ΕΘΝΙΚΟ & ΚΑΠΟΔΙΣΤΡΙΑΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ΣΧΟΛΗ ΘΕΤΙΚΩΝ ΕΠΙΣΤΗΜΩΝ
ΤΜΗΜΑ ΓΕΩΛΟΓΙΑΣ & ΓΕΩΠΕΡΙΒΑΛΛΟΝΤΟΣ

NATIONAL & KAPODISTRIAN UNIVERSITY OF ATHENS
SCHOOL OF SCIENCES
DEPARTMENT OF GEOLOGY & GEOENVIRONMENT

ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝ ΣΠΟΥΔΩΝ
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POST GRADUATE PROGRAM
ENVIRONMENTAL, DISASTER & CRISES MANAGEMENT STRATEGIES

Μεταπτυχιακή Διατριβή Ειδίκευσης
Master Thesis

Digital Applications in Urban Public Transport: A Comparative Analysis of Shared and Sustainable on-demand transport solutions in Germany and Greece

Ψηφιακές Εφαρμογές στις Αστικές Δημόσιες Συγκοινωνίες:
Μια Συγκριτική Ανάλυση των Διαμοιραστικών και Βιώσιμων Συγκοινωνιακών Λύσεων κατά παραγγελία για την Γερμανία και την Ελλάδα

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I. Acknowledgements

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II. Abstracts

i. Abstract (English version)

Digital applications are transforming the functioning of cities, proposing solutions to urban challenges. Digital transport solutions have become a representative example of the implementation of sustainable mobility strategies in cities. This master thesis focuses in the case of on-demand Ridepooling and aims to investigate whether on-demand Ridepooling is a sustainable urban mobility solution. Can on-demand Ridepooling contribute to the sustainable development of urban areas and can it really provide solutions to the urban mobility challenges cities face today? What is a sustainable mobility solution and how is it measured? These are the driving questions of this research, that presents an interdisciplinary comparative assessment of on-demand Ridepooling in Germany and Greece. Unique operational data of on-demand Ridepooling in Germany are published for the first time. Operations are predicted and simulated for Greece, where on- demand Ridepooling doesn't exist yet. Moreover, significant literature review on sustainable mobility indicators is presented. The relation of on-demand Ridepooling to the three pillars of urban sustainable development is examined. Furthermore, a selection of interviews with key stakeholders, planners, and transport experts provides unique insights regarding the differentiated paths those two countries are following in shared transport solutions. Finally, policy recommendations are extracted, regarding a) the applicability of digital shared mobility solutions, such as on-demand Ridepooling and b) the synergies between public policies and market forces in order to achieve effective and sustainable mobility solutions for the urban ecosystem.

Key words: *Shared Public Transport, Sustainable Mobility, on-demand Ridepooling, Comparative Analysis, Policy Recommendations, Urban Mobility Revolution, Germany, Greece*

ii. Abstract (Greek version with Title)

«Ψηφιακές Εφαρμογές στις Αστικές Δημόσιες Συγκοινωνίες: μια Συγκριτική Ανάλυση των Διαμοιραστικών και Βιώσιμων Συγκοινωνιακών Λύσεων κατά παραγγελία για την Γερμανία και την Ελλάδα»

Οι ψηφιακές εφαρμογές μετασχηματίζουν την λειτουργία των πόλεων, προτείνοντας λύσεις στις αστικές προκλήσεις. Οι λύσεις ψηφιοποιημένων συγκοινωνιών αποτελούν ένα αντιπροσωπευτικό παράδειγμα εφαρμογής βιώσιμων στρατηγικών κινητικότητας στις πόλεις. Η παρούσα μεταπτυχιακή εργασία επικεντρώνεται στην περίπτωση του Συνεπιβατισμού κατά παραγγελία (κ.π.) (on-demand Ridepooling) και έχει ως στόχο να διερευνήσει το κατά πόσο ο Συνεπιβατισμός κ.π. αποτελεί βιώσιμη λύση αστικής κινητικότητας. Μπορεί η υπηρεσία του Συνεπιβατισμού κ.π. να συμβάλει στην αειφόρο ανάπτυξη αστικών περιοχών; Μπορεί πραγματικά αυτή η υπηρεσία να προσφέρει λύσεις στις προκλήσεις αστικής κινητικότητας που αντιμετωπίζουν σήμερα οι πόλεις; Τι αποτελεί βιώσιμη λύση κινητικότητας και πώς αυτή μετράτε; Τα παραπάνω ερωτήματα καθοδηγούν την παρούσα έρευνα, που παρουσιάζει μια διεπιστημονική και συγκριτική αξιολόγηση του Συνεπιβατισμού κ.π. για την Γερμανία και την Ελλάδα. Μοναδικά επιχειρησιακά δεδομένα της υπηρεσίας του Συνεπιβατισμού κ.π. στην Γερμανία δημοσιεύονται για πρώτη φορά. Προβλέψεις και προσομοιώσεις της υπηρεσίας παρουσιάζονται για την Ελλάδα, όπου η λειτουργία του Συνεπιβατισμού κ.π. δεν υφίσταται ακόμα. Επιπλέον, παρουσιάζεται σημαντική βιβλιογραφική ανασκόπηση δεικτών βιώσιμης κινητικότητας και εξετάζεται η σχέση του Συνεπιβατισμού κ.π. με τους τρεις πυλώνες της αστικής αειφόρου ανάπτυξης. Επιπροσθέτως, επιλεγμένες συνεντεύξεις με εμπειρογνώμονες, συγκοινωνιολόγους, πολεοδόμους και σημαντικούς φορείς παρέχουν μοναδικά στοιχεία σχετικά με τις διαφοροποιημένες τάσεις που ακολουθούν αυτές οι δύο χώρες στις διαμοιραστικές συγκοινωνιακές λύσεις. Τέλος, εξάγονται συστάσεις πολιτικής σχετικά με: α) την εφαρμογή ψηφιακών λύσεων διαμοιραστικής συγκοινωνίας, όπως αυτής του Συνεπιβατισμού κ.π και με β) τις συνέργειες μεταξύ δημόσιων πολιτικών και δυνάμεων της αγοράς, προκειμένου να επιτευχθούν αποτελεσματικές και βιώσιμες λύσεις κινητικότητας για το αστικό οικοσύστημα.

Λέξεις Κλειδιά: *Διαμοιραστική Δημόσια Συγκοινωνία, Βιώσιμη Κινητικότητα, Συνεπιβατισμός κατά παραγγελία (κ.π.), Συγκριτική Ανάλυση, Συστάσεις Πολιτικής, Επανάσταση Αστικής Κινητικότητας, Γερμανία, Ελλάδα*

III. List of Abbreviations

BVG = Berliner Verkehrsbetriebe = Berlin Transport Operator Company

CST = Canadian Centre for Sustainable Transportation

DESI = Digital Economy and Society Index

EU = European Union

GDP = Gross Domestic Product

GTFS = General Transport Feed Specification Data

I_SUM = Index of Sustainable Urban Mobility

ITDP = Institute for Transportation and Development Policy

KPIs = Key Performance Indicators

LHM = Landeshauptstadt München = City State of Munich

MVG = Münchner Verkehrsgesellschaft mbH = Munich Transport Operator Company

OECD = Organization for Economic Co-operation and Development

ORSA = Athens Regulatory Plan Organization (Οργανισμός Ρυθμιστικού Σχεδίου Αθήνας)

PT = Public Transport

PTO = Public Transport Operator

SUMPs = Sustainable Urban Mobility Plans

TNCs = Transportation Network Private Companies

VCD = Verkehrsclub Deutschland = German Traffic Association

VDA = Verband der Automobilindustrie = German Automobile Industry Association

0. Introduction

Movement is a core evolutionary necessity as far as survival on Earth is concerned (Darwin, 2009). All micro – and macro- organisms need to directly or indirectly move to survive and reproduce themselves (Ibid.). Movement is a prerequisite for the development and maintenance of cells, associated with the fulfillment of basic needs, survival and prosperity. The science of Biology explains principally that in order for a cell to maintain itself, robust movement is required from the cell's compartments (Alberts *et al.*, 2014). The cellular compartments precisely and robustly are being transported by regulatory mechanisms inside the cell. This movement defines the cell's survival, development and prosperity.

Biology's principles and learnings about organizational structures can be a useful model for understanding the subjective creations of human beings. Those subjective creations are the urban environments, the cities that human beings create to reside in. Cities are like cells, and human citizens are the compartments of those urban constellations. Likewise, with cells, in order for a city to efficiently function, maintain and prosper, a sustainable and efficient mobility system is needed. This mobility system can be identified as the public transport (PT) system that every city has, enabling public movement for its citizens.

Mobility is a core function of life in cities. It plays a fundamental role in the economy, the urban environment, and the society itself, by shaping the access, the quality and the status of those pillars. Subsequently, the quality of urban mobility enables the possibilities and opportunities of each citizen and defines their everyday life. We conclude, that urban mobility is of high importance, as it offers and expresses at the same time, the level of freedom residents have in their urban environments.

Parallel to human development and evolution, cities being the cells that host humans, experience changes as well. Compared to the past, cities today undergo alterations, that give birth to multiple challenges (Walker, 2011). The phenomenon of the urbanization process; the severe concentration of the world population in the cities, is an undeniable reality (United Nations, 2018). At the same time, the world population grows rapidly, which combined with the urbanization, impose spatial challenges that urban planners, politicians and policy experts need to resolve.

In this urban reality, comes another factor that has been adding challenges since the last four decades, into today's growing cities: the private passenger car. A symbol of freedom in the 70's, the holy grail of private transport, the private passenger car developed massively after the 2nd World War, establishing itself globally as the standard for land transport. However, today it finds itself as one of the core reasons of problems that cities face. Unbearable urban congestion, inequitable distribution of urban space (Peñalosa, 2013), CO_2 and NO_X emissions contributing to health problems, fatal accidents, Global Warming - and these are just some of the most well-known direct influences that private passenger cars have brought to cities (Bakogiannis *et al.*, 2016) (Chestnut and Mason, 2019). Combined with the economy's and society's dependence on fuels and cars, the seriousness of car centricity can also be underlined in the social imbalances and movements produced by specific tax alterations on fuels that have political implications, like in the recent case of the French "Yellow Vest" movement (Kar-Gupta, 2019).

Reflecting upon the urban challenges, the principle of sustainability shines positively above them, as the rescuing shift, as the guideline that could drive solutions (United Nations, 2018). Sustainability imposes itself as the inevitable way of urban living that needs to be adopted, in all three pillars of urban life; economy, society and environment. In the aftermath of the financial and economic crisis of 2008, which 11 years ago struck the globe, significant new trends in the global economy, have made their appearance. One of those trends concerns ownership and collaborative consumption, particularly as it is conceived by the younger generation. The new generation of *homo economicus* (Oxford Dictionaries, 2019) does not have the need to possess goods, but rather focuses on the use of them as ownership is replaced by management and consumers become users and creators (Stahel, 2015). Those new consumers embrace the practice of collaborative consumption, over ownership. The fundamentals of a new-born economy, the Sharing Economy are clearly set and here to stay. Subsequently, the practice of sharing is affecting the mentality of citizens, the way they transact in the urban economy and they way they interact with each other, creating new models of utilizing goods.

Last but not least, the sphere of technology is also playing a great role in the evolution of cities. As the world is experiencing the 4th industrial revolution; the epoch of digitalization (Schwab, 2018), cities experience the influence and the need for digitalization. The forces of digitalization affect multiply the way cities organize themselves, especially in public goods provision sectors. One of these affected sectors, is also the mobility one, with the PT system on the front line.

As new technologies emerge, it becomes clear that not all urban systems are developing as fast. Public transport for instance. In the last 100 years, the development of public transport has stagnated. In recent years, new transport modes and new mobility mentalities have appeared, creating the mobility revolution that our times are experiencing (Zhang, 2017). Such new mentalities include all types of shared mobility and also the autonomous mobility (Ibid.).

Cities have started to place their hope to those new mobility trends, experimenting and embracing notions of them, in the spotlight of dealing with their urban challenges. Cities are trying to face their new challenges, by adopting new ways of thinking that can lead to the adoption of new technological solutions. One of these innovative mobility solutions happens to be on-demand mobility (Cohen and Kietzmann, 2014) (Greenblatt and Shaheen, 2015) and its product of on-demand Ridepooling; which is the topic of this research.

The current research focuses on publicly operated on-demand Ridepooling, as being the newest shared PT mode that cities experiment with. In the name of minimizing private passenger cars, in the name of creating a modern, resilient and at the same time a flexible PT system, cities have started to test on-demand Ridepooling. At the same time, there are many citizens and officials who criticize or oppose such systems, arguing for the traditional transport modes and raising concerns about the cannibalization of classical PT.

What is really valid in those two opposing sides and how sustainable is Ridepooling in the end? Can it really provide solutions for the mobility challenges cities face today, under the pressure of urbanization, congestion, global warming and urban space scarcity? What is a sustainable mobility solution, how is it defined and to what extent is on-demand Ridepooling sustainable? How can the mobility revolution be utilized to solve urban problems and how could on-demand Ridepooling operate in the end to really bring an urban change? These are the driving questions of this research, that analyses on-demand Ridepooling through an interdisciplinary approach.

The current research consists of 5 chapters. The first chapter presents mobility today, its essence and its aforenoted challenges. It continues introducing analytically shared urban transport, in the spotlight of the Shared and Digital Economy. The second chapter is devoted to Sustainability and Sustainable Transport. Sustainability is presented as the emerging principle of our times, that should orchestrate urban development and growth, for the sake of urban maintenance and prosperity. Emphasis is given on how the principles of sustainability are translated in the field of mobility. The research presents, an analytical literature review on Sustainable Mobility and on the established indicators and metrics used to define it. Those metrics are further used and set as the baseline for the comparison, analysis and criticism of whether on-demand Ridepooling is a Sustainable Urban Mobility solution. For the sake of this comparison, this research uses the on-demand Ridepooling indicators that door2door GmbH is using, to implement on-demand Ridepooling in German cities. With the courtesy of door2door GmbH on offering their data, the comparison of on-demand Ridepooling with the Sustainable Mobility Indicators of the international bibliography is enabled.

Moving forward, the third chapter of this research is analyzing existing cases of on-demand Ridepooling in German cities. The focus is given to Berlin and Munich, where on-demand Ridepooling is revolutionizing urban mobility. The German economic, political and mobility reality is presented in the background of on-demand Ridepooling public operations, in Berlin and Munich. Important insights are given on obstacles, visions, operations and stakeholder management. Those insights are based on a selection of interviews with key stakeholders, planners and transport experts as well as unique secondary data from operations and strategic planning. It is also important to highlight that, part of those operations data are published for the first time, with the courtesy of the Munich's Public Transport Company and Operator (MVG) and the software private company door2door GmbH. Subsequently, this research provides unique evidence and enlightening conclusions on shared mobility and Ridepooling, that can serve as pioneering examples for other cities to be inspired by and even follow according to their customized urban mobility problems.

The fourth chapter of this research is proceeding to a comparative analysis of on-demand Ridepooling between Germany and Greece. Attempting to apply the enlightening conclusions from the German cases on Ridepooling, a simulation of on-demand Ridepooling for the case of Greek cities is presented. The cities of Athens and Thessaloniki are analyzed, on their economic and mobility challenges. This analysis serves as the starting point for imagining and proposing on-demand Ridepooling, under specific guidelines. The comparative analysis between Germany and Greece, reveals variables that are prerequisites for the enabling of Ridepooling on a larger scale. Such success variables include the level of digitalization of the economy, the shaping and implementation of public policy in transportation, the entrepreneurship activity and the synergies between public policies and market forces.

The fifth chapter collects and discusses the unique results of this research on the following questions a) how sustainable is Ridepooling, b) how should it be operated and what does it take for a city to do so, c) how is Ridepooling operating in Germany and d) why and how could it potentially operate in Greece. These questions provided the inspiration and triggered the realization of this research. Their answers are summarized into final guidelines and policy recommendations. Last but not least, the firth chapter concludes with further open questions and implications of on-demand Ridepooling, that remain to be researched in the future.

1. Urban Mobility Today

1.1. The essence of Urban Mobility Today

Movement is a core function that has evolutionary been selected for survival of life on earth. All micro – and macro- organisms need to directly or indirectly move to survive and reproduce themselves. Movement is a prerequisite for the development and maintenance of cells, molecular structures and living organisms as it is associated with the fulfillment of basic needs, (survival and) to the prosperity. The science of Biology explains principally that in order for a cell to maintain itself, robust movement is required from the cell's compartments. The cellular compartments precisely and robustly are being transported by regulatory mechanisms inside the cell. This movement defines the cell's survival, development and prosperity.

Learning from the science of Biology, being the study of the objective and undeniable creations of nature, we can understand better the subjective creations of human cities, which human beings create to reside in. Those cities are like cells, and human citizens are the compartments of those urban constellations. Likewise, with cells, in order for a city to efficiently function, maintain and prosper, a sustainable and efficient mobility system is needed. This mobility system can be identified as the PT system that almost every city has. The PT system is the one that enables public mobility for the citizens.

Cities are the expression of the human urban life, where humans, like all organisms, form their societies necessary to fulfil their needs. Citizens need to be mobile and interact with other citizens, for the sake of food, work, entertainment and more. It is therefore undeniable, that human mobility in cities is a basic characteristic and vital aspect of urban life.

As urban mobility is connected to various aspects of urban life, it influences and gets influenced bidirectionally from important themes of urban life. Figure 1.1., provided by the author as part of personal brainstorming, presents an Organogram which illustrates the relation of urban mobility to important aspects of urban life. More specifically, the pillars of the Economy, Environment, Society, Urban Development, Urban Space, Policy, Big Data and Technological Innovation, are identified as core themes, that affect and get affected by urban mobility. As illustrated, each pillar expands into detailed brunches, of how urban mobility affects those pillars. Significant details of how urban mobility affects those pillars, include the dissolution of ghettos, accessibility to people and work and equity on public space. Public -private collaborations, the price of the petrol barrel, financial crisis, sustainable, innovative and technological solutions are affecting urban mobility as well.

Moving further, the quality each time of urban mobility will define the quality of life one may have in cities. Incomplete supply of urban mobility is connected to a decreasing equity, freedom and quality of life. As Jarret Walker, the eminent PT expert explains, the notion and quality of freedom citizens can enjoy is closely connected and dependent to the urban mobility and the PT network a city provides (Walker, 2011).

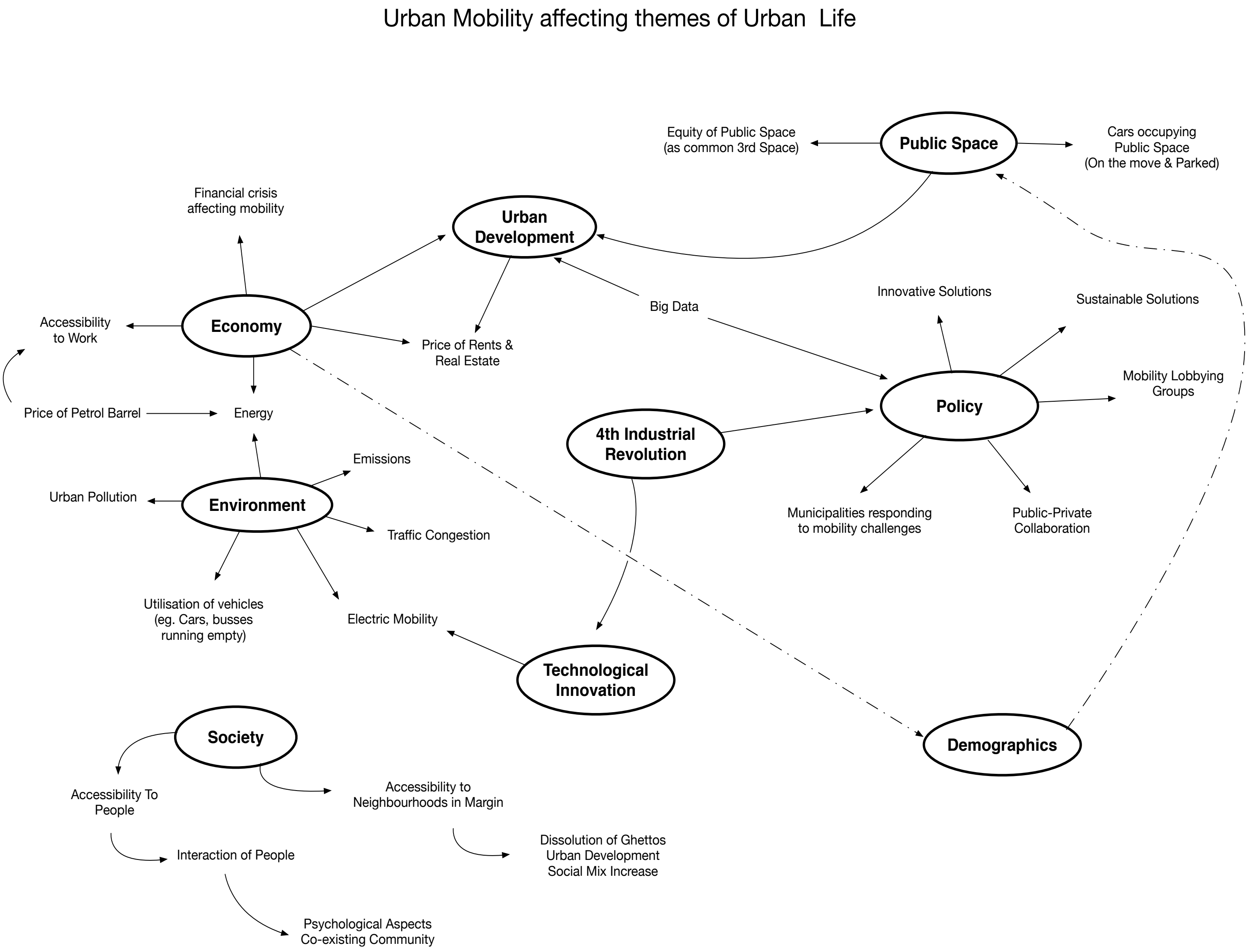

Figure 1.1. The relation of Urban Mobility to aspects of Urban Life. The figure provided by the author as part of personal brainstorming, presents an Organogram illustrating the relation of urban mobility to important themes of urban life. The pillars of the Economy, Environment, Society, Urban Development, Urban Space, Policy, Big Data and Technological Innovation, are identified as core themes, that affect and get affected by urban mobility. Each pillar is subsequently expanding into detailed brunches, of how urban mobility affects those pillars. Significant details of how urban mobility affects those pillars, include the dissolution of ghettos, accessibility to people and work and equity on public space. Public -private collaborations, the price of petrol barrel, financial crisis, sustainable, innovative and technological solutions are affecting urban mobility as well.

1.2. The Challenges of Urban Mobility

Today, urban environment is being challenged by multiple forces. Such tenacious forces include the population growth, the urbanization process, the CO_2 and NO_x emissions, the car centricity and its subsequent traffic congestion and scarcity of public urban space. Those emerging urban challenges are the ones that loudly ring the alarming bells of the need of changing how mobility is organized today in urban environments.

To this warning bells of change, cities need to respond, by finding and adopting solutions to their urban mobility. Adaptability to change is crucial for every system. This principle coming once more from biological ecosystems, applies perfectly to the human made urban systems, like the one of urban mobility. If the PT systems do not adjust to the rapid change that happens in their urban environment, then the probability of their failure as systems is high.

1.2.1. Urbanization and Population Growth

Population growth is a reality. In 2017 the world population accounted 7,6 billion. The United Nations report that until 2050, the world's population is expected to increase by 2.2 billion, reaching 9.8 billion (United Nations, Department of Economic and Social Affairs, 2017).
At the same time, urbanization is a clear real process happening already in the past decades and expected to continue even more drastically. The world's population living in urban areas in 2018 was 4,2 billion people, and it is expected to be increased by 2,5 billion people, reach 6.4 billion by 2050 (United Nations, 2018). This projection will mean that between 2007 and 2050, the world's urban population will have doubled itself, from 3,3 billion in 2007 to 6,7 billion in 2050 (United Nations, 2008).

Considering the world population residing in urban areas as a percentage of the total world population, 55% of the world population was living in urban areas in 2018 and it is expected to be increased to 68% by 2050. At the same time, in the European context urbanization follows a similar increasing trend. In 2018 the split proportion of urban – rural population in Europe accounted 74% for urban and 26% for rural residents (United Nations, 2018), meaning that more than two-thirds of the European population live in urban areas.
Economically speaking, up to 85 % of Europe's GDP is generated in urban areas (European Commission, 2019). This indicates not only the profound economic importance of urban areas for the EU, but also the dependence of the EU economic development and growth on urban areas.

Looking towards the future, in 2050 it is expected that the European population residing in urban areas will be increased, reaching the 84% of the total European population (United Nations, Department of Economic and Social Affairs, 2014). Consequently, the undeniable agglomeration in cities will impose large urban planning challenges, for all aspects of the urban life, such as mobility, education, housing, health care and more. Public sources are scarce and are designed to serve a fixed number of civilians. Higher population densities will entail changes in the way public recourses are planned and distributed.

Summarizing, as Noland and Polak state, due to the growth of cities in population and land use, increasing pressure is being placed on the reliability of urban transportation systems (Noland and Polak, 2002). Questions such as, *how will cities deal with the increasing citizens number, in terms of mobility?* and *how will cities face the new complex transport challenge?* arise.

1.2.2. Car centricity, Emissions and Traffic Congestion

Car centricity, is another challenge urban environments face today. Cities in the 20^{th} century were build around cars, as Vlastos, Prof of Urban & Transport Planning underlines in his interview for this research. Due to the existence, and in some cases dominance, of private passenger cars in cities, a sequence of other problems are born and challenge cities. Car centricity, is connected to CO2 and NOx emissions that pollute the urban atmosphere, producing health problems to citizens, due to the fact that cars minimize exercise and do increase air contamination (Pucher and Dikstra, 2003). What is more, Peñalosa, the former mayor of Bogota who advocates for sustainable urban mobility, underlines that car centricity leads to unequal distribution of public space between private passenger car users and pedestrians (Peñalosa, 2013), positing that car centricity is causing the scarcity of public space. As Peñalosa adds, while every citizen has the right in front of the law to public space, 80 passengers in one bus, have cumulatively a higher priority than 1 passenger in a private car (Ibid.). Additionally, to the disbalanced equity, excessive car centricity leads to traffic congestion, that in turn leads to costs. In conclusion, car centricity is a detrimental phenomenon, adding barriers to the existence a sound urban environment.

Bakogiannis et al. begin their detailed presentation of the above multilateral problem by explaining that private motorized transport entails high costs for both individuals and society. Those costs can be direct, such as road construction, private car purchase and maintenance, but also indirect, such as obesity, fatalities, air pollution and congestion (Bakogiannis *et al.*, 2016). Since the establishment of the automobile back in the 1^{st} Industrial Revolution, today car traffic has increased tenfold, when cycling and PT have seen hardly any growth (Litman, 2018). Even if car ownership is a costly case, worldwide vehicle ownership extracted for a representative sample of 45 OECD countries has been since 1960 unanimously increasing (Dargay *et al.*, 2007).

Subsequently, apart from increasing congestion, the worldwide vehicle ownership increase has lead to increasing emissions. More specific, in the United States, transportation accounts for nearly 30 % of all greenhouse gas emissions (Chestnut and Mason, 2019), while in 2009 the European Commission announced that road transport is causing 40% of Europe's CO_2 emissions and urban traffic is causing 70% of other air pollutants such as NO_x and PM10 (Bakogiannis *et al.*, 2016).

From an economic perspective, it is worth noting that it has been estimated that in Europe the external costs of individual motorized transport, seen as road transport costs, are able to reach up to the 8% of the national GDP (Bakogiannis *et al.*, 2016).

At the same time, the high demand on earth resources that fuel cars, contradicts the scarcity of those resources (United Nations, 2012). Already in 1997, the United Nations foreshadowed that in the next 20 years the transportation sector will be in a growing demand for energy (United Nations Sustainable Development Goals, 2019), that will not be sustainable to satisfy.
Those challenges question the future of the conventional car that once symbolized urban freedom in the 1970s. The importance of this questioning, can be also understood by the fact that the EU since the last decade is focusing more and more on CO_2 and NO_x regulations (Transport and Environment, 2018). The seriousness of this topic, as well as the dependence on fuels and cars that the economy and society have, can be also underlined in the social imbalances and strikes, that specific tax alterations on fuels can produce. The recent 2018, and persisting until today, social and political movement of the "Yellow Vest" in France, is exemplary on how complicated, serious and deeply rooted in economics the topic of fuel and its handling is today (Kar-Gupta, 2019).

Concluding, the need of thinking differently on public mobility, is today more urgent that ever. It entails a different attitude, than the one that also produced all those mobility challenges that cities face today. For example, research shows that increasing the hard infrastructure of highways in cities, is not resolving the problem of traffic congestion, but on the contrary it is contributing even more to congestion (Handy, 2015). It is obvious that outdated solutions from the past decades cannot resolve any longer the urban mobility problems of today, and new perspectives need to bring new and innovative solutions.

1.3. Shared Mobility in the Shared and Digital Economy

In the aftermath of the financial and economic crisis of 2008, which 11 years ago stuck the globe, significant new trends in the global economy, have established stronger their appearance, More specifically, Cohen and Kietzmann underline that the Sharing Economy and its sharing models may have a causality connection to the global economic recession of 2008 and to its new emerging need of thrifty spending (Cohen and Kietzmann, 2014).
The Sharing Economy (or elsewise called on-demand access based economy) is the broader term describing emerging economic-technological systems, which first appeared in the 2000s (Bálint, 2016) and until today comprise a manifested way of how the economy can alternatively be organized. Thus, the practice of sharing is highlighted as more important that the status of owning.

At the same time, in the spotlight of technological innovation and the epoch of the internet and the virtual space, economy and society is being influenced and transformed, on the way everyday life is realized (Ibid). As mobility is a core part of the urban life, mobility itself undergoes a revolution as well, driven by the digitalization process and the Sharing Economy (Zhang, 2017).

More specific, modes of shared mobility are becoming more and more appealing to cities, fueling the urban mobility revolution (Zhang, 2017) and posing a potential solution to the complex problems cities face today. Shaheen et all. indicate that recently "socio-economic forces coupled with advancements in technology, social networking, location-based services, wireless services, and cloud technologies are contributing to the growth of shared and on-demand mobility" (Shaheen, Cohen and Bayen, 2018).

Gabe Klein, the former Director of the Washington D.C. Department of Transportation and at the same time a strong promoter of shared mobility states " ..in front of climate change [..] we need to radically restructure our lives and how we move. This requires us to engage with any new form of mobility that could bring us closer to the goal of sustainability" (Klein, 2018). Klein furthermore states that "we do not need to slow down the adoption of new technologies, (but) we need to speed up our ability to integrate them" (Ibid.).

Sharing mobility concepts are not a new phenomenon though, as they have been existing for some decades now (Orsatto and Clegg, 1999). As Transport Expert Kokkinos, formerly from OASA S.A. (Athens Public Transport Authority) explains in his valuable interview for the current research (Annex. 8.7.), shared mobility modes have existed since the 1970s in the USA. The reason though why today shared mobility is attracting a lot of attention and actual operational scale, is due to recent improvements on the information and communication technologies (Cohen and Kietzmann, 2014), such as the mobile geolocation technology.

The international Transport Forum of OECD, conducted in 2015 and 2017 two researches, in Lisbon and Helsinki concerning shared automated and shared on-demand mobility respectively. The studies research the effect of shared mobility on the urban ecosystem, for the potential case of having shared automated or shared on-demand mobility replacing private passenger cars, amongst other transport modes.

The results of those researches underline that shared self-driving mobility solutions combined with high-capacity PT, "could remove 9 out of every 10 cars and use 65% fewer vehicles during peak hours in a mid-sized European city" (International Transport Forum, 2015).

The policy recommendation of the Lisbon study reaffirms that shared vehicle fleets free up significant amounts of space in a city. What is more, the policy recommendation underlines the important role of authorities, in shared mobility fleets. In specific the regulatory and fiscal role of the public sector is vital on guiding the developments of shared mobility in cities, but also in some cases maintaining market barriers (Ibid.). As the newest Helsinki study proposes develops further the policy recommendations around authorities, it underlines that "the benefits of on-demand shared mobility services depend on creating the right market conditions and operational frameworks" (International Transport Forum, 2017). Finally, the recommendations conclude that shared mobility solutions when acting as feeder services to existing PT modes such as metro or rail lines, "better and more equitable access to opportunities, improved (public) service quality and a reduction of CO_2 emission" can be achieved (Ibid.). At this point, the importance of integration is underlined, as a key factor a successful operation of shared urban mobility. On a final emissions note, when shared mobility is operated with the use of electric vehicles in its fleet, emissions can be further reduced (Ibid.)

1.3.1. The modes of Shared Mobility - Definitions and Criticism

This research presents in summary some of the most significant shared transport modes today including; Carpooling, Carsharing, Ridehailing/Ridesharing, Bikesharing and on-demand Ridepooling. After the short analysis of all, this research is devoted to the mode of on-demand Ridepooling, investigating if it serves as a sustainable urban mobility solution and examining its use in Germany and potentially in Greece.

1.3.1.1. Carpooling

Starting with carpooling as one of the oldest shared transport modes, Kokkinos explains in his interview (Annex 8.7.) that back in the 1970s, USA cities where facing unbearable traffic congestion and where in the need of a smart solution to tackle this problem. The concept of carpooling emerged in corporate environments, where vehicles owners allowed other passengers, with same or similar destinations, to ride in the same private vehicle.

For the sake of distinguishing further shared transport modes, it is important to point out that the owner of the shared vehicle in carpooling was and is always a private person. Kokkinos explains further, that carpooling was mainly organized between employees of the same corporation or institution, to enable shared rides that had same or similar starting and ending destinations. This would save time and costs for the employees, and spare street space for the public. Employees would organize carpooling analogically and manually, by setting up city maps in the office walls, where everyone willing to participate would pin their home locations, aka their end destinations.

1.3.1.2. Carsharing

Carsharing, as a shared mobility mode, refers to the business models of companies acquiring vehicles and supplying the at key points inside a city (Cohen and Kietzmann, 2014)
Carsharing, allows to registered members to pick up a vehicle at those key points inside the city, and drop it off at another point.

Called otherwise as one-way carsharing by Shaheen et al., the practice of carsharing has had a rapid worldwide expansion since 2012 (Shaheen *et al.*, 2015). At the same time, it has been acknowledged, that carsharing is offering a valid solution to the firs-last mile connectivity problem, which is identified as a major urban mobility issue (Ibid.). The first-last mile issue is referring to the access to and from PT (Shaheen and Chan, 2015).

Apart from the flexibility that carsharing is offering, carsharing is substantially reducing CO_2 emissions, amongst all other Greenhouse emissions (Ibid).
As cars stand idle 95% of their time, Carsharing by making cars accessible to non-owners is reducing the number of cars required for a given kilometer distance (Frenken and Schor, 2017).

1.3.1.3. Ridehailing/Ridesharing

Ridehailing or Ridesharing, refers to the on-demand ride service that transportation network private companies (TNCs) such as Uber, Lyft, and Sidecar provide, to connect community drivers with passengers, through the use of an online platform and smartphone applications (Shaheen and Chan, 2015). Ridehailing platforms operate under a for-profit business model, using the power of social networking to scale infinitely (Cohen and Kietzmann, 2014). Today the power and establishment of Ridehailing companies in cities around the world is impressive. For example Uber, one of the most successful Ridehailing companies, operates since 2009 in more than 600 cities, at 65 countries in the world (Uber Technologies Inc., 2019), reporting for 2018 revenues of 11.27 billion $ and net income of 997 million $ (Dickey, 2019).

It is important to mention that, Ridehailing or otherwise Ridesharing, has been controversial, receiving a lot of critic, on whether it is as a real mobility solution, or it is actually worsening the mobility reality of cities. Barrios et al. found out that the introduction of Ridehailing/Ridesharing "is associated with an increase in arterial vehicle miles traveled, excess gas consumption, annual hours of delay in traffic" (Barrios, Hochberg and Yi, 2018), as well as with "reductions in the utilization of city buses" (König, Bonus and Grippenkoven, 2018a).

Given the fact that Ridehailing is most of the times provided by independent private companies such as Uber and Lyft that are independent from or competing with the PTOs, the Ridehailing service is not intergraded in the PT network but operates as an additional one. This can explain the aforenoted increases of traffic, driven kilometers and gas consumption.

What is more, as those private companies seek for profit to sustain their business models, they choose to operate only in some specific busy areas of high demand, in order to secure the profit of their business. This process, also known in the mobility market as "cherry peaking", is disturbing the urban mobility ecosystem and gets in contradiction to the real mission of public mobility, that is to be offered in all urban areas, with the cost of not profitable operations.

Andreas Steinbeißer, Head of Marketing from the Munich's pubic transport operator, who's interview insights are discussed at following chapters 3 and 5, explains that Ridehailing private operators are cannibalizing the PT network. Due to the very low prices, the wrong and selective operational coverage of only busy areas and no first-last mile perspective, Ridehailing is not integrated to the pubic system and as a result is worsening the urban mobility problems cities face today.

At the same time, Ridehailing has been banned from a large number of cities in world. More specific, the Ridehailing company Uber is not allowed to operate in many counties, due to the fact that it "breaches regulations that local taxi firms must adhere to" and its operation is connected to "unfair trade practices" amongst all market players (Rhodes, 2017)

Last but not least, it is important to note that the taxation of Ridehailing services such as Uber has been an issue in multiple international jurisdictions (Shaheen, Cohen and Zohdy, 2016). Due to the creation of shell-corporations, Ridehailing services avoided paying local taxes (Ibid.).

1.3.1.4. Bikesharing

Bikesharing is describing those systems that enable the sharing of public bicycles, allowing users to access bicycles at specific urban stations (Shaheen *et al.*, 2015) or use bicycles stationed at random points in the city without the use of a docking station.

According to the interviews with transport experts Vlastos and Mentz (Annex 8.7.), bicycle is highlighted as the most resilient and sustainable urban transport mode. Shaheen et. al mention that 50% of Bikesharing members in America, has reduced their personal car usage and 5,5% sold or postponed a vehicle purchase (Shaheen and Chan, 2015). Considering the previously analyzed urban problems that cars produce, we can conclude that Bikesharing can be a very much useful urban mobility solution, to the challenges cities face today.

1.3.1.5. On-demand Ridepooling

On-demand Ridepooling is defined as the operating transport service, where passengers are sharing journeys in a shuttle. The operation of the service is based on an intelligent algorithm that defines the vehicle's route based on the on-demand ride requests of travelers (König, Bonus and Grippenkoven, 2018).

Based on the interview with Benedikt Lahme, Business Development Manager from the private sector (Interviews in Annex 8.7.), on-demand Ridepooling made its debut in Germany as a PT mode, in 2017. Since then, in the last two year, on-demand Ridepooling is attracting attention as a disruptive innovation that has already started to be considered in the market, as standard shared mobility mode.

König et al. underline that when on - demand Ridepooling systems are operated publicly in cities, they can really contribute to the reduction of traffic congestion and emissions, by decreasing the number of private passenger car rides and increasing the average number of passengers per vehicle (König, Bonus and Grippenkoven, 2018). Public on-demand Ridepooling can be realized through the collaboration of the public and private sector, with a private company offering the Ridepooling software as a white label product to the Public Transport Operator (PTO) of a city. The PTO in that case, keeps the operation and service data under public ownership, receiving at the same time consultancy from the private software provider, allowing private technological innovation and knowledge to flow into the public sector.

Taking into consideration once more the analysis of the Helsinki Study at chapter 1.3., integration is core to the successful operation of shared urban mobility. Taking also into account the aforenoted analysis of the cannibalization problem, the guidelines of a sound on-demand Ridepooling implementation are already being formed.

2. The essence of Sustainability

Following the analysis of the urban challenges cities face, as well as their connection to urban mobility, it is clear that cities today need to act and find new solutions to their challenges that have been accumulated in the past decades. Such imposed urban challenges include the urbanization process and the simultaneous population growth, the car centricity and its subsequent traffic congestion and increased emissions.

Focusing on the first challenge of urbanization, and in the effort of finding a way for urban cities to provide quality life to their citizen, the United Nations strongly believes that key to the successful management of the world's rapid urbanization, is the principle of Sustainability and its Sustainable Development (United Nations, 2018).

2.1. The definition of Sustainability

Sustainable Development is defined as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Therefore, sustainability insures that "individual, short-term decisions are consistent with strategic, long-term goals" (Litman, 2018). Sustainability itself is composed by three pillars; the economy, the environment and the society (United Nations, 2014), that interact and influence each other when analyzed in urban environments.

More specific, Sustainability and Sustainable Development are able to manage urban growth in a successful manner and deal with its imposed challenges. As urban growth is closely connected to the three dimensions of sustainable development (economic, social and environmental) (United Nations, 2018), urban growth needs interventional and intergraded policies driven by Sustainability. Only then through those policies, can the beneficial aspects of urbanization be absorbed, accessed by and shared amongst citizens (Ibid.), that face at the same time the challenging parts of urbanization in their everyday life. Only then will a city be able to provide a democratic and equitable urban space for citizens to pursue a quality life, in all three pillars of economy, society and environment.

2.2. The definition of Sustainable Mobility

In the spotlight of all the challenges cities face; urbanization, population growth, emissions, scarcity of public space, car centricity and traffic congestion, and following the Sustainability analysis, an important question arises for urban mobility; How can the sustainable approach be translated into a solution for urban transportation.

The answer comes by International Organizations and Institutions, such as the United Nations and the European Union.

The United Nations have defined and set an Agenda for Sustainable Development, to be implemented until 2030, where the sustainability approach is translated into goals. This agenda identifies 17 sustainable goals, in which Sustainable Transport is also included and connected to 3 out of those 17 goals. More specific, the United Nations categorizes Sustainable Transport under goal 3 of "Good health and well-being" goal 9 of "Industry, Innovation and Infrastructure" and goal 11 of "Sustainable cities and communities" (United Nations Sustainable Development Goals, 2019).

Eurostat measures Sustainable Development by 10 specific indicators, and one of those indicators deals with sustainable transport (Eurostat, 2018a), underlining the importance of sustainable transport to the success of Sustainable Development.
To put sustainable mobility in praxis, the European Union has produced Sustainable Urban Mobility Plans (SUMPs) to provide guidelines to cites on the topic. In specific, a Sustainable Urban Mobility Plan is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices, taking into consideration the integration, participation, and evaluation principles (European Commission, 2013). Additionally, the European Union has created a

variety of initiatives such as the CIVITAS network and the URBACT program to enhance Sustainable Mobility in cities.

We can therefore conclude that there is an interdependence between the Sustainable Development that can manage the urban challenges of our age, and the Sustainable Transport concept. Those two factors influence and enable each other vice versa.

Moving forward on defining Sustainable Transport, the Canadian Centre for Sustainable Transportation (CST) defines a Sustainable Transportation system as the one that "a) allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations, b) is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy and c) limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non- renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise" (Litman, 2018).

More specific, Figure 2.1. illustrates the variety of objectives, under the three pillars of Sustainability, that pay into Sustainable Transport (Litman, 2018).

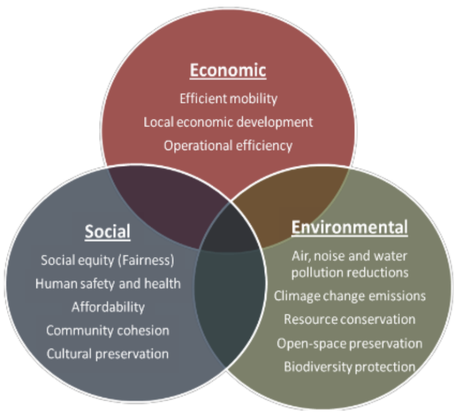

Figure. 2.1. The Sustainable Transport Objectives. The figure illustrates the objectives that pay into Sustainable Transport. The objectives are categorized into the three pillars of Sustainability; the economy, the environment and the society (Litman, 2018).

Horst Mentz, Transport Expert and Head of Traffic Planning at the City State of Munich (Landeshauptstadt München), during his interview for the current research (Annex 8.7.) is also defining Sustainable Mobility. In specific for Mentz, what qualifies a mobility solution as sustainable is its ability to provide a) less individual transport, b) reduce air pollution and c) increase public space. As Mentz adds sustainable transport should offer to citizens quality of PT and flexibility to use public space and provide flexibility to the system to spend public money in a smart and efficient way. As Mentz concludes on the topic of Sustainable Mobility, he underlines that its indeed connected to the three pillars as following: economic wise sustainable transport must be payable for all, social wise sustainable transport must be accessible for all giving the opportunity to everyone to be mobile and environmental wise sustainable transport should minimize emissions.

2.2.1 Sustainable Mobility Indicators

Moving further, on how Sustainable Mobility is measured, there have been specific studies that have tried to define through Indicators, what Sustainable Mobility means. Those studies have established Metrics to compare, measure and quantify this definition of Sustainable Mobility.

In the current research, a short literature review is presented from the most prominent studies on Sustainable Mobility Indicators.

Only three of the most recent studies, are introduced and analyzed in summary, starting from the most generic to the most specific one. The goal of this presentation is to further go ahead and bring on-demand Ridepooling, as a toddler transport solution, close to those sustainable mobility metrics, and analyze it according to those Indicators. A personal attempt of comparing on-demand Ridepooling to those sustainable mobility indicators is presented. For the purpose of this comparison, this research uses the on-demand Ridepooling definition and indicators that door2door GmbH is using. With the kind courtesy of door2door GmbH on offering their data, specific and measurable demand and supply indicators are provided for the on-demand Ridepooling service. Those specific indicators enable the comparison of on-demand Ridepooling to the Sustainable Mobility Indicators of the international bibliography.

Starting with the short literature review on urban sustainable mobility indicators, Table 2.1. is presenting an overview of the main sustainable urban mobility indicator sets (Pitsiava-Latinopoulou *et al.*, 2014). From 1997 until 2013, the table collects the most important studies in the field, on metrics, methodologies, indicators, measurements and models that translate sustainability in transport.

Table 2.1. A literature review overview on sustainable urban mobility indicators.

No	Authors	Year	References	Number of indicators
1	Kupiszewska, D.	*1997*	Modelling for sustainable cities: the transport sector	32
2	OECD	*1999*	Indicators for the integration of environmental concerns into transport policies	27
3	Newman, P., Kenworthy, J.	*1999*	Sustainability and cities: overcoming automobile dependence	22
4	Department of the Environment, Transport and the Regions	*2000*	Local quality of life counts	12
5	European Environmental Agency	*2002*	Indicators of transport and environment integration TERM	38
6	Gilbert, R., Irwin, N., Hollingworth, B., Blais, P., Lu, H., Brescacin, N.	*2002*	Sustainable Transport Indicator Project, CST	14
7	Jones, P., Jucas, K., Whittles, M.	*2003*	The 'Civilising Cities' initiative	15
8	Minken, H., Jonsson, D., Shepherd, S., Järvi, T., May, A., Page, M., Pearman, A., Pfaffenbichler, P., Timms, P., Vold, A.	*2003*	PROSPECTS project's methodological guidebook	19
9	Nicolas, J., Pochet P., Poimboeuf, H.	*2003*	Towards sustainable mobility indicators application to the Lyons conurbation	18
10	Gilbert, R., Irwin, N., Hollingworth, B.	*2003*	Sustainable transportation performance indicators (STPI)	14
11	Department for Environment, Food and Rural Affairs	*2005*	Securing the future	68
12	Department for Transport	*2005*	How to monitor indicators in Local Transport Plans and Annual Progress Reports - 2005 Update	8
13	Jeon, C., Amekudzi, A.	*2005*	Addressing sustainability in transportation systems: definitions, indicators and metrics	30
14	Zegras, Ch.	*2006*	Sustainable transport indicators and assessment methodologies	18
15	Savelson, A., Colman, R.	*2008*	Sustainable transportation in Halifax regional municipality, GPI (Genuine Progress Index) for Atlantic Canada	14
16	Moles, R., Foley, W., Morrissey, J.	*2008*	Practical appraisal of sustainable development, methodologies for sustainability measurement at settlement level	11
17	Litman, T.	*2008*	Sustainable transportation indicators	12
18	Appleton B., Davies M.	*2008*	SMART transportation ranking report (27 Canadian cities)	12
19	Litman, T.	*2009*	Sustainable transportation indicator data quality and availability	35
20	Litman, T.	*2009*	Well measured developing indicators for comprehensive and sustainable transport planning	41
21	Doody, D.G., Kearney, P., Barry, J., Moles, R., O'Regan, B.	*2009*	Evaluation of the Q-method as a method of public participation in the selection of sustainable development indicators	5
22	Castillo, H., and Pitfield, D. E.	*2010*	ELASTIC - A methodological framework for identifying and selecting sustainable transport indicators	15
23	Tanguay, A., Lefebvre, J.F., Lanoie, P.	*2010*	Measuring the sustainability of cities: an analysis of the use of local indicators (23 study)	63
24	Mascarenhas, A., Coelho, P., Subtil, E., Ramos, T.B.	*2010*	The role of common local indicators in regional sustainability assessment	5
25	Choon, S. W., Siwar, C., Pereira, J. J., Jemain, A. A., Hashim, H. S., & Hadi, A. S.	*2011*	A sustainable city index for Malaysia	30
26	Shen, L. Y., Jorge Ochoa, J., Shah, M. N., & Zhang, X.	*2011*	The application of urban sustainability indicators - A comparison between various practices	115
27	Zheng, J., Garrick, N. W., Atkinson-Palombo, C., McCahill, C., & Marshall, W.	*2013*	Guidelines on developing performance metrics for evaluating transportation sustainability	22

The table presents an overview of the main sustainable urban mobility indicator sets, defined by the international bibliography. The table includes a variation of indicators, metrics, methodologies and models, that translate sustainability into transport (Pitsiava-Latinopoulou et al., 2014).

Moving forward, the current research is focusing at the most recently published analyses on sustainable urban mobility indicators and guidelines.

On a higher level of how sustainability can be applied in transportation, Todd's Litman guidelines and indicators for sustainable and livable transport planning, from the Victoria Transport Policy Institute are presented. Table 2.2. presents the transport planning objectives divided in four categories of Sustainability and Livability Goals (Litman, 2018).

Table. 2.2. The Transport Planning Objectives of Sustainability.

Sustainability Goals	Transport Planning Objectives							
	Transport Diversity	System Integration	Affordability	Resource (energy and land) Efficiency	Demand Management (efficient pricing & prioritization)	Land Use Accessibility (smart growth)	Cost Effective Operations	Comprehensive and Inclusive Planning
Economic productivity	✓	✓		✓	✓	✓	✓	
Economic development	✓	✓	✓	✓	✓	✓		✓
Energy efficiency	✓	✓		✓	✓	✓		
Affordability	✓	✓	✓	✓	✓	✓		
Operational efficiency					✓		✓	✓
Equity / Fairness	✓	✓	✓		✓	✓		
Safety, security and health	✓	✓	✓	✓	✓	✓		✓
Community development	✓	✓	✓	✓	✓	✓		✓
Heritage protection	✓			✓	✓	✓		✓
Climate stability	✓	✓	✓	✓	✓	✓		
Air pollution prevention	✓	✓	✓	✓	✓	✓		
Noise prevention	✓			✓				
Water pollution	✓	✓	✓	✓	✓	✓		✓
Openspace preservation	✓	✓	✓		✓	✓		✓
Good planning								✓
Efficient Pricing				✓	✓		✓	

The table presents the transport planning objectives divided in four categories of goals that enable sustainability and Livability (Litman, 2018).

The four categories of Sustainability and Livability goals include the economy, the society, the environment and the governance. Analyzing Table 2.2., the economic development alongside with the economic productivity seem to be the most important targets, of sustainable transport. At this point it is worth of noting, that it has been calculated that a shift to sustainable mobility can provide savings up to 70 trillion $ by 2050, when considering all transport costs and losses due to traffic congestion (including vehicles, fuels, and operational expenses) (Sustainable Mobility for All, 2017).

In the second section of the table, the social aspects of sustainability are presented. Community development, health and equity are scoring the biggest influence on the transport objectives. On the third environment section, climate stability as well as air pollution, public space is strongly connected to all transport planning aspects.

Litman, is moving one step further by connecting the first analysis of sustainable transport goals to performance indicators (Ibid.). Table. 2.3. is illustrating this relation, where for each category of Economy, Environment, Society and Governance, measurable indicators are extracted, that can quantify the sustainable transport goals.

Table. 2.3. The Transport Planning Objectives of Sustainability and their Performance Indicators.

Sustainability Goals	Objectives	Performance Indicators
I. Economic		
Economic productivity	Transport system efficiency. Transport system integration. Maximize accessibility. Efficient pricing and incentives.	• Per capita GDP and income. • Portion of budgets devoted to transport. • Per capita congestion delay. • Efficient pricing (road, parking, insurance, fuel, etc). • Efficient prioritization of facilities (roads and parking).
Economic development	Economic and business development	• Access to education and employment opportunities. • Support for local industries.
Energy efficiency	Minimize energy costs, particularly petroleum imports.	• Per capita transport energy consumption • Per capita use of imported fuels.
Affordability	All residents can afford access to basic (essential) services and activities.	• Availability and quality of affordable modes (walking, cycling, ridesharing and public transport). • Portion of low-income households that spend more than 20% of budgets on transport.
Efficient transport operations	Efficient operations and asset management maximizes cost efficiency.	• Performance audit results. • Service delivery unit costs compared with peers. • Service quality.
II. Social		
Equity / fairness	Transport system accommodates all users, including those with disabilities, low incomes, and other constraints.	• Transport system diversity. • Portion of destinations accessible by people with disabilities and low incomes.
Safety, security and health	Minimize risk of crashes and assaults, and support physical fitness.	• Per capita traffic casualty (injury and death) rates. • Traveler crime and assault rates. • Human exposure to harmful pollutants. • Portion of travel by walking and cycling.
Community development	Help create inclusive and attractive communities. Support community cohesion.	• Land use mix. • Walkability and bikability • Quality of road and street environments.
Cultural heritage preservation	Respect and protect cultural heritage. Support cultural activities.	• Preservation of cultural resources and traditions. • Responsiveness to traditional communities.
III. Environmental		
Climate protectin	Reduce global warming emissions Mitigate climate change impacts	• Per capita emissions of global air pollutants (CO_2, CFCs, CH_4, etc.).
Prevent air pollution	Reduce air pollution emissions Reduce exposure to harmful pollutants.	• Per capita emissions of local air pollutants (PM, VOCs, NOx, CO, etc.). • Air quality standards and management plans.
Prevent noise pollution	Minimize traffic noise exposure	• Traffic noise levels
Protect water quality and minimize hydrological damages	Minimize water pollution. Minimize impervious surface area.	• Per capita fuel consumption. • Management of used oil, leaks and stormwater. • Per capita impervious surface area.
Openspace and biodiversity protection	Minimize transport facility land use. Encourage more compact development. Preserve high quality habitat.	• Per capita land devoted to transport facilities. • Support for smart growth development. • Policies to protect high value farmlands and habitat.
IV. Good Governance and Planning		
Integrated, comprehensive and inclusive planning	Planning process efficiency. Integrated and comprehensive analysis. Strong citizen engagement. Lease-cost planning (the most overall beneficial policies and projects are implemented).	• Clearly defined goals, objectives and indicators. • Availability of planning information and documents. • Portion of population engaged in planning decisions. • Range of objectives, impacts and options considered. • Transport funds can be spent on alternative modes and demand management if most beneficial overall.

The table presents the Performance Indicators, extracted for the Sustainable Transportation, according to the 4 sustainability categories of, economy, environment, society and governance (Litman, 2018).

Moving forward, to a second analysis of Sustainable Transport Indicator, Table 2.4. presents the work of Da Silva et al. on the Index of Sustainable Urban Mobility (I_SUM). Sustainable Transport Indicators have been identified, based on specific domains and themes, influential for sustainability (Da Silva et al, 2010). Here, the major domains that get translated into Sustainable Transport Indicators are; accessibility, social inclusiveness, polluting emissions, political management, infrastructure and non-motorized modes.

Table 2.4. The sustainable urban mobility indicators that form the I_SUM (Index of Sustainable Urban Mobility)

	I_SUM	
DOMAINS	THEMES	INDICATORS
ACCESSIBILITY	Accessibility to transport systems	Accessibility to transit Public transportation for users with special needs Transport expenses
	Universal accessibility	Street crossings adapted to users with special needs Accessibility to open spaces Parking spaces to users with special needs Accessibility to public buildings Accessibility to essential services
	Physical barriers	Urban fragmentation
	Legislation for users with special needs	Actions towards universal accessibility
ENVIRON. ASPECTS	Control of environmental impacts	CO Emissions CO_2 Emissions Population exposed to traffic noise Studies of environmental impacts
	Natural resources	Fuel consumption Use of clean energy and alternative fuels
SOCIAL ASPECTS	Support to the citizens	Information available to the population
	Social inclusion	Vertical equity (income)
	Education and active citizenship	Education for sustainable development
	Public participation	Participation in decision-taking
	Quality of life	Quality of life
POLITICAL ASPECTS	Integration of political actions	Integration of different government levels Public-private partnerships
	Acquisition and management of resources	Acquisition of resources Investments in transport systems Distribution of resources (public x private) Distribution of resources (motorized x non-motorized)
	Urban mobility policy	Urban mobility policy
TRANSPORT INFRA.	Provision and maintenance of transport infrastructure	Density of the street network Paved streets Maintenance expenditures in transport infrastructure Streets signaling
	Distribution of transport infrastructure	Transit lanes
NON-MOTORIZED MODES	Bicycle transportation	Length and connectivity of cycleways Bicycle fleet Facilities for bicycle parking
	Non-motorized modes	Pathways for pedestrians Streets with sidewalks
	Trips reduction	Travel distance Travel time Number of trips Measures to reduce motorized traffic

The indicators are connected to identified domains and themes influential for sustainability. Da Silva et al. weight each theme differently, constructing the final I_SUM (Da Silva et al, 2010).

Moving further, on the third and most technical presentation of Sustainable Mobility Indicators, this research presents the work of the Institute for Transportation and Development Policy (ITDP) on designing sustainable transport systems and subsequent policy recommendations.

ITDP's goal is to help city be more livable, equitable, reducing their carbon emissions, enhancing social inclusion, and improving the quality of life for people in cities (ITDP, 2019). Based on the sustainability analyses of Chapter 2, the ITDP has a sustainable vision for mobility. In 2019, Chestnut and Mason published a study for the ITDP on Sustainable Mobility indicators. Those indicators are classified in three categories of what they measure each time; a) proximity to transport, b) access to opportunity and c) city characteristics (Chestnut and Mason, 2019).

Each of those three categories, have subcategories that are quantitative explained;

a) proximity to transport has six sub-indicators on people/job/low income households near transport
b) accessibility to opportunity has three sub-indicators on access to jobs/ low-skill jobs/ people by sustainable transport (60 and 30 minutes)
c) city characteristics has three subcategories on simple and weighted density and on sustainable transport mode share

The author of the current research has collected the material of the above ITDP publication and has created Table 2.5., illustrating those 3 main indicators with their subcategories.
Finally, these indicators can be used to evaluate the level of sustainability a city scores in its PT network. For instance, for the case of the city of Minneapolis, ITDP calculated that "73% of the population, 89% of all jobs, and 84% of low income households are within a 500 meter walk or a 10-minute bike ride to frequent transportation" (Institute for Transportation and Development Policy, 2019). Applying to many cities and comparing, baselines and scores can be extracted for sustainable urban mobility.

Connecting to on-demand Ridepooling, those technical sustainable mobility indicators from ITDP, could be used as a reference, to investigate how much is on-demand Ridepooling contributing to those scores, once its service is applied on the streets. The question here arises once more; *How sustainable is the contribution of on-demand Ridepooling to the public transport reality of a city? How sustainable is on-demand Ridepooling as a mobility solution?*

Table 2.5. Indicators for Sustainable Mobility by the Institute for Transportation and Development Policy (ITDP).

Category of Indicator	Sustainable Mobility Indicators		
a) Proximity to transport	**People near rapid transport**= indicator measures % of the population that is within a half-kilometer walk or a max10-minute bike ride (on restricted protected bike lines) of a rapid transit station, a proxy for accessibility to destinations, illustrates the relationship between population distribution and the coverage of rapid transit services. **This indicator can show where people are not currently served by rapid transport.**	**People near frequent transport** = measures the % of the population within a 500-meter walk or a max10-minute bike ride (on restricted protected bike lines) of frequent transit service. **The indicator shows the reliable transport coverage to access destinations.**	-
	Job near rapid transport = measures the % of jobs that are within a max 10-minute bike ride or walk of a rapid transit station	**Job near frequent transport**= measures the % of jobs in the city located within a 10-minute journey of a frequent transit stop	-
	Low income households near to rapid transport = measures the % of population that makes less than 20.000 USD a year that lives within about a 10-min bike ride or walk of a rapid transit station. **The indicator measures the equity in a transit system**	**Low income households near frequent transport** = investigates the equity of a transport system while serving a city, it measures the % of people near frequent transit (referring to the total population) and the % of low-income households near frequent transit and compares them.	.
b) Accessibility to opportunity	**Access to jobs by sustainable transport (60 and 30 minutes)** Access to Jobs by Sustainable Transit can be defined as the average number of jobs that can be reached from a census tract within 30 or 60 minutes on a weekday morning at 8 a.m. Using an ArcGIS based software for the city's spatial analysis, the city is visualized by polygons representing census tracts. This indicator in this analysis is weightented by the total population, as access to jobs referrs to population as a whole.	**Access to low-skill jobs by sustainable transport (60 and 30 minutes)** Access to Low-skilled jobs by Sustainable Transit can be defined as the average number of low-skilled jobs that can be reached from a census tract within 30 or 60 minutes on a weekday morning at 8 a.m. This indicator is weightented by the number of workers with less than a high school education.	**Access to people by sustainable transport (60 minutes)** Access to People by Sustainable Transit can be defined as the average number of people that can be reached from a census tract within 30 or 60 minutes (on a weekday morning at 8 a.m). While the spatial analysis is visualized in the ArcGIS based software, population can be counted for all census tracts of the operating are.
c) City characteristics	**Block density** Is defined as the number of blocks per square kilometer of the urban area.	**Weighted residential density** Calculated for each census tract and then multiplied, calculated for the whole city area	**Sustainable transport mode share** A measurement of behavior among travelers in a city. Identifies cities with higher rates of sustainable transport use

The table created by the author, extracts its information from the study published by the ITDP in 2019 (Chestnut and Mason, 2019). The table illustrates the three categories of indicators, that were developed to understand urban mobility and to promote and measure its sustainability. Indicator a) proximity to transportation, has 6 sub indicators. Indicator b) accessibility to opportunity, has 3 sub-indicators. Indicator c) city characteristics has 3 sub-indicators. Note: Rapid transportation is defined as transportation that operates in a separated dedicated way, such as bus rapid transportation, light rail, and metro (Ibid).

2.2.2. Comparing on-demand Ridepooling to the Sustainable Mobility Indicators

To answer the questions set on chapter 2.2.1 on *how sustainable is the contribution of on-demand Ridepooling to the public transport reality of a city? and how sustainable is on-demand Ridepooling as a mobility solution?,* the author of this research attempts to compare on-demand Ridepooling to the sustainable mobility indicators presented in chapter 2.2.1. For the purpose of this comparison, this research uses the on-demand Ridepooling definition and indicators that door2door GmbH is using to bring on-demand Ridepooling on the streets of Germany. With the kind courtesy of door2door GmbH on offering their data, specific and measurable demand and supply indicators are provided for the on-demand Ridepooling service. Those specific indicators enable the comparison of on-demand Ridepooling to the Sustainable Mobility Indicators of the international bibliography.

In specific, the comparison attempted, is connecting on-demand Ridepooling as applied by door2door GmbH, to the technical sustainable mobility indicators from ITDP, analyzed at chapter 2.2.1.

Part of the on-demand Ridepooling product door2door GmbH sells to PT companies, is the so-called “Insights” platform, serving as a mobility analytics software based on geographical information systems (GIS). The system is used for the planning and simulation of on-demand Ridepooling, visualizing first of all the static public mobility reality of a city.
Demand and supply mobility indicators in the software, describe this public mobility reality of a city. At the same time, those indicators drive the operation scenario of on-demand Ridepooling, as they identify potential gaps or weaknesses of the PT system. Once an operating scenario for on-demand Ridepooling is chosen, “Insights” simulates dynamically on-demand Ridepooling operations, presenting at the same time performance key results for the service.

Focusing on the wished comparison with the Sustainable Mobility Indicators from the literature review, the useful “Insights” on-demand Ridepooling indicators are divided into supply and demand mobility indicators as following;

Supply Indicators:

a) Walking Accessibility = How easy is to reach a form of public transport within 5 minutes (indicator measured in stations)
b) Public Transport Coverage = The area covered within 15 minutes using public transport (indicator measured in km^2)
c) Frequency = How often public transport departs from this area (indicator measured in departures)

Demand Indicators:

a) Population Density = The number of inhabitants per km²
b) Public Transport Searches = The amount of searches related to this area made through trip planning apps
c) Ridepooling Searches = The amount of Ridepooling searches related to this area made through Ridepooling apps (data provided by door2door's operations)
d) Predicted Searches = The number of predicted Ridepooling searches for a specific urban area, based on an algorithm that balances accordingly existing data from Berlin
e) Car Journeys = The number of journeys made by car from or to this area (data provided by external partners)
f) Mobile Phone Movement = The number of journeys recorded by mobile phones from or to this area (data provided by external partners)

Figures 2.2. and 2.3. illustrate the supply and demand indicators of on-demand Ridepooling, used by door2door GmbH.

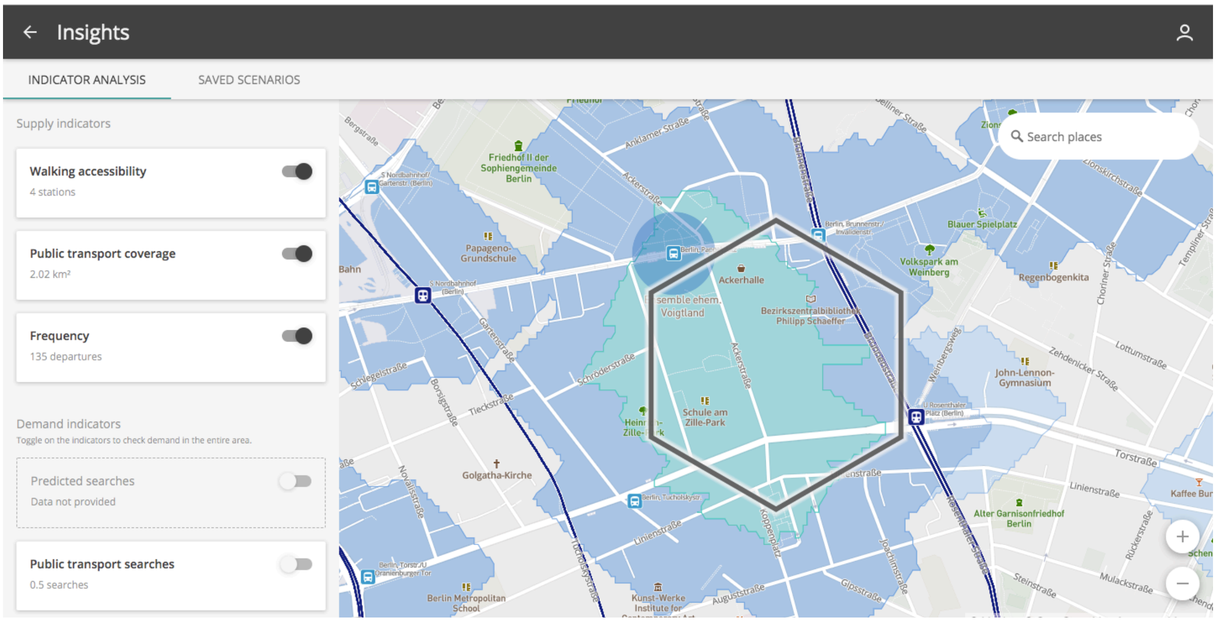

Figure 2.2. The supply indicators used for the planning of on-demand Ridepooling at door2door GmbH, through the "Insights" software. All three supply indicators are enabled, coloring with green the walking accessibility and with blue the public transport coverage. The 5 -and 15- minutes timeframes accordingly, are calculated from the center of the chosen hexagon cell. The indicator of frequency is illustrated by the blue circle. Courtesy of door2door GmbH.

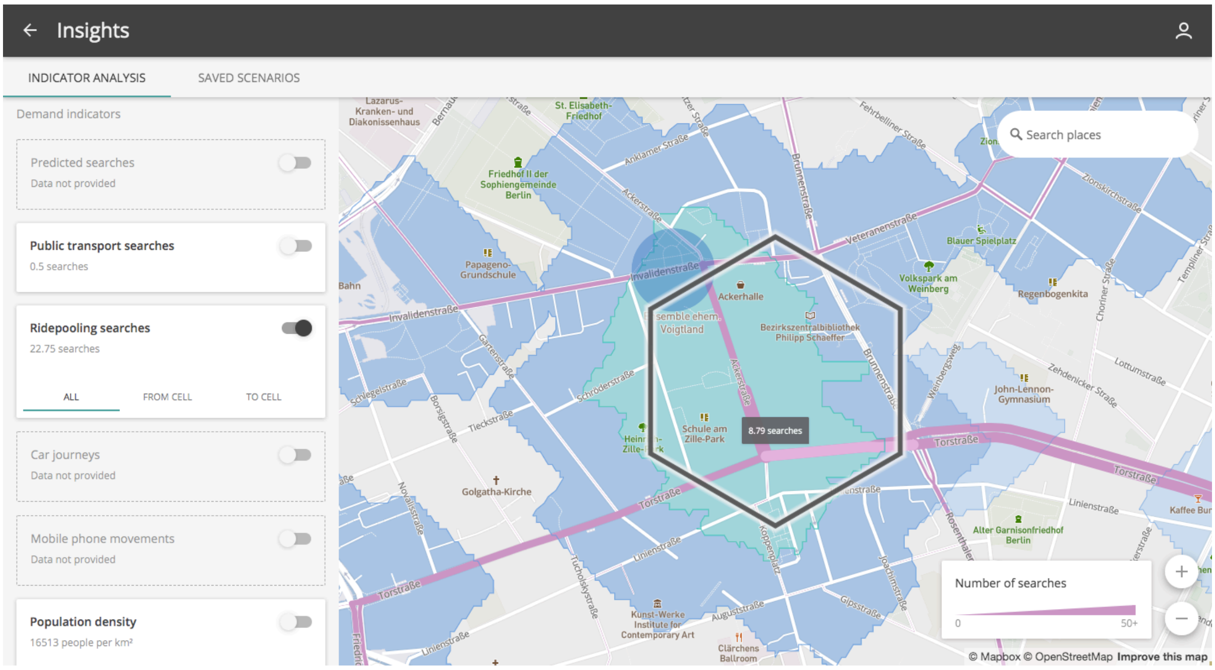

Figure 2.3. The demand indicators of on-demand Ridepooling at door2door GmbH, through the "Insights" software. The specific Ridepooling searches indicator is enabled, illustrating with pink lines the demand for Ridepooling. At the same time the supply indicators are enabled, coloring with green the walking accessibility and with blue the public transport coverage, with their 5- and 15-minutes timeframes calculated when starting inside the chosen hexagon cell. The supply indicator of frequency is illustrated by the blue circle. Courtesy of door2door GmbH.

Summarizing, the on-demand Ridepooling indicators, include an analysis of accessibility, frequency and coverage, indicators that also appear in all the Sustainable Mobility Indicator presented in the literature review (Table 2.2., 2.3., 2.4., 2.5.). More specific, the time framed indicators of accessibility and coverage for on-demand Ridepooling, are in line and even score shorter times than the ITDP sets in its Sustainable Mobility Indicators (Table 2.5.). Moreover, on-demand Ridepooling takes into account the indicator density, which appears in the third part of the Sustainable Mobility Indicators of ITDP (Table 2.5.).

The decrease of CO_2 emissions and other air pollutants, have a significant place in the Sustainable Mobility indicators, as presented in the literature review (Figure 2.1. and Table 2.2., 2.3., 2.4.). Based on the analysis at chapter 1.3, it is proved that the use of on-demand shared mobility, entails as well the wished reduction of CO_2 emission (International Transport Forum, 2017). Moreover, the topics of public space and equity appear in the literature review, as part of the Sustainable Mobility objectives to be achieved (Table 2.3.). The Lisbon and Helsinki studies, analyzed at chapter 1.3, indicate that on-demand shared or autonomous mobility can offer equitable access to opportunities and provide new space due to the removal of 9 out of 10 cars from the streets (International Transport Forum, 2015) (International Transport Forum, 2017).

Based on the above analysis, we can therefore conclude that the objectives and indicators that plan and describe on-demand Ridepooling, are in line with the standards set in the presented literature review of the Sustainable Mobility Indicators. As analyzed, the main parts of the on-demand indicators are being included in the Sustainable Mobility Indicators bibliography. Last but not least, the Helsinki study underlines that the found benefits of on-demand shared mobility, can be enabled under specific operational frameworks and policies (Ibid.) Those frameworks are clarified in the later chapters of this research, where unique results from interviews with transport experts are presented.

3. Urban Mobility and Economy in Germany

Germany is a European country, located in the west of the European continent. Germany was one of the founding members of the European union, participating in all the unions' primary forms since 1951 (European Union, 2018). Nowadays, Germany is the most populated EU Member State (eurostat, 2018), with a population of almost 83 million people for 2018 (Destatis, 2018b).
Apart from its historical and demographical role, Germany's significant role for the EU today, can be also recognized by its economic power. The country accounts the highest Gross Domestic Product (GDP) in the European Union scoring a 3.386.000.000 billion Euro for 2018, equal to the 21% of the whole European Union's GDP of 15.877.040.200 billion Euro (Eurostat, 2018b). Having the largest national economy in the European continent, Germany's economic power and leadership, is clearly underlined. At the same time, in 2018 the government's depth as a percentage of the national GDP scored a 60,9%; a rather modest percentage, given the fact that for the same year, the EU average governmental depth as a percentage of the GDP was 80% (eurostat, 2019a).

Moving forward and focusing on the micro-perspective of the citizens, in Germany the Gross Domestic Product per capita for 2018 equaled 40.843 thousand Euro (Destatis, 2018c), indicating a rather wealthy economic situation for the median German citizens, when compared to the median EU citizen with a 30.900 thousand Euro of GDP per capita for 2018 (Eurostat, 2018b).

Apart from Germany's prosperous economy, Germany also has a unique social characteristic that is connected to the national economy. That is, that Germany is a very car centered society. In the latest report of Eurostat in May 2019, on passenger cars in the EU, it is shown that for 2016, Germany amongst all EU countries, had the highest number of registered passenger cars equal to 45 million passenger cars (eurostat, 2019b). In the number of new registered cars, Germany scored once more by far first amongst the EU countries, with 3.285.904 new passenger cars for 2016. Amongst those new registrations, over half (53,1%) where petrol powered passenger cars and only 2% where passenger cars with alternative fuels (Ibid.). The above numbers indicate once more the intensity of emissions and car centricity for Germany. For the sake of comparison, Germany scores far too low on passenger cars with alternative fuels, when other countries score way better, such as Poland with 8,2% and Norway 16,9% (Ibid.).

For 2018 Germany counted 47.1 million passenger cars (Kraftfahrt-Bundesamt, 2019), which divided by the country's aforenoted population equals to a private passenger car motorization rate of 57% .

The car centricity of Germany resembles also another important fact for the current analysis, and that is the automobile sector. Germanys has one of the strongest car industries and manufactures, that influence not only the national economy of the country but also the national and European politics.

According to the Federal Statistical Office of Germany, 1.75 million employed citizens in Germany, equal to about the 4% of the labor force, are directly and indirectly connected with the automotive industry (Destatis, 2018a). Moreover, according to the same report of the Federal Statistical Office, the German automotive industry is Germany's most important industrial sector, generating an economic output of 134.9 billion euros (for 2016). This corresponds to a 4.7 % of the gross value added in Germany for 2016 (Ibid.).
Other important reports such as the latest one from the European Federation for Transport and Environment, explain the weight and the economic importance of the automotive industry in Germany, as of being 2,5 times bigger than the European average and almost three times bigger than the German food and beverage industry (Transport and Environment, 2018).

The economic importance of the automotive sector in Germany, is translated also to a very strong lobbying power, that acts for the prosperity of the German automotive industry and at the same time can also affect politics in multiple ways. More specifically, Germany's automotive lobby is the German Automobile Industry Association, abbreviated as VDA (Verband der Automobilindustrie e. V.) (VDA, 2018). Unfortunately, the interactions of VDA, are not always in favor of environmental progress and emission regulations in the area of Germany and the EU itself. According to the "CO_2 Emissions From Cars " report published by the European Federation for Transport and Environment, campaigning for cleaner transport, German industry experts exercise unhealthy political influence to European Commission proposals and target goals that try to regulate car CO_2 emissions (Transport and Environment, 2018). The occasions where environmental policy concerning the EU was weakened by Germany as a country or by high level members of the VDA, were unfortunately not rare. An example of the power the German Automotive industry can have on the European Commission for its favor, was the lastminute change and the relaxing of the proposal for the post-2020 car and van CO_2 regulations in 2017, influenced politically by the president (at that time) of the VDA (Ibid.).

We can conclude that tackling the car centricity in Germany and trying to offer an alternative to private passenger cars in cities, is not an easy goal. Resolving the car congestion and minimizing car emissions, are complex challenges that are rooted in the heart of the economic and political system of Germany. As Germany has a leading role in the EU, those challenges become subsequently and automatically also Pan-European, with the German political and economic influence being strongly visible on the European challenges on cars and emissions.

3.1. Germany and on-demand Ridepooling

Moving forward and zooming in the topic of shared urban mobility and Ridepooling, there are several German cities of all sizes, that have taken the challenge and embraced on-demand Ridepooling in their streets. Some of those cities are Berlin, Munich, Hamburg, Stuttgart, Duisburg, Freyung and more, where on-demand Ridepooling is realized through the collaboration of the private and the public sector. The on-demand Ridepooling software is provided by a Ridepooling company and sold to the Public Transport Operator (PTO) of the city. Ridepooling itself is finally provided and operated by the PTO as an additional PT mode of the city's network.

In each city or village, there are unique urban and rural characteristics each time, that create a different mobility reality. For example, the mobility challenges that Freyung as a village of Bavaria face, are cater-cornered opposite from the mobility issues that Munich faces, the capital of the Bavarian state. Therefore on-demand Ridepooling in every city/village serves a different goal each time and implements a different service that corresponds to the city's needs.

Table. 3.1. On-demand Ridepooling in Germany.

German City	***Public Transport Operator (PTO)***	***Ridepooling Software Company***	***Ridepooling Brand***	***Year of Release***
Berlin	BVG (Berliner Verkehrsbetriebe)	ViaVan Technologies B.V	BerlKönig [a]	2018 [a]
Munich	MVG (Münchner Verkehrsgesellschaft mbH)	door2door GmbH	IsarTiger [b]	2018 [b]
Hamburg	VHH (Verkehrsbetriebe Hamburg-Holstein GmbH)	ioki GmbH	ioki Hamburg [c]	2018 [c]
Stuttgart	SSB (Stuttgarter Straßenbahnen AG)	moovel Group GmbH	SSB Flex [d]	2018 [d]
Duisburg	DVG (Duisburger Verkehrsgesellschaft AG)	door2door GmbH	myBUS [e]	2017 [e]
Freyung	Town of Freyung* *Local government partners with "Prager Reisen" Local Operator	door2door GmbH	freYfahrt [f]	2018 [f]

The table presents the German cities, where on-demand Ridepooling is embraced as an extra public mobility mode and is operated under the public transport operator (PTO) of the city. The second column of the Table presents the PTO of the city and the third column presents the Ridepooling software company that collaborates each time with the city's PTO, to provide the Ridepooling technology. The fourth column of the table presents the name of the Ridepooling Brand, that serves as a mode for the cities and as a product for the companies. Data taken each time according to availability from: [a] (BerlKönig, 2019); [b](MVG, 2018); [c] (VHH, 2018); [d] (moovel Group GmbH, 2018); [e] (door2door GmbH, 2019c); [f] (door2door GmbH, 2019b).

Table. 3.1. presents in summary, German cities that have established on-demand Ridepooling and through their cooperation with private software provider companies, Ridepooling has been enabled on the city streets. Each time, the private software company, collaborates with the PTO that is the client of the private software company and at the same time the owner of the Ridepooling service. Examining Table 3.1. geographically, we can observe that Ridepooling has been embraced warmly by important cities of Germany. Moreover, chronologically we can conclude that the Ridepooling establishment in Germany is rather recent.

This is also confirmed by the fact that in September 2017, Duisburg's PT company, DVG, became the first in Germany to run an on-demand Ridepooling service as a fully integrated part of the PT network (door2door GmbH, 2019b). The private company that provided the software and the mobility platform for DVG to launch on-demand Ridepooling was door2door GmbH. On-demand Ridepooling launched under the brand of myBUS, with 16 shuttles on the streets today. Duisburg has a population density of 2.140 residents per km2 and the operating area chosen area for the service is 44 km2. In the relative case study that was published, it is explained that DVG successfully transformed its fixed-route, - stops and - schedules into a dynamic and digitalized service (Ibid.), that paves the way for German cities to digitalize and alter their systems, by adding Ridepooling.

We can clearly conclude that on-demand Ridepooling has arrived in Germany, altering the way PT used to be, by adding integrated shared shuttles in the system.
German cities trying to address and catch up with the mobility revolution that somehow runs faster than the slower changes the public mobility undergoes, do reply to the trend of on-demand Ridepooling. German cities experiment with trial phases and later adopt the innovative technology. As Benedikt Lahme Business Development Manager at door2door GmbH adds, in the interview he gave for this research; the adoption of Ridepooling solution has been standardized (Annex 8.7.). Lahme continues explaining that today in 2019, two years after the Ridepooling revolution Germany saw, national and international Mobility Fairs consider Ridepooling as no “innovation”, “disruption” any more, but as an intermodal integrated standard for the market (Annex 8.7.). For comprehension purposes, on-demand Ridepooling in Germany can be considered as the digital and flexible evolution of its analog ancestors Sammeltaxi and Rufbus. Sammeltaxi and Rufbus have been offering on-demand mobility solutions mainly in rural areas in Germany, with very restricted schedules.

Concluding, in the scope of urbanization, the increased transport demand and the need of an agile mobility system, German cities are indeed changing their public transportation. Questioning the traditional mobility system and its traditional enlargement through heavy infrastructure, German cities evolve differently. They instead empower their PT networks by adopting on-demand Ridepooling, as a flexible, dynamic and digitalized asset for the public system.

3.2. German Use Cases of on-demand Ridepooling: Berlin and Munich

In this chapter, three use cases of on-demand Ridepooling in two German cities will be presented and analyzed. The respective cities are Berlin and Munich, where Ridepooling is enabled through the collaboration of the pubic and the private sector. However, as already mentioned, Ridepooling is operated still under the Public Transport Operator (PTO) of the city, considering Ridepooling as a PT mode. The PTO each time buys the Ridepooling software as a white label from a private company and operates Ridepooling receiving at the same time consulting from the private software provider along the way.

Berlin and Munich face different urban environments and developments, that define different mobility needs. As aforenoted, Ridepooling has subsequently different operating scenarios adjusting to the mobility reality and capacity of each city. This is one of the reasons why Berlin and Munich, can be taken as representative examples and serve as different models for other cities to be inspirited and advised, on how and why to bring on-demand Ridepooling publicly on the street.

3.2.1. The case of Berlin

3.2.1.1. The urban mobility profile of Berlin

Berlin is the capital of Germany, surrounded by its Metropolitan area of Berlin/Brandenburg. Berlin is the most populous city in Germany with 3.748.148 residents (Amt für Statistik Berlin-Brandenburg, 2019). The city spreads across 891 km^2, in 12 boroughs, with a population density of 4.055 residents per km^2 (Amt für Statistik Berlin Brandenbourg, 2018). Figure 3.1. illustrates The 12 boroughs of Berlin.

Presenting a short mobility background for the city, Berlin counted 1.195.100 million registered private passenger cars in 2017 (Ibid.) and 8.138 registered taxis in 2018 (Statista, 2018). It is remarkable that Berliners spend 154 hours and 1.340 Euro per year due to traffic congestion (INRIX, 2019). At the same Berlin is ranked as the number one German city suffering from traffic congestion. The cities highway "B96" that enters the city from its southern part of Tempelhof, was the most congested street in Germany for 2018 (Ibid.)

Table 3.2. presents the most important urban and mobility characteristics of the city of Berlin. The first part of the table presents the urban characteristics of Berlin that are useful for shaping a basic image of how the city looks like from an urban planning perspective. The second part of the table illustrates information about the Public Transport System in Berlin. The third part of the table illustrates the traffic congestion costs Berliners are facing.

Figure 3.1. The boroughs of Berlin. Berlin is consisted by 12 boroughs. (Amt für Statistik Berlin Brandenbourg, 2018)

Table. 3.2. Urban and Transport characteristics of Berlin for 2018.

BERLIN	
Urban Characteristics	
Population as a #	3.748.148 mill. residents [a]
Population Density	4.055 residents per km^2 [b]
City Size	891 km^2 [c]
Number of Boroughs	12 [d]
Transport Network Information	
Public Transport Authority	VBB [f]
Public Transport Operator	BVG [g]
Metro Lines (U-Bahn Untergrundschnellbahn) City rapid railway (S-Bahn Stadtschnellbahn)	10 [h] 16 (Operating by Deutsche Bahn AG) [i]
Tram Lines	22 [j]
Bus Lines	154 [k]
Registered Taxis	8.138 [n]
Registered Personal/Passenger Cars (for 2017)	1.195.100 mill. [q]
Passenger Cars Involved in accidents with personal injury	17.279 [r]
Traffic Congestion Data	
Lost hours in Congestions per year	154 hrs [t]
Direct Costs of Congestion per Driver	1.340 EUR [v]

An overview of the population and city size characteristics of Berlin, as well as an overview of the city's transport network and its congestion. Data taken each time according to availability from: [a] (Amt für Statistik Berlin-Brandenburg, 2019); [b,c,d] (Amt für Statistik Berlin Brandenbourg, 2018); [f](VBB, 2019); [g](BVG, 2019b); [h,j,k] (BVG, 2019a); [i](S-Bahn Berlin GmbH, 2019); [n](Statista, 2018); [q,r] (Amt für Statistik Berlin Brandenbourg, 2018); [t,v] (INRIX, 2019).

3.2.1.2. On-demand Ridepooling in Berlin

In September 2018, BVG, the PT operator company in Berlin, launched on-demand Ridepooling under the brand of BerlKönig, through the collaboration with the private provider ViaVan (BerlKönig, 2019). The service owned by BVG, operates publicly in the whole city of Berlin, on a 24/7 basis and a free-floating system of virtual stops. The vision of the operator is to "provides affordable, shared and environmentally friendly rides" that offer the comfort of a private car, but are almost cheap as a bus (Ibid.). The goal of the service is to minimize individual motor vehicles by providing drivers with a public alternative. Passenger can book rides, by downloading the mobile application of the service, which in February 2019 counted 90.000 registered customers (Stresse, 2019). Furthermore, the BerlKönig service includes wheelchair accessible vehicles promoting social inclusiveness (BerlKönig, 2019) and more than half of its vehicle fleet (68 vehicles) is fully electric promoting environmental mobility (Stresse, 2019). The fleet of the service is aiming to have 300 fully electric vehicles by 2020, increasing its 132 total vehicles that were licensed for its launch in 2018 (Stresse, 2019). Moreover, looking at how passengers embrace the service in Berlin, it was published that the average maximum usability of the vehicles at peak times has been 70% (Ibid.). The operating area of the BerlKönig includes 5 central boroughs, as shown in Figure 3.2.

Figure 3.2. The operating area of BerlKönig in Berlin (BerlKönig, 2019). On-demand Ridepooling operates in Berlin, publicly under BVG in the following boroughs; Mitte, Friedrichshain-Kreuzberg, in the southern part of Pankow (Prenzlauer Berg area), the northern parts of Tempelhof-Schöneberg and the northern parts of Neukölln.

Evaluating the success story of the BerlKönig, the service has been criticized for cannibalizing the preexisting traditional PT modes and potentially adding more traffic on the streets (Šustr, 2019). In specific, members of the German coalition government, such as Tino Schopf, have been questioning the meaningfulness of the service (Stresse, 2019), being operated in central districts of the city, where PT has relatively no gaps (Šustr, 2019). What is for sure, is that the service is evaluating its debut experimenting service, figuring out best practices, in line with its vision (Stresse, 2019). A vision of minimizing the environmental impact of transport and minimizing the use of private cars in Berlin.

Based in the aforenoted analysis of the sustainable mobility indicators, the current research is not able to drive more specific conclusions on the sustainability of the BerlKönig on-demand Ridepooling service. This is due to the fact that no core indicators describing the service were available, to be compared with the sustainable mobility indicators bibliography.

Figure 3.2.1. The BerlKönig shuttle (VISION mobility, 2017). BerlKönig brings on-demand Ridepooling on the streets of Berlin through a public-private collaboration. BerlKönig is operated publicly by BVG, the PT of Berlin and ViaVan Technologies B.V is providing the needed software for the system to run.

3.2.2. The case of Munich

3.2.2.1. The urban mobility profile of Munich

Munich is the third biggest city of Germany, located in the south of Germany. The city is surrounded by the State of Bavaria, serving as its capital. Munich has a flourishing economy, comparted to diverse industries, which generate the 31% of the GDP of the Bavarian State, a percentage equal to 104,2 billion EURO for 2015 (München Betriebs-GmbH & Co. KG, 2015). What is more, when focusing in Munich's labor, the average working person in Munich is considered to be of the wealthiest of the country. More specific, in 2015, an average working person would receive a GDP per gainfully employed person of 98.041 EURO, which was 39 % higher than the national average in Germany (Ibid.).

Moving forward to the urban characteristics of Munich, Table 3.3. presents the most important urban and transport characteristics for the city. The first part of the table presents the urban characteristics of Munich that are useful for shaping a basic image of how the city looks like from an urban planning perspective. The second part of the table illustrates information about the Public Transport System in Munich. The stakeholders as well as numbers describing transport supply, are presented to start understanding the transport reality in Munich. Information on Taxi and private single car vehicles are also provided. The third part of the table illustrates the traffic congestion costs Munich citizens are facing. Furthermore, Munich is expanding in 25 boroughs, as illustrated in Figure 3.3.

Table 3.3. Urban and Transport characteristics of Munich in 2018.

MUNICH	
Urban Characteristics	
Population as a #	1.542.211 residents [a]
Population Density	4.963 residents km2 [b]
City Size	310,70 km2 [c]
Number of Boroughs	25 [d]
Transport Network Information	
Public Transport Authority	MVV [f] (Münchner Verkehrs- und Tarifverbund)
Public Transport Operator	MVG [g] (Münchner Verkehrsgesellschaft mbH)
Metro Lines (U-Bahn Untergrundschnellbahn) City rapid railway (S-Bahn Stadtschnellbahn)	8 [i] 8 (Operating by Deutsche Bahn AG) [h]
Tram Lines	17 [j]
Bus Lines	90 [k]
Registered Taxis	3.336 [n]
Registered Passenger Cars	716.246 [q]
Motorization rate	*50,5%* [m]
Traffic Congestion Data	
Lost hours in Congestion per year	140 hrs [t]
Direct Costs of Congestion per Driver	1.218 EUR [v]

An overview of the population and city size characteristics of Berlin, as well as an overview of the city's transport network and its congestion. Data taken each time according to availability from: [a] *(München Betriebs Portal GmbH & Co. KG, 2018);* [b] *(Mstatistik München Betriebs Portal GmbH & Co. KG, 2018c) ;* [c,d]*(München Betriebs Portal GmbH & Co. KG, 2019b)* [f] *(MVV, 2019);* [g] (MVG, 2019)*;* [, i, j, k] *(Münchner Verkehrsgesellschaft mbH, 2018) ;* [h] *(S - Bahn München DB, 2019);* [q]*(Mstatistik München Betriebs Portal GmbH & Co. KG, 2018b);* [m]*(Mstatistik München Betriebs Portal GmbH & Co. KG, 2018a);* [n] *(Statista, 2018);* [t ,v] *(INRIX, 2019).*

Munich today has more than 1,5 million residents and its population has been increasing in the last ten years by 13% (München Betriebs Portal GmbH & Co. KG, 2019a). More specific, in 2018 Munich counted 1.542.211 residents, and for the first three months of 2019, Munich counts already 1.544.300 residents (München Betriebs Portal GmbH & Co. KG, 2019a).
As one of the most economically vibrant German cities, Munich attracts German and International population every year counting in total citizens from 190 different nations (München Betriebs Portal GmbH & Co. KG, 2019a). The overall population density in Munich is 4.963 residents per km^2, with the number however reaching up the extreme for Munich's urban capacity of 15.706 residents per km^2 for Munich's central boroughs (Mstatistik München Betriebs Portal GmbH & Co. KG, 2018c).

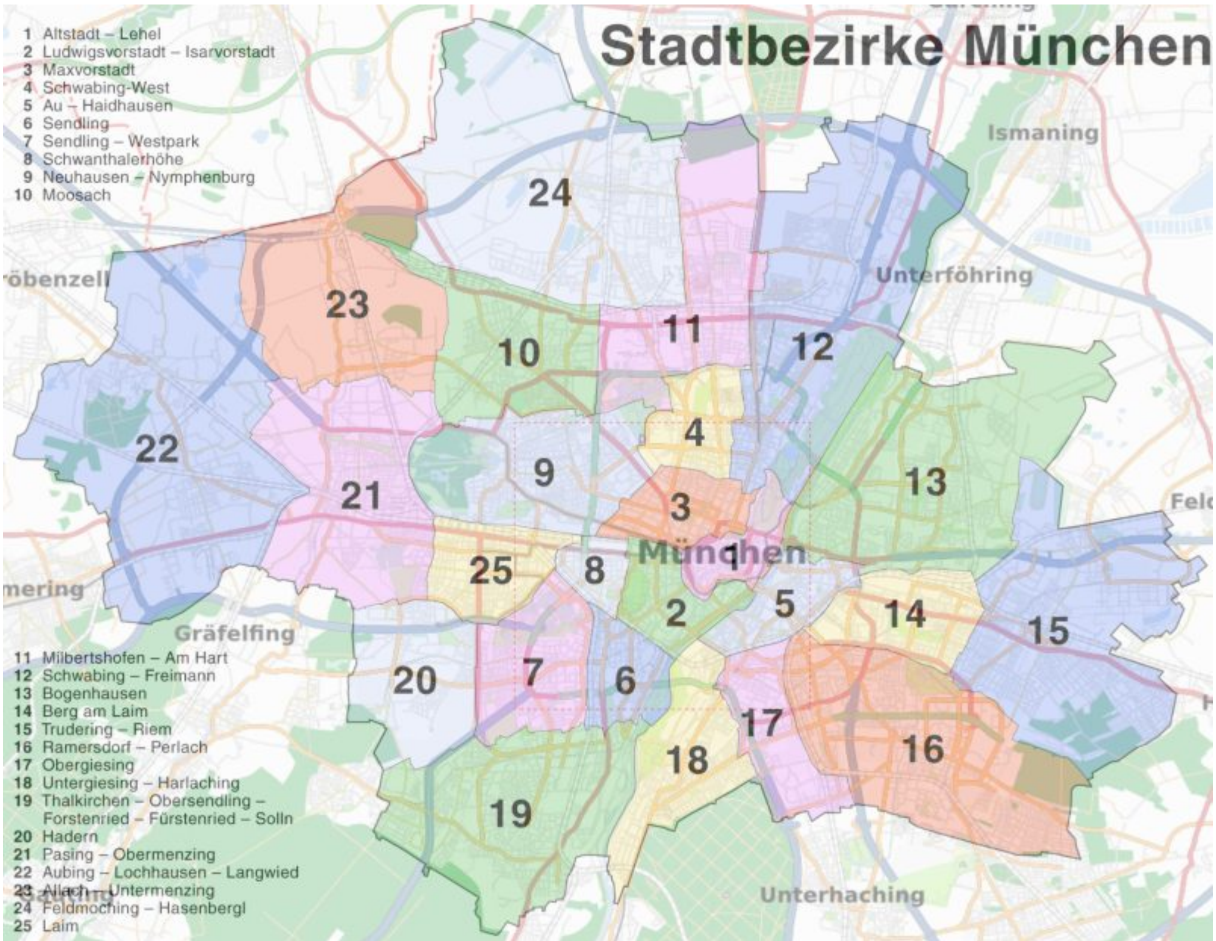

Figure 3.3. The 25 Boroughs of Munich (OpenStreetMap Wiki, 2016). The city is expanding in 310,70 km2 (München Betriebs Portal GmbH & Co. KG, 2019b).

At the same time, Munich is growing in a high pace (München Betriebs Portal GmbH & Co. KG, 2019a), due to also the city's prosperous economy and society that attracts many new coming citizens. Andreas Steinbeißer Transport Expert and Deputy Head of Marketing at MVG explains in his interview for the current research, the city's urban growth is a reality that poses a transport challenge, as mobility is core to the city's urban life (Annex 8.7.). The transport network of Munich operates to its best capacity every day, but of course needs to adjust to the new needs that the city's growth imposes (Ibid.).

Munich is also a highly motorized city, with almost half of its 1,5 million citizens owing a car (Table 2 data: 1.542.211 residents and 716.246 passenger cars for 2018), In the last 8 years, a yearly increase of more than 20% on newly registered passenger cars was calculated (Mstatistik München Betriebs Portal GmbH & Co. KG, 2018b).

At the same time the city suffers from intense traffic congestion problems, also due to its car centricity. As the population and the registered cars grow, Munich has to deal with daily increased traffic jams. Already four years ago MVG clearly stated that "in the city center (of Munich) traffic is already at its limit" (MVG, 2015). Steinbeißer, also confirms in his interview the car centricity Munich is facing, with traffic congestion of thousands of cars queueing every day to enter and exit the center of Munich. More specifically, he underlined that 3 out of 4 cars driving in the streets of Munich, are empty driven only by one person. Steinbeißer continues that an average family owns 2 to 3 cars, explaining that Munich as a rich city, can afford this luxury (Annex 8.7.). Moreover, private cars in Munich spend 95% of their time parked, occupying public space (Figure 3.4.).

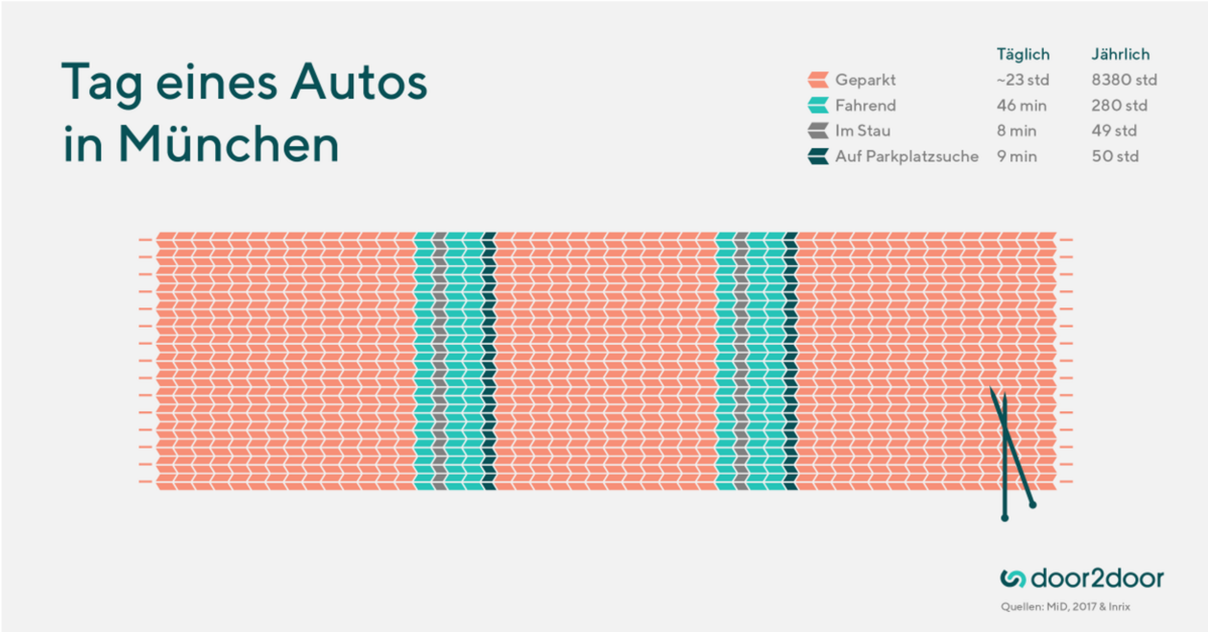

Figure 3.4. The Day of a Car in Munich at 2017. In Munich, a car spends most of its "life" immobile. More specifically, a car spends 96% of its time parked, only 3% of its time the car is driven and 0,5% of its time the car is either being in traffic or searching for a parking place. Courtesy of door2door GmbH.

Steinbeißer continues, explaining that the PT system of Munich, especially the metro lines, are operating every day in their full capacity, being packed by passengers. Analyzing historically Munich's PT network, Munich's first bus operated in 1861 and first tram in 1876. In 1898, the city's growth had to be matched by an expansion of the PT network (MVG, 2015). In 1906, Munich's population reached half a million and the need of moving the city's public transportation into a higher gear started to become imperative. In 1971, when Munich's population reached 1.3 million, the city's first underground line was introduced (Ibid.). Today, Steinbeißer, at his interview, admits that the traditional ways of PT are important and set the base of the network. However, they are not enough, explaining that the traditional transport network (including metro, tram and bus) has been stagnated since the last 100 years and there is finally the need of development. Moving further, he explains that new mobility solutions, shall complement the traditional system and help it become more attractive for citizens.

It is true that hard infrastructures, such as metro, are expensive and their launch is a long-run one. For example, Munich announced already in 2014 that MVG is planning the new metro line U9 that will provide an additional route through the city center decompressing its extreme traffic. Today in 2019, the plans are still developing and progressing (Münchner Verkehrsgesellschaft mbH, 2019), but still no U9 metro line is running and decompressing congestion. For the sake of comparison at this point, it is important to mention that other mobility solutions such as on-demand Ridepooling can be implemented way faster than other hard infrastructures, such as a new metro line. Julian Ropers, Senior Mobility Consultant at doo2door GmbH, shares his experience explaining that if in a city political consensus concerning the implementation of on-demand Ridepooling is achieved, then the rolling out on-demand Ridepooling on the streets may take from 2 to 6 months. This short implementation timeframe is an important information, as urban mobility problems pressure the society already since a while. Any mobility solution shall not be delayed but be given as soon as possible to the urban environment.

Apart from the long-term frameworks of implementation, hard infrastructure is also costly. Munich for example acknowledging that estimated numbers are way different than the reality numbers, is estimating for the new U9 line an initial cost of 3 billion Euro, translated into almost 286 million Euro per km as a starting cost (Ibid.). To compare with other lines, the Berlin metro line U55 finalized in 2009 costed almost 224 million Euro per km. On the way more expensive side of new metro lines, in New York the Second Avenue Subway (metro) line at its 1st phase finalized in 2017 costed more than 1,5 billion Euro per km (Levy, 2017).

It is clear that heavy infrastructure can be extremely costly. Even if the discussion of upcoming autonomous mobility argues that it can reduce costs (Davidson and Spinoulas, 2016), autonomous mobility in the public sector is still placed in future, and cannot be provided fully today as a solution to the mobility challenges. The need of cost efficient and more agile solutions that respond to today's urban transport demand is becoming more and more prominent.

Having already analyzed the rapid population growth in Munich, the capacity problem of the transport network, alongside with the private car challenge, we can conclude that Munich's transport network is in danger of lagging behind its demographical change which is unfortunately happening faster than the expensive and slow extension of its hard-traditional transport infrastructure. The suffocation of the PT network in Munich is a reality that needs solutions today.

3.2.2.2. On-demand Ridepooling in Munich

In May 2018 on-demand Ridepooling launched in Munich, under the product brand of *IsarTiger*, adding a new public transport mode to the city's PT network.

The routes of the IsarTigar service are calculated dynamically as shared pools by an algorithm, based on users' on-demand journey requests. The passengers can be picked up from physical PT fixed stops that they have to proceed to and can be dropped out to any "free" stop that they wish. The drop off is therefore characterized as free-floating, and the whole system as a last mile solution.

Ingo Wortmann, Chairman of the Management Board of MVG, explained in his interview at the launch of Ridepooling in Munich that Metro, Tram and Busses are operating at their best from fixed stop to fixed stop, but they are not sufficient enough for Munich's transport needs (münchen.tv, 2018). At the same time, Andreas Steinbeißer, Head of Marketing of MVG and Project Manager of IsarTiger, explains in his interview for this research Munich's PT operator has the vision to offer to its citizens such a robust and flexible PT system, that the need of private passenger car in Munich will not exist.

Therefore, the on-demand Ridepooling was planned for the PT network of Munich and got designed in three phases. Currently, in May 2019 the service is running as a pilot project, integrated into the PT network. The service has been designed as a combination of physical fixed stops and a free-floating system, expanding from in the inner city of Munich (MVG, 2018). Figure 3.5. illustrates the IsarTiger operating area, which was chosen strategically, as one of the most heterogenous city areas including industrial, residential and commercial complexes, as well as cultural and subcultural hubs. The heterogeneity is representative for Munich's economic and social diversity, reassuring more realistic results for the test pilot.

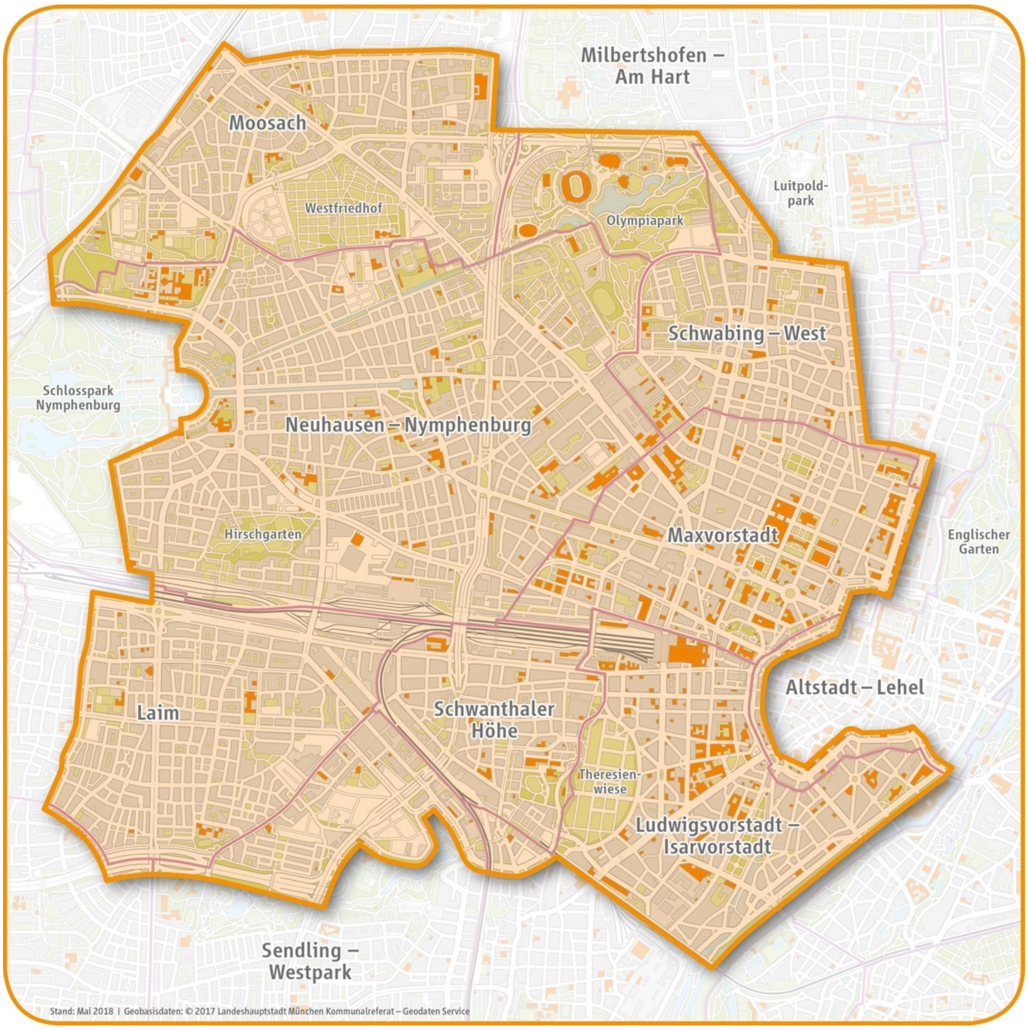

Figure 3.5. The IsarTiger Operating Area until May 2019 (MVG, 2018). This starting operating area was chosen strategically by MVG, as one of the most heterogenous areas of the city, representative for Munich's economic and social diversity. More specifically, Steinbeißer from MVG, shared in his interview that the operating area of 33km² includes industrial, residential and commercial complexes, as well as cultural and subcultural hubs (Annex 8.7.). This truly mixed area will help and at the same time challenge the IsarTiger test phase, on more realistic and representative results, on whether on-demand Ridepooling could work on the long run for Munich. From June 2019, a quadrupling of the operating area is planned.

Analytically, phase number 1 includes a closed pilot operation to MVG customers/passengers that hold the yearly MVG public transport card. The pilot operation started in July 2018 and runs until today May 2019. The scope of this operation is to test the service, receive insights on its usage patterns, demand trends and mobility needs of the customers. The service runs from the center of Munich to the west districts of the city. At the same time, the service is free of charge and is being operated under MVG. The fleet of the service is composed by 25 cars and the operation times for the moment includes Thursday during 18.00 – 00.00 o'clock, Friday during 18.00 – 02.00 o'clock and Saturday 18.00 – 05.00 o'clock. In the planning background, MVG accompanies the test phase with parallel market research and keeps on receiving constantly consulting from the Customer Success Team of door2door on future steps and expansion (Ibid.).

Phase number 2 described as public testing, starts in July 2019, where the service will launch publicly for every MVG customer. In stage 2, expected to start in July 2019, the test will be carried out publicly until the end of 2020. Now everyone has the opportunity to use the new MVG service - and then pay for it - through the service area in Munich. Adjustments to the operating area and operating times may also occur during this period - depending on how the demand develops (Ibid.)

Phase number 3 would include the fully establishment of on-demand Ridepooling operation after 2020, if until then the new offer has proven to be meaningful in the previous test phases (Ibid). This would mainly include a successful passenger participation and a feasible economic operation for the service, where simply its costs shall be covered, as Steinbeißer explains in his interview (Annex 8.7.). Moreover, as a supplement to the existing PT system, MVG aims to obtain a permit for regular services under the German Passenger Transportation Act and prepares a cooperation with the Munich taxi centers. In the future plans of Munich, MVG considers operating on-demand Ridepooling with different scenarios in the center and in the suburbs of a city. Understanding that the mobility needs and problems for those two areas can differ, apart from the central operation of the IsarTiger, MVG is considering a future supplementary operation of in the Munich suburbs, to connect and feed passengers to end S-Bahn stations and to other major PT hubs.

The private Berlin-based company door2door GmbH provides MVG with the software needed for the IsarTiger to operate, through the collaboration of the private and the public sector. This includes three parts; the mobility analytics software based on geographical information systems (GIS) for the planning and simulation of the service, the turnkey Ridepooling software that brings the service on the streets and the multimodal route planner app offered as a white label product, for passengers to book rides. Finally, the service is fully public, and the operational and passenger data, remain under the ownership of MVG, as Steinbeißer highlights (Annex 8.7.).

Concerning the cost of the service, it is not known exactly how much on-demand Ridepooling costs in comparison to other mobility modes. However, it is for sure known that on-demand Ridepooling is a cheaper solution to bring in a city's network, than a metro. As Ridepooling is a new mobility solution that has emerged in the last 2 years, cities are now experimenting with operations to be able to calculate the real cost of Ridepooling in comparison to a bus that, for example, is running empty. As Andreas Steinbeißer from MVG explains in his interview for the current research, one thing is for sure and that is that on-demand Ridepooling is not profitable but also does not have the goal to be so. The goal of such a service from a financial point of view, is to simply cover its costs, and not produce losses that mostly PT in general produces. Based on Steinbeißer's calculations, 6 requests per hour of 2–5 km each, are needed, for the IsarTiger to cover its costs of paying the driver's labor and the automobile costs. A goal that is realistically achievable, as Steinbeißer explains, considering that the public launch of the service in July 2019, will include 100 times more potential users than today's smaller testing user sample, for the same operating area.

3.2.2.3. The Causes and Forces behind on-demand Ridepooling in Munich

Andreas Steinbeißer, the IsarTiger Project Manager from MVG, through his interview for the current research, provided useful insights on why and how the PTO of Munich has embraced on-demand Ridepooling.

On the question of which were MVG's incentives to plan and launch Ridepooling, the answer was mainly the vision that MVG has on providing such a complete PT system, that will be so robust and flexible at the same time, that citizens will no longer more need to use private passenger cars. Steinbeißer goes on explaining, that in Munich 3/4 of cars are driven in single occupancy, due to the fact that Munich is a rich city and residents can afford to possess more than one car. As Munich suffers on top from congestion and profound population growth, completing the above vision is a challenging goal, that MVG takes very seriously.

In comparison to Berlin which offers space for mobility to get unfolded, Steinbeißer explains that Munich is a way smaller city where not all bus lines are optimally planned, due to space constrains. As a result, this makes citizens to sometimes prefer their private cars on covering small distances, than a bus that does not have a flexible or route-wise smart schedule. In those cases, combined with car centricity that Munich faces, busses can end up running empty. Subsequently, here arises another reason why MVG chose to experiment with on-demand Ridepooling, and this was the flexibility that such a system brings in favor of the particularities of a city. In specific, the IsarTiger can offer to Munich the flexibility that buses do not have, due to the short distances. Steinbeißer moreover explains, that the IsarTiger is designed to cover all those "problematic" - up to 5km routes, for which citizens would prefer their private car and worsen traffic congestion in their city.

Steinbeißer clarifies as well, that the IsarTiger is not designed to drive through and cross the whole city of Munich, but mainly offer an alternative to private cars, for the first-last mile of journeys. The ideology of integration is very important for MVG, where each PT mode, such as the IsarTiger, shall not cannibalize other modes, or contribute to the severe congestion the city is facing. Figuratively Steinbeißer underlines that if traditional PT covering wide urban areas is the trunk of a tree, then IsarTiger is strictly only the leaves of the tree. This highlights once more the complementary character of IsarTiger towards gaps of the PT network.

When asked on the biggest challenges that the IsarTiger is facing today, Steinbeißer talks about public investment and reputation fighting.
In the spotlight of the open mobility market and the existence of other private mobility operators such as Uber, the argument that IsarTiger is not cannibalizing traditional public transportation is not always easy to be heard. As private companies that operate on-demand mobility seek for profit to sustain their business models, specific busy areas of high demand are chosen for the operation in order to secure profit for their business. This process, also known in the mobility market as "cherry picking", is disturbing the urban mobility ecosystem, as it offers in a very low price on-demand mobility, not integrated in the PT system, adding more congestion in the busy areas that it chooses to operate and cannibalizing PT that exist in those areas, as people

chose the cheap private service over the public one. Steinbeißer underlines, that on-demand Ridepooling shall be designed carefully, not to be used for crossing the whole city, adding more congestion in the streets. IsarTiger has considered the above concerns and as explained, operates integrated to PT and for short distances, of first – last mile.

What is more, the IsarTiger shuttles operate with bio-natural gas, which emits less CO_2 than other gas sources. As Steinbeißer explains, the combustion of bio-natural gas includes much more water than a normal gasoline one, making IsarTiger 80% eco-friendlier than diesel or petrol cars.

The second challenge that the IsarTiger and MVG is facing, has to do with public investment. Unfortunately, there is much political and lobby influence on the direction that public grants are distributed. It is often the case, that the private automobile has a stronger power on claiming public money, which often leaves the public sector of mobility receiving way less public money (Annex 8.7.). This argument can be very much supported by the previously analyzed (introduction of chapter 3) lobby power of the German Automobile Industry Association (Verband der Automobilindustrie e. V.), which has a strong political influence nationally and internationally.

Concluding on public transport cannibalization effects, Steinbeißer underlines that pricing on-demand Ridepooling for passengers is very important. The price itself could be a useful tool for regulating such negative effects, in any city. On-demand Ridepooling could be more expensive in central areas, and cheaper in suburbs, where for example it may substitute an empty bus line. Rich private car users that afford to leave in central districts, may afford a higher price for Ridepooling, that is still cheaper than a taxi but higher than PT. This can motivate wealthy car users to leave their private car and use such shared modes, that pick them up conveniently from their standing points (work, home) like a private car would do. Moreover, by differentiating the price for central areas, people that used PT, that may belong to non-rich financial classifications, will continue using PT, and will not be motivated so easy to start using Ridepooling and stop using their older PT choices, such as metro. On the contrary, in the suburbs where Ridepooling may be used to collect and feed people to end metro stations, substituting inefficient bus lines that produce more cost running empty, Ridepooling could potentially have a different price, closer to the PT one. After all, for the case of Munich, cannibalization happens already with the operation of Uber in the city, and therefore what MVG is trying to do with the IsarTiger is gain the market of on-demand Ridepooling in a more thoughtful and integrated way, for the sake of a solid PT network.

As Lahme, Business Development Manager at door2door GmbH underlines in his interview (Annex 8.7.), cities need to control public goods such as transport. What is more, Lahme believes that to avoid instability in the mobility market, PTOs have to join the mobility revolution, embrace new modes such as on-demand Ridepooling, and set the sound rules of how such modes shall operate in the city. Otherwise, with the absence of the public sector, instability or excessive development may be produced in the mobility market, similar to what happened in the house market for the Berlin case, where public land was sold in the 2000's really cheap to the private sector, that today imposes alarmingly increasing house rents.

3.2.2.4. Unique Key Performance Indicators (KPIs) of on-demand Ridepooling in Munich

Currently IsarTiger is preparing for its second phase of operations; the public launch. As explained previously, in July 2019 the public launch will allow all passenger on PT in Munich to use the IsarTiger and get pooled in the city.
Until today, the IsarTiger has been operating for one year, 3 days a week. Data have been collected thought out its operation and categorized accordingly under specific indicators and metrics. Those specific metrics give a tangible illustration of the IsarTiger operation, analyzing its reality on the streets and wisely guiding decisions and next steps for its service.
With the curtesy and the allowance of MVG on basic data sharing, part of those useful metrics are provided to this research, in order to understand better the practice of Ridepooling. The basic data shared are also very important because they convey a positive message to cities about Ridepooling. As Munich pioneers and leads the way of innovation and digitalization in public transport, MVG is a courageous operator that envisions a diverse, modern and adaptive PT network, which can be seen as an inspiring example for other cities in the world, to receive best practices and insights on publicly operated Ridepooling.

The basic provided metrics here describe: total passengers transported, availability, vehicle productivity and booking frequency from the same users.

At this point, unique Key Performance Indicators (KPIs) of the IsarTiger service are provided with the courtesy of MVG and door2door. The presented data are published for the first time. The provided performance metrics describe: total passengers transported, availability, vehicle productivity and booking frequency from the same users.

Starting from the total passengers transported, the IsarTiger, during the first 4 months of 2019 almost doubled its transported passengers, underlining that passengers are embracing and trusting on-demand Ridepooling in Munich. More specifically, the IsarTiger counted in total 454 passengers in January 2019, 652 in February 2019, peaking to its record in March 2019 with 975 passengers and an increase of 45,54% in comparison with the previous month. The high number of passengers was maintained in April 2019 as well, with 921 passengers.
Secondly, the average availability rate of the IsarTiger for the first four months of 2019 was 94%, ranging always from a 89,9% to 98%. The availability rate describes the total amount of ride requests being accepted by the system, when compared to the total amount of requests.
Thirdly, the average vehicle productivity per hour is presented, illustrating how many passengers per vehicle per hour got pooled. Between January and April 2019, the average vehicle productivity scored an increase of 23,4%. The 1,44 pooled passengers per hour per vehicle in January, reached 1,88 pooled passengers per hour per vehicle in April. This increase underlines that the sharing vehicles capacities are being utilized, realizing the vision of pooling people together, in the effort of minimizing single passenger car trips in the city.
A fourth indicator describing the on-demand Ridepooling operation in Munich is the booking frequency. The indicator describes the average number of bookings per user per month. This indicator provides once more information about the trust and usability passengers show to the service. In January 2019 the same user would book on average 2,18 rides per month, in February 2019, on average 2,64 rides and in March 2019 on average 2,83 rides. This illustrates an increase of 30% of the IsarTiger booking frequency in the first three months of 2019.

The data presented for those four indicators convey the message that on-demand Ridepooling is growing steadily in Munich. More specific, the increase of the total passengers transported and the booking frequency, once more reflect the popularity and positive perception on-demand Ridepooling is receiving from Munich active passengers. At the same time increases of the vehicle productivity and availability indicators show that MVG is taking seriously the escalation of the service, offering a robust on-demand Ridepooling system that responds to the increasing demand for PT in Munich.

Figure 3.6. The IsarTiger shuttle (MVG, 2018). IsarTiger brings on-demand Ridepooling on the streets of Munich through a public-private collaboration. The IsarTiger is operated publicly by MVG, the PT of Munich and door2door GmbH is providing the needed software for the system to run.

3.3. Policy in Germany

Policy plays an important role to the implementation of on-demand Ridepooling in Germany. Two main policy points need to be referred in this research.
First of all, the German state is tasked by Basic Law (Grundgesetz) to offer public transport to it citizens (VDV, 2019). This task is described by the administrative term of "Daseinsvorsorge". Public transport is seen as a basic civic service for existence and its supply shall be secured by the state (Ibid.).

The challenge of "Daseinsvorsorge" on PT supply is that every local PTO interpretates this basic law differently, and translates it in praxis according to the PTOs capabilities. Lahme explains that in some cases, this may lead to inefficient PT networks, due to lack of funding like in the cases of rural areas in Germany (Annex 8.7.). At this point it is important to underline that the European Union and the central German government are offering funding for PTs to digitalize and enhance their PT service (Ibid.). On-demand Ridepooling can be included in such initiatives.

A second important aspect of regulation in German PT includes the fact that the German Passenger Transport Law (PBefG – Personenbeförderungsgesetzes) does not foresee on-demand Ridepooling as such (Bundesamt für Justiz, 2017). The on-demand Ridepooling service is pretty new, embraced by PTOs in Germany since 2017 as discussed previously, and the Passenger Transport Law pretty old, with its main content established in 1961 (Ibid.). As the PT sector in Germany is heavily regulated, on-demand Ridepooling needs to adopt in the existing policies and find a "window" to be enabled. As Björn Siebert, Lead Policy and Regulatory Affairs expert from door2door GmbH underlines in his interview, in most of the German cases the Ridepooling service falls under an experimental law clause of 4 years operations. In specific, the service is run under a bus line permit and by law is perceived as an extension of bus lines (Annex 8.7.). Examples are given from the case of the IsarTiger in Munich where the starting points of the service are fixed PT stops, and the end stops are free floating chosen by passengers. Furthermore, the freYfahrt on-demand service in Freyung introduced 270 new virtual stops, to be used for regular pooling. The service operates by law as a bus line and the virtual stops are identified as public transport stops (Ibid.).

As Siebert goes on, there has been a lot of lobbying in Germany to change and modernize PT Law in order to include on-demand Ridepooling services. In specific the coalition of the German government agreed in 2018, that an opening of the legal framework of the Passenger Transport law is needed, in order to legally include new platform-based digital mobility services such as on-demand Ridepooling (Glinski, 2018).

We can conclude that cities willing to enable on-demand Ridepooling, need to take into consideration the local regulations and public policy that exist on PT. Regulation may act as a barrier, if not addressed properly.

4. Greece and on-demand Ridepooling

Moving forward after the German cases, this research examines also the status of mobility and the potential application of on-demand Ridepooling in Greece, through a comparative approach.

Through the interviews with transport experts (analytically presented at chapter 5) alongside with secondary research, useful insights are presented for the case of Athens and Thessaloniki, where shared mobility is still in an embryonic stage. The research provides the status quo of mobility in the two biggest cities of Greece, discusses the found results, providing explanations for the reasons behind the undeveloped digital shared transport in Greece. The research moves further, providing unique simulations for on-demand Ridepooling for the two Greek cities, presenting how on-demand Ridepooling could look like in Athens and Thessaloniki.

More specifically, the on-demand Ridepooling simulation could be possible with the use of an appropriate geographical information systems (GIS) software called “Insights”, kindly provided by door2door GmbH. The software includes the digital maps of Athens and Thessaloniki, illustrating the public mobility reality for the cities. This can be done, as the urban characteristics and the official PT network data are added in the software. The PT network data are represented by the general transport feed specification data (GTFS) provided by the PTOs of Athens and Thessaloniki.
The software can afterwards simulate on-demand Ridepooling scenarios, by presenting the demand and supply of Ridepooling. To do so, as in the Greek cities no Ridepooling exists, the demand is predicted. An algorithm that predicts Ridepooling Searches using points of interest for the cities (such as residency, entertainment, work locations) is applied on the cities, proposing an image of the Ridepooling demand. That algorithm was created by Mariam Maarouf, Software Developer at door2door GmbH and her Mobility Intelligence team. As Maarouf explains, the algorithms' predicting results are based on real demand Ridepooling data from the city of Berlin, where door2door operates privately the on-demand Ridepooling Brand of alligator shuttle (Maarouf, 2019). The demand data from Berlin are properly balanced and processed according to the urban, mobility and economic characteristics of other cities that do not operate Ridepooling, and for which the demand is being predicted. This is how finally, estimations on demand data for Ridepooling can be produced for cities that actually do not operate Ridepooling (yet). In this picture, the supply is added selectively, according to the Ridepooling scenario that is wished. The supply framework can vary on the fleet size (number of shuttles), the operating area, the waiting time, the pooling potential and more. After all, having both the predicted demand and the wished supply, Ridepooling scenarios can be illustrated, presenting how Ridepooling could look like for Athens and Thessaloniki.
In those cities, emphasis is given to specific urban areas that PT is either underdeveloped or problematic. After this analysis, the research draws first conclusions about Ridepooling in Greece.

4.1. Economy and Digitalization in Greece

Greece is geographically located at the crossroads of Europe, Asia, and Africa. The country is gifted with a strategical position in the Mediterranean, being situated at the same time in the southern tip of Europe and the Balkan Peninsula.

Compared to Germany, the population of Greece is 7,5 times smaller, with the Greek population reaching 11.124.603 million people in 2019 (Worldometers, 2019). At the same time, Greece is also a member state of the European Union, joining though way later than Germany, in 1981 (European Union, 2019).

Moving forward to the economic profile of Greece, in 2018 the Gross Domestic Product in Greece was 184.713.600 million Euro, equal to a GDP per capita of 17.200 thousands Euro per citizen (Eurostat, 2018b). Eleven years ago, in 2008, the country's GDP per capita was peaking at 28.448 thousand Euro per citizen (World Bank Group, 2019).

In 2009, Greece was stuck with one of the most severe economic crisis that Europe has faced, becoming the target and the scapegoat of the global financial crisis of 2008. Greece shook the global news when in 2009 its existing "fiscal crisis turned rapidly into a sovereign debt crisis, which finally mutated into a full-blown recession" (Matsaganis, 2013).

For the next 10 year, Greece spend a period of hard economic recession, the results of which can be seen in all economic and social country indicators and can be felt by all Greek citizens life change. More specific, in the crisis period, youth unemployment struck unprecedented scores, with the average youth unemployment in 2017 reaching 43.6%, peaking at 57.6% for the Greek region of Epirus, a rate among the highest of all OECD regions (OECD, 2019).
Moreover, the enormous governmental depth for 2018 accounted a 181,1 % of the county's GDP, the highest percentage in the European Union (eurostat, 2019a) and the second highest in the world (Trading Economics, 2019).

Kaplanoglou and Rapanos explain that the crisis has intensified the risk of a long-lasting poverty and inequality in Greece, due to its development and management choices (Kaplanoglou and Rapanos, 2018). As on-demand Ridepooling can offer access to opportunity and strengthen equity in the urban life (Table 2.3.) we could argue that on-demand Ridepooling could minimize the intensified inequality resulting from the crises.

Moving forward to the demographic landscape of Greece, the population in Greece is highly concentrated in cities, with 79.0 % of the population (equal to 8,788,635 people) residing in urban areas in 2019 (Worldometers, 2019). Those urban areas appear to have a significant role for the economic reality of the country. Their importance, can be underlined by the fact that between 2001 and 2015, including the years of the economic recession, the GDP was declining less in metropolitan areas compared to the rest of the country (OECD, 2019).

At the same time, Greece is also a highly motorized country. Based on the Hellenic Statistical Authority's timeseries on the Greek vehicle fleet, it is calculated that in last 30 years, during the period of 1988-2018, the number of private passenger cars in Greece has increased 257%. The calculation of this enormous increase of private passenger cars as well as the sources of the initial used numbers, are explained and presented in Annex 8.3. Moreover, in 2018 Greece counted 5.249.135 million private passenger cars (ΕΛΣΤΑΤ, 2018), which compared to the country's population of 11.124.603 million, brings the conclusion of a private passenger car motorization rate of almost 50%. In comparison to Germany's aforenoted total vehicle motorization rate of 69,2% and taking into account Germany's way bigger population, GDP per capita and GDP, Greece's specific private passenger car status is impressive. The above numbers can underline the private passenger car "obsession" that for the country of Greece.

In the spotlight of the 4th industrial revolution (Schwab, 2018), another aspect worth of including to the analysis of Greece's economic and technological profile, is the level of the economy's digitalization.
The European Union defines the Digital Economy and Society Index (DESI) as a composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU member states in digital performance and competitiveness (European Commission, 2018b). The index includes factors such as the integration of digital technology, the level of digitalization of the public sector, the use of internet services and more (Ibid.)

Given the fact that innovation in the sector of mobility includes technological development and digitalization, the DESI index provides useful background information on the adaptability of new mobility solutions. For the case of on-demand Ridepooling, digitalization plays a central enabling role. More specifically digitalization is expressed in the internet and smartphone penetration for passengers and as software supply for the mobility operator. It can be therefore concluded, that a successful implementation of on-demand Ridepooling, depends to a large extent on the digitalization level of the economy.

Based on the EU ranking of the DESI for 2018, Greece had the lowest score, with the 27th penultimate position amongst the 28 EU countries, with a DESI score of 38,4%. For the same year 2018, the EU DESI average was 54%, whereas Germany scored a 55,6% just above the EU average, ranking 14th in the 28 EU counties, on the Digital Economy and Society Index (Ibid.).

Based on the interviews with transport experts Vlastos and Kokkinos, it is confirmed that today in 2019, on-demand Ridepooling in Greece does not exist, in any kind of private or public provided operation. Following the analysis of the DESI index, where digitalization is vital for the existence of on-demand Ridepooling, we can theoretically correlate the nonexistence of such mobility solution in Greece, to the low level of digitalization in the country's economy and society.

However, even if Greece scores way too low on the DESI and digitalization plays a central role for on-demand Ridepooling, this does not necessarily mean that it is impossible to implement on-demand Ridepooling in Greece. There have been exemplary cases where on-demand Ridepooling has been implemented without the support of smartphones, from the passenger's side. The town of Freyung, in Bavaria, Germany, launched in 2018 on-demand Ridepooling, with both land line and smartphone booking features, to also serve the elderly population of the town that is not familiar with smartphone usage and bookings (door2door GmbH, 2019b). After all, the willingness of digital evolution does exist in Greece, as for the first time in 2016 the country establishment a Ministry of Digital Policy, Telecommunications and Media as well as a National Digital Strategy (European Commission, 2018a).

Concluding, digitalization plays a core role for the implementation of innovative and shared mobility solutions, and countries that adopt digitalization in a wider range of sectors, do ease the implementation of such mobility solutions, like on-demand Ridepooling.

4.2. The case of Athens

4.2.1. The urban mobility Profile of Athens

Athens is the biggest city and the capital of Greece, belonging in Attica; the surrounding metropolitan area of Athens. Geographically, Athens is located in the center of the Greek territory, when including the territorial waters as well. Athens has a dominant importance to the economic prosperity of Greece, with a significant amount of the national GDP concentrated in the metropolitan region of Athens. More specific, in 2010 the metropolitan area of Athens produced 48% of the total national GDP (ΠΕΠ Αττικής 2014-2020, 2019). Moreover, it has been calculated that if Athens was to be removed from Greece, the GDP per inhabitant would drop by 19.8% in 2015 (McCarthy, 2017).

Apart from the leading economic role Athens has for Greece, demographically the metropolitan area of Athens, gathers the one third of Greece's population, with 3.154.152 people residing in the broader area of Athens in 2019 (World Population Review, 2019a). At the same time, Athens economic and demographic firsts, are accompanied with one of the highest densities in Europe. More specific, in 2019 population density in Athens is in average 17.040 residents per km^2 (Ibid.), surpassing in some districts such as Kallithea and Nea Smyrni the suffocating number of 20.000 residents per km^2 (CIESIN, 2018).

Athens is also a highly motorized city, depending on private passenger cars. From all the motor vehicles circulated in Greece in 2018, the 64% of them equaling to 5.282.695 million were private passenger cars (ΕΛΣΤΑΤ, 2018). Out of them, 2.900.000 million were registered in the broader metropolitan area of Athens (Ibid.). Compared to the total private passenger cars registered in whole Greece, the above numbers translate to the 55% of the Greek passenger cars being concentrated in Athens. If we clearly think of what does this really mean, we will come to the rather insane realization that more than half of Greece's passenger cars are located in Attica, the metropolis of Athens, which is the 2,8% of the Greek territory (ΕΛΣΤΑΤ, 2019). As Vlastos also underlines in his interview, nevertheless Athens having way too narrow streets, that do not enable easy driving, the households of the capital still do own many times more than one motor vehicles. The above clearly highlight the intense car centricity of Athens, underlining also the subsequent effects of congestion and air pollution issues that the capital has to face.

From an economic perspective, the urban area of Athens has suffered from economic degradation. Panori and Psycharis, explain that during the 2004-2015 period, economic and social conditions in the metropolitan area of Athens were worsened (Panori and Psycharis, 2018).

Table. 1.1. Urban and Transport characteristics of Athens for 2018-2019.

ATHENS	
Urban Characteristics	
Population as a # (of the Metropolitan Area)	3.154.152 residents [a]
Population Density	17.040 residents per km^2 [b]
City Size	411,107 km2 [c]
Number of Boroughs	40 [d]
Transport Network Information	
Public Transport Organization	OASA S.A. [e]
Public Transport Operators	STASY S.A. & OSY S.A. [f]
Metro Lines (Operated by STASY A.E., including the electric railway "Elektrikos")	3 [g]
Tram Lines (Operated by STASY A.E.)	3 [i]
Bus Lines (Operated by OSY A.E.)	258 [k]
Trolleybus Lines (Operated by OSY A.E.)	19 [l]
Registered Public Passenger Cars (of the Metropolitan Area, Including mainly Taxis)	16.923 [m]
Registered Private Passenger Cars (of the Metropolitan Area)	2.900.000 [n]

An overview of the demographic characteristics as well as the public transport status of the urban complex of Athens. Data taken each time according to availability from: [a,b] (World Population Review, 2019a); [c] Annex 8.4..; [d](Papathanassiou, 2019); [e] (OASA, 2010); [f](ΣΤΑ.ΣΥ Α.Ε., 2019)· (Ο.ΣΥ Α. Ε., 2017) ; [g,i,k,l] (moovitapp, 2019); [m,n] (ΕΛΣΤΑΤ, 2018)

Moving forward to concrete data, Table 4.1. describes the basic urban and transport characteristics of Athens. Based on the administrative structure of Kallikrates the capital region of Greece is identified as the urban complex of Athens, composed by five main peripheries; the periphery of the Athens Central Sector, the periphery of the Athens Northern Sector, the periphery of the Athens Southern Sector, the periphery of the Athens Western Sector and the periphery of Piraeus (ΠΕΠ Αττικής 2014-2020, 2019). All five peripheries are composed by 35 and 5 boroughs accordingly, completing the 40 boroughs of the broader urban area of Athens (Papathanassiou, 2019). Figure 4.1. illustrates the above analysis.

Figure 4.1. The 40 boroughs of Athens (Περιφέρεια Αττικής, 2019). Based on the Kallikrates administrative structure, 40 boroughs form the urban complex of Athens (ΠΕΠ Αττικής 2014-2020, 2019), which are above illustrated in the five colors of; yellow, red, green, dark pink and purple. In yellow, the Athens Central periphery can be recognized. In red, the Athens Northern periphery can be recognized. In green, the Athens Southern periphery can be recognized. In dark pink, the Athens Western periphery can be recognized. In purple, the Piraeus periphery can be recognized. The areas colored outside of the above five mentioned colors, are parts of the broader metropolitan area of Athens, Attica.

As the "Environmental Strategical Analysis" of Attica explicitly explains, the urban area of Athens is suffering from increasing non-planned residential extension, severe transportation problems, constant urbanization, lack of urban green and of free public spaces (ΠΕΠ Αττικής 2014-2020, 2019). The lack of public space, green, congestion and disorderly urbanization contribute to a broader mobility problem the urban area of Athens is facing today.

Finally, as discussed public urban mobility enables freedom and access to economic activity. Urban mobility defines to an extend the quality of life one can have in an urban constellation. Therefore, the absence of urban mobility can be destructive to the prosperity or urban areas.
For the case of Athens, this significant role of urban mobility can be strongly recognized in suburban areas with low income. The absence of public urban mobility sets those areas in the danger of underdevelopment, poverty and ghetto creation. Representative examples on this, can be seen in the area of Ano Perama, that belongs to the urban complex of Athens and in the area of Nea Zoi Aspropurgou that borders directly with the western part of the urban complex of Athens (360°, 2019). Both areas do not have public transport coverage, which pays into the marginalization and poverty of the area (Ibid.). The areas are left out of the PT network, and

subsequently left out of the society and economy of the city. It can be understood that the degradation of urban mobility and of urban life are bidirectional, and therefore mobility can play an important role to the urban upgrade and development of areas.

4.2.2. On-demand Ridepooling in Athens

The urban area of Athens includes 40 districts (Figure 4.1.) in which agglomeration, population density and mobility quality score different levels each time.

When comparing Athens to Berlin, both capitals have similar populations residing in their urban complexes. However, based on the presented data, Athens expands in an urban territory almost half of the Berlin one, with almost a five-fold population density. Considering also the similar passenger car motorization rates of Greece and Germany, we can understand that the mobility reality on the street, especially on the traffic congestion factor, can be twice worse for Athens, when compared to Berlin.

The pubic mobility profile of Athens offers a variety of options to move around. As Table 4.1. illustrates, the two PTOs of Athens, STASY S.A. and O.SY. S.A. share the public mobility operations, offering a network of 3 metro lines (including the electric railway line of “Elektrikos”), 3 tram lines, 258 bus lines and 19 trolley lines. The numbers, especially of busses, may be impressive and the average coverage good. However, there are some districts in the city that do not face optimal PT coverage, where PT may not be flexible, often or convenient. In such areas, residents can be demotivated to use PT, and therefore may choose with a higher probability to use their private passenger car, that provides in that case a more efficient mobility.

The areas were the PT network has gaps were identified by a software, that visualizes the general transport feed specification data (GTFS) for the Athens public transport schedules. The software named “Insights” and was provided once more with the courtesy of door2door GmbH. Based on the interview with Vlastos, and to the authors’ personal experiences, being born and raised in Athens, the areas of deficient PT were confirmed. For those areas, on-demand Ridepooling was simulated and proposed as a PT solution. The demand of the service was predicted, based on real demand data from Berlin that were balanced based on the Athenian urban characteristics.

Deciding on which areas on-demand Ridepooling would be simulated, the urbanization, car centricity and density analysis in Athens, played also a role. More specifically, the author of the current research would not suggest Ridepooling in core central areas of Athens, as it is speculated that this would increase congestion and risk public cannibalization of the preexisting PT modes, given the fact that in the city center PT coverage is mostly efficient.

Figure 4.2., 4.3., 4.4., 4.5. illustrate how on-demand Ridepooling could look like, in order to demotivate private passenger car usage in the spotlight of poor PT coverage. The Figures are extracted by the “Insights” software that identifies the PT gaps through the GTFS for the Athens PT network.

Figure 4.2. refers to the Zografou area where the campus of the National and Kapodistrian University of Athens is located. PT has been identified as undersupplied with no flexibility in the bus schedules, as shown in the indicators in the left. The Figure illustrates with pale pink

lines the predicted demand of on-demand Ridepooling. The red arrows indicate the pale pink lines. Figure 4.3. illustrates the PT reality of Psychiko, a wealthy area, where the population density is low and efficiently and flexible PT exists only in the main highway of the area, leaving the chosen residential areas around the illustrated hexagon in the faith of private passenger car usage. Figures 4.4. and 4.5. illustrate the mobility situation of Politeia and Ekali, two wealthy areas of northern Athens, where PT as illustrated does not serve the area and citizens rely completely on private passenger car. All four areas of Zografou, Psychiko Politeia and Ekali are strongly proposed for on-demand Ridepooling.

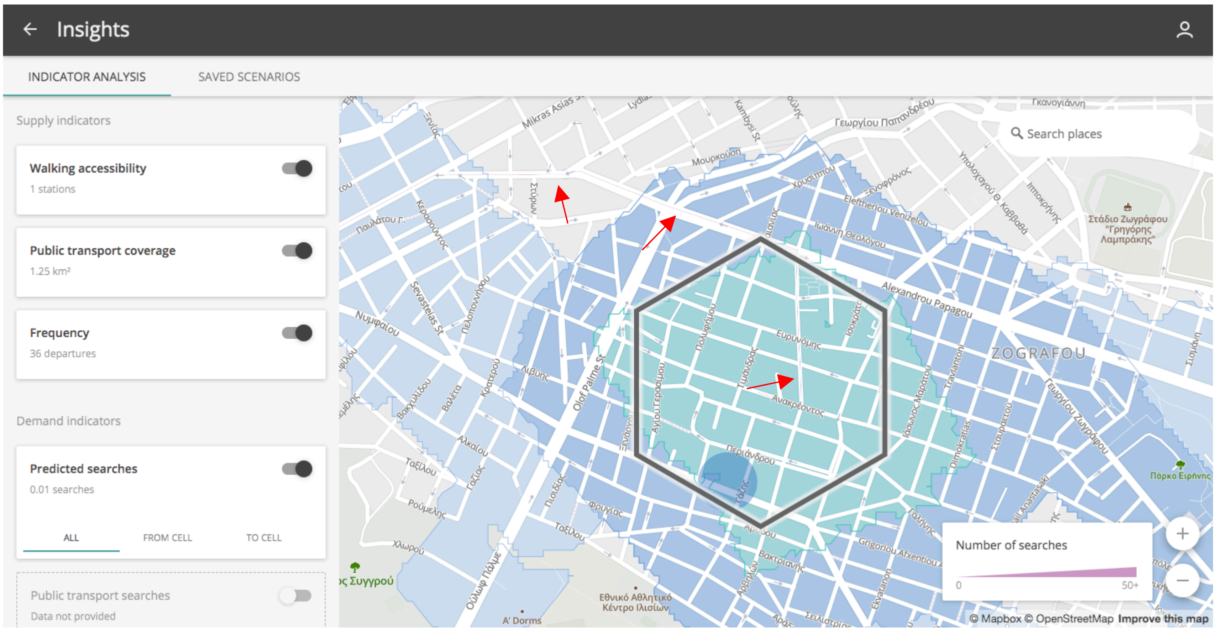

Figure 4.2. Predicted on-demand Ridepooling for Zografou area, in Athens. The red arrows point out the pale pink lines of the service. The green area illustrates the walking accessibility to PT in 5 minutes and the blue area illustrates the PT coverage within 15 minutes. Courtesy of door2door GmbH.

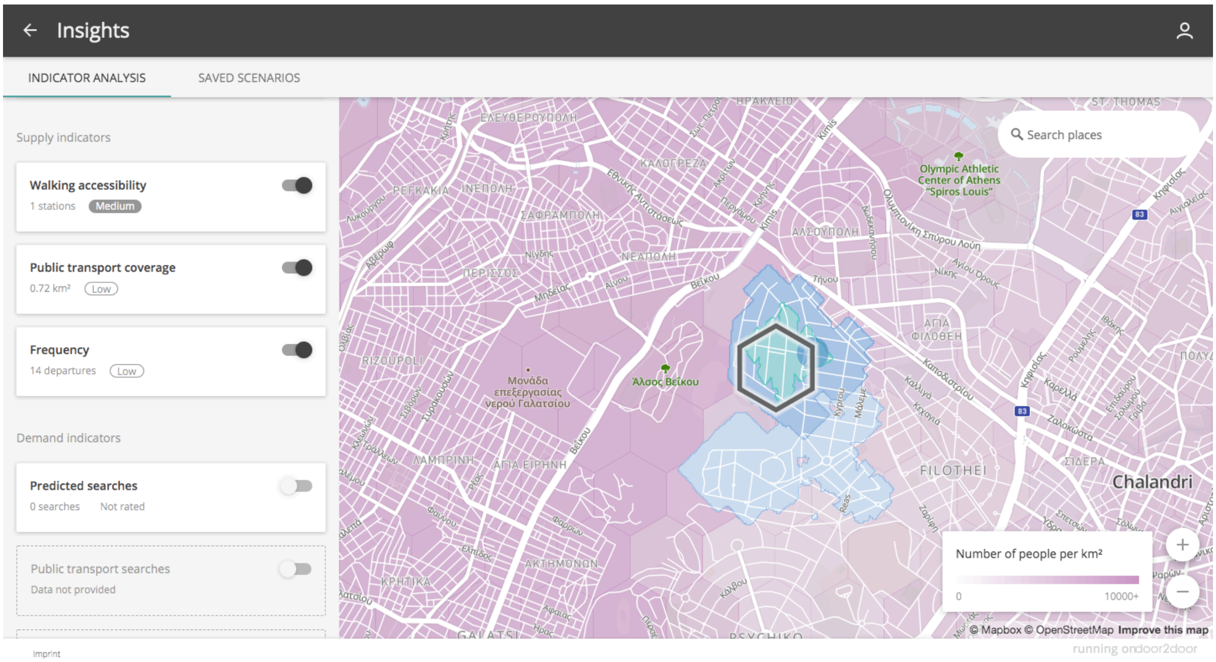

Figure 4.3. The public transport reality of Psychiko, in Athens. PT supply is ranked as low, as shown in the indicators on the left. This reality, urges citizens to use their private passenger car. The green area illustrates the walking accessibility to PT in 5 minures and the blue area illustrates the PT coverage within 15 minutes. The pink background illustrates the population density. Courtesy of door2door GmbH.

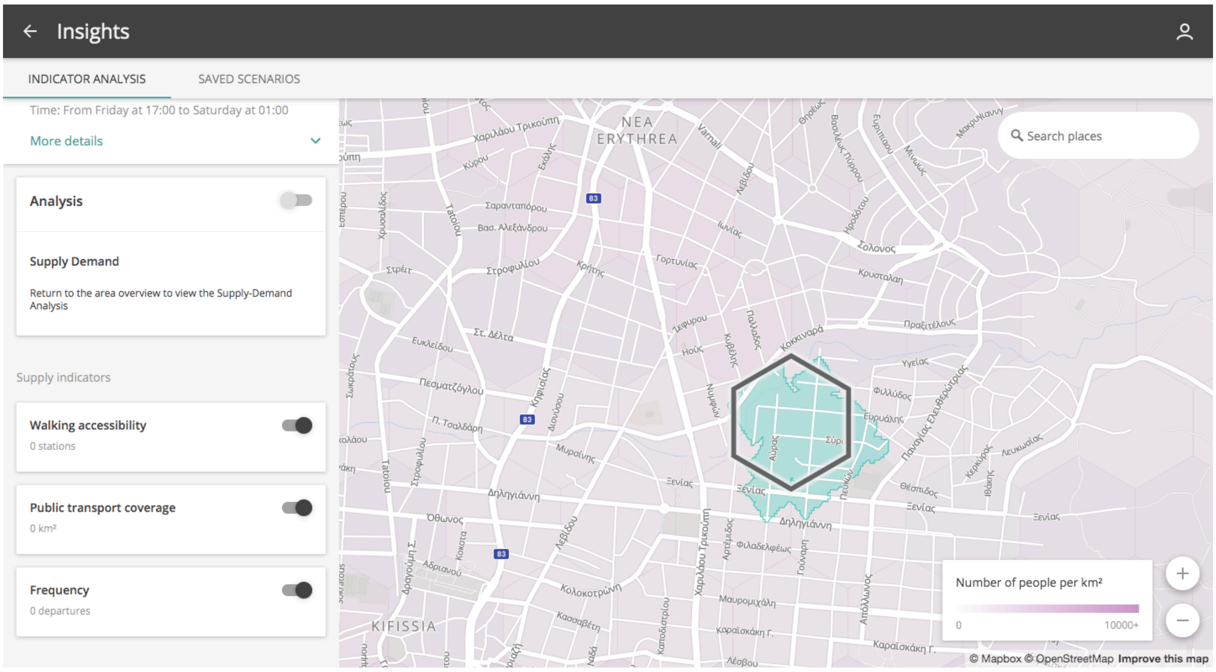

Figure 4.4. The public transport reality of Politeia, in Athens. PT supply is not existing, as shown in the indicators on the left. The green area illustrates the walking accessibility to PT in 5 minutes from the selected cell. No blue area illustrating the PT coverage within 15 minutes exists. Both indicators are ranked as 0. This reality urges citizens to use their private passenger car. The pink background illustrates the population density. Courtesy of door2door GmbH.

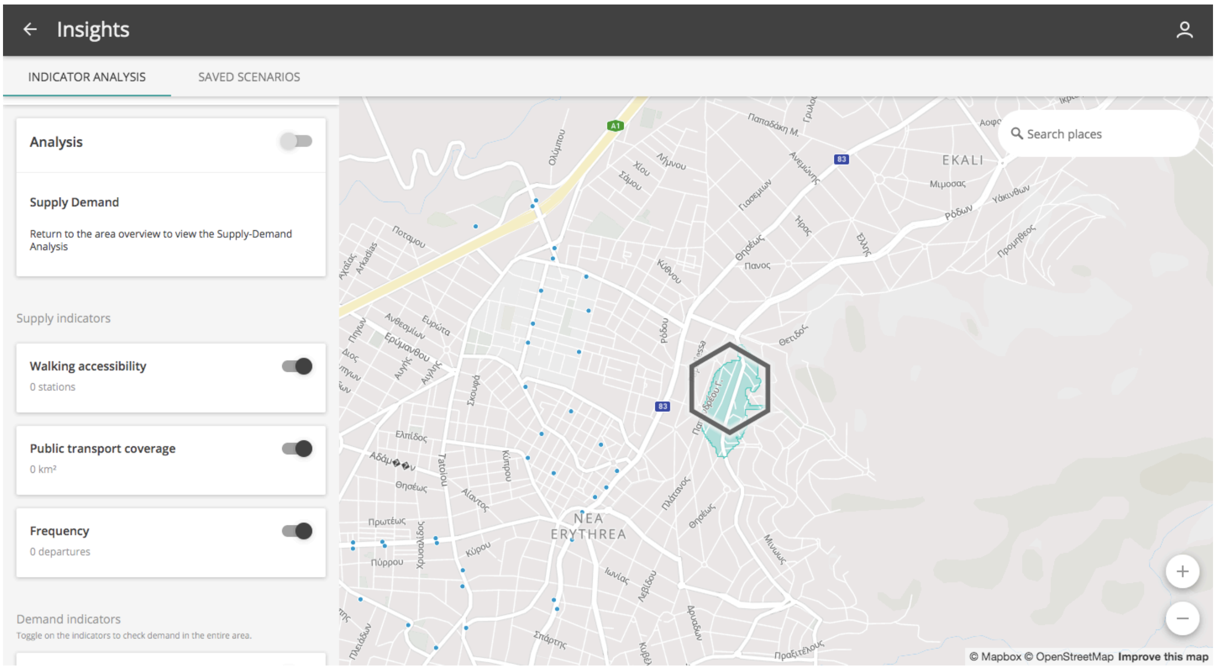

Figure 4.5. The public transport reality of Politeia and Ekali, in Athens. PT does not supply the chosen area, as shown in the indicators on the left. The green area illustrates the walking accessibility to PT in 5 minutes from the selected cell. No blue area illustrating the PT coverage within 15 minutes exists. Both indicators are ranked as 0. This reality, urges citizens to use their private passenger car. Moreover, the blue dots illustrate the bus coverage of the area that does not reach the area of Politeia and the further up of Ekali. The pink background illustrates the population density. Courtesy of door2door GmbH.

Concluding, it is interesting to compare Athens and Berlin on some basic passenger data, as this research proposed that existing on-demand Ridepooling in Berlin, could also be applied in Athens. These data refer to normal PT usage without including on-demand Ridepooling. However, the data reveal similarities in the PT commuting profile of Athens and Berlin. In specific, the average time people spend commuting with PT, on a weekday is 62 minutes for Berlin and 71 minutes for Athens (moovitapp, 2019a) (moovitapp, 2019b). Moreover, the percentage of passengers who ride with PT for more than 2 hours every day is 15% in Berlin and 16% in Athens (Ibid.). On the average amount of time that people wait at a station on a weekday, Berliners score 10 minutes and Athenians 18 minutes (Ibid.). Lastly, the percentage of people who wait for more than 20 minutes at a station, is 10% in Berlin and 34% in Athens (Ibid.). The above data indicate that the passenger reality using classic PT in both capitals is similar. Athens is even scoring worse in indicators concerning journey and waiting times. Based on the fact that on-demand Ridepooling is operating in Berlin, Athens could potentially adopt fast on-demand Ridepooling as well, given the similarities on passenger experience.

4.3. The case of Thessaloniki

4.3.1. The urban mobility profile of Thessaloniki

Thessaloniki is the second biggest city in Greece, surrounded by and being the base of the metropolitan area of Thessaloniki and the periphery of Central Macedonia. The urban complex of Thessaloniki has 895,915 residents (CIESIN, 2018), being the economic center of the Greek north. Population density is Thessaloniki is in average 7.100 residents per km^2 (World Population Review, 2019b), reaching however in central areas such as Ampelokipoi, the extreme number of 21.925 residents per km^2 (CIESIN, 2018).

Table. 4.2. Urban and Transport characteristics of Thessaloniki for 2018-2019.

THESSALONIKI	
Urban Characteristics	
Population as a # (*of the Metropolitan Area)	895.915 residents [a]
Population Density	7.100 residents per km^2 [b]
City Size	132,349 km2 [c]
Number of Boroughs	7 [d]
Transport Network Information	
Public Transport Authority	OSETH S.A. [e]
Public Transport Operators	OASTH S.A. [f]
Metro Lines	-
Tram Lines	-
Bus Lines	80 [k]
Registered Public Passenger Cars (Including mainly Taxis)	2.455 [m]
Registered Private Passenger Cars	522.601 [n]

The table presents an overview of the demographic characteristics as well as the public transport status of the urban complex of Thessaloniki. Data taken each time according to availability from: [a] (CIESIN, 2018); [b](World Population Review, 2019b); [c]Annex 8.5. ; [d] (Ανδρικοπούλου and Καυκαλάς, 2015); [e] (Ο.Σ.Ε.Θ. Α.Ε., 2018); [f] (Ο.Α.Σ.Θ., 2012b); [k] (Ο.Α.Σ.Θ., 2012a); [m, n] (ΕΛΣΤΑΤ, 2018)

Figure 4.6. The 7 boroughs of the urban complex of Thessaloniki (Wikimedia Commons, 2011). Based on the Kallikrates administrative structure, the 7 illustrated boroughs form the urban complex of Thessaloniki (Ανδρικοπούλου and Καυκαλάς, 2015). Annex 8.5. explains in detail the formation of the urban complex, from its municipalities and municipal sections.

4.3.2. On - demand Ridepooling in Thessaloniki

The public transport profile of Thessaloniki is presented in Table 4.2. In comparison to Munich, Thessaloniki is almost 3 times smaller in size and 2 times smaller in population, as it can be derived by the previously presented data. The two cities, operate almost the same amount of bus lines, with Thessaloniki having 80 bus lines (Ο.Α.Σ.Θ., 2012a) and Munich 90 bus lines (Münchner Verkehrsgesellschaft mbH,2018). It should be also noted, that the Thessaloniki PT mix, is comparted only by busses (Ο.Α.Σ.Θ., 2012b), whereas Munich offers a variety of metro, tram, city rapid railway and bus choices (MVG, 2019).

Thessaloniki can be also characterized as Munich, by urban spatial narrowness. As Munich has been dealing with inefficiencies in some bus lines, due to urban space constrains, the same situation can be assumed for Thessaloniki that unfolds in a "narrow strip" of land from the north to the south.

For the urban mobility reality of Thessaloniki, it was identified that bus lines do not connect efficiently specific districts directly to each other, such as in the case of neighboring district Kalamaria and Pulaia. When a passenger car journey from one to another may take 5 minutes, a bus journey may take more than 20 minutes, due to the detour and bad connection of the two neighbors. Therefore, citizens often prefer car, over the bus. This underlines an issue some bus lines have, which is the radial line expansion from the city center to the districts, without any connection among the districts themselves. Figure 4.7. illustrates poor connection in Pulaia and Figure 4.8. illustrates predicted on-demand Ridepooling for Pulaia and Kalamaria.
Moreover, it has been identified that the edges of the city, are also not connected with an optimal way to each other, where connections include time consuming bus line changes and waiting times. Given the fact that the city is not large to cross, citizens prefer to cross districts through the city by private passenger car within 15 minutes, rather than taking the adventure of the PT choice that may equal for the same journey to 60 minutes.
Figure 4.9. illustrates the PT reality in the area of Panorama in the southern part of the Thessaloniki urban complex. As shown, PT is not serving the area, which means that citizens rely completely on private passenger cars.
Figure 4.10. proposes on-demand Ridepooling for the southern part of the city, serving Panorama and Pulaia. Figure 4.11. illustrates the specific use case of on-demand Ridepooling for the Mediterranean Cosmos commercial mall, part of the southern Thessaloniki as well.

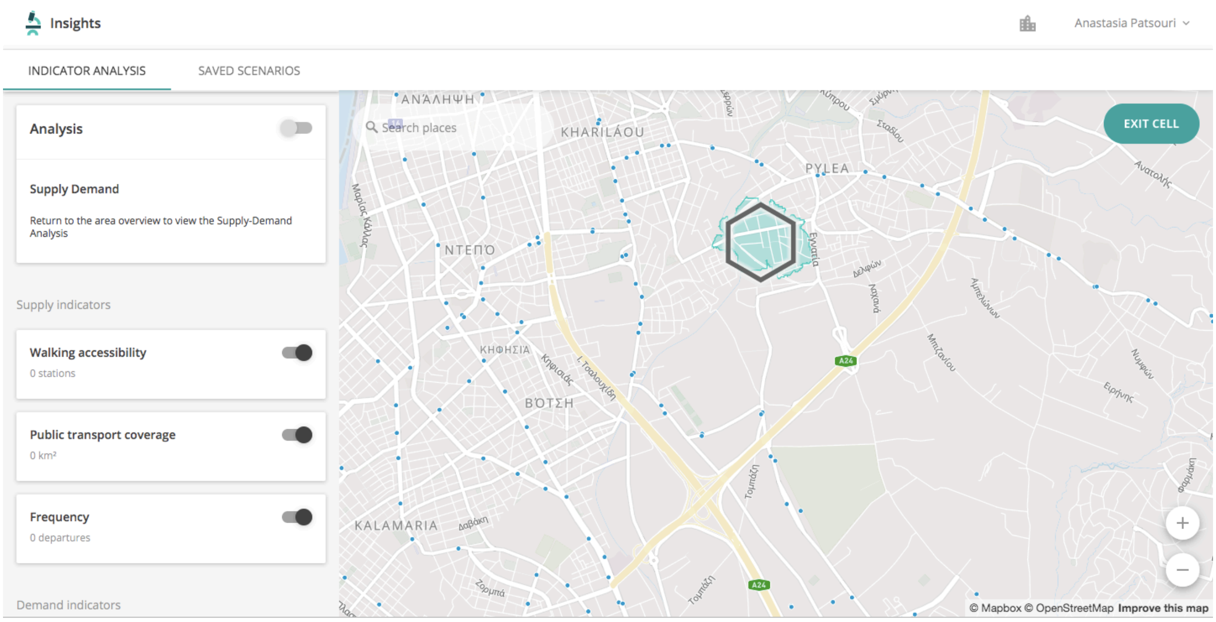

Figure 4.7. The public transport reality of Pulaia, in Thessaloniki. Apart from the fact that Pulea does not have optimal PT coverage (indicators scoring 0 on the left), Pulaia is also not connected directly to Kalamaria by PT. The blue dots illustrate the basic bus coverage of the Pulaia, that does not connect the area to Kalamaria the neighbor borough. Busses need to detour and as a result a distance of 5 minutes may take 20 minutes. Citizens are urged strongly to use their private passenger cars. Courtesy of door2door GmbH.

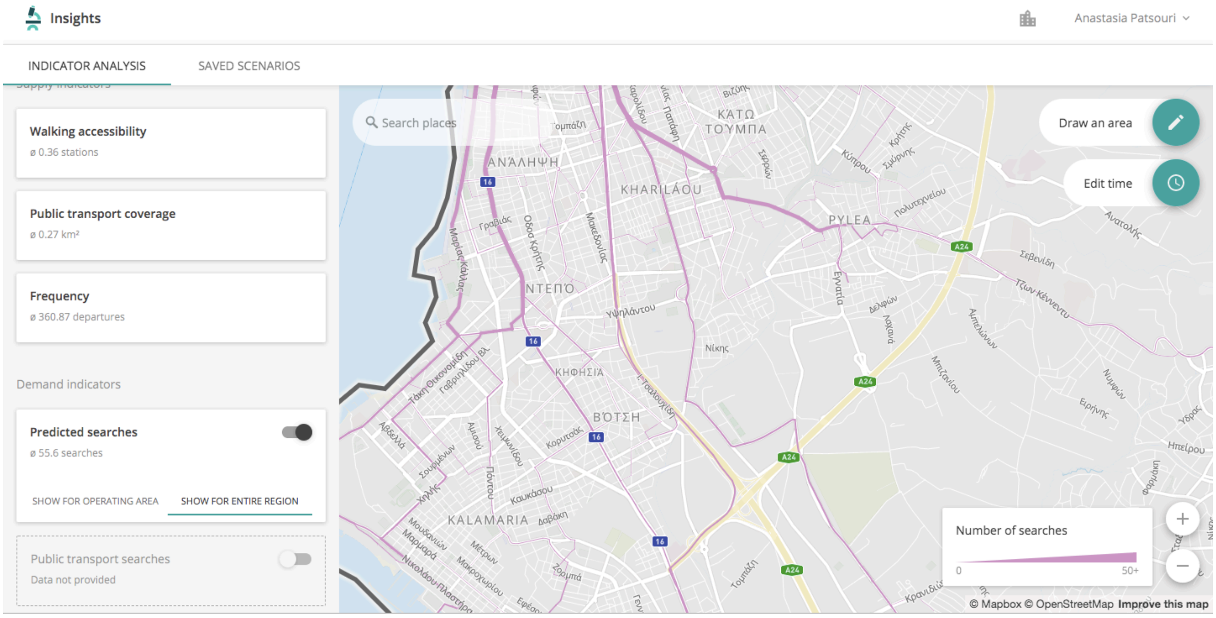

Figure 4.8. On-demand Ridepooling for Pulaia and Kalamaria, in Thessaloniki. The pink lines illustrate the demand of the service. Main idea, is to connect the two boroughs with each other directly. Courtesy of door2door GmbH.

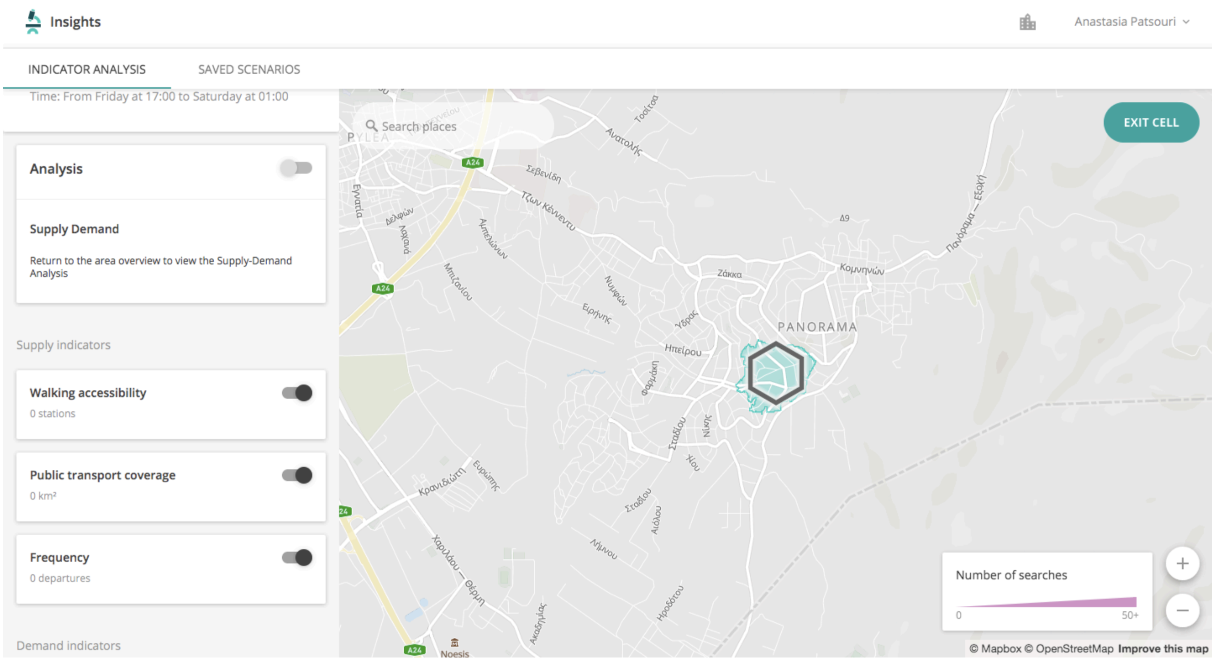

Figure 4.9. The PT reality in Panorama, Thessaloniki. PT is not serving the area, which means that citizens rely completely on private passenger cars. Courtesy of door2door GmbH.

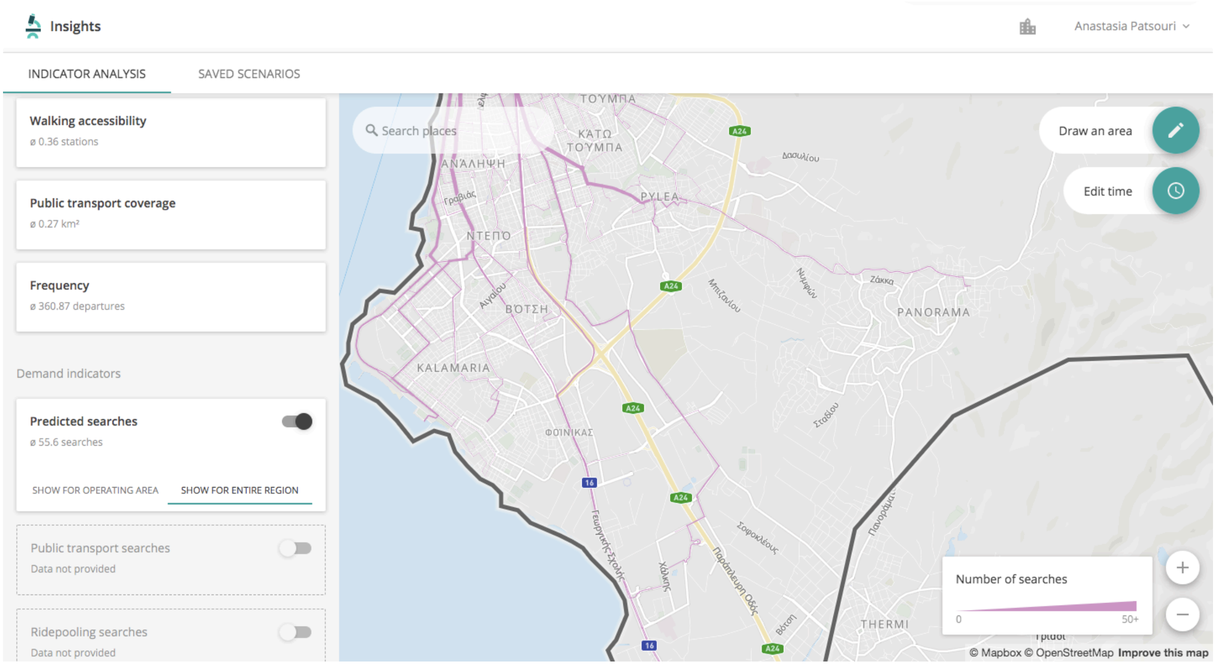

Figure 4.10. On-demand Ridepooling for Pulaia and Panorama, in Thessaloniki. Panorama is not connected to the PT network, as shown in Figure 4.9. The pink lines of the figure illustrate the predicted demand for the service. Courtesy of door2door GmbH.

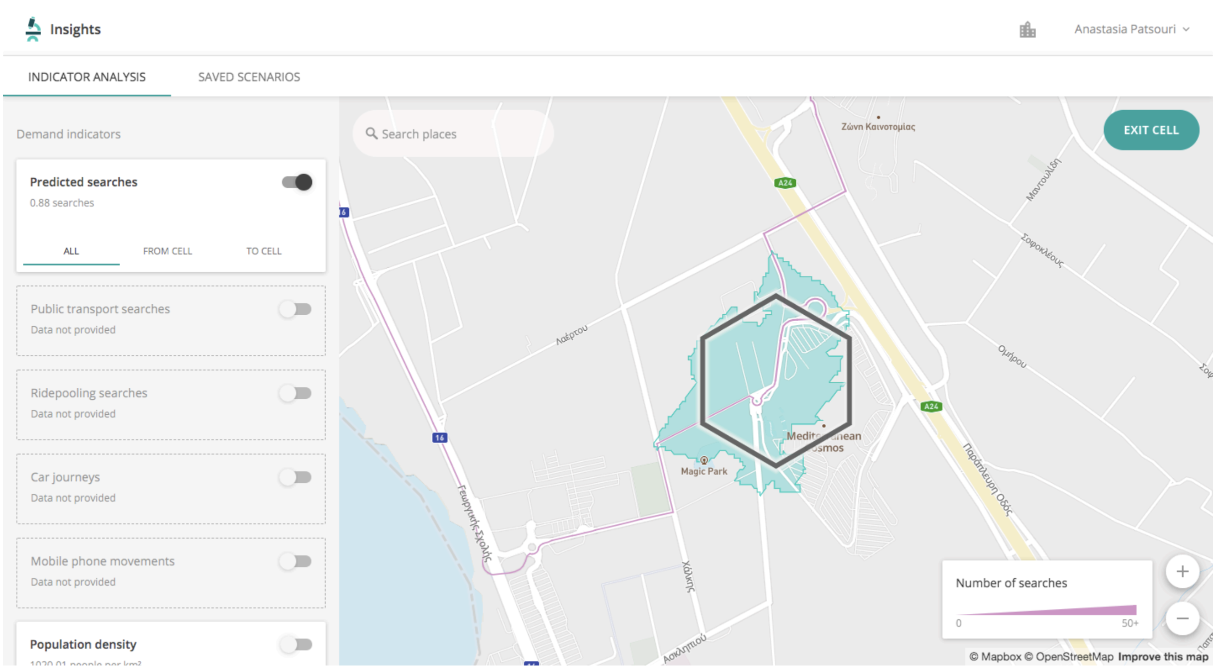

Figure 4.11. On-demand Ridepooling for the Mediterranean Cosmos commercial mall, in Thessaloniki. The pink lines illustrate the demand of the service. Main idea, is to connect the mall in a more flexible manner to PT. Courtesy of door2door GmbH.

5. Policy Recommendations and Discussion

Following the above comparative analysis of on-demand Ridepooling in Germany and Greece, as well as the previous Sustainable Mobility Indicators analysis, this paper continues presenting policy recommendations on-demand Ridepooling best practices and applicabilities. The policy recommendations are extracted from a presented analysis of barriers and enabling factors, in regard to on-demand Ridepooling implementations.

Additionally, this section summarizes the results from the Sustainable Mobility Indicators analysis, on whether on-demand Ridepooling can be considered a sustainable mobility solution for cities. Connecting to the questions set at the beginning of the paper, conditional answers are provided on how on-demand Ridepooling could sustainably contribute to the urban mobility challenges of our epoch.

Starting from the factors that enable on-demand Ridepooling, transport experts Mentz and Lahme, underline the essence of stakeholder inclusiveness (Annex 8.7.). From his experience launching on-demand Ridepooling in various European cities (door2door GmbH, 2019a), Lahme highlights that on-demand Ridepooling can be publicly launched in a city, only when there is political unanimity amongst all affected stakeholders (Annex 8.7.). Stakeholders for on-demand Ridepooling may include different levels of political authorities that affect transport decision-making in a city and taxi organizations that can potentially participate in the service. Table 5.1. illustrates an overview of the stakeholder groups typically involved in transport projects.

Table. 5.1. The typical stakeholder groups involved in transport projects.

Typical stakeholder groups involved in transport projects (based on GUIDEMAPS)

Government / Authorities	Businesses / Operators	Communities / Local Neighbourhoods	Others
Local authorities	Transport operators/ providers	National environmental NGOs	Research institutions
Neighbouring cities	Transport consultants	Motorist associations	Universities
Local transport authority	Car sharing companies	Trade unions	Training institutions
Traffic police	Bicycle rental operators	Media	Experts from other cities
Other local transport bodies	Other mobility providers	Local authority Forums	Foundations
Other local authority bodies	National business associations	Local community organisations	
Politicians	Major employers	Local interest groups	
Other decision-makers	Private financiers	Cycle/walking groups	
Partnering organisations	International/national business	Public transport user groups	
Project managers	Regional/local business	Transport users	
Professional staff	Local business associations	Citizens	
Emergency services	Small businesses	Visitors	
Health & safety executives	Retailers	Citizens in neighbouring cities	
European Union	Utility services (e.g. electric, telecoms)	Disabled people	
Ministry of transport	Engineers/contractors	Landowners	
Other national ministries		Transport staff	
Regional government		Parents/children	
		Older people	

The stakeholder groups are defined by the Sustainable Urban Mobility Plans (SUMPs) developed by the European Commission (European Commission, 2013).

A second important enabling factor for on-demand Ridepooling concerns the involvement of the public sector. The Lisbon study from OECD, underlines the important regulatory role authorities play in the realization of shared urban mobility (International Transport Forum, 2015). In specific, the regulatory role of the public sector is vital to guiding the development of shared mobility in cities, but also in some cases maintaining market barriers (Ibid.). Mentz, and Lahme also underline that the participation of the public sector is significant, for a sound operation on the streets (Annex 8.7.). Useful examples are given from the real estate sector in Berlin, where the public sector, having not played an active regulatory role, allowed for excessive hikes in rent prices,(doubling since the last 10 years) creating housing challenges and social conflicts (Bellut, 2018). As Steinbeißer from MVG explains, the public sector shall have a loud voice on on-demand Ridepooling in order to compete with the expanding private sector, which does not inherently have the mission of offering mobility equitably (Annex 8.7.). One of the core principles of public transport (PT) is the concept of geographic equity (Walker, 2008), where PT shall operate in both dense and non-dense areas, serving as much citizens as it can. Steinbeißer explains that private mobility operators need to run profitable services, in order to sustain their business models, and therefore choose to operate only where profit may exist (Annex 8.7.). Vlastos also explains that public mobility is the one that takes the challenge of operating under a non-profitable state to serve all areas, in the name of equity on PT (Ibid.). Therefore, we can conclude that the goal of profit from the private sector is contradicting the goal of equity from the public sector, producing a conflict of interest. Moreover, the selective private operation strategies of "cherry picking" on profitable urban areas, usually leads to operations on central, dense areas. Steinbeißer explains that those central, dense areas, usually already face traffic congestion, and as the independent private operators are not integrated to the PT system, they end up producing oversupply of transport and worsening traffic. (Ibid.).

It can be therefore advised, that for an equitable transport system, including on-demand Ridepooling, the involvement of the public sector is vital. Enabling this involvement, the schemes of private – public collaborations can be very valuable, for the public sector to be in the front line of new shared mobility solutions. Moreover, the public sector can benefit from the private sector, as innovation and technical knowledge can flow from the private sector to the public one. The presented IsarTiger and BerlKönig services, in Munich and Berlin, are representative examples of this fruitful collaboration on the "know how to" bring on-demand Ridepooling on the streets. In this collaboration, it is important to underline that the operational and private passenger data remain under public ownership, such as in the aforenoted use cases. Public ownership is crucial, as it protects passenger data away from misuse and exploitation, given the fact that data may often become an object of unhealthy hoarding for the private sector.

Moreover, as underlined in the scientific community, integrated transport planning, can act as an effective tool for changing travel behavior (Milakis, 2006), (Bakogiannis *et al.*, 2016). Therefore, the PT operators play an educating role in introducing on-demand Ridepooling to passengers, in a unified manner, that does not exacerbate the urban mobility problems.

Furthermore, on the aspects that enable a sound on-demand Ridepooling system, the Helsinki study from OECD underlines that benefits from on-demand shared mobility, can be enabled under specific operational frameworks (International Transport Forum, 2017). As analyzed in section 3.2.2.3., on-demand Ridepooling should avoid cannibalizing existing PT networks. The idea of a first-last mile operation of on-demand Ridepooling, as part of a multimodal journey, is a good example of a non-cannibalizing service. Therefore, integration to the existing public system is foreseen as a healthy practice for on-demand Ridepooling. At the same time as analyzed in section 3.2.2.3., the recommended operational scenarios for on-demand Ridepooling, may include the substitution of costly bus lines that citizens do not use due to various inefficient urban planning reasons or the feeder case of "feeding" passengers to end stations of rapid railway, connecting the outskirts to the central PT network.

On the potential cannibalization issue shared mobility may have on preexisting PT, it has been discussed that a variation of the price of on-demand Ridepooling according to the operating area, could avoid the effect of cannibalization. As already discussed, on-demand Ridepooling wants to motivate citizens to stop using their private passenger car, but does not want that citizens start to use only on-demand Ridepooling instead of pre-existing PT. The differentiation of the price of the service can be useful to drive citizens' behavior and choice. In practice, this solution means making the service pricier in central areas to motivate car users to give up their car, and cheaper if operating in areas where there are no other public mobility choices. After all, MVG in Munich and BVG in Berlin already price on-demand Ridepooling higher than PT and cheaper than a taxi (MVG, 2018) (BerlKönig, 2019).

On the contrary to the analysis of factors that enable sound on-demand Ridepooling operations, there are also factors that act as barriers. Those barriers need to be taken into consideration when planning on-demand Ridepooling in a city, in order to overcome or manage them successfully.

Firstly, it has been discussed that the PT operators and companies, may have two problematic characteristics that act as barriers for implementing new mobility solutions; aversion to innovation and understaffed teams. Lahme explains in his interview that often PTOs are characterized by old-school ideology, fear and aversion to technological innovation. In combination to traditionalism on how public transport should operate, these factors are obstacles for on-demand Ridepooling to be embraced and implemented in cities (Annex 8.7.). As Lahme goes on, he refers also to cases where PTOs may be open to new mobility solutions, but do not have the human resources to implement and manage new projects. As Lahme highlights, the two above characteristics, can be seen in PTOs of small-medium sized German cities (Ibid.).

Secondly, political forces such as the automobile lobby, may also be detrimental to the implementation of new public shared mobility solutions. As analyzed in section 3.2.2.3., MVG explains that often the political influence the German automobile industry has in politics, is so powerful that it is able to attract a higher attention from the government, absorbing a much higher amount of public subsidies, leaving the PT operators underfinanced (Ibid.). Moreover, political forces appear as barriers also in the case of political instability and changing governments. As Kokkinos explains for the case of Greece, his efforts of implementing the shared transport mode of carpooling in Athens in the 1980 where erased by the opposite government that was established in the early 1980s, in the middle of his project (Annex 8.7.). Moreover, the topic of local regulation falls also under political forces, that may challenge on-demand Ridepooling. As discussed at chapter 3.3., existing public policy on PT needs to be taken into consideration.

Thirdly, culture is considered to be another factor crucial for the success of on-demand Ridepooling, according to transport experts Mentz, Vlastos and Kokkinos (Annex 8.7.). Vlastos highlights in his interview that the aspect of culture shall be considered from the beginning of any planning. The mentality citizens have on shared transport and on private passenger cars, is crucial for the adoption of on-demand Ridepooling (Ibid.). Kokkinos underlines that the aversive mentality on sharing vehicles, due to social status reasons, can be detrimental to any ambitious project of shared urban mobility (Ibid.). As he adds, Athenians had this mentality, which was not helping his attempts of establishing carpooling in Athens.

Concluding on the factors that may challenge on-demand Ridepooling, poor digitalization may be a barrier for a city to implement on-demand Ridepooling. Based on the analysis of existing operations in Germany, digitalization plays an important enabling role for on-demand Ridepooling, as the service is based on software tools that operate digitally. Referring to the Digital Economy and Society Index (DESI) for Greece and Germany in 2018, Greece is scoring the penultimate position amongst the 28 EU on digital performance competitiveness, whereas Germany surpasses Greece by 20 percentage points, being at the same time higher than the EU average (European Commission, 2018b). Germany's high DESI underlines the digital development the country has and can be connected to the numerous German cases of on-demand Ridepooling in the last two years (Table 3.1). Comparing to Greece's very low DESI and to the fact that on-demand Ridepooling in Greece does not exist today, we can conclude that low digitalization is not easing the implementation of digital mobility solutions, like in the case of on-demand Ridepooling.

On the sustainability side of on-demand Ridepooling, sections 2.2.2. and 3.2.2.3. analyzed how the objectives and indicators that plan and describe on-demand Ridepooling, are in line with the standards set by Sustainable Mobility Indicators bibliography, presented in Table 2.2., 2.3., 2.4. and 2.5. It is important to note once more, that those on-demand Ridepooling indicators where extracted by door2door GmbH, describing how on-demand Ridepooling is perceived and implemented by German cities (Munich, Duisburg and Freyung) where door2door GmbH provides the operating software of the service (door2door GmbH, 2019a).

From an economic perspective, it is worth highlighting that on-demand Ridepooling can be a cost-efficient service, covering its costs fully, as discussed at chapter 3.2.2.1. and 3.2.2.2. On-demand Ridepooling does not include enormous expenses and long-term implementation timeframes, like traditional PT infrastructure needs. Given the fact that urban mobility challenges demand solutions today, and that those solutions are able to sustain themselves, on-demand Ridepooling appears to be part of the solution of urban mobility challenges.

Finally, from a social perspective, the potential crisis relief aspects of on-demand Ridepooling for a society are underlined. As analyzed previously, on-demand Ridepooling can offer access to opportunity and strengthen equity (Table 2.3.). As referred previously, the financial crisis intensifies poverty and inequality such in the case of Greece. We can therefore argue that on-demand Ridepooling could contribute to ameliorating the consequences of a crisis, such as inequality, by increasing the access to opportunity and people, and equity concerning public space.

6. Conclusions

On-demand Ridepooling has been attracting significant attention in today's urban environments. In the spotlight of the sharing economy, the digitalization process and the urban mobility challenges cities face today, cities embrace on-demand Ridepooling operations.

The paper concludes positively on the sustainability aspects of on-demand Ridepooling, as a shared transport mode that can be in line with the sustainable urban mobility standards of the bibliography. Additionally, the interdisciplinary and comparative approach of the paper identifies key factors that enable the sustainable operation of the service and form policy recommendations. Those recommendations that allow a sustainable and sound on-demand Ridepooling strengthening PT, include the factors of integration, private – public collaboration, operation scenarios of first-last mile / feeder cases, price differentiation of the service, stakeholder inclusiveness, public sector ownership of data and public sector orchestration of the on-demand Ridepooling service. Considering the challenging factors that need to be addressed, political influence, PT regulations, culture and mentality, digitalization level and aversiveness to innovation, can act detrimental to a successful service implementation. Concluding, on-demand Ridepooling can be sustainable when it is designed as a complementary to the PT network and when specific factors are taken into consideration. The policy recommendation of this paper addresses these factors.

Finally, from an economic point of view, on-demand Ridepooling appears to sustain itself as a service and can be implemented in short timeframes, when compared to hard PT infrastructure projects. Given the fact that urban mobility challenges demand urgent solutions, sound on-

demand Ridepooling appears capable to be part of them. From a social point of view, on-demand Ridepooling seems capable to minimize crisis results such inequality and poverty, by increasing access to opportunity and people, and public space equity.
Future research will focus on the numerical and long-term effects of on-demand Ridepooling on the micro and macro economy of an urban city, to drive even more precise policy on the topic. Additionally, as today's empirical data concerning passenger's appraisal are limited (König, Bonus and Grippenkoven, 2018b), future research can target passenger behavior to better comprehend the incentives behind transport choices. Then, the goal of incentivizing citizens to switch from their private passenger car, to sustainable public transport can be achieved. Thus, the vision of minimizing the number of cars troubling urban space would be realized, and sustainable mobility modes would be able to combat the urban mobility challenges that cities face today.

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8. Annexes

8.1. List of Figures

8.2. List of Tables

8.3. Calculation of Private Passenger Car Growth in Greece

Tables 8.3.1. and 8.3.2. present the mathematical calculations of Private Passenger Car Growth in Greece for the period 1988-2018 (30 years)

Private Passenger Cars In Greece	
1988 (in millions)	**2018 (in millions)**
1.470.486	5.249.135

Table 8.3.1. The table illustrates the number of Private Passenger Cars in Greece for the period of 1988-2018 (30 years). The numbers were extracted from the timeseries that the Hellenic Statistical Authority published, for the same referred period. These numbers can be found under the following citation: ΕΛΣΤΑΤ, (2018). Στόλος Οχημάτων 2018 [online] Ελληνική Στατιστική Αρχή. Available at: https://www.statistics.gr/statistics/-/publication/SME18/-. [Accessed 05/25/2019]

Growth of Private Passenger Cars in Greece between 1988-2018 (in %) *	***Growth calculated as: $(Cars_{2018} – Cars_{1988}) / Cars_{1988}$ x 100**
256,96599 ≈ 257	$Cars_{2018} – Cars_{1988} =$ 5.249.135 - 1.470.486 = 3.778.649 3.778.649 / $Cars_{1988} =$ 3.778.649 / 1.470.486 = 2,5696599 2,5696599 x 100 = 256,96599

Table 8.3.2. Calculating the growth of Private Passenger Cars in Greece between 1988-2018 (30 years). The first column of the table presents the result of the calculations, and the second column presents analytically all made calculations.

8.4. Calculating the size of the urban complex of Athens

Based on the administrative structure of Kallikrates (ΠΕΠ Αττικής 2014-2020, 2019), the capital region of Greece is identified as the urban complex of Athens, composed by two main prefectures; the prefecture of Athens and the prefecture of Piraeus. The prefecture of Athens includes four peripheries; Periphery of the Athens Central Sector, Periphery of the Athens Northern Sector, Periphery of the Athens Southern Sector, Periphery of the Athens Western Sector. The prefecture of Piraeus includes only the Periphery of Piraeus.

Size of Athenian Urban Complex	
Peripheries of the Athenian Urban Complex	Size of Periphery in km^2
Periphery of the Athens Central Sector	88,064
Periphery of the Athens Northern Sector	133,857
Periphery of the Athens Southern Sector	70,165
Periphery of the Athens Western Sector	67,725
Periphery of Piraeus	51,296
Sum of total Urban size of Athens	*411,107*

Table 8.4.1: The size of the Athenian Urban Complex. The total size is calculated as the sum of each periphery belonging to the urban complex, based on the Kallkrates administrative structure. The size of each periphery was extracted from the Hellenic Statistical Authority published data. These numbers can be found under the following citation: ΕΛΣΤΑΤ, (2011). Απογραφή πληθυσμού 2011. Μόνιμος πληθυσμός, αστικότητα, ορεινότητα, έκταση [online] Ελληνική Στατιστική Αρχή. Available at: http://www.statistics.gr/el/2011-census-pop-hous. [Accessed 05/06/2019]

8.5. Calculating the size of the urban complex of Thessaloniki

Based on the administrative structure of Kallikrates, 8 municipal sections from 7 municipalities form the urban complex of Thessaloniki (Ανδρικοπούλου and Καυκαλάς, 2015). Table 7.2.2 illustrates analytically on its first column those 8 sections from the 7 urban municipalities of Thessaloniki.

Size of Thessaloniki Urban Complex	
Municipalities and sections of the Thessaloniki Urban Complex	Size of Municipality in km^2
Municipality of Thessaloniki	19,676
Municipality of Kordelio-Evosmos	13,365
Municipality of Neapolis-Sykies	12,494
Municipality of Ampelokipoi-Menemeni	10,252
Municipality of Pavlos Melas	24,151
Municipality of Kalamaria	6,519
Municipal section of Panorama (part of Pylaia-Chortiatis municipality)	20,899
Municipal section of Pulea (part of Pulea-Chortiatis municipality)	24,993
Sum of total Urban size of Thessaloniki	*132,349*

Table 8.5. The size of the Thessaloniki Urban Complex. The total size is calculated as the sum of each municipality and each section belonging to the urban complex. The selection of the municipalities and sections, belonging to the urban complex, was based on the urban planning academic class material of the Aristotle University of Thessaloniki that can be found under the following citation:
Ανδρικοπούλου, Ε & Καυκαλάς, Γ. (2015). Εργαστήριο Χωροταξικού Σχεδιασμού. [online] Αριστοτελειο Πανεπιστημιο Θεσσαλονικης, Τμήμα Αρχιτεκτόνων Μηχανικών. Available at: opencourses.auth.gr/modules/document/file.php/OCRS426/%CE%A0%CE%B1%CF%81%CE%BF%CF%85%CF%83%CE%B9%CE%AC%CF%83%CE%B5%CE%B9%CF%82/P02.pdf [Accessed:06/06/2019].

The size of each periphery was extracted from the Hellenic Statistical Authority published data. These numbers can be found under the following citation: ΕΛΣΤΑΤ, (2011). Απογραφή πληθυσμού 2011. Μόνιμος πληθυσμός, αστικότητα, ορεινότητα, έκταση [online] Ελληνική Στατιστική Αρχή. Available at: http://www.statistics.gr/el/2011-census-pop-hous. [Accessed 05/06/2019].

8.6. Interview Questions

8.6.1. First Interview Question Bank to Mobility Experts

1. Which are the **prerequisites** for a city to be able to implement sustainable mobility solutions (such as schemes of shared transport: Ridepooling, Ridesharin, Carsharing/pooling, Bikesharing and more).

2. Do cities associated to your work, **consider implementing** sustainable mobility solutions? If not, which are the cities known for experimenting with such mobility solutions?

3. Why cities **fail** implementing sustainable mobility solutions? Do you have any examples from your career?

4. Which are the biggest **challenges / barriers** (you have encountered) while trying to put in practice sustainable mobility solutions, such as any type of **shared mobility**? Do you have any examples from your career, where you tried implementing schemes of shared mobility?

5. What makes a mobility solution sustainable and how do you measure its sustainability (what qualifies a mobility solution as sustainable)? In that sense, which **metrics** can be measured for the succession of sustainable mobility solutions?

6. Which is the **value added*** of sustainable transport modes to the whole economic system in the region of your expertise? If not calculable, which is the value added that has been speculated? *(*value added = industry's contribution to the gross domestic product (GDP))*

7. Which are the **elements of urban planning** that enable functionable sustainable and shared mobility networks? (Characteristics that Elements that need to be taken into consideration for a sustainable mobility network)

8. To what extent is the **Urban Economy** of a city connected to Mobility?

9. Which **externalities** do you wish to have in your system, produced by sustainable transport modes/solutions? Which ones do you want to avoid? Do you have any examples from your city expertise, your career or your policy-making expertise?

10. To what extent is your institution promoting sustainable **shared mobility** solutions? Do you have **examples of operations** in cities/regions?

11. Have you implemented (or planning to implement) **Policies and Strategies** on shared mobility solutions? If not, are you aware of such Policies, Strategies or Regulations in cities/regions? If yes, can you name those cities/regions?

12. Which is the involvement of the Transport Expert in the analysis of the **Economic, Social and Environmental impacts** of transport (and especially of the sustainable

shared transport modes)? Could you give some measurable and representative examples of impacts for each of those 3 categories?

13. What is your experience on (Technical-) **Economic analyses** that evaluate and select alternatives for the transport system? Such alternatives could be the sustainable schemes of shared transport (Ridepooling, Ridesharing, Carsharing/pooling, Bikesharing and more).

14. As a Transport Expert, while analyzing mobility and traffic, which are the **goals and results** you are aiming for? How are those results answering the question of how (sustainable) transport contributes to **Urban Economic Development**?

15. Which are the **transport indicators** from which one can draw conclusions on the efficiency, sustainability and resilience of a transport mode? (wished extraction of y = f (x) model)

16. As a Transport Economist/Expert, which are the **Transport Indicators** that you would choose to associate with Economic Development Indicators in order to extract a correlation?

17. From your own experience in cities you have worked on, after sustainability and/or cost-benefit analyses of different transport modes, which is the **most resilient, efficient and sustainable mode of transportation**?

18. α. Could a system of shared mobility be successful in **Greece**? If yes, where? Which are the **characteristics** of **cities** where this urban transport model could be implementable?

    β. Following questions 1 & 7, which are the **prerequisites** needed to implement ridesharing for the case of Greece?

8.6.2. Second Interview Questions Bank to Public Transport Operators (PTOs)

1. What is the relation of your PTO to data?
2. What is the relation of your PTO to sustainability?
3. Which are Future plans of your PTO in regard to the on-demand Ridepooling service?
4. Is it true that Ridepooling will operate over/at the same time with other transport modes to gain the market from private players such as Uber? How will you avoid cannibalization and criticism of the on-demand service from traditionalists/fundamentalists?
5. Which gaps is the on-demand system fulfilling? Are there any gaps between lines, examples of operations, like the S-bahn end stations, or of parallel S-bahn lines that in-between are not well connected?
6. Is the your on-demand Ridepooling service replacing busses? If yes, why?
7. Reflecting on the economic aspects, are the costs of on-demand Ridepooling really smaller than other of other modes, and what is your PTO speculating on this?
8. What is the existing policy in Germany on on-demand Ridepooling, and how is it affecting your operations?

8.7. Interview Transcripts

8.7.1. Interview with Björn Siebert

Björn Siebert is Lead Policy and Regulatory Affairs at door2door GmbH. Previously he was Senior Manager for Economic Innovation Policy at the tech association Bitkom and before that he served in different positions in the German government such as the German Bundestag in the Foreign Affairs Council and in the German Chancellery in the Minister of State Office for bureaucracy, reduction and better law making.

Anastasia Patsouri (AP): Hello Björn, thank you very much for taking the time to be interviewed for this research. […].
Björn Siebert (BS): Hello, it is my pleasure […].

AP: So, my master thesis is about on-demand Ridepooling and how it can affect Urban Sustainable Development, within sustainability's 3 pillars of economy, society and environment. I am investigating to what extend is on-demand Ridepooling a sustainable urban mobility solution and if it can contribute on combating urban challenges today. […] I would like us to focus of the following topics:
1. What is the Passenger Law (PBeFG) in Germany and what is its amendment about?
2. What is the situation in the German, European context with Ridepooling regulation?
3. Why cities fail to implement it?
4. What could help to deal with pain points in implementation, and do you see a bright change in this matter?
Starting from the PT German legislation. How can you implement on-demand Ridepooling, you can apply it only for 4 years, and can you be a private company, or do you need to be a city as operator of the service?
BS: You can be a PTO, a private company, a city or to apply for the service.

Operators have to apply for the service as if it was identified and operating under regular bus lines. Usually cities need a strong partner from the intelligence field, from the software field because they do not have the capacity and capability to implement the service on their own. Then, the service falls under an experimental period of operations for 4 years.

AP: […] Therefore, at the moment competitors of door2door are also applying for the service publicly?
BS: With some competitors it is happening, and they apply together with cities. There are also plenty of other competitors that are running a service that is not considered as public transport. In that case they apply for license as well – for example clever shuttle has operations in 12 cities already in Germany. […] Existing Passenger Law does not foresee on-demand Ridepooling. This is (also) problem of German regulation, since those new pooling and shared services are not known to the law, operators have to create new applications in every city - there is no common application. Every city has to deal with its PT authority, and every authority has lots of room to make sense of the Law - to translate the Law differently from city to city. This creates a big problem in Germany because you cannot scale up because every city is different and interprets the Law differently.

AP: The solution there is that there is a need of a unified Law or as you mentioned in the case of clever shuttle they do not operate (as part of) on the network - the solution would be that you find a model that is embodied in the network? How do you skip this problem you described with the Law translation that does not enable the implementation and its scalability?
BS: First of all, politics has already established that the public transportation Law needs to be changed, to add a new paragraph that allows pooling and rideshare. In the coalition treaty of the current government there it has been announced that PT Law will be renewed within the next 4 years. The government, the ministry of transportation, has started with a position paper on this - its not a draft for a new law, but the base for discussion before they introduce a new bill. There will be a new paragraph only for Ridepooling, they will make Ridepooling possible for PT only under the bus line permit and they will open pooling to other permits like renter-car permit, make it easier to offer those services as well. The potential problem is if you open this rental permit for pooling the return obligation will be also removed. Every private operator will be allowed to run transportation in every city, which means more competition for the public operators. If you want an integrated solution with all players involved especially the public transport sector as a backbone this is the wrong way to do because it opens the door to many competitors like Uber who could overwhelm the market easily and put cars everywhere. So, this is just a draft so far in the early beginnings and I think there will be a more conservative final draft in the end which will not liberalize the market completely but taking into account also this danger.

AP: So at the moment the existing legislation is not allowing Ridepooling fully, but only experimenting cases. So, all d2d cases (with all clients and cities in Germany) and all competitors cases, are in this experimental clause of 4 years operations?
BS: Not exactly, d2d is the only company that is not using the field experimenting case because pooling has been in the genes of public transport. A regular bus service has been always pooling people.
The problem with a bus permit is that it allows pooling, but you need bus stops. You have the permit of a line. For example, the IsarTiger in Munich (run by d2d), is a prolonged part of a bus line. The starting point will always be public transport stop, taking you home, at work or wherever – it is a last mile solution. Moreover, in Frying where we are driving with virtual stops, we have regular pooling from bus lines and we have virtual stops that can be identified as public transport stops. We could apply in that case as a bus line, but it took over a year to get the permit and it was a lot of paperwork, as it was something that it was not seen before. But since we have that on the street in Freyung and in Munich right now, we have set an example for others on how it could be done. Our work can be used as a blueprint for other cities as well.

AP: So in those cases on-demand Ridepooling is an extension of the bus line not a substitution.
BS: It is an extension of existing service not a substitution. To make it better and more accessible for people for the first and last mile. Either you are picked up from home and driven to a bus stop, or you are picked up from a bus stop and driven home. So you do not have those park and ride cases - all those commuters that drive by car to the train station, are now picked up by a shuttle and put together in one vehicle instead of having several hundreds of people in cars that drive to a bus stop and park their car there. Now passengers will be picked up at home and pooled and you have one mini bus/shuttle instead of 100 cars. You have seen this in the Lisbon study also, this is the same effect there.

AP: And do we already have results on this, can we already prove that it is working in the direction we want?
BS: Not yet, because we are too early in the stage, operations are only active in a part of the city. And the fleet is also too small to have a measurable impact in the overall transportation system in the city. At the moment, only estimations can be done from the cities themselves, that are nevertheless very valuable.

8.7.2. Interview with Benedikt Lahme

Benedikt Lahme is an Economist and Business Development Manager at door2doorGmbH. He is working with the public transport operator in German city, to enable on-demand Ridepooling in cities. He is representing the private sector.

Anastasia Patsouri (AP).: [..] Thank you for giving your time to the current research on on-demand Ridepooling [..]. Maybe you can introduce yourself first.
Benedikt Lahme (BL): [..] I am a Business Development Manager at door2doorGmbH, working closely with cities that want to change their PT reality.

AP: Great, [..] I would like to know more about those insights while doing business with cities, I would like to know those sales insights from your side when facing cities as customers. Additionally, I would like to know the customer's needs and problems when you talk to them, which are their pitfalls. What do customers tell you, what is their mobility problem, what is their mobility reality.
BL: First of all, we have two different people we are talking to. I would say on the one hand we have received many cities and sometimes also rural areas and on the other hand we have corporations, meaning big enterprises. But let's focus on the cities. That's most of the work we are doing. So here we have also two different groups, on the one hand side we have the PTs and mobility providers who are actually operating services in a specific city.
On the other hand, we have politicians in a way, that come from different backgrounds. Of course, the politicians are driven by local problems, mobility problems mostly such as traffic jams. And of course, on top media is focusing on those problems, [..] much focus media gives on traffic. This media focus creates pressure to politicians. Citizens who vote for them, are also upset for urban mobility problems. […] Cities are facing traffic problems [..] and yes maybe autonomous mobility might solve this, but this may come fully in 10 years, the problem is today though […] cities need to change their current businesses to more flexible […] combat traffic. The people who think of the future mobility though in those PTOs, are small group of people because most of the majority is doing daily business […] focusing on their daily business meaning they are not looking too far into the future […] some a little bit old school. Or they do not have the human resources, the capacity, such as in small PTOs. But we talk to so many people, many different stakeholder that influence a city and its PTO […] if we want to enable on-demand Ridepooling, all these stakeholders need to be aligned […] different authorities of different levels […] many stakeholders.

AP: So, cities itself do not identify problems but try to change mobility because media is pressuring the city that there is an urban problem?
BL: Yes and No, as I said there are some people in those PTOs who are already very future oriented. There is also political pressure [..] that something needs to be done for digitalization of PT products […] with the attitude “you need to do on-demand Ridepooling because the media is demanding for that”. Just an example. We were talking to cities, where the media has confronted them. Media reports from neighboring cities that new mobility solutions emerge. And then citizens, media, are demanding also for similar things, asking the people who are in charge of the business or the PTOs or their mayors. Of course, media always puts pressure and presents the environment problem connected to mobility. And of course, on-demand mobility is kind of fancy a topic together with the digitalization of mobility […]. Since 2017 that it popped out in Germany, with Duisburg, for me there is a mobility revolution happening. […] And of course, due to many reasons, not everyone is ready to jump in [..] funding might stop this also, not every PTO has the economic capacity as well […]. However, in market fairs and conferences, we see that players have become now familiar with on-demand Ridepooling, it has started for some to be a standard […] like for the cases of the pioneers.

AP: I see. Going back to the business insights, when you approach a city, what are you explaining to the city in order to present on-demand Ridepooling – why do they need this service in their cities?
BL: […] I try to convince cities about stepping into this mobility revolution, in the way that fits to them […] There are the sustainability reasons that are the umbrella/high level reasons above all discussions […] apart from them, there is the aspect of the state participation in this mobility revolution [..] The city has an important role to play many topics, the education you need good schools, the economy you need stability and growth, the roads you need good roads without traffic […]. So public transport is equally very important and has a core urban function and that's what I'm saying [..]. And then when I talk to cities, I make the comparison of mobility and living. […] housing in Germany in the past in Germany […] we had most of the cities owning apartments which they were offered for a low(er) price to citizens. Poorer people could afford those prices. And this has changed in the last 20 years […] cities started to sell their houses and apartments. And now we have a tremendous change in the system, where prices of rent are increasing unstoppable. And this is dramatic producing social conflict […]. We didn't have that problem 20 years ago. One explanation for it is that the cities have missed to further invest in their land and so nowadays they don't have control anymore of the prices of rent [...] as they simply sold everything without a plan. And this is something which should not happen with mobility as well, because as I've said this is one very important urban pillar […] having successful mobility […] as a city you need to have a good service that pays into minimizing pollution, it pays into the worker's life balance […] it also pays into economy if you are running mobility successfully, then citizens are helped multiply. Cities should not have an interest in losing the control over mobility, as it happened with real estate [..] this very important topic and could end up in a similar problem as the housing one. Look at Uber and other private companies [..]. They do cherry picking. Cities need holistic approaches in the end. You should make sure that your PT runs equally, that picks up people Uber doesn't pick because of lack off profit. In the end PT does not care about profit on the first place. Moreover on-demand Ridepooling could even help cities with their economic losses, as it is speculated that on-demand Ridepooling can be cost efficient. [..] What we try to promote, what we try to make sure is that your public transport company is somehow stepping in to these new mobility markets like the on- demand and more flexible one, before the private sector conquered everything. And why not, in the future, through those new mobility solutions, PT might be able to even be profitable. […] We tell cities, that they need to be part of the change otherwise, the change will happen without them […] and then there is the high risk of the burden of not being part of this change.

8.7.3. Interview with Horst Mentz

Horst Mentz is the Head of Traffic Planning at the City State of Munich (Landeshauptstadt München). He is a Transport Expert Engineer for more than 40 years.

Anastasia Patsouri (AP): Which are the **prerequisites** for a city to be able to implement sustainable mobility solutions (such as schemes of shared transport: Ridepooling, Ridesharing, Carsharing/pooling, Bikesharing and more).
Horst Mentz (HM): Political will, political necessity, public participation

AP: Do cities associated to your work, **consider implementing** sustainable mobility solutions? If not, which are the cities known for experimenting with such mobility solutions?
HM: In the past cities extended their infrastructure, today they combine the different modes and add innovative mobility solutions. Examples can be seen in almost every big city.

AP: Why cities **fail** implementing sustainable mobility solutions? Do you have any examples from your career?
HM: Wrong operation area, the inner city given to carsharing, less discussion between administration – society – local politics, better connection to lifestyle, housing estate

AP: Which are the biggest **challenges / barriers** (you have encountered) while trying to put in practice sustainable mobility solutions, such as any type of **shared mobility**? Do you have any examples from your career, where you tried implementing schemes of shared mobility?
HM: Political barrier, acceptance in the society, more transparence in benefit for both administration and citizens, experimental operating urban areas.

AP: What makes a mobility solution sustainable and how do you measure its sustainability (what qualifies a mobility solution as sustainable)? In that sense, which **metrics** can be measured for the succession of sustainable mobility solutions?
HM: When the mobility solution is connected to less individual transport, to reduction of pollution (CO_2, air pollution etc.) and to more public space.

AP: Which is the **value added*** of sustainable transport modes to the whole economic system in the region of your expertise? If not calculable, which is the value added that has been speculated? *(*value added = industry's contribution to the gross domestic product (GDP))*
HM: Less cost for the infrastructure, to save cost for housing, for the external cost, more flexibility in the countryside referring to the public transport

AP: Which are the **elements of urban planning** that enable functionable sustainable and shared mobility networks? (Characteristics that Elements that need to be taken into consideration for a sustainable mobility network)
HM: Information, continuous discussion, best praxis sharing, political awareness

AP: To what extent is the **Urban Economy** of a city connected to Mobility?
HM: Domestic budget, cost-benefit calculation, economic cost referring to the transport mode

AP: Which **externalities** do you wish to have in your system, produced by sustainable transport modes/solutions? Which ones do you want to avoid? Do you have any examples from your city expertise, your career or your policy-making expertise?
HM: Reduce all negative aspects referring to transport (space, pollution, cost, etc.), cannibalism of public transport, behavior, lifestyle of the young generation.

AP: To what extent is your institution promoting sustainable **shared mobility** solutions? Do you have **examples of operations** in cities/regions?
HM: The administration and the local parliament has to build the frame for smart mobility, dialog between all stakeholders.

AP: Have you implemented (or planning to implement) **Policies and Strategies** on shared mobility solutions? If not, are you aware of such Policies, Strategies or Regulations in cities/regions? If yes, can you name those cities/regions?
HM: The aim is to combine parking management with sharing mobility (reduce fees for sharing systems, install parking facilities, advantage for e-mobility). Every big city in Germany, every metropolitan area has this aim.

AP: Which is the involvement of the Transport Expert in the analysis of the **Economic, Social and Environmental impacts** of transport (and especially of the sustainable shared transport modes)? Could you give some measurable and representative examples of impacts for each of those 3 categories?
HM: Economic = Transport must be payable for all, Social = Everyone must have the opportunity to be mobile, Environmental = Transport must be sustainable

AP: What is your experience on (Technical-) **Economic analyses** that evaluate and select alternatives for the transport system? Such alternatives could be the sustainable schemes of shared transport (Ridepooling, Ridesharing, Carsharing/pooling, Bikesharing and more).
HM: Masterplan for transport, transport development plan, cost-benefit calculation.

AP: As a Transport Expert, while analyzing mobility and traffic, which are the **goals and results** you are aiming for? How are those results answering the question of how (sustainable) transport contributes to **Urban Economic Development**?
HM: Less individual transport, less negative impacts, more flexibility to spend public money, more public space.

AP: Which are the **transport indicators** from which one can draw conclusions on the efficiency, sustainability and resilience of a transport mode? (wished extraction of y = f (x) model)
HM: Acceptance of the user, quality of public transport, impact of public space (more flexibility in using the public space), social participation.

AP: As a Transport Economist/Expert, which are the **Transport Indicators** that you would choose to associate with Economic Development Indicators in order to extract a correlation?
HM: Acceptance of the user, of the passenger, Environmental impacts, Running Costs.

AP: From your own experience in cities you have worked on, after sustainability and/or cost-benefit analyses of different transport modes, which is the **most resilient, efficient and sustainable mode of transportation**?
HM: My ranking = 1. Bike, 2. Foot, 3. Public Transport, 4. Individual Transport.

8.7.4. Interview with Andreas Steinbeißer

Andreas Steinbeißer is Transport Expert, Deputy Head of Marketing at MVG (Munich's Public Transport Operator) and Project Manager of the IsarTiger, the on-demand Ridepooling service of MVG.

Anastasia Patsouri (AP): Warum hat die MVG die IsarTiger etabliert und hat MVG als Grundvision nachhaltige Gedanken?
Andreas Steinbeißer (AS): [..] Die erste Inspiration kam von einem Artikel in der Frankfurter Allgemeinen Zeitung nämlich in 2016. [..] es war über Allygator in Berlin, in diesem Artikel wurde beschrieben welche Vorteile es tatsächlich für den Bürger hat. Ich lese diesen Artikel durch und sag das ist ja die Lösung unseres Problems für Verkehrsprobleme Stau Probleme und so weiter. Letztendlich geht es darum die Thematik ist sehr gut herausgearbeitet worden. Jede geteilte Fahrt ist eine gute Fahrt. Und darum geht es Ridepooling, [..] heute in München wir haben ein Riesenproblem mit Staus und baumelnd steht der Stauber [..] hat ganz viele Autos unterwegs. Drei Viertel davon werden Einzelbelegung gefahren. Es ist ja viel zu viele Autos. München ist eine sehr reiche Stadt. Der Trend geht zu zweit dritt Autos.
Unsere Vision [..] um zu vermeiden, dass überhaupt Leute sagen ich brauche ein eigenständiges Auto ein eigenes Auto muss ich natürlich ein System einstellen das so toll ist so Gutes dass es für den einzelnen Bürger gar nicht mehr notwendig ist ein eigenes Fahrzeug zu besitzen oder gar zwei oder drei sind daher bei mir selber auch in der Vergangenheit. In München jede Familie besitzt mehr als ein Auto. München ist reich, im Vergleich zu anderen deutschen Städten.
[..] Nächste U-Bahn oder ist eigentlich ein Auto nötig? Im öffentlichen Verkehr [..] diese Frage der Flexibilität, hatte ja auch Nachteile. Zum Fahrplan einer bestimmten Stelle sein kann ist das ganze Gebiet nicht optimal erschlossen. Wir fahren ja um sehr viele Gebiete herum, München ist viel enger als Berlin denn Berlin ist viel großzügiger. In Berlin die Straßen sind größer die Gehsteige sind größer das Pflaster Münchens und deswegen fahren und ganz ganz viele Gebiete mit unserem Bus drum herum.
[..] das ist auch der Grund, weil die Leute eine Auto haben.

AP: Ich kann ja mit dem Auto fahren. Diese Linien sind nicht produktiv die fahren leer, oder? [..] Weil auch München so eng ist und deswegen manche Linien sind nicht klug genug?
AS: Ja, aber die IsarTiger ersetzt Busse die leer sind oder [..] im zukünftig zu ersetzen. Was wir jetzt machen ist ergänzender Verkehr. Es geht um diese letzte Meile. Es geht um den kleinen Mobilität Hunger zwischendurch. Wir machen jetzt einen Test. Es ist jetzt noch nicht so dass wir etwas auf die Straße stellen das Verkehrliche tatsächlich Relevantes. Sondern wir erproben jetzt das ganze System, das es vom Prinzip her funktioniert. Wenn ich mir aber in München Karte anschaue da gibt es ganz viele Gebiete wo wir am Abend tatsächlich ein schlechtes Angebot 5 Minuten Takt 60 Minuten Takt. Natürlich ist es kein gutes Angebot. Und an dieser Stelle könnte zukünftig die IsarTiger ein Angebot liefern. Man muss dazu sagen München ist extrem voll. [..] Linien die sind einfach nicht so smart oder voll.

AP: [..] Es gibt viel critique über Ridepooling [..] wie soll es operieren, nicht überall, nicht im Zentrum vielleicht nur in die Lücken des Systems [..] die Frage ist, wo soll Ridepooling operieren?
AS: Pooling ist so provinziell so viele Leute reden über Kannibalisierung des Systems des U-Bahn-Netzes sozusagen. Ich habe dieses Argument so geschrieben [..] es ist einfach, zu kannibalisieren, wenn man nicht aufpasst. Wie der private Markt [..].

AP: Operiert die IsarTiger sozusagen, um den Markt von privaten Akteuren, die überall operieren, zu gewinnen?
AS: Das ist alles was wir jetzt gerade machen. Also sprich was wir jetzt gerade jetzt gerade machen .. testen, das System perfektionieren. Im Gegensatz zu Berlin verlangen wir ja doch kein Geld oder will ich zukünftig ein Geld verlangen. Muss das System perfekt laufen. [..] das Thema Kannibalisierung ist sehr wichtig. [..] Innerhalb des ÖPNV gibt es natürlich auch sehr viele Fundamentalismen [..] gegen on-demand Ridepooling. Muss man auch respektieren. Aber, schau ÖPNV hat sich in den letzten hundert Jahren nicht entwickelt. [..] den klassischen ÖPNV nicht zu verunsichern, sondern Ihnen/allen die Chance zu zeigen was man mit ÖPNV (alles) erreichen kann nämlich die Flächen erreichen. ÖPNV ist von Netzen gesprochen. Ein Netz hat die Eigenschaft, dass da viele Löcher dran. Und jetzt bemühen wir mal ein anderes Bild. Wenn du sagst die U-Bahn ist der Baumstamm. Trambahnen die Zweige und Blätter sind niemand. Und von außen betrachtet auf dem Baum drauf schaust ist es eine große grüne Masse Fläche eine große Fläche und wenn er ganz nah im Geäst stellte fest, dass diese große grüne Fläche von erstaunlich vielen kleinen Blättern gebildet wird. IsarTiger ist nichts anderes als das [..] das heißt es geht hier nicht darum, dass eine Person durch ganz München durchfährt, sondern es geht ja eher darum das kleine Teilabschnitte von meinem Service an kleine Teilabschnitte abgebildet werden. Es geht um zwei drei Kilometer vier Kilometer [..] mit dem Fahrrad wieder steigen [..] zwei weitere Kilometer in lauter kleine Abschnitte natürlich. Natürlich wird mit der Einführung dieses neuen Systems irgendwann ein neues Gleichgewicht erforderlich sein. Um Kannibalisierung zu vermeiden. Aber wenn so tolles System auf die Straße stellen muss ist es in München nicht mehr notwendig sein eigenes Auto zu besitzen zu müssen - das ist doch das eigentliche Ziel. Die Argumente sprechen für sich. [..] und Kannibalisierung könnte durch verschiedene Strategien und Guidelines begrenzt werden.

AP: Könnte die Preise diese Kannibalisierung begrenzen [...]?
AS: Warum Uber zu mehr Verkehr führt - weil es zu billig ist. Mobilität hat einen gewissen Preis billiger als das Taxi ein bisschen teurer als üblich. Darüber kann sag ich kann mir die Fahrt leisten ich kann mir die Mobilität leisten. Aber ist es nicht zu billig. Mobilität ist ein Produkt des Service wie jedes andere Produkt auch wie der andere Service auch. Wenn du einen Service arbeitest für einen sehr geringen Preis dann wird dieses Service auch letztendlich entwertet. Und Mobilität ist ein sehr hohes Gut. Und auch ein teures Gut. Also jetzt schon mal meine Vergangenheit. [..] Aber mit dieser „teuren" fährt konnte er auch weiterreisen. Eine weitere Strecke zurückzulegen ist noch teurer und muss teurer sein.[..] Und wenn ja elektrisch ist dann gibt es keine Emissionen.[..] Die IsarTiger operiert mit Erdgas, es hat wenig Kohlenstoffatome mit viel Wasserstoff, das Kohlendioxid hat mehr Wasser.

AP: In der Zukunft dieses wird die IsarTiger günstiger außer dem Zentrum wo echte Lücken existiere? Vielleicht an Gebiete wo die S-Bahn nicht so gut vernetzt ist? [..] würde eine Ersetzung sich geben?
AS: [..]der Preis ist Kilometer abhängig Es geht nicht darum bestimmte Gebiete teurer zu machen. Es geht nicht darum jetzt. Wir schauen aber zunächst was kommen kann.

AP: Und dann wollte ich über wirtschaftliche Sachen fragen. Du hast über Kosten gesprochen. Sind sie wirklich klein, hat MVG eine Idee dazu spekuliert? Was würde es kosten, wenn in Zukunft eine Ersetzung passiert?
AS: Ich erschließe mit einem Netz mit einer typischen Linie ein Gebiet. Das sich im Prinzip eine Linie durch unsere Kunde muss zu einer bestimmten Uhrzeit an einer bestimmten Stelle sei. Der Bus fährt aber.
[..] Die Folge ist Zehn-Minuten-Takt immer also kein Geld, denn die Menschen entscheiden sich nicht, den Bus zu benutzen. Ich nehme die IsarTiger, in diesem gleichen Gebiet, um ein optimaler Start zu machen [..]. Viel besseres Angebot als ich vorher hatte, aber ich habe Fahrer kosten zunächst hoher, weil die Leute mehr Service benutzen.

AP: Hat das jemanden verstanden oder kalkuliert oder ist es eine Spekulation?
AS: Es gibt keine die das wirklich zeigt. Wir spekulieren. Im ergänzenden Verkehr behaupte ich, dass das System kostendeckend zu betreiben. Nach meiner Rechnung sechs Passagiere/Buchungen pro Stunde sind gebraucht, um die Kosten zu decken, die Fahrer und die Automobil Kosten [..] die IsarTiger durchschnittlich fahrt vier Kilometer und die durchschnittliche Reisezeit 14 Minute ist. Wir verlangen einen Grundpreis von

sagen wir mal drei Euro [..] mit Einnahmen von sieben Euro pro Stunde lass uns sagen [..] Tür zur Tür IsarTiger holt dich ab [..] wir schaffen eine Auslastung von sechs Plätze im Fahrzeug. Ich werde es doch schaffen - alle sieben Minuten und ich sage es mal alle Viertelstunde [..]
Diese Kalkulationen sind sehen die Bestätigung durch die Probe. Wir hätten mehr als die. Aber die jetzige Nachfrage können ist es so dass im Augenblick 2000 Menschen in diesem ersten kleinen Gebiet teilnehmen kann. In demselben Gebiet arbeiten wohnen und leben 200.000 sozialversicherungspflichtige Menschen. Rein theoretisch könnte ich 200000 Menschen im Service haben. [..] Unsere Spekulationen [..] Es ist doch machbar!

AP: Warum hat die IsarTiger dieses Gebiet gewählt?
AS: In dieses Gebiet, sind die Leute nicht gleichmäßig, es gibt Industrie, Neubau, Hochhäuser, niedrige Häuser, Kultur, Subkultur – es gibt alles. Dieses Gebiet repräsentiert Komplet die Stadt.

AP: Und was macht MVG mit allen Daten?
AS: Die Daten bleiben also bei MVG, ist immer so.

AP: Vielleicht die letzten Fragen wären über Nachhaltigkeit wieder, [..] also was sagt MVG und IsarTiger über Nachhaltigkeit? Von einer Macro-Perspektive?
AS: Klar will MVG Probleme lösen und klar IsarTiger ist mit einer größeren Idee des Nachhaltigkeit verbunden. Die IsarTiger ist Teil dieses Bild, dieses Macro-Bild von nachhaltigen Städten, wir haben es im Kopf. Nachhaltigkeit ist eigentlich die treibende Kraft. Um so ein cooles System zur Verfügung zu stellen. [..] Egal ob in München einen ersten Schritt zu einem vernünftigen Preis nicht zu billig aber zu einem vernünftigen Preis. [..] Es ist nicht notwendig, dass man ein eigenes Auto hat. Genau darum geht es ein kurzes System hinzustellen, das so cool ist. Logisch. [..] Aber die Menschen sind ja unterschiedlich kompromissbereit. Eine öffentlicher Nahverkehr Nutzer ist sehr kompromissbereit. Jemand der egoistisch im Auto sitzt ist nicht gleichmäßig kompromissbereit. Aber ich kann mit alle diejenigen ein bisschen Kompromissbereitschaft sind arbeiten und [..] eine billige Losung als das Auto zu Hause zu bieten.
Auto ist ja auch teuer. Diese persönliche Freiheit so diese persönliche Freiheit, die Flexibilität, die darf nicht billig sein sondern wir kaufen die Freiheit kostet ja so was im Mobilität.

AP: Wichtiger Point, Freiheit kostet, muss man sich bewusst sein.
AS: Ticket ist wichtig, es ist nicht Symbolik. Es ist ganz gefährlich zu denken, dass Mobilität billig ist. Es führt zu noch mehr Verkehr.

AP: Über Politik [..] Es gibt keine konkrete Regel über on-demand Ridepooling, ich habe verstanden, dass die Mobilitäts-Entwicklung passiert schneller als Deutschlands Regel und Politik Entwicklung.
AS: Momentan die bestehende Politik in Deutschland sieht den Betrieb von on-demand Ridepooling in alle Städte als Experiment. Personenbeförderungsgesetz wird angepasst oder soll angepasst werden. Das wird allerdings erst bis Ende dieser Legislaturperiode geschehen [..] bis Ende 2020.
Das Problem ist dass unsere Politik im Augenblick Lobby getrieben ist. [..] Wir als Verkehrsunternehmen brauchen Genehmigung [..] Private Verkehrsfirmen wählen die Guten Gebiete da wo viele Leute Geld verdienen. Und diesen Verkehrsgesellschaften verdienen Geld. Aber uns geht es ja darum Mobilität zu sorgen. Für diese Stadt [..] so es lebenswert bleibt [..] damit Mobilität lebensfähig ist und so für alle funktioniert. Unsere Motivation ist eine ganz andere Motivation [..] diesen Betrieb zu betreiben als Moya oder cleversten oder Uber. Die wollen und müssen ihr Geld verdienen. Das ist der große Unterschied. Verkehrsbetrieben haben eine Stimme in die der Lobbyismus Politik [..] Entscheidungen komplett von privaten Lobbys befördert.

AP: Ich weiß [..] Ich habe eine ganze Sektion in meine Thesis wo ich erzähle wie stark ist das Autolobby in Deutschland. Wie die Automobilindustrie in Deutschland und ihrer Lobby Europa beeinflusst, und wie jede EU Emissionen Entscheidungen verspätet sind. Aber in der kleineren Bild von München hat München eine Stimme für on-demand Ridepooling?
AS: Wenn alle Politik nur für private Industrien passen müssten dann müssen wir tatsächlich kämpfen eine Stimme zu bekommen. Wir müssen auch immer wieder sagen, wir sind die Guten.
An alle Vorwürfe von der (Stadt)Politik ständig antworten, dass Wir doch die Guten sind und dass letztendlich die IsarTiger nicht Kannibalisiert. Ein flächendeckendes System auf die Straße stellen das ist ja möglich, dass du später kein eigenes Auto mehr. [..] tatsächlich ÖPNV hat in Deutschland aus der Tradition heraus verhältnismäßig wenig bis nicht ernst genommen und auch regelmäßig zu wenig Geld bekommen.

Zum Beispiel, beim Thema Elektromobilität Forderung, sind Millionen ausgeschrieben worden die für die Automobilhersteller für die Automobilindustrie. Aber schau, Straßenbahn ist auch Elektromobilität. Wir bräuchten ein bisschen Geld für mehr Gleise ein bisschen Geld für einen Beitrag für die neue Linie für die Metro. Wir haben dieses Geld nicht. Dass wir letztendlich für die Verkehrswege verantwortlich werden.
Das ist genau das was mit der Kapazität. Mit Metro und Straßenbahn Stau zu vermeiden. Jetzt im Zentrum steht gerade das Auto. Das gilt es zu vermeiden. Ein großes Thema [..].

8.7.5. Interview with Prof. Thanos Vlastos

Thanos Vlastos is Professor of Urban & Transport Planning at National Technical University of Athens (NTUA), School of Surveying Engineering, Department of Geography and Regional Planning. Prof. Vlastos has extensive experience in sustainable mobility issues.

Anastasia Patsouri (AP): Ποια είναι η οικονομική διάσταση ενός συστήματος Συνεπιβατισμού (on-demand Ridepooling), [..] πάνω στη διαδικασία όπου ένας συγκοινωνιολόγος σχεδιάζει κάνει κάποια μελέτη για τις οικονομικές επιπτώσεις ενός τέτοιου συστήματος?
Thanos Vlastos (TV): Υπάρχει η **οικονομική διάσταση,** αλλά είναι **σύνθετη.** Αν αρχίσει ο δήμος να προβληματίζεται να κρατήσει μια γραμμή ή να την κλείσει και να βάλει τα λεφτά του στον Συνεπιβατισμό [..] γίνεται σύνθετο, γιατί η δημόσια συγκοινωνία δεν βγάζει τα λεφτά της είναι ελλειμματική (στην Ευρώπη λιγότερο, εδώ που την έχουμε τσάμπα είναι τελείως ελλειμματική) Αλλά δεν νομίζω ότι είναι πραγματικά κερδοφόρα. [..] Σε άλλες περιπτώσεις δεν είναι μόνο ότι θέλουν να αντικαταστήσουν μια γραμμή, είναι και ότι δεν τους φτάνουν οι υπάρχουσες και θέλουν και άλλες ή άλλα προβλήματα υπολειμματικής προσφοράς ή κακού σχεδιασμού. **Τον Συνεπιβατισμό θα τον έβλεπα σαν ειδικό μέσο τύπο μετακινήσεων, μεταξύ κέντρου και προαστίων, εσωτερικό των προαστίων, αραιοκατοικημένων προαστίων, μπορεί να αποκλίσεις κάποια πράγματα όπως εσωτερικό κέντρου**, αλλά σε κάθε περίπτωση υπάρχει άλλος λόγος. Ο οποίος θέτει και το ζήτημα της προοπτικής προς την πιο συμπαγή πόλη που υποτίθεται είναι και η πιο βιώσιμη.

AP: Προϋποθέσεις πόλης για να εφαρμόσει βιώσιμες & καινοτόμες λύσεις κινητικότητας;
TV: Εγώ θα έλεγα δεν υπάρχει καμία προϋπόθεση, δηλαδή όποια πόλη να έχεις στα χέρια σου, κάτι μπορείς να κάνεις. Πολιτικά, σε κάθε πόλη μπορείς κάτι να κάνεις. Πχ. Η Αθήνα είναι μια πόλη φτιαγμένη για το αυτοκίνητο. **Όλες οι πόλεις στον 20ο αιώνα χτίστηκαν για το αυτοκίνητο**. Αυτό δεν σημαίνει ότι δεν μπορούμε να τις γυρίσουμε. Τώρα συμβαίνει στην Αθήνα το εντελώς ανάποδο. Είναι μια πόλη που έχει πολλούς στενούς δρόμους, κανονικά θα έπρεπε να είναι όλοι πάνω σε ένα ποδήλατο, είναι όλοι πάνω σε αυτοκίνητα και αγοράζουν όλοι μεγαλύτερα. Εδώ πέρα **χρειάζεται πολιτισμός, παιδεία, κουλτούρα**.

AP: Θα βάζατε εδώ πέρα πιο ποιοτικά χαρακτηριστικά προϋποθέσεων δηλαδή;
TV: Χρειάζεται κουλτούρα, παιδεία. Δεν θα το έβαζα σαν προϋπόθεση, αλλά σαν ποιοι θα ήταν οι παράγοντες στους οποίους θα πρέπει να δουλέψεις. **Να δουλέψεις την πολιτισμική σου κουλτούρα**. Αλλά μετά έχεις να δουλέψεις και το πρόβλημα, να βρεις λύσεις, να κάνεις πράγματα, **να διώξεις αυτοκίνητα** και να κάνεις πεζοδρόμια. Δεν τα καλώ προϋποθέσεις όμως, γιατί αυτό σημαίνει ότι χωρίς αυτό δεν κάνεις τίποτα. Στην Ελλάδα δεν έχουμε τίποτα έτσι και αλλιώς, όλο χωρίς είμαστε. Αλλά μπορούμε να κάνουμε πολλά πράγματα.

AP: Άρα λέτε οι πόλεις εφόσον είναι πόλεις κάτι μπορείς να κάνεις πάνω τους, κάπως μπορείς να ενεργήσεις.
TV: Δεν υπάρχει πόλη που να μην μπορείς να κάνεις τίποτα. [..] Και η δημόσια συγκοινωνία είναι σημαντική, πρέπει να δουλέψεις με αυτήν.

AP: Το θέμα της κακής σύνδεσης ΜΜΜ στην Πολυτεχνειούπολη και στην Πανεπιστημιούπολη γενικότερα, θα το φανταζόσασταν σαν μια πιθανή περίπτωση χρήσης του Συνεπιβατισμού;
TV: [..] Τα παιδιά έρχονται με μέτρο εδώ στην Κατεχάκη, που είναι περίπου ένα χιλιόμετρο από την Πολυτεχνειούπολη και περιμένουν στη στάση για να τα πάρει το λεωφορείο. […] Προσπαθήσαμε να κάνουμε ένα σύστημα Carpooling, για να σταματάνε τα Ι.Χ. ένα χιλιόμετρο εκεί να παίρνουν τα παιδιά να τα πηγαίνουν μέχρι το Πολυτεχνείο και το ανάποδο. [..] Ι.Χ. μπορεί να είναι είτε φοιτητών και καθηγητών όπως μεταξύ άλλων κάναμε μια μεγάλη καμπάνια, με ειδικές καρτέλες που συνδεόντουσαν και με την ταυτότητα του οδηγού για θέμα ασφάλειας [..] Τελικά ποιο ήταν το συμπέρασμα - ότι αυτοί που έχουν

αυτοκίνητο δεν θέλουν να πάνε μαζί με όλους, αλλά και αυτοί που δεν έχουν αυτοκίνητο πάλι δεν θέλουν να μπούνε μέσα στα Ι.Χ. όλων.
Αυτό που στη Αμερική εμφανίστηκε και έπιασε, κατέρρευσε στην Ελλάδα. Τα θέματα ασφαλείας και κουλτούρας είναι πολύ σημαντικά. [..] Σήμερα όχι, δεν έχουμε είδος Συνεπιβατισμού σαν το on-demand Ridepooling που να οργανώνεται από το δήμο, από το κράτος.
AP: Ποιο είναι για εσάς το πιο αειφόρο και πιο ανθεκτικό μέσο μεταφοράς;
TV: Μακράν το ποδήλατο [..].

8.7.6. Interview with Nassos Kokkinos

Nassos Kokkinos is a Civil Transport Engineer and was Head of Public Relations and Information Department of OASA S.A. (Athens Public Transport Authority) for 15 years.

Anastasia Patsouri (AP): [...] Πείτε μας για την εμπειρία σας με τις Μεταφορές Διαμοιρασμού (Shared Mobility).
Nassos Kokkinos (NK): Δούλεψα για πολλά χρόνια στον Οργανισμός Αστικών Συγκοινωνιών Αθήνας. Το πρώτο Project λοιπόν που μου ανέθεσαν, ήταν να κάνω μια μελέτη και να εφαρμόσω την ιδέα του Συνεπιβατισμού (ως Carpooling τότε) στην Αθήνα. […] θα προσπαθούσα να προτείνω λύσεις για κάτι που έλειπε στην Ελλάδα. Μιλάμε αρχές του 1980 [..] ψάχνω λοιπόν και βρίσκω μια συγκοινωνιακή λύση, ένα τέχνασμα που ανακάλυψαν οι Αμερικάνοι τη δεκαετία του 70 γιατί επειδή ήταν πληγωμένοι οι αυτοκινητόδρομοι στην Αμερική και είδαν ότι η μέση πληρότητα των οχημάτων ήταν 1,2 επιβάτες ανά όχημα δηλαδή ένα στα πέντε οχήματα είχε και δεύτερο συνεπιβάτη. Που σημαίνει ότι ο κόσμος […] δηλαδή αυτοί που δημιουργούσαν την αιχμή ήταν αυτοί που πηγαίνουν στη δουλειά τους το πρωί, ώρα αιχμής. [..] Όσες λωρίδες κυκλοφορίας και να φτιάχνανε ήταν πνιγμένες με αυτοκίνητα με ένα άτομο άρα τι σκέφτηκαν να κάνουν - να φτιάξουν μία λωρίδα η οποία να δοθεί αποκλειστικά για τα αυτοκίνητα στα οποία είχαμε κι άλλους επιβάτες - τέσσερις επιβάτες. Άνοιξαν λοιπόν μια αποκλειστική λωρίδα, που εσύ κι άλλοι τρεις επιβάτες είχατε δικαίωμα να χρησιμοποιήσετε, στην η οποία πηγαίνατε πολύ πιο γρήγορα χωρίς κίνηση. Αυτό έδωσε τη δυνατότητα να αυξήσουν την ικανότητα των αυτοκινητοδρόμων τους διότι μεγάλωσε η παροχή ατόμων και όχι παροχή οχημάτων. Το ίδιο πράμα κάνανε και στις γέφυρες δηλαδή στη γέφυρα του Μπρούκλιν ας πούμε υπήρχαν διόδια εκτός αν είχες άλλους τρεις επιβάτες οπότε ήταν δωρεάν άρα τι κάνανε δώσανε ένα προνόμιο στους ανθρώπους να παίρνουν κι άλλους όταν έχουν άλλο μαζί. Πώς μπορούσες να βρεις άλλους τρεις ώστε να χρησιμοποιήσεις αυτό το σύστημα; Εκεί δημιουργούνται οι πρώτες τεχνικές του καρπού του carpooling. Οι πρώτες τεχνικές ήταν δύο ειδών. Η μία ήταν κρατική και η άλλη εργασιακή, έμπαινε στο χώρο της δουλειάς. Δηλαδή η General Electric είχε 15.000 εργαζόμενους στην περιοχή του New Jersey, οι οποίοι μένανε σε διάφορα προάστια γύρω γύρω. Τι έκανε λοιπόν, έφτιαχνε ένα γραφείο κάπου στην εταιρεία στο οποίο υπήρχε ένας χάρτης ο οποίος είχε ένα κάδρο στον τοίχο, και πήγαινες και έβαζες με μια καρφίτσα πού μένεις. Εφόσον όλοι ερχόντουσαν στο γραφείο και είχαν ίδο τον έναν προορισμό, το matching γινόταν αυτομάτως σε κάθε περιοχή. Εναλλάξ οι πέντε που έμεναν ας πούμε στο ίδιο τετράγωνο χρησιμοποιούσαν εναλλάξ το αυτοκίνητο του καθενός. Βέβαια, αυτό δημιούργησε διάφορα μικρο-προβλήματα ανάμεσα στους εργαζομένους σε βάθους χρόνου […] αλλά ο **δήμος είχε το όφελος από την αποσυμφόρηση των δρόμων.** [..] Εισηγήθηκα λοιπόν να εφαρμόσουμε κάτι τέτοιο και στην Ελλάδα
Η Αθήνα πνιγμένη τη δεκαετία του 70-80 από το αυτοκίνητο με πολύ μεγάλο πρόβλημα συμφόρησης. […] προσπαθούσα να βρω που θα μπορούσε να εφαρμοστεί σε ποια εταιρεία και μου φαινόταν καλή πρώτη κίνηση η Τράπεζα της Ελλάδος. Με δυόμισι χιλιάδες εργαζόμενους κέντρο της Αθήνας [..] προτείνω λοιπόν να το εφαρμόσουμε. […] Βρίσκοντας ως κοινωνικό εταίρο τον διοικητή του ΙΚΑ και το περίφημο Fund των καταναλωτών, για την κοινωνική στήριξη του Project, φτιάχνουμε ερωτηματολόγια προς τους εργαζομένους για να ξεκινήσουμε το Project. Σαν απάντηση από τα δυόμισι χιλιάδες ερωτηματολόγια που μοιράστηκαν σε όλους τους υπαλλήλους επιστράφηκαν τα 200 [..].

Anastasia Patsouri (AP): Ποια ήταν τα **εμπόδια** που συναντήσατε στην εφαρμογή του Project;
Nassos Kokkinos (NK): Το **κοινωνικό** και το **ασφαλιστικό**. […] άτομα σε διευθυντικές θέσεις, δεν ήθελαν να μπαίνουν στο ίδιο αυτοκίνητο με τον κλητήρα. Στην Αμερική, δεν υπάρχει αυτό το κοινωνικό κόμπλεξ, ο θυρωρός με τον εκατομμυριούχο παίζουν μαζί γκολφ ή πάνε μαζί στο γήπεδο. Αυτά είναι τα κοινωνικά όχι. Στην Ελλάδα υπάρχει διαχωρισμός (ταξικός, πολλαπλός) των ανθρώπων ενώ στην Αμερική σε αυτό το θέμα δεν υπήρχε. […] αυτό το πράγμα ισοπεδώνει με κάποιο τρόπο το Project σου. […] Αφού λύσαμε και το ασφαλιστικό με ετήσιες κάρτες, είχαμε στο **τέλος το πολιτικό**. Στις εκλογές του 1981

εκλέγεται άλλη κυβέρνηση, και η χώρα γνωρίζει μεγάλη πολιτική αλλαγή […]. Το Project λοιπόν μπαίνει στο συρτάρι για πάντα, ως «κάτι» της προηγούμενης κυβέρνησης που πρέπει να αλλάξει ριζικά τώρα, με όλα όσα άλλαζαν στη χώρα τότε. […] Και αυτή ήταν η καταστροφή του Project, […] όπως και πάρα πολλά Project είχαν την ίδια μοίρα [..] που δεν εφαρμόστηκε ποτέ. Η πολιτική κατάσταση είναι πολύ σημαντική και κρίσιμη για την επιτυχία κάθε τέτοιας προσπάθειας και πολιτικά. Η κοινωνία της Ελλάδας τότε μην ξεχνάς είχε μόλις βγει από πόλεμο εμφύλιο, δικτατορία και έμπαινε στην μεταπολίτευση – χαοτικό [..].