 Hygienic reasons (no possibility to shower /	Inappropriate distance: 5.6 Excessive time consumption: 5.7 Hygienic reasons (no possibility to shower /	Inappropriate distance: 5.6 Excessive time consumption: 5.8 Hygienic reasons (no possibility to shower /	Inappropriate distance: 5.9 Excessive time consumption: 5.8 Hygienic reasons (no possibility to shower /	**Inappropriate distance: 6.3** **Excessive time consumption: 6.4** **Hygienic reasons (no**

	change clothes): 4.0 Lack of route information: 2.1 Unpredictable weather: 4.5 Health reasons / physical form: 2.7	change clothes): 4.3 Lack of route information: 2.7 Unpredictable weather: 4.7 Health reasons / physical form: 3.2	change clothes): 3.1 Lack of route information: 2.1 Unpredictable weather: 3.4 Health reasons / physical form: 2.3	change clothes): 3.2 Lack of route information: 2.1 Unpredictable weather: 4.3 Health reasons / physical form: 2.8	**possibility to shower / change clothes): 4.5** **Lack of route information: 3.0** **Unpredictable weather: 5.2** **Health reasons / physical form: 3.4**
Likelihood of choosing mobility types	Ridesharing as a driver: 4.1 Ridesharing as a passenger: 4.2 **Use of public transportation: 4.2** **Cycling: 3.5** Walking: 2.9	Ridesharing as a driver: 4.1 Ridesharing as a passenger: 3.6 Use of public transportation: 3.4 Cycling: 3.2 Walking: 2.8	Ridesharing as a driver: 3.6 Ridesharing as a passenger: 3.8 Use of public transportation: 2.7 Cycling: 3.4 Walking: 2.4	Ridesharing as a driver: 4.2 Ridesharing as a passenger: 3.2 Use of public transportation: 2.5 Cycling: 3.4 **Walking: 3.3**	**Ridesharing as a driver: 4.8** **Ridesharing as a passenger 4.6:** Use of public transportation: 3.9 Cycling: 3.2 Walking: 3.2
Importance of motivators for change	Financial incentives or reward for ridesharing, use of public transportation, cycling and walking: 4.2 Use of a company electric vehicle, bicycle or scooter: 4.2 High quality of mobility services: 5.2 Integration of different forms of mobility (e.g., integration of public transport using bicycles through one application): 4.5 Overview of services and assistance in choosing the appropriate form of mobility: 3.8	Financial incentives or reward for ridesharing, use of public transportation, cycling and walking: 4.5 Use of a company electric vehicle, bicycle or scooter: 5.1 High quality of mobility services: 5.7 Integration of different forms of mobility (e.g., integration of public transport using bicycles through one application): 5.1 Overview of services and assistance in choosing the appropriate form of mobility: 4.3	Financial incentives or reward for ridesharing, use of public transportation, cycling and walking: 3.3 Use of a company electric vehicle, bicycle or scooter: 3.4 High quality of mobility services: 4.1 Integration of different forms of mobility (e.g., integration of public transport using bicycles through one application): 3.3 Overview of services and assistance in choosing the appropriate form of mobility: 2.9	Financial incentives or reward for ridesharing, use of public transportation, cycling and walking: 3.7 Use of a company electric vehicle, bicycle or scooter: 4.0 High quality of mobility services: 5.1 Integration of different forms of mobility (e.g., integration of public transport using bicycles through one application): 3.9 Overview of services and assistance in choosing the appropriate form of mobility: 3.3	**Financial incentives or reward for ridesharing, use of public transportation, cycling and walking: 5.5** **Use of a company electric vehicle, bicycle or scooter: 5.4** **High quality of mobility services: 6.2** **Integration of different forms of mobility (e.g., integration of public transport using bicycles through one application): 5.6** **Overview of services and assistance in choosing the appropriate form of**

	I don't want to change my habits: 4.1	**I don't want to change my habits: 4.1**	I don't want to change my habits: 3.8	I don't want to change my habits: 4.0	**mobility: 5.5** I don't want to change my habits: 4.0
Likelihood of following scenarios	Over the next five years, I will be replacing my current vehicle with an electric one (including hybrid and hydrogen powered vehicles): 3.1 Over the next five years, I will replace my car with other forms of mobility (ridesharing, public transport, cycling, walking): 3.1 Over the next five years, I will use autonomous vehicles to transport from point A to point B: 2.6 Over the next five years, I will only use shared forms of mobility (example Avant2Go): 2.1 Over the next five years, I will stop using my personal vehicle: 1.8 Over the next five years, I will use mobility as a service (integration of all types of mobility in one application): 3.2 Over the next five years, I will pay for a mobility subscription package that includes all mobility options: 2.9	Over the next five years, I will be replacing my current vehicle with an electric one (including hybrid and hydrogen powered vehicles): 3.7 Over the next five years, I will replace my car with other forms of mobility (ridesharing, public transport, cycling, walking): 2.9 Over the next five years, I will use autonomous vehicles to transport from point A to point B: 2.6 Over the next five years, I will only use shared forms of mobility (example Avant2Go): 2.4 Over the next five years, I will stop using my personal vehicle: 2.0 Over the next five years, I will use mobility as a service (integration of all types of mobility in one application): 3.1 Over the next five years, I will pay for a mobility subscription package that includes all mobility options: 2.9	Over the next five years, I will be replacing my current vehicle with an electric one (including hybrid and hydrogen powered vehicles): 3.2 Over the next five years, I will replace my car with other forms of mobility (ridesharing, public transport, cycling, walking): 2.9 Over the next five years, I will use autonomous vehicles to transport from point A to point B: 2.5 Over the next five years, I will only use shared forms of mobility (example Avant2Go): 2.1 Over the next five years, I will stop using my personal vehicle: 1.8 Over the next five years, I will use mobility as a service (integration of all types of mobility in one application): 2.5 Over the next five years, I will pay for a mobility subscription package that includes all mobility options: 2.4	Over the next five years, I will be replacing my current vehicle with an electric one (including hybrid and hydrogen powered vehicles): 3.1 Over the next five years, I will replace my car with other forms of mobility (ridesharing, public transport, cycling, walking): 2.6 Over the next five years, I will use autonomous vehicles to transport from point A to point B: 2.7 Over the next five years, I will only use shared forms of mobility (example Avant2Go): 2.0 Over the next five years, I will stop using my personal vehicle: 1.9 Over the next five years, I will use mobility as a service (integration of all types of mobility in one application): 2.7 Over the next five years, I will pay for a mobility subscription package that includes all mobility options: 2.5	**Over the next five years, I will be replacing my current vehicle with an electric one (including hybrid and hydrogen powered vehicles): 3.5** **Over the next five years, I will replace my car with other forms of mobility (ridesharing, public transport, cycling, walking): 4.0** **Over the next five years, I will use autonomous vehicles to transport from point A to point B: 3.3** **Over the next five years, I will only use shared forms of mobility (example Avant2Go): 2.7** **Over the next five years, I will stop using my personal vehicle: 2.3** **Over the next five years, I will use mobility as a service (integration of all types of mobility in one application): 3.3** **Over the next five years, I will pay for a mobility subscription package that includes all mobility**

	Over the next five years, I will pay for mobility according to each ride separately: 2.7	**Over the next five years, I will pay for mobility according to each ride separately: 2.9**	Over the next five years, I will pay for mobility according to each ride separately: 2.7	Over the next five years, I will pay for mobility according to each ride separately: 2.7	**options: 3.0** Over the next five years, I will pay for mobility according to each ride separately: 2.7
Attitude towards using a personal vehicle	**I don't have a car / access to a car: 12.7 %** I already use other means of mobility and intend to reduce car use even further: 12.7 % I currently use the car frequently, but plan to reduce it in the future: 7.3 % I currently use the car frequently and have not considered the reduction in the usage: 20.0 % Due to the current situation, minor use of the car is not possible: 47.3 %	I don't have a car / access to a car: 5.9 % I already use other means of mobility and intend to reduce car use even further: 11.8 % I currently use the car frequently, but plan to reduce it in the future: 7.8 % I currently use the car frequently and have not considered the reduction in the usage: 29.4 % Due to the current situation, minor use of the car is not possible: 45.1 %	I don't have a car / access to a car: 10.3 % I already use other means of mobility and intend to reduce car use even further: 6.9 % **I currently use the car frequently, but plan to reduce it in the future: 13.8 %** **I currently use the car frequently and have not considered the reduction in the usage: 31.0 %** Due to the current situation, minor use of the car is not possible: 37.9 %	I don't have a car / access to a car: 4.5 % I already use other means of mobility and intend to reduce car use even further: 4.5 % I currently use the car frequently, but plan to reduce it in the future: 4.5 % I currently use the car frequently and have not considered the reduction in the usage: 31.8 % **Due to the current situation, minor use of the car is not possible: 54.5 %**	I don't have a car / access to a car: 3.3 % **I already use other means of mobility and intend to reduce car use even further: 20.0 %** I currently use the car frequently, but plan to reduce it in the future: 13.3 % I currently use the car frequently and have not considered the reduction in the usage: 26.7 % Due to the current situation, minor use of the car is not possible: 36.7 %
Gender	Male: 32.7 % Female: 67.3 %	Male: 47.1 % Female: 52.9 %	Male: 41.4 % Female: 58.6 %	**Male: 54.5 %** Female: 45.5 %	Male: 16.7 % **Female: 83.3 %**
Age (average)	33.1	33.0	32.4	**35.5**	33.8

Completed level of education	Primary school: 0.0 % High school: 16.4 % Higher school /Training programme: 7.3 % Undergraduate studies: 43.6 % Master's studies: 32.7 % PhD studies: 0.0 %	Primary school: 0.0 % High school: 17.6 % Higher school /Training programme: 5.9 % Undergraduate studies: 45.1 % Master's studies: 29.4 % PhD studies: 2.0 %	Primary school: 0.0 % High school: 13.8 % **Higher school /Training programme: 13.8 %** Undergraduate studies: 34.5 % **Master's studies: 34.5 %** PhD studies: 3.4 %	**Primary school: 4.5 %** **High school: 36.4 %** Higher school /Training programme: 0.0 % Undergraduate studies: 36.4 % Master's studies: 22.7 % PhD studies: 0.0 %	Primary school: 0.0 % High school: 23.3 % Higher school /Training programme: 6.7 % **Undergraduate studies: 46.7 %** Master's studies: 16.7 % **PhD studies: 6.7 %**
Location of residence	Village: 30.9 % Small town:12.7 % Town: 12.7 % City: 43.6 %	Village: 27.5 % Small town: 7.8 % Town: 23.5 % City: 41.2 %	**Village: 44.8 %** Small town: 0.0 % **Town: 27.6** % City: 27.6 %	Village:18.2 % Small town: 4.5 % Town: 27.3 % **City: 50.0 %**	Village: 36.7 % **Small town: 20.0 %** Town: 10.0 % City: 33.3 %
Average monthly income	2,080.0 €	**2,471.1 €**	2,124.1 €	2,285.7 €	1,740.7 €