Aalto University
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MOBILITY AS A SERVICE “MaaS”

Four Case Studies

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Abstract

Human mobility has consistently been an essential segment in human development. Megatrends such as Social change, urbanization and globalization, services and sharing economy, scarcity of resources, and technological advances are affecting society and economy in several ways. Over past several decades, public investments have been made to expand and improve mobility service across the urban areas.

Over the next few years, the transportation sector gets ready for rapid changes, moving towards an advanced mobility supported by strong technology stream and the convergence of superior megatrends that are increasing the massive wave of conversion.

Despite the changes happening in mobility, experts argue the challenge for transit agencies is attracting people out of their cars and use public transport, however, due to several difficulties public transport creates for private car users, they still prefer to use their own car. There are several reasons behind this but accessibility and convenience can be identified as two major factors for choosing private car rather than public transport.

One of the concepts currently is developing in several countries to address public transport challenges is Mobility as a Service. MaaS is a service model that frames the mobility based on customer preferences and priorities in which users major commuting needs are fulfilled and offered by a single mobility provider.

Up until now, research focus has been more on the theoretical and technical aspects of the phenomenon and there is a lack of studies about current available MaaS providers in respect of their offering to real-world users. The objective of this study is to focus on the B2C value proposition that is being offered by a selected number of MaaS providers to determine how they differ in respect of their offering for target users and how they fit into the framework of an ideal mobility provider.

Four cases including Whim, Moovel, Go La, and Moovit were selected to conduct the benchmark. The result of the benchmark indicates although it is difficult to name a service as the best among the others, Whim service in Finland fits better into the MaaS concept. It is the only service that offers several mobility modes as a monthly subscription to the user in addition to providing a seamless user experience for moving from point A to B.

MaaS has a great potential to be implemented into daily commuting. From the user's point of view, it can address several difficulties of using public transport service, However, there are several areas of MaaS that are unclear and makes it difficult to define a concrete approach for its implementation. One of the main unclarified aspects of the concept is its business model and B2B offering. The future of MaaS depends heavily on the B2B side of the phenomena. Defining a concrete business model for MaaS to provide a clear idea of how it benefits the stakeholders competing each other, makes it easier for those businesses involving in MaaS to decide on implementing it into their services and thus, enables MaaS growth as of the solutions addressing mobility and daily commuting of travellers.

Keywords Mobility as a Service, MaaS, Whimapp, Moovel, Moovit, Go La

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Chapter 1 – Introduction

1.1 Research Background

In today's world, various factors of change have influenced transport, such as traffic, climate change, and economy. Currently, improving mobility is not only a technical concern but also a social concern and addressing it creates value for society and economy. New means of communication and information technologies have provided better and easier ways of accessing several transport choices compared with a decade ago. Each day, there are new ideas and businesses entering transportation industry. Alongside of these changes, urban development has increased the chance of succeeding in developing innovative solutions for mobility.

Social trends have a major impact on changing behaviours and attitudes of users. Understanding these trends and their potential plays a major role in developing and implementing a well-designed service aiming to improve the user's experience and their mobility. The growing trend of collaborative economy and access over ownership services such as Uber, Airbnb, Spotify, and Netflix are great examples of integrating these trends into a well-designed service.

Perhaps one of the most interesting ideas recently raised in Nordic countries is Mobility as a Service "MaaS". MaaS is a new concept providing a platform to travel from point A to B in an integrated manner. It combines all means of transportation, such as public transport, car sharing, bike sharing, and taxi into a single service. In short, by subscribing to a single service, users can have access to several transport options, and service providers will manage everything else, such as route finding, travel planning, and payments.

1.2 Research Objectives

The objective of this master's thesis is to focus on B2C value proposition being offered by a selected number of MaaS providers to determine how they differ in respect of their offering for target users. In other words, this thesis aims to do a comparison between four mobility

service providers to find their strengths and weaknesses according to a framework designed by this study.

1.3 Thesis Structure

This is a case study research. First, by understating the phenomena of MaaS and its place in current transportation, the study provides a clear understating of the concept and its value proposition, and second, by benchmarking four mobility service providers including two mobility as a service providers, and two trip planning providers, the study aim is to conduct a cross-case analysis to find out how these services are different from each other, and how they compared to the concept of MaaS.

The nature of this study requires a deep understanding of the concept and the focus is set to be on travellers and their needs. Thus, qualitative research method is the approach taken by the study. Data to conduct the benchmarking of this study is collected from two resources. First, online data that are available through providers' websites where they provide information about their offerings, and second, from mobile phone application available to use for travellers. This enables the study to evaluate providers' offerings in practice and from the end-user point of view.

Based on several kinds of literature, a set of indicators a mobility service provider should have to address travellers needs and follow megatrends is defined. These indicators are used in the study to compare and benchmark the selected cases. Then based on the indicators, each of the selected services will be analysed and studied to identify their offering, differences, and how they fit into the MaaS concept in terms of value propositions.

Chapter 2 - Theoretical Background

2.1 Current State of Transport

As of 2016, the number of megacities with around ten million populations is more than thirty worldwide and the UN predicts it become more than frothy by 2030 (United Nation 2016, 2). The citizens and travellers demand a satisfying level of transport provided by the transport companies, public transport or by themselves in different ways. However, public transport sector has always struggled to attract and retain passengers due to its current offers in comparison to more personalized modes.

Over past several decades, public investments have been made to expand and improve mobility service across the urban areas. As stated by Chakrabarti (2017), based on National Transit Database of U.S, between years 1991 and 2012, the total annual investment of government on transport increased from $22 billion to $58.5 billion. However, increasing investment has not been translated into increased productivity or ridership. For instance, between 1991 and 2012 the number of unlinked passenger trips per revenue vehicle hour (the standard measurement for service effectiveness) decreased from 46.5 to 39.4.

Experts argue the challenge for transit agencies is attracting people out of their cars and use public transport, however, due to several difficulties public transport creates for private car users, they still prefer to use their own car. There are several reasons behind this but accessibility and convenience can be identified as two major factors for choosing private car rather than public transport. To support this claim, In an article published in Transport Policy journal by Chakrabarti (2017), he states:

> I find that few car owners use transit, and that lack of access to the household vehicle(s) explain choice of transit to a large extent. While discretionary transit use (or transit use by choice) is rare, I find evidence that fast (relative to car), frequent and reliable transit service along with fewer transfer requirements strongly correlate with car-owners' transit mode choice. Home

and workplace neighbourhood density, proximity to transit stop, and availability of rail are other critical facilitators.

In most cases it is evident the current public transportation offers are not competitive enough to attract private car owners to choose public transport. This can be dependent on the definition of comfortable commuting for each individual, however, most of the travellers prefer faster and more personalized transport methods and current public transport offers can hardly beat the private car option mostly in its personalized offerings.

2.2 The Conversion of Mobility

Human mobility has consistently been an essential segment in human development. It plays a central role in local and global processes of economic, social, and political change. One billion cars were manufactured in the 20th century, with currently more than 600 million cars moving around the world. Car travel is expected to triple by 2050 in comparison to 1990 worldwide (Hawken and Lovins, 2002). An "automobile culture" is developing in all countries and the most considerable one is China. By 2030, there may be almost one billion cars worldwide (Motavalli, 2000). Transport industry and mobility as a whole are expanding and the number of transport means such as cars, buses, trains, and aeroplanes is increasing. However, in addition to production increment, the ways travellers are using these products is changing concurrently.

Over the next few years, the transportation sector gets ready for rapid changes, moving towards an advanced mobility supported by strong technology stream and the convergence of superior megatrends that are increasing the massive wave of conversion. These major drivers give the promise of creating a new mobility future that offers equal and affordable accessibility, unlocks huge economic values, enables the transition to a more cost and energy efficient transport of goods and people, and improves the safety for everyone.

In a study about the Future of Urban Mobility, Arthur (2011) states the world's population is moving increasingly towards city-based. Around 3.5 billion or 51% of people are currently living in urban areas and an increment is expected to happen with 6.3 billion people or up to

70% of the population by 2050. Now an in future, urban mobility is one the major challenges that countries need to deal with in their cities. Thus, massive investment will take place in future. Currently, 64% of all travel distances are happening in urban areas and its amount is expected to triple by 2050.

The proportion can vary depending on the region. Considering Europe as an example, up until now, more than 74% of the EU-28 live in urban areas, the percentage is expected to rise to 80% by end of 2030 (EEA, 2013). In 2013, The average of passenger transport activities by any motorized mode of transport were around 12,700 kilometres per person and a total of 6456 billion kilometres for the whole EU-28 (EC, 2015). According to EU (2012), the transport sector is producing 23% of total CO2 emissions in Europe and by 2050, the transport sector contribution in CO2 emission is expected to be up to 50%.

There is a growing interest in investments for rapid transit worldwide. For over two decades, systematic efforts have been undertaken to provide better mobility and reduce the gloomy impact of traffic congestion in cities across Europe. A considerable number of European Commission's transport-related projects under the CiViTAS programmes, such as regional Co-operation, FP7 R&D ICT and Transport framework, and IEE, have led to significant outcomes ranging from concept creation to pilot implementation and development (Korver, 2012).

In the other hand in U.S and China, there has been an important effort to increasing transport infrastructures. Neff and Dickens (2015) found that by 2015 in the U.S, 30 light rail transit (LRT) and 15 metro rail transit (MRT) systems were operating. In the other hand in China, by 2014, there were 83 rail transit lines operating in 22 cities and the vast majority of them were built in the 21st century (CRI 2015).

Traditionally, the focus of public transport sector has been on offering inflexible services by a 'take it or leave it' model with limited transport modes to offer. Thus, for users who their needs are not fulfilled by public transport, car ownership is the option for mobility purposes. For instance, in Europe, 83% of land-based traveller kilometres are met by private car or taxis. Cost and complexity of entry, regulatory environment, and incumbent economic of

scale are a particular set of circumstances that helped to avoid major changes in the public transport sector (Becque, 2015).

In the last few years, a process of changes has been influencing transportation and mobility system and is still ongoing. Demand for transport, the volume of daily traffic and, alongside with them, the need for mobility infrastructure is continuously increasing. In addition to this, the rising price of the fuel is challenging society and economy. As stressed by the European Commission (2013), new challenges and concern continue to emerge. Among these, energy consumption, the difficulties of overcoming congestion and accessibility, climate change, and air quality are of paramount importance. Thus, the priority objective is to improve and enhance accessibility and mobility while, concurrently, reducing road accident, congestion, and pollution in cities. To achieve that, a plan is required to develop a new transportation system that is capable of tackling current and future challenges. The new system has to be designed and adapted based on the current and upcoming situation.

To succeed in developing a new system, it is crucial to have a clear understanding of megatrends. According to Lancefield (2016), a megatrend is a movement or pattern which has a major effect on businesses and the whole society. Megatrends are affecting society and economy in several ways and hence, they have an impact on demand and supply of transportation and mobility. They are the key factors that are affecting the current transition process of mobility and transportation system. Thus, studying megatrends and their effects delivers a critical insight into the nature of conversion process and its related challenges.

Several megatrends have been identified by different studies, however, this thesis focuses on five established trends that play the major role in the transition of mobility: Social change, urbanization and globalization, services and sharing economy, scarcity of resources, and technological advance.

2.2.1 Social Change

Decreasing the size of households has an impact on the demand for housing and results in a new structure planning and shifts in traffic. These changes alongside with more use of

communication technology and social media results in changing of behaviours and creates different mobility models compared with a few years ago.

Current seniors compared with their previous generations, are wealthier, healthier, have more dynamic and active lifestyle, and they aim to travel more, however, they are not following the same pattern for travelling as their previous generation. They want to gain recognition, experience, and value while travelling.

In addition to above changes, nowadays people are driving less. In the U.S those born between the 1980s and 1990 (also known as Millennials) own fewer cars and drive less in comparison to the previous generation. A study by Klein and Smart (2017) shows that since the mid-2000s, drivers licensing and car use have been decreasing in the US and peer countries, among the young in particular. In addition to that, on average, Millennials own about 13% fewer cars compared to families with older cohorts. However, Millennials economic situation considers being a factor for these differences. Several other research has found that this is not unique to the U.S and it can be applied to several other countries across the globe (Goodwin, 2012; Delbosc, 2016)

According to Heikkilä (2014), the generations who were born between 1980 and 2005 have a strong impact on the society in the future compared to other generation. They are self-confident, ambitious, and requiring higher standards in every aspect of life. They also feel they have an impact on the society with what they do. Thus, in addition, to earn money, they aim to work for something that creates that impact, motivates them. This generation requires flexibility in what they do; they want to have flexible hours and work in an office or at home depending on their desire.

Millennials are eager to own the newest devices and use new and trendy technologies alongside with being always connected with friends and family. They tend to try new services are more involved in using new services. For instance, according to a survey conducted in 2008 by Martin and Shaheen (2011), based on car-sharing organization, vehicle ownership, gathering demographic, and travel data in North American, car-share members were relatively young (67% were found to be between age 20 and 40), highly educated (84%

were found to have at least a bachelor's degree), and have a mid-range income (43% had a yearly incomes of around less than 60,000).

Being connected to information and communication, they can experience everything while on the go. This can lead to a less demand for transport or better trip planning by using all the available information on the internet, however, the interactive world of internet has made these generations to demand immediate response thus, they are impatient to deal with slow and poorly functioning systems.

Based on the characteristics of these generations, they adopt new technologies and services in comparison to older ones, however, they would desire to a more user-friendly and individual travel experience. Thus, they prefer to use a public transportation that is very similar to private care in respect of personalization and this can be accomplished by utilizing the fast developing technologies (Heikkilä, 2014).

2.2.2 Urbanization and Globalization

Urbanization can be defined as the process rural areas become urbanized due to industrialization and economic development. Demographically, urbanization denotes population redistribution from rural to urban area settlements progressively. However, the criteria for defining the urban area may vary in different countries and cautious is needed when comparing urbanization internationally. The major difference between rural and urban is that in urban are populations live in denser, larger, and more divergent cities in comparison to more spare, small, and less heterogeneous rural areas.

The urbanization is now trending in world and cities population is growing fast. According to United Nation (2016), In 2016, there were 512 cities with one million or more inhabitants globally and it is estimated to increase to 662 cities by 2030. As of 2016, 45 cities identified to have a population between 5 and 10 million inhabitants and it is expected that 29 more additional cities join the lost by 2030.

According to the Urban Europe Strategic Research and Innovation Agenda (2015), in 2010 73% of the European population was identified as urbanized. In contrast with South America and Asia, Europe has a high number of small and medium-sized cities and few cities with more than 1M inhabitants. People move to cities more than before, creates congestion and the need for more parking spaces.

Currently, urban transportation system faces a growing pressure due to expanding of cities and exploding of the population. It is not a secret plenty of commuters in urban spaces spend hours in transit daily, making them stressful and extremely tired. One of the most frustrating parts of transport in urban areas is the waiting time. Forgetting a metro card could easily lead to spending considerable time in a long ticket line and results to delay for attending work or a meeting. Transit designers should provide a system that tackles these challenges to find a solution that makes commuting more reliable and accessible based on individual needs.

Globalization can be simply defined as the process of integrating peoples and nation economically, culturally, and politically into a larger community. It can be seen as an incremental process that has brought nations and people closer together over centuries. Technological innovation has solved barriers of distance and time, and along with that, improved flows of information and data have promoted much more awareness and understanding compared to a few decades ago. Globalization focus is on the globe rather than nations. It is a complex procedure in which the enhancements in technology (especially in transportation and communications) is merged with the deregulation of business markets and open borders, thus it results to expanded flows of people, goods, money, information, and services, creating a large network.

> Since the ‘80s, the world economy has become increasingly “connected” and “integrated”; on the one hand the decreasing transportation costs and the diffusion of Information and Communication Technologies have implied a fast downgrading of the concept of “distance”, while – on the other hand – gross trade, Foreign Direct Investment (FDI), capital flows and technology transfers have risen significantly (Lee and Vivarelli, 2006).

As stated by Heikkilä (2014), modern transport has provided a fast and convenient way to travel from a country to another. Students are increasingly interested to study abroad to learn new cultures and languages, and alongside with that people aim to travel and work abroad. Furthermore, the international relation of universities is rising and migration to other countries is increasing. In addition to modern transport, the internet has a great impact on globalization by providing instant access to information around the world. These changes need to be considered while planning for future, and accordingly, the mobility system should fulfil the requirements arising with globalization in respect of user expectations. (Heikkilä, 2014).

2.2.3 Services and Sharing Economy

During past years, the idea of offering services with products has been popular. Service business is considered a new type of shifting that involves companies providing functionality rather than only selling their products. Sharing economy or collaborative consumption, is a model of sharing services and items, instead of owning them by oneself.

Many believe servicizing model as having great impact and potential to reduce industrial effects on the environment (Fishbein, McGarry and Dillon, 2000; White, Stoughton, and Feng, 1999). For instance, offering services can create incentives for producers to redesign their products in order to extend the lifespan, and as a result, reducing material and energy intensity (Stahel, 1994). Consequently, selling functionality on top of the product may create an opportunity to enhance the trend of economic growth that requires intensive energy and material use, while reducing manufacturing cost and resources over time.

Since past few years, integrating access over ownership phenomena with ICT has provided a platform for several businesses to build new service offerings. There are successful instances of these new businesses, such as UBER (taxi service), Spotify (music, podcast, and video streaming service), Airbnb (peer-to-peer online marketplace and homestay network), and Netflix (provides streaming media and video on demand).

Considering the importance of protecting the environment and using resources efficiently while minimizing pollution in the transportation industry, it is crucial to detach the continuation of economic growth from damaging the environment and wasting resources. This requires taking both production and consumption more patterned and structured, however, policies and actions taken to date had focused mainly on the production side rather than offering a service to use the transport means more efficiently.

In mid-1980s car-sharing become popularized in Germany and Switzerland. This mode was exist in Europe since the 1940s and from Europe, it spread to North America and Asia in the 1990s (Shaheen, 2016). As stated by Shaheen (2016), as of July 2015, there were 23 active programs in the U.S, 20 in Canada, one in Brazil, and one in Mexico totalling around 1.5 million car-sharing members who share more than 22,000 vehicles in America. It is expected to see growth in car-sharing including one-way-rental where the user can return the car to a different location than receiving it.

Service offerings in association with sharing economy provide a more affordable model in which people use resources more efficiently due to the distributed cots to multiple users. Applying this phenomenon to the transport industry results to a model in which people share their cars and other vehicles alongside with rides and equipment. Integrating this model into daily transportation leads to efficient use of transport means and parking spaces, and consequently less traffic and air pollution. In addition, it improves the whole mobility ecosystem and urban life.

With the advent of ICT, travellers who aim to move from point A to B are now demanding easy and instant travel planning based on available transport means. They require having a predefined route and transporting mean. New solutions are required beyond the basic transportation website or application to offer a unified service that merges and fulfils all user needs. A solution that can fulfil these needs by providing a comprehensive service to be offered based on traveller needs and available transport options.

2.2.4 Resource Scarcity

The scarcity of resources and the climate change are growing economic concern. Energy demand is expected to increase by around 50% by 2030, and water withdrawals by 40% (NIC, 2012). Growing world population is demanding more resources and the existing economic model pushes beyond the upper limits of the planet's capability to cope. In addition, the pressures of climate change and economic growth are placing stress on limited, non-renewable resources such as minerals and fossil fuels. As a result, countries and industries whose economics are mostly dependent on non-renewable resources need to go towards a more sustainable growth model in industries and services. This requires a plan in which innovative solutions provide a more effective way of using resources.

It goes without saying that mobility and transportation are facing same challenges as any other industry in respect of resources and limitations. The transport sector has to deal with issues such as shortage of infrastructure, environmental pollution, and congestion in cities and on the road. Scarcity can be a strong driver for the transition of mobility in many local and national context. In one way scarcity of time, clean air, oil, road space, land, and finance can be the leading cause to move towards promoting smarter, cheaper, and greener mobility, in the other way scarcity can be identified as an obstacle for a radical change. However, in both ways, scarcity and finding new solutions to save a particular resource, such as money, time, oil, and space, are in top when aiming to plan for future.

> For example, the Netherlands and Singapore both emphasize territorial scarcity as an argument for greater efficiency of urban planning. In Singapore, the focus on scarcity of land since the 1960s led to land use and transport planning based on the primacy of public transportation (71% in the total modal share at the moment of fieldwork in 2015) and limiting auto mobility growth through a vehicle quota system and a road pricing scheme. On the one hand, these scarcity-driven measures are partly responsible for the robust public transport system and the fame of Singapore Land Transport Authority (LTA) among transport and land use planners around the world.

> On the other hand, these policies also contributed to the desirability of the car as an exclusive commodity (Nikolaeva, 2016).

To improve the current transport system and tackle the scarcity challenges it faces, an enhanced model is required for an optimal allocation of the resources between several transport sectors. As Heikkilä (2014) mentions, technological developments results in innovations, such as cars use renewable energy and less-consuming vehicles. However, innovative technology and service are unable to tackle all the challenges related to climate change and resource scarcity, but a comprehensive conversion in mobility and transportation can enhance the process of change.

2.2.5 Technological advance

The modern world of transportation has taken technology in use to improve driving and traffic management for a safer and better journey. New technologies are changing the way countries design, plan, build, and operate their transportation system. Transport agencies use technology to detect crashes, count traffic, manage traffic signal systems, collect tolls and fares, and control transit operation. Travellers depend on electronic maps, traffic condition reports, real-time transit information, and several other services that have been existing for just a few years.

Currently, technology is a key driver of the changes is methods to decide to take a journey, in particular, the use of more location sensitive, internet enabled mobile devices and the information they provide to users. Mobile devices produce transport information to travellers and in addition, they collect data to be used by operators to improve their services, build customer relationships, and manage traffic flows in real-time.

As has been mentioned by Fellander, Ingram, and Teigland (2015), the increased use of smartphones alongside with easy access to the internet is considered as the main facilitators of the transformation of the transport sector towards Intelligent Mobility. Without the help of big data analytics and ICT that provide the understanding of performance patterns and

behaviours, several of these new services could not be developed and Intelligent Mobility may not exist.

New players are joining the transportation market, such as software companies specialized in the electronic vehicle as they integrate their software with personal vehicles. In addition to that, data is being and shared and communicated between cars, roads, locations, and buildings, creates a virtually wired network of moving objects. These reconfigurations enable cars to be more than just a separate piece of metal moving on the ground. This is a shift from an old divided traffic flow, to a new organic flow (Peters 2006) in which several traffic participants can survive and co-operate under new kinds of communication that regulate the overall network as a whole.

The advancement of technology affects the demand for mobility. It optimises the use of transport networks in several ways, such as information provision, traffic analysis and regulation, and safety enhancement. In addition to the use of technology in enhancing mobility services, technology has been integrated into physical transport means such as cars as well. By implementing several technology and sensors, automated cars or self-driving cars can move around without having a driver behind the wheels. There are several techs and car companies who are integrating technologies with the car to produce driverless cars.

Several major technological developments, such as dissemination of smartphones, mobile broadband, autonomous driving, advances in electric vehicles, and big data availability are now playing an enabler role for developing new mobility model named Mobility as a Service "MaaS".

2.3 MaaS

2.3.1 MaaS Concept

Traditionally mobility has been running by managing a group of vehicles around networks a framed to achieve specific transport objective. In contrast with this tradition, MaaS is a service model that frames the mobility based on customer preferences and priorities. Despite

the interest into MaaS, a commonly accepted definition for it, is still missing and has led to several interpretations of its terms and scope but the idea of MaaS is revolutionary, yet simple: integrating several transport means, into one package to be offered to customers. MaaS makes it possible for both policymakers and travellers to improve how goods and people move from point A to B.

According to Hietanen (2014), MaaS is a new model of mobility distribution where users major commuting needs are fulfilled and offered by a single mobility provider. MaaS combines all means of transportation, such as public transport, car-sharing, bike-sharing, and taxi into a single service. In short, by subscribing to a single service, users can have access to a comprehensive range of transport options and service providers will manage everything else, such as route finding, travel planning, and payments.

In another definition, Heikkilä (2014) describes MaaS as a system, in which, a comprehensive range of mobility services are provided to customers by mobility operators. These companies buy mobility services (i.e. transport like public transport, taxi, car-sharing, bicycle etc.) from service producers, and combine them as a new service to be offered to end users. Customers can access the service by using an application on their smart devices, however, MaaS is not just a mobile app; it is a concept to use mobility as a service, where it focuses on promoting access over ownership.

In a research report published by Finnish Transport Agency (2015), MaaS is a paradigm change in current mobility, transforming both utilization of physical resources and customer experience. It introduces a new approach to the effective planning and use of several travel opportunities as well as new modes and transportation alternatives. In addition to that, it has an impact on land use, city planning, political and public organizations, economy, and people.

The European Commission (2016), locates MaaS in the area of Intelligent Transportation System in its H2020 Work Programme that aims for a smart, green, and more integrated transport. Thus, we can identify ITS as the foundation of MaaS development. MaaS can be considered as an over the top service in the transport sector. Seamless and integrated

mobility services can be offered to a user by a private or a public mobility provider. MaaS has disruptive digital business models and services that are mainly based on subscription but can also accept the microtransaction. Depending on providers, several mobility packages can be offered to the customers in addition to travel options, such as home deliveries, city logistics, and transport in other cities or countries.

2.3.2 MaaS Ecosystem

MaaS ecosystem is formed by a range of several stakeholders, each of whom has a crucial role in developing and delivering the MaaS offers. In a report published by The Transport Systems Catapult in the UK (2016), MaaS ecosystem players can be defined as customers, MaaS providers, Data Provider, and the Transport Operator.

- **The Customers:** subscribe to the packages offered by MaaS providers and consume the service offerings.
- **The MaaS Providers:** design, operate, and offer the MaaS value proposition to fulfil on-demand user requirements.
- **The Data Provider:** Play the role of data broker to service the information and data sharing requirements of the MaaS Providers and the Transport operators.
- **The Transport Operator:** provide the transport services and assets including private and public transport, highway capacity, city assets such as vehicle charging points, car parking, and digital assets such as ITS infrastructure.

2.3.3 MaaS Core Innovation

Core innovation of MaaS can be defined as its ability to provides a digital platform that aggregates the services offered by Transport Operator. This business model is well known in other sectors; Amazon.com is one example of this aggregator model in the retail sector. MaaS fulfils the position of an aggregator and enables Transport Operators to interface with their customers in a new way. In regards to this, Transport Systems Catapult in the UK (2016) defines two core strengths for MaaS business model:

- **Servitisation:** MaaS provider offers a value proposition that consists a bundle of several mobility services. This lead to competition in Transport Operator business by incentivising them to grow their market share or to innovate to maintain their competitiveness.
- **Data Sharing:** MaaS provider shares information and data about mobility needs of their customers to help Transport Operators enhance their services. In addition to that, MaaS provider fills the gap in which Transportation Operators do not cooperate with each other due to competition, that may prevent this type of innovation where Transport Operators may compete in the same market and for same customers.

2.4 MaaS Benefits

Improving customer experience can lead to success and it benefits everyone. Users now require more personalized ways for transportation but current transport sectors' offers are impersonal and divided into several segments. Thus, a new strategy needs to be applied on the top of the current transportation system. The new services should improve the transport sector as a whole and create several commercial opportunities for mobility providers. It needs to reduce their cost of providing the service and increases the use and efficiency of their offers. In addition to the benefits for transport providers, the new approach needs to make cities more livable by improving accessibility and reliability.

As Giesecke, Surakka, and Hakonen (2016) state, among several approaches to tackle mobility challenges, MaaS has a great potential in two ways. First, it capable of reducing the use of private cars. Second, on its conceptual level, MaaS enables the transport of goods and passengers by the same vehicle. Consequently, MaaS approach to tackle mobility challenges is potentially more sustainable, in respect of the environment, compared to the rest of individual transport modes other than bicycling or walking.

Flood and Mulligan (2015) highlight the core offerings of MaaS as the freedom it gives to the user to choose how to start a journey with an option to optimize it while on the move. This is the critical change from the block provision of mobility to more adaptable and user-

centred approach to fulfilling travellers' needs within a dynamic system. By providing an on-demand service, the starting point is not a map and a timetable but a plan that fits into customer requirements for a specific journey.

According to Giesecke, Surakka, and Hakonen (2016), in public discussions, MaaS is widely known as the next example of a change in the transportation system. Products that are built on MaaS concept, are expected to provide an improved way of daily travel. Not only it needs to be easier, more accessible, and more reliable but also, it has to be sustainable and cost-efficient compared to current solutions. On the other hand, from the user's point of view, MaaS needs to be easy to plan, book, and pay, and alongside with that, seamless during actual trip. It should be able to fulfil a variety of user requests based on individual priorities and it needs to be applicable to several transport modes, governance, and other boundaries.

MaaS can be beneficial for both public and business sectors. For the public sector, by enabling the potential of ICT, it improves the effectiveness of the whole transport system, leading to an efficient allocation of resources based on end users and their real needs. Alongside with that, by using advanced data analysis, MaaS provides a more reliable transportation system that enhances traffic incident management. In addition to public sectors, MaaS can be a profitable market that creates new business opportunities for traditional transport and infrastructure by co-creation.

Moving Forward Consulting UG (2016), describe MaaS benefits as its ability to upgrade and combine current transport service to offer a more efficient solution for commuting. MaaS supports the increasing demand for mobility needs. It creates more value in the end to end mobility offerings and offers an improved service in intermodal transportation by providing better information to its users before, during, and after travel.

As stated by Kaim (2016), from the customer's and end users' standpoint, MaaS provides an interesting value proposition that encourages end users to adopt the system. This is accomplished by offering an improved user experience in regard to:

- **Journey Planning:** Users are able to plan their journey in real-time. They can and from several modes that are intelligently provided according to their personal preferences, such as time, comfort, and cost.
- **Ease of Transaction:** MaaS offers several payment channels to users, such as a smartphone, watch, and smart card or bankcard for accessing their mobility services regardless of the transport mode they choose.
- **Flexible Payment terms:** Users can pay for their mobility modes via pre-paid, post-paid, or pay-as-you-go. In addition, a monthly subscription can be offered.
- **User Experience:** Data analytics improves the overall user experience. Real-time data provides the best possible journey experience by handling the choices they make and fulfilling their requirements.
- **Personalized Service:** A comprehensive and on-demand service that is fully personalized, builds a relationship between MaaS providers and their customers by providing two-way communication. The whole service is based on customer's feedback and users are in centre of its offerings.

2.5 Issues and Challenges of MaaS

Mobility as a Service phenomenon is still new and lacks a clear definition. As argued by Holmberg, Collado, Sarasini, and Williander (2016), it is difficult to categorize services that consider being in MaaS category. One may consider Uber as a MaaS service. Some claim that MaaS is same as combined mobility service (CMS) because it provides a platform where multiple and different mobility means such as taxi, car-sharing, bike-sharing, and public transport are combined into one service. Others consider MaaS as an extended travel planner.

The key points for the need of MaaS are acceptable and convincing, as several political concerns and megatrends drive and enable it. However, MaaS concept and its vision have almost remained descriptive. Thus, the leaps and steps towards its realization and comprehensive explanation of the MaaS activities and structure are still undefined. In order for MaaS as a concept to be applied in a larger scale than one city, and in future to be applied

for transportation of goods, it needs to be more specific about the required steps of developing it. Schweiger (2016), defines three categories for the challenges that MaaS is facing for its development including, institutional, operational, and technical.

- **Institutional:** Each existing institutional environment has its own key factor, some of them may have worked together and coordinated before and some may be competing each other. Thus, there is a concern regarding the vendors' desire to provide an open solution and share data with their competitors. This requires changes within participating organization and might be challenging. In addition to sharing data, participating organizations may run their business differently; the service operations and handling customer need differs from one organization to other. New tools for customer service and operation may be needed and the roles and responsibilities of individuals may change.
- **Operational:** Many transit agencies run their business separately and the new service requires them to change the way they operate or schedule their services. Besides that, they are required to provide transit services based on an array of policies, regulations, and objectives from several regulatory and governmental agencies, while they supposed to fulfil the travellers'' needs simultaneously. Thus, due to these challenges, there can be a lack of desire to coordinate their operation with MaaS ecosystem and the entire transportation system.
- **Technical:** Integrating MaaS into transportation system can be challenging depending on current infrastructure and technological advancement of the older transportation system. If technology fails, there is no clear instruction of how to perform MaaS manually. Alongside with that, travellers with no credit accounts, or mobile devices that are capable to handle MaaS functions, cannot necessarily access to the new services. Moreover, lack of ITS infrastructure and technical guidance, especially in rural areas makes it difficult to apply the concept in larger scales.

2.6 Theoretical Framework

The aim of this thesis is to review and benchmark the value propositions that are being offered by some of the MaaS providers. Based on current activities, a number of providers are selected and reviewed to conduct the study on them. This benchmark focuses on values that MaaS providers offer to two targeted groups: First, travellers who are using their services for mobility purposes, second, businesses and other sectors who cooperate with MaaS providers to run their service and fulfil user requirements. By doing that, the performance, strengths, and weaknesses of targeted providers can be identified both for in respect of end users and business partners. As a result, a set of recommendations can be provided to enhance and boost the MaaS development by improving and optimizing its offerings to target groups.

To frame this study, it is required to have an understanding of an ideal service in respect of its users and stakeholders. In this case, to study and benchmark some of the providers' performance, the study needs to build a framework that could be used as a reference when conducting the empirical and qualitative research about MaaS or services with a similar concept. Implementing this framework into the study process, enables the study to investigate the quality level in which providers are meeting and ideal service criteria and it what level their offers can be framed in MaaS concept.

In the past few years, researchers had a great interest in service quality and customer satisfaction measurement, apart from in the definition and application of service quality indicators that can be implemented by service operators to evaluate their performance. For instance, in the U.S, TRB (Transportation Research Board) was supporter of the TCRP (Transit Cooperative Research Program), in which some manuals and guidebooks were published to measure customer satisfaction in public transport (TRB, 1999b), calculate transit performance measures (TRB, 2003a), and evaluating quality of service and transit capacity (TRB, 2003b). Another example is in the European Union countries; where some programmes were promoted, and the CEN (European Committee for Standardization)

developed a manual to measure public transport quality, including categories of indicators to be used for benchmarking purposes (European Committee for Standardization, 2002).

There are several available studies about MaaS concept, however, in the materials used to conduct this study, there is lack of a comprehensive framework in which all the features of an ideal MaaS service is defined. As a result, this study aims to build its own framework consisting of several indicators. These indicators are based on several studies about MaaS and other combined transportation services may sharing similarities with MaaS features. By reviewing several studies about quality determinants in transport providers the parameters to benchmark a mobility service can be defined as transit mode options, availability, reliability, information, payment options, price, seamlessness, customer support, and environmental and health impacts.

2.6.1 Transit Mode Options: This characteristic of the mobility service provider is considered as a key point in analysing and comparing them with each other. In this category, the study aims to benchmark the service providers in respect of the variety of transport modes that they have integrated into their system. These can include taxi, public transport, car-sharing, ride-sharing, bike-sharing, and any other means that can be used to move passengers from point A to B. A wider offers in respect of transit options can lead to attracting more users to the service.

2.6.2 Service Availability: The attributes included in this category are represented by characteristics of service availability in term of coverage and possible ways to access the service, meaning it benchmarks the selected provider in respect of the area in which their services are available and accessible, such as city, country and globally; and it benchmarks the ways users can have access to the service, such as Mobile applications and website.

2.6.3 Service Reliability: Service reliability is considered a crucial aspect for travellers. According to Turnquist and Blume (1980), transit service reliability is the capability of the transport system to maintain regular headways or adhere to the schedule and a consistent travel time. Kimpel (2001) and Strathman (1999) agree that reliability is more about schedule adherence. In addition, Beirao and Sarsfield-Cabral (2007), state that the

uncertainty of the transport mean arrival time makes the service unreliable. Lack of reliability in transport services adds additional waiting and travel time for the passengers (Wilson, 1992; Strathman, 2003). As a result, service unreliability can end up to loss of passengers and less interest in using the service while improving the reliability can attract more users to the service (El-Geneidy, 2007). Arriving on time can be one of the most important aspects for the users when deciding to choose a transport mode. Considering benchmarking service providers, service reliability is a factor that defines the quality of the offered service.

2.6.4 Price: The service aspect regarding price includes comparing the cost of the using or subscribing to the service with the cost of other available options, such as public transport and taxi. The availability of volume discounts for instance for a monthly subscription and the availability of discounted price for instance for students are important to be considered while doing the benchmark. As the price can be a key factor in planning a journey or using a service, service providers prices should be able to compete with current market according to its value proposition to the travellers.

2.6.5 Information: The availability of the information that is provided by the service for planning and starting a journey affects the service quality. Travellers need to know how to use the service, where the journey starts, which route is used, where to get off, and if any other transfers are required. In addition to that, estimated time of journey and arrival plays an important role while choosing a transit mode. This information should be available and easily understandable for the traveller. If there be lack of required information, potential travellers are unable to use the service properly (TRB, 2003a).

2.6.6 Payment Options: This attribute of the benchmark is related to the available options for users to subscribe and pay for the service. It benchmarks package offerings, such as time subscription, pre-paid, post-paid, and pay as you go in addition to payment solutions, such as pay by credit card, online payments, and cash. A well-designed service should provide several options for the users both for payment options and mobility packages.

2.6.7 Seamlessness: This category of the study reviews current mobility providers in respect of the providing a seamless experience for its user. One of the main goals of mobility services and specially MaaS is to provide a service in which all the mobility requirements of the user can be fulfilled within a single service. This includes all the steps for planning, choosing, paying, starting, and ending a journey. To achieve that, service providers should offer a seamless service that functions standalone without forcing the users to use some other services to complete the steps of taking a journey.

2.6.8 Customer Support: Customer support includes those attributes making it more pleasant and easier for users to resolve possible issues with the service and need for help. The service provider should be able to fulfil customer needs in a reasonable time when a problem occurs before, during, and after using the service. Well designed and easy to use customer care, can attract more user to the service and improve customer satisfaction.

2.6.9 Environmental, Health Impacts, and Extra Features: This attributes of the service benchmarks the extra features of a service such as personal customization and the impact of using the service on environments and personal health. It enables the study to benchmark the service offering in terms of the information they provide to the users about the impacts of their transit mode on personal health and environments. This information must be available to the users when they aim to start and plan a journey and it can affect their decision making. Several attributes can be included in this category, such as effects in terms of emissions, noise, traffic, the consumption of natural resources in terms of space or energy, and the number of calories they burn when deciding about the mode of transit. Several procedures and models enable service providers to quantify the effect of transit in terms of noise, pollution, and calorie burning.

Chapter 3 – Research Design and Methodology

3.1 Research Objective

Several studies and research have been conducted around MaaS concept, its potential, and other concept related subjects. So far, the focus has been more on the theoretical and technical aspects of the phenomenon and there is a lack of studies about current MaaS providers in respect of their offering to real-world users. The objective of this study is to focus on the B2C value proposition that is being offered by a selected number of MaaS providers to determine how they differ in respect of their offerings for target users, and how they fit into the framework of an ideal mobility provider according to the current state of mobility and user needs.

3.2 Research Scope

As MaaS is relatively a new phenomenon, the focus of providers has been mostly on MaaS for daily travellers rather than implementing it in goods transportation and integrating it with goods transportation can be a long time development process. Thus, this study aims to select a number of companies who provide MaaS for daily mobility of citizens and study their offers for both end users and business partners. Companies are selected globally and based on their current activities as well as their public data availability.

3.3 Research Method

Research methods lead the process of conducting the research. To be beneficial, they should fit the nature of the study and the problem. Quantitative and qualitative are identified as two main categories of research methods. According to McLeod (2008), Quantitative research collects data in a numerical form which can be categorized and measured in the measurement

unit, whereas qualitative research gathers non-numerical data and is suitable for achieving an in-depth understanding of hidden reasons and motivations of a problem.

Despite the fact that qualitative and quantitative methods have similarities, this study aims to focus on the context of the B2C values that are being offered by MaaS providers, and reasoning behind decision making. Thus, it is qualitative in nature. In addition to collecting and understanding available materials, it needs a sensitive and in-depth method of collecting data, such conducting research on companies who aim to enter the market, and understanding what other experts have concluded in their research. To achieve that, most of the data are collected from materials that can be found on the Internet such as, MaaS providers' website, academic research, articles and journals about MaaS and user behaviours and expectation.

In addition to be a qualitative study, this is a case study research and carries cross-case study. For this purpose, after analysing each individual case, in the end, a cross-analysis of the studied cases will be conducted.

This study aims to define a theoretical expectation of an ideal MaaS product by collecting relevant data. By doing that, it is feasible to create a list of indicators being equipped with an ideal MaaS product. By providing these indicators, case studies of the selected companies are made to define the strengths and weaknesses of their product. By achieving that, the study can present the recommendations to overcome the weaknesses.

3.4 Data Collection

The information for conducting a research can come from a range of materials and sources. Likewise, several techniques can be used to gather primary data. As it has mentioned before, this research is a case study that involves studying a single phenomenon "MaaS", thus, data are collected from documents and other available material or records from the selected MaaS providers.

The case study method provides a way to use interview and documented materials for understating the reasons and logic behind each selected MaaS providers' actions and offers, however, there are some limitations for case study analysis. Methodological consideration, researcher subjectivity, and external validity are number of criticism that case study analysis has been subjected to, however, because MaaS in relatively a new phenomenon and there is a lack of numeric and long-term data about MaaS providers performance, this outcome of this case studies can be beneficial for further researcher about MaaS, it's offering, approaches to boost its development , and recommendations to involve more users and partners into the service.

In addition to data that are available online, the study aims to benchmark the service functionality of each provider. To achieve that, the applications that the service is accessible by, will be tested for its reliability. This includes a two weeks testing period for each service and the goal is to evaluate the service availability and reliability during the period.

To start collecting the data, it is required to gain understating and get familiar with targeted MaaS providers. Collecting data from publicly available material on MaaS Providers websites helps to understand and evaluate the value proposition of their offers from end users point of view and compare those values with MaaS as well as each other.

3.5 Data Analysis

The collected data about MaaS providers offerings need to take processes and procedures to transform into some form of interpretation and explanation. To achieve that, collected data from test results and MaaS providers' materials are organized and sorted into a defined framework. The study uses this framework to create descriptive analysis and explanation of collected data. This makes it easier to categorizes MaaS providers' offerings and do the comparison to achieve the research objectives.

For all four cases, collected data are grouped and explained within the theoretical framework. First, the collected data is analysed for each case individually and then, the cases are compared with each other in a cross-case study. The result of the analysed data is

represented in a table consisting of the theoretical framework and its indicators. By using the table, study analyses and benchmarks the four cases to identify their advantages and disadvantages from each other and ultimately from the desired MaaS.

Chapter 4 – Findings

4.1 Case: Whim

4.1.1 Company and its Services

Whim is a product of "MaaS Global", a Helsinki based company founded in 2015. The service can be identified as the first available product closest to MaaS concept in respect of its offerings and design. The founder of the company is known as the father of the MaaS concept. MaaS Global serves as an operator between transport service providers, users and third parties.

The Whim mobile app frees travellers to move easier and in an integrated way within the city. It combines public transport, taxis, cars rentals and more. A monthly Whim package can cover all daily journeys of a user and in addition to the monthly package, it can be used on a pay-per-ride basis. Whim can be synced with user's calendar and removes the hassle of travel planning by planning it in advance.

Currently, Whim is available in the Helsinki region in Finland and according to MaaS Global (2017), it will be expanded into the West Midlands, UK and Amsterdam area, NL at the end of 2017. In addition, negotiations are currently ongoing in several other cities including Vienna, Copenhagen, Antwerp, Toronto and Singapore.

4.1.2 Summary of Benchmarking

Whim offers a seamless experience to the travellers to take a journey from point A to B by providing taxi, public transport and car rental services within a single app in Helsinki region. Traveller is able to plan, choose, book, and pay for the mode of transit they wish to take. It offers several monthly packages in addition to pay-per-ride. Its price is competitive and in some cases cheaper than other services, however, there is no discount group available in the offering. For instance, students are unable to get the student discount for public transport despite the fact that they can benefits from it by the travel card offered by the public transport

provider. The Whim app is reliable and responsive, however, if a traveller faces a problem, there is lack of customer support for handling the issue. In addition to supporting issue, Whim app offers very limited extra features regarding environmental and health impact of selecting a specific mode of transport.

4.1.3 Benchmarking

4.1.3.1 Transit Mode Options: Whim offers three transport modes for moving from point A to B. Three modes are Taxi, Public Transport, and Car Rent (Figure 1 and 2).

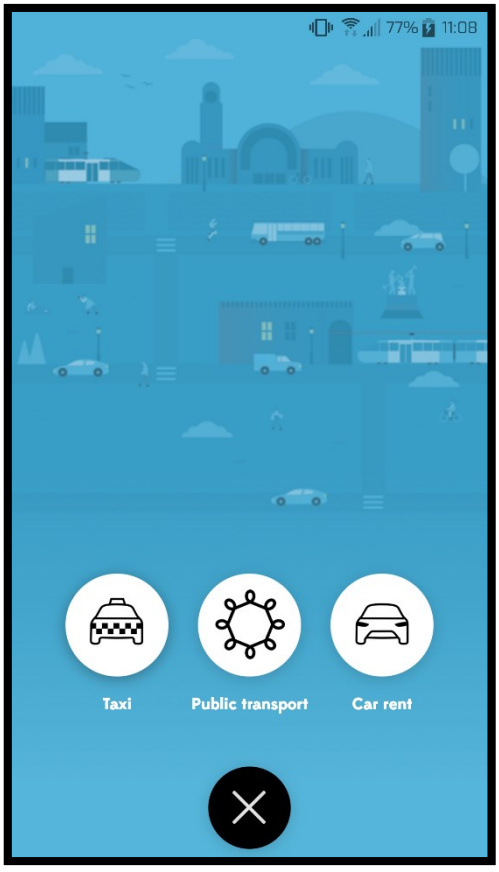

Figure 1: Selecting the mode for transport.

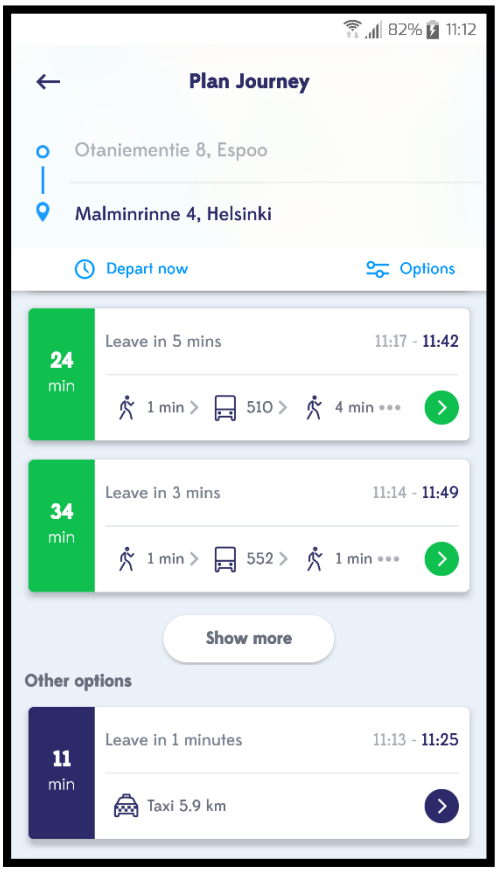

Figure 2: Planning a journey.

Taxi: Whim offers third parties taxi services within the app. If a user decides to use a taxi for moving from point A to B, after entering the starting point and the destination, they can request a taxi with an estimated price. In addition to that, before sending the request, the estimated time of arrival of the taxi and getting to

the destination is shown. For planning the journey by using the taxi mode, the user can request the type of taxi according to their needs. For instance a standard taxi or a minivan (Figure 3 and 4).

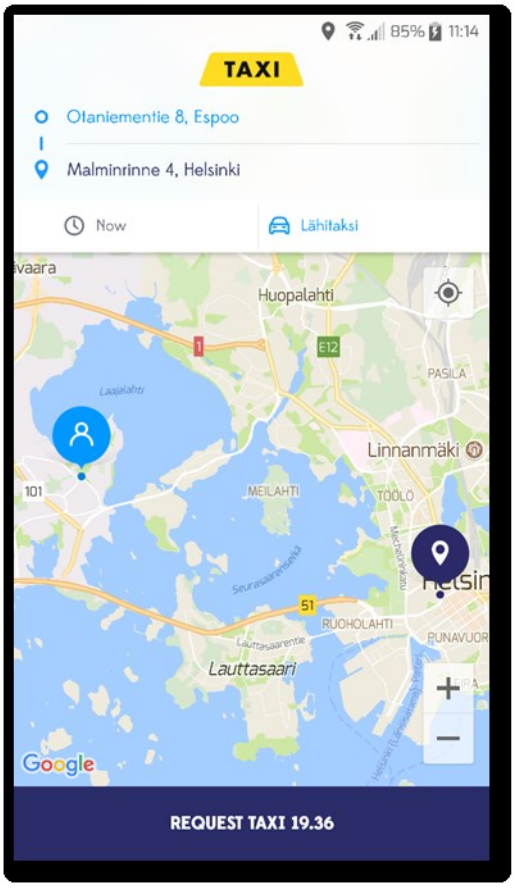

Figure 3: Requesting a taxi.

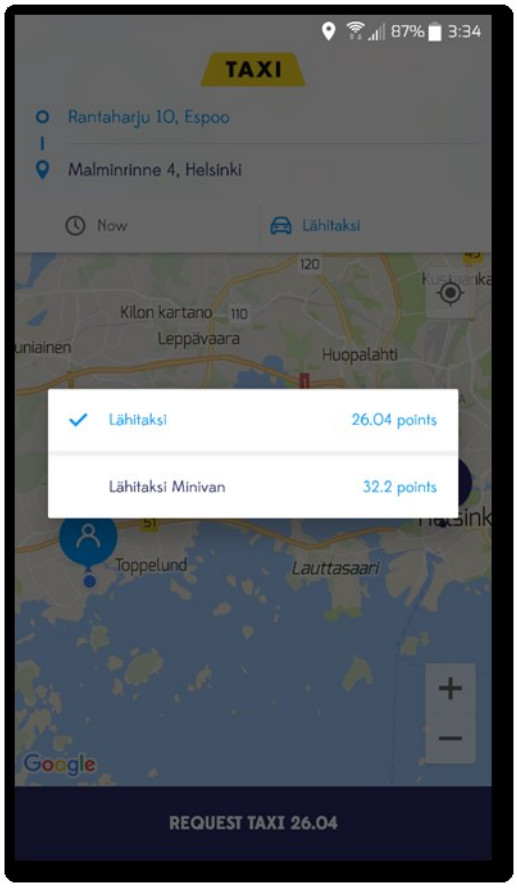

Figure 4: Choosing the type of taxi.

Public Transport: Whim offers its users Public Transport option as a mean to move from point A to B. This includes using Bus, Tram, Metro, and Trains. By subscribing to the monthly service or purchasing a single ticket, travellers are able to move around the city with any available public transport that is offered by Helsinki Regional Transport Authority known as HSL (Figure 5 and 6). Users can plan their journey by entering the destination and Whim guides them about how, when, and which public transport they should use. In addition to that, Whim estimates the time of arrival and offers other path or time options depending on user needs. This option can be sorted by Earliest Departure, Soonest Arrival, and Greenest Mode.

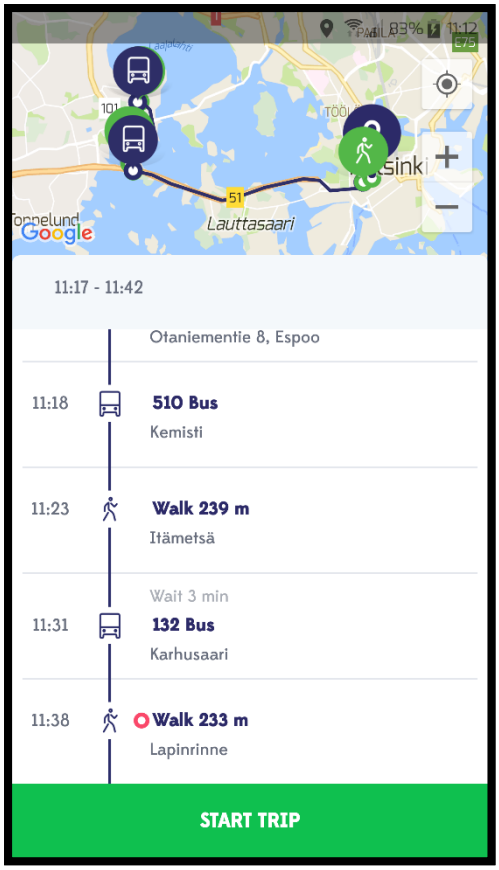

Figure 5: Path Finding.

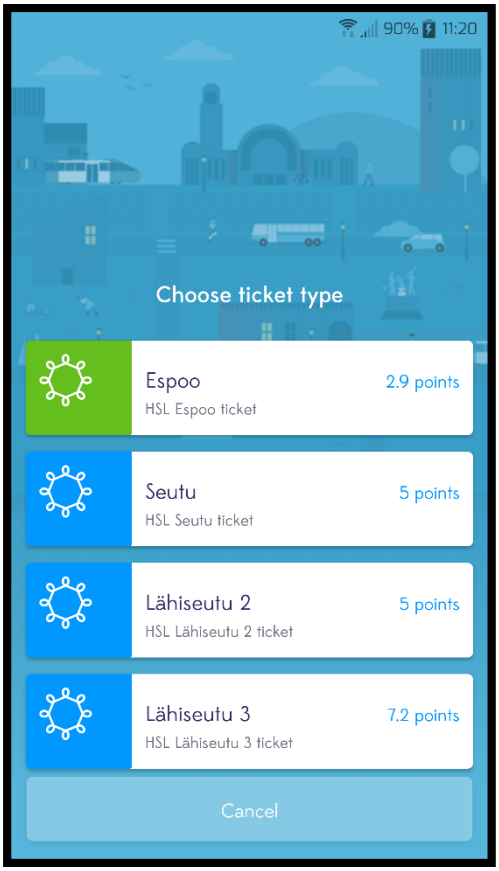

Figure 6: Choosing the type of ticket.

Car Rent: Whim provides its user renting a car as another option to move from point A to B. This service is offered by Whim and other third-party companies and within the app. However the availability of this mode depends on the selected package, any user can rent a car by paying its cost according to their needs. The location for picking up the rented car is not defined by the user nor adjustable. It is based on pre-located terminals where the Whim or car rental company pick up points are. There are several types of car available to choose and the traveller can decide base on their needs and budget (Figure 7 and 8).

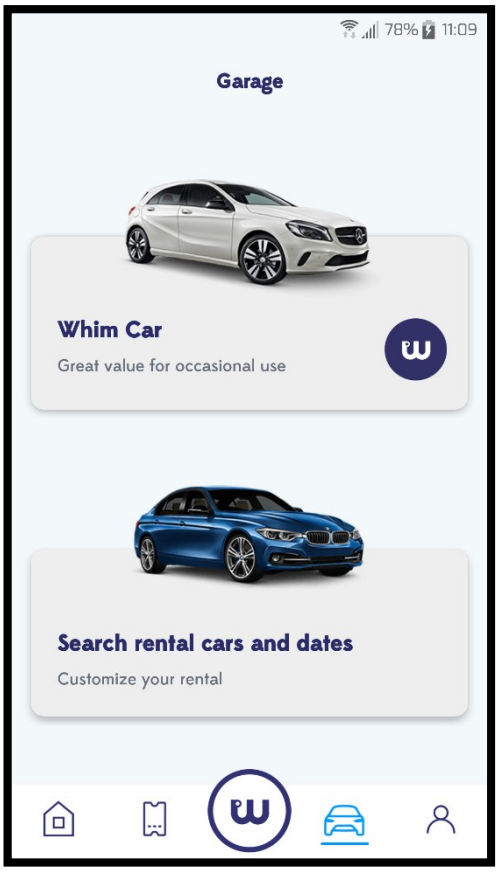

Figure 7. Choosing Car Rent Company.

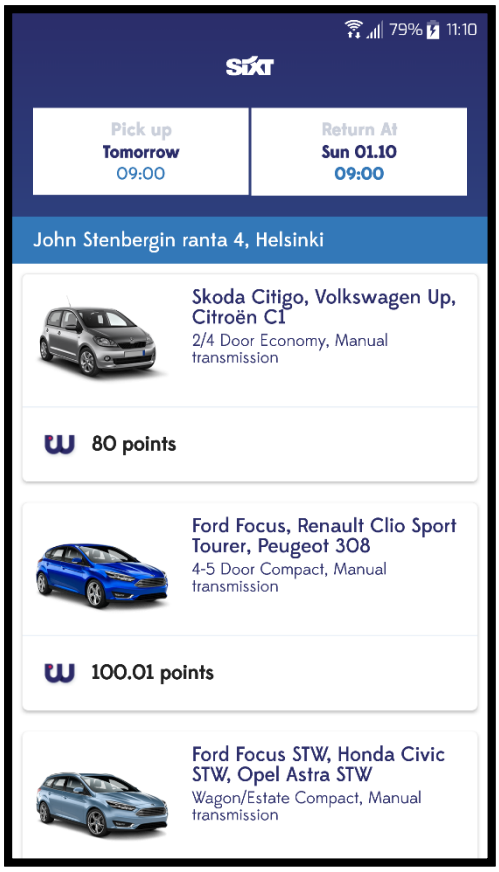

Figure 8. Available Cars.

4.1.3.2 Service Availability: In terms of accessing to the service, Whim is currently available only as an application to be installed on iOS and Android devices with the Android app currently in Beta phase (September 2017). Until now, there is no web application for accessing the service and there is no announcement regarding launching a web application for the service.

According to MaaS Global (2017), In terms of geographical area of service availability:

> Whim is currently launched in the Helsinki region in Finland in 2016, the Whim service is being piloted in the West Midlands, UK, and later this year in Greater Amsterdam in the Netherlands. In addition, negotiations are currently ongoing in several other cities including Vienna, Copenhagen, Toronto and Singapore. The launch in Antwerp, Belgium, was announced in a press briefing on the 30th of September. It's expected that the first test users

will get their hands on the service later this year, with a commercial launch to follow in early 2018 (MaaS Global, 2017).

4.1.3.3 Service Reliability: The reliability and functionality of Whim can be studied from two perspectives. First, the service that is offered by Whim which is the focus of the test and the study and second is the service that is offered by mobility providers that are integrated into the Whim service, such as public transport or taxi companies.

Whim: A two weeks test period was planned and conducted for measuring the simple functionality of the Whim service such as planning, pricing, and responsivity in Helsinki region (20th September to 3rd October). During this two weeks, every day from 8:00 AM to 10:00 PM, planning a journey by using public transport, requesting a taxi, and searching to rent a car were tested seven times every two hours. The service was available and responsive in all tests except on 2th of October where it was a service break for around two hours (2:00 PM to 4:00 PM), however, the app announced it both before and after the break when the service was up again. Regarding, planning and schedule to use public transport, path and transport mode suggestion were same as the providers own platform such as "HSL Reittiopas" journey planner in Helsinki region in Finland.

Mobility Providers: Whim main offering is to integrate available mobility modes and offer them into a single service. Despite the fact that changes in schedule or estimations can affect user experience but it is more public transport or taxi companies responsibilities to fulfil the traveller's needs in respect of schedule and being on time, due to the fact that Whim is unable to have a major impact on the performance of these third-party companies.

4.1.3.4 Price: The price of using the Whim service in Helsinki City is the indicator for doing the price comparison. Whim offers four different pricing to address users mobility needs These four options are Pay Per Ride, Whim Urban, Whim Go, and Whim Business.

Pay Per Ride: No monthly fee and commitment. The user can take a journey by selecting from all transport mode offered by Whim, and pay for trips as they go. The cost is the same as the price of providers' official way to purchase a ticket (Figure 9).

Whim Urban: Travellers have unlimited use of public transport in Helsinki. Taxi ride up to 15€. It costs 55€ per month but worth 70€. In addition, travellers can access to cars, and taxis just pay as they go. This package is 21.42% cheaper compared to the its standard cost for the travellers (Figure 10)

Whim Go: Travellers have unlimited use of public transport in Helsinki. Taxis and car rentals up to 124€. It costs 149€ per month but worth 179€. In addition, travellers can access to cars, and taxis just pay as they go. This package is 16.75 % cheaper compared to its standard cost for the travellers (Figure 11).

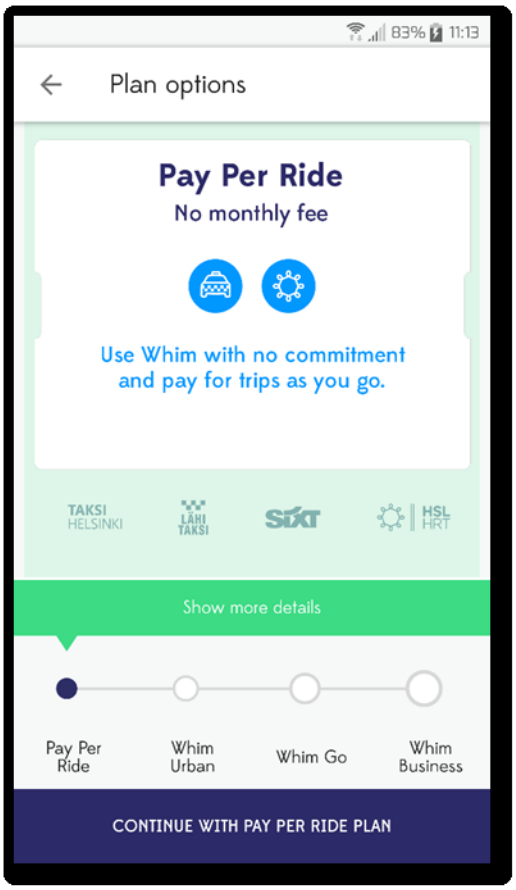

Figure 9: Pay per ride.

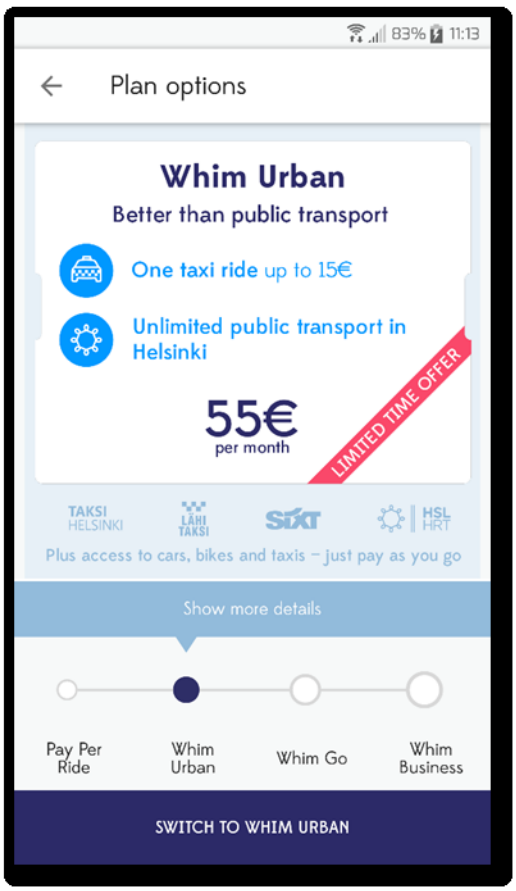

Figure 10. Whim Urban.

Whim Business: Unlimited travel plan including taxis, public transport, and car rental. This package aims to address businesses mobility need. The price and value of it are undefined. It is based on a contract between Whim and the corporate customers. For any enquiries, corporate customers need to contact Whim directly, and study is unable to define the price and value of this plan (Figure 12).

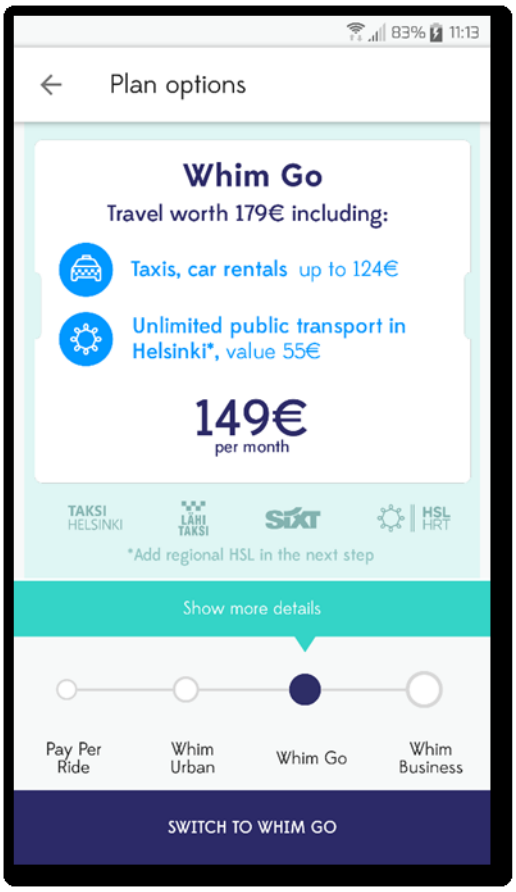

Figure 11: Whim Go.

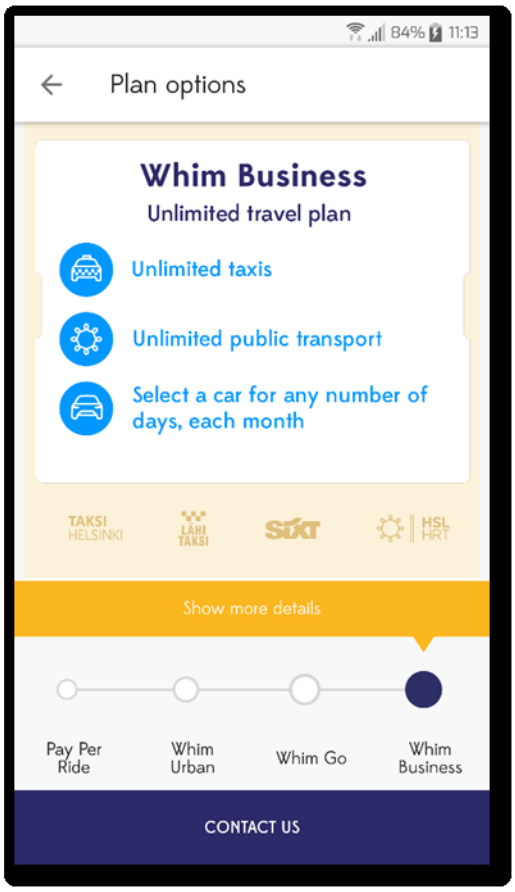

Figure 12: Whim Business.

4.1.3.5 Information: The process of planning a trip starts with entering the destination on the main page of the Whim app. After that, all the available transport options are shown on the screen. These options briefly give information about duration of the journey, departure and arrival time, estimated duration of walking, and the public transport Name/ Number the user need to take. The user may select one of these options fitting they need.

By selecting an option, a detailed journey plan is presented to the user. These details include estimated time of journey and arrival, routing on the map, Name/ Number and locations of a transfer (if any), and a detail about the distance of walking for instance 400 m (Figure 13, and 14).

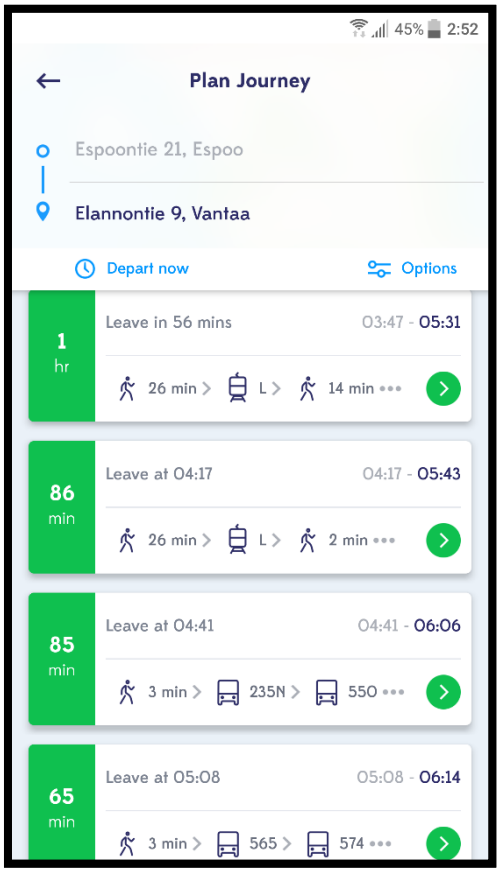

Figure 13: Available mode.

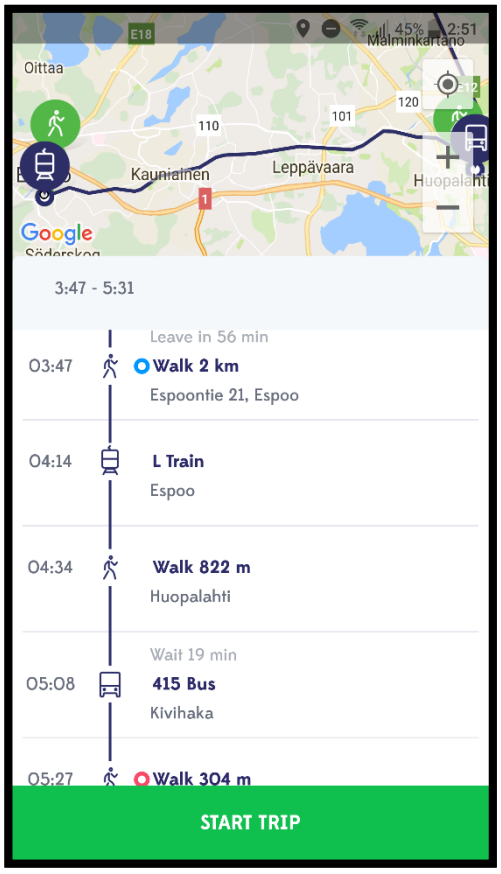

Figure 14: Routing guide.

4.1.3.6 Payment Options: Whim offers debit/credit cards including Visa, Master, and American Express as a method for payment. Payments are being accepted as Euros and then converted to points then travellers can use them to purchase a ticket, hire a taxi, rent a car or use for a monthly plan. Each one Euro equals to one Whim point. The user can add their debit or credit card information in the app and use for payments. For monthly plans, there is an auto-renewal by default, however, the user can cancel it if they want (Figure 15 and 16).

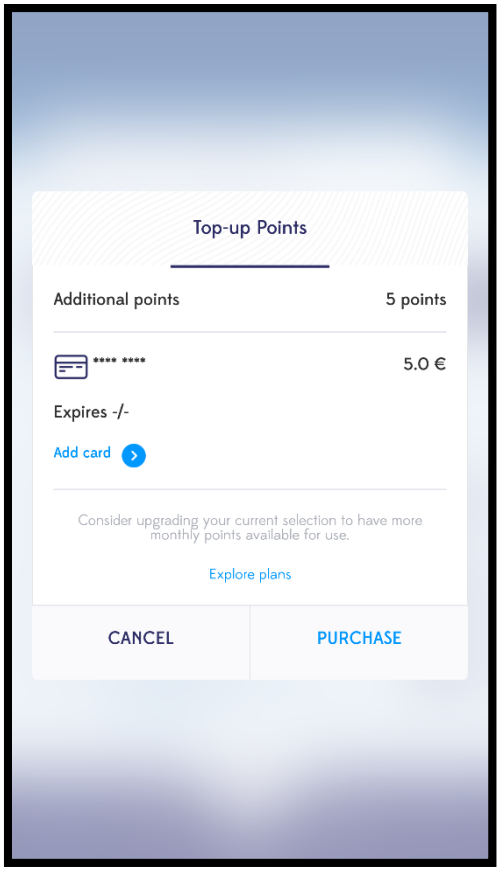

Figure 15: Top-up points.

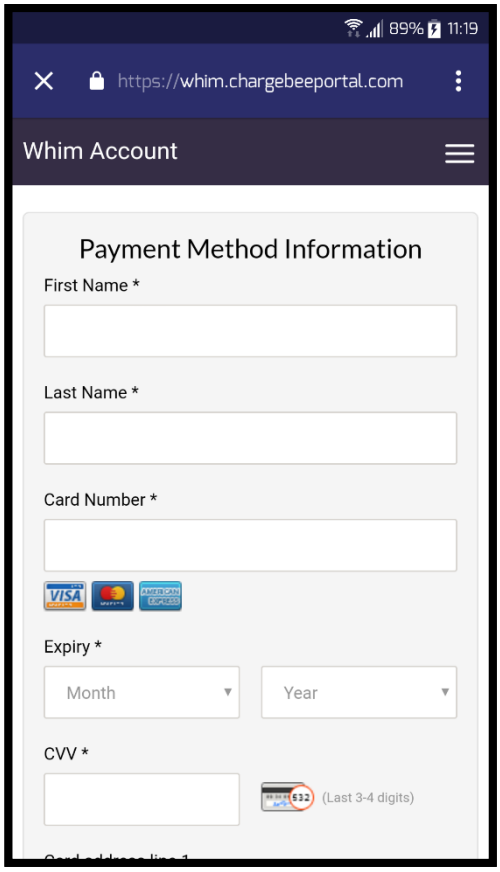

Figure 16: Payment methods information.

4.1.3.7 Seamlessness: Whim app is designed in a way that provides a seamless user experience to for planning, taking, and paying for a journey. All the required steps are being handled within the Whim app with a simple and user-friendly process. There is no redirection to any other websites or applications to complete the process of moving from point A to B. Everything is proceed and handled within a single app.

4.1.3.8 Customer Support: Whim offer in-app customer support only through submitting a ticket. There are several guides to solving possible issues that may happen while using the service. It covers a broad range of topics and questions that a user may face during interacting with the service and detailed guide including pictures on how to solve the issues. To test the customer support responding time, a ticket was submitted, however, there were never was a response to the ticket (Figure 17 and 18).

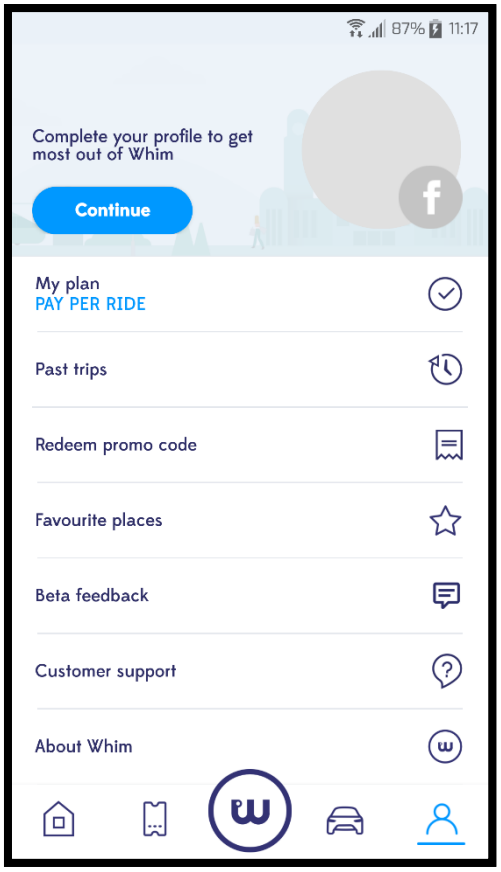

Figure 17: Customer support in account setting.

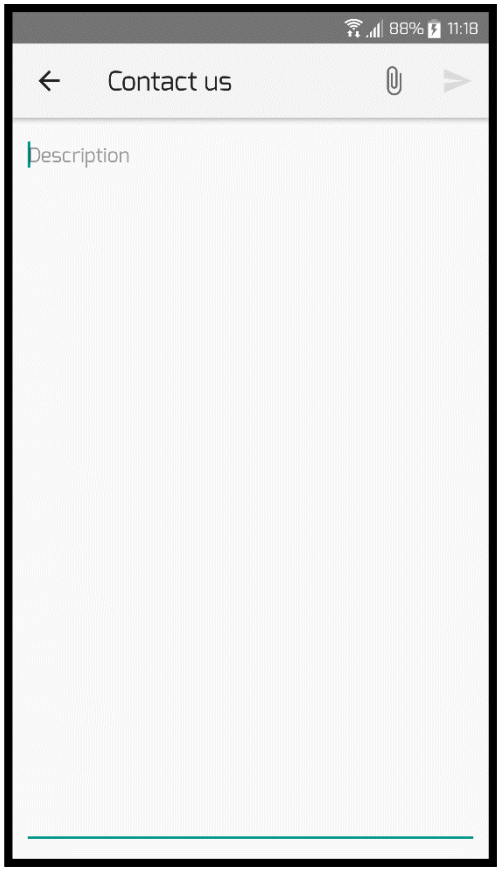

Figure 18: Submitting a ticket.

4.1.3.9 Environmental, Health Impacts and Extra Features: Currently, Whim only offers a sorting option based on greenest mode on its platform. When user plan a journey and several options are shown, they can sort the result by "Greenest Mode", however, there is no clear definition of how Whim defines that. There is lack of information about environmental and health impacts of choosing a specific mode or route for taking a trip. In addition, it enables the user to add favourite places and sync their calendar with the app.

4.2 Case: Moovel

4.2.1 Company and its Services

Moovel is the product of Daimler, the company that invented the automobile in 1886 and owns Mercedes-Benz. The service offers new ways to connect the urban mobility ecosystem

in Germany and they offer complementary products: Moovel App, Moovel Transit and RideTap. The Moovel App can be identified as a mobility service and can fit in this research.

Moovel enables users to Search, book and pays for rides with a single app. By using Moovel in Germany, travellers can simply book and pay for car2go, mytaxi and Deutsche Bahn in a single experience. The Moovel mobility app is available throughout Germany, however, public transportation mobile payments are available in Stuttgart and Hamburg and in this benchmark, available services in these two cities have been studied.

The service is available mainly in Germany, however, it is possible to be used in 12 more cities around the world with fewer offerings compared to its offerings in Stuttgart and Hamburg. To explain more, in other cities it provides information about the route, arrival data, the price for public transportation, and in some cities real-time transit data and link to Uber when public transportation is not the option to go for the users.

4.2.2 Summary of Benchmarking

Moovel offers a seamless experience to the travellers to take a journey from point A to B by providing taxi, public transport and car-sharing services within a single app in Stuttgart and Hamburg in Germany. Traveller is able to plan, choose, book, and pay for the mode of transit they wish to take. It only offers pay-per-ride and there is no monthly or package subscription. Its price is same as the market price for the providers that are integrated into the service. The Moovel app is reliable and responsive and if a traveller faces a problem, there is 24/7 support available through the phone for handling the issue. Moovel provides no information regarding the environmental or health impact of taking a specific mode of transport to take a journey.

4.2.3 Benchmarking

4.2.3.1 Transit Mode Options: Moovel offers its five transport modes for moving from point A to B when users want to search for modes, however, at the time of

conducting this study, Taxi, Public Transportation, and Car-Sharing are available to use (Figure 19 and 20).

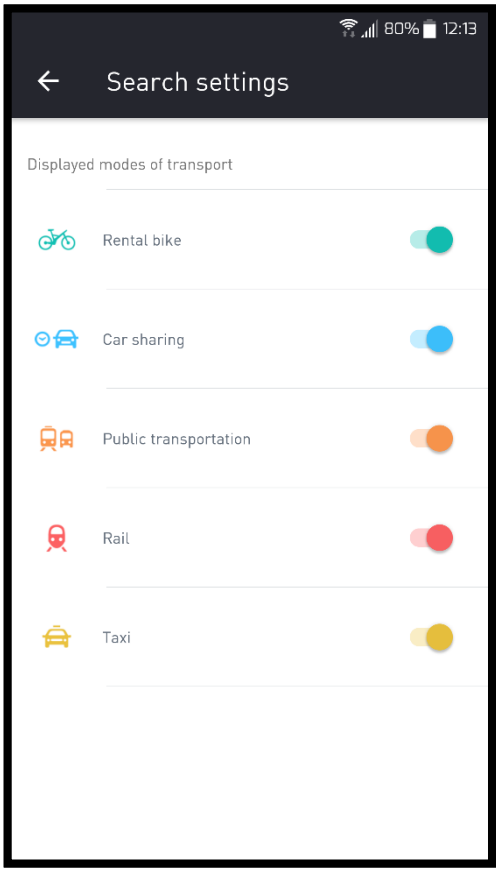

Figure 19: Selecting the mode for transport.

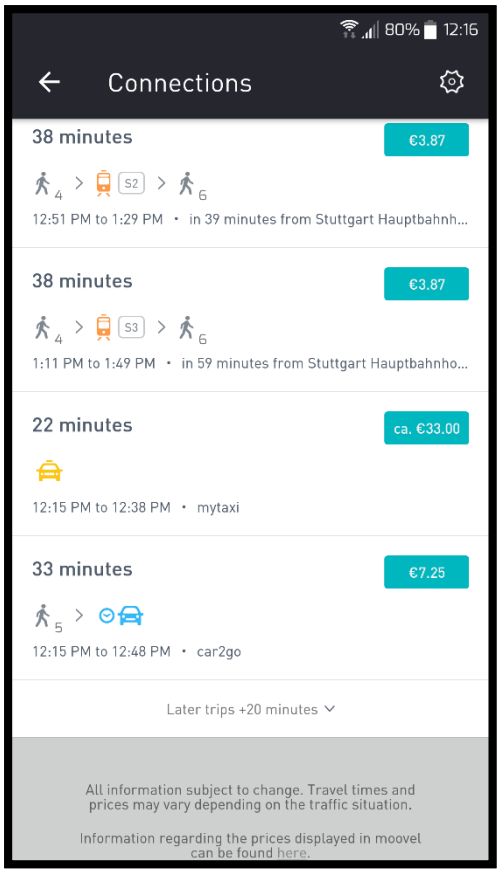

Figure 20: Available mode

Taxi: Moovel offers third-party taxi service within the app. If a user decides to use a taxi for moving from point A to B, after entering the starting point and the destination, they can request a taxi with an estimated price. In addition to that, before sending the request, the estimated time of arrival of the taxi and getting to the destination is shown. For planning the journey by using the taxi mode, the user can send a message to the driver by writing it in a text field while they want to pay for the order but there is no option to choose the type of taxi (Figure 21 and 22).

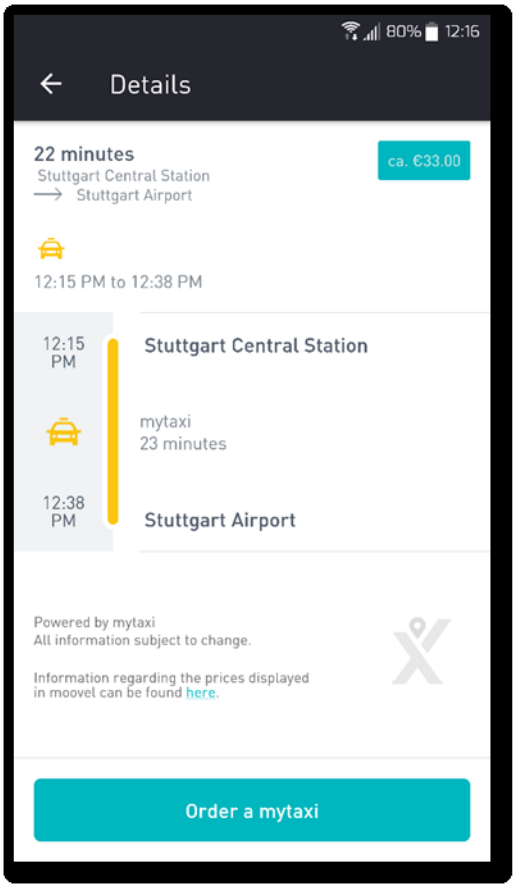

Figure 21: Requesting a taxi.

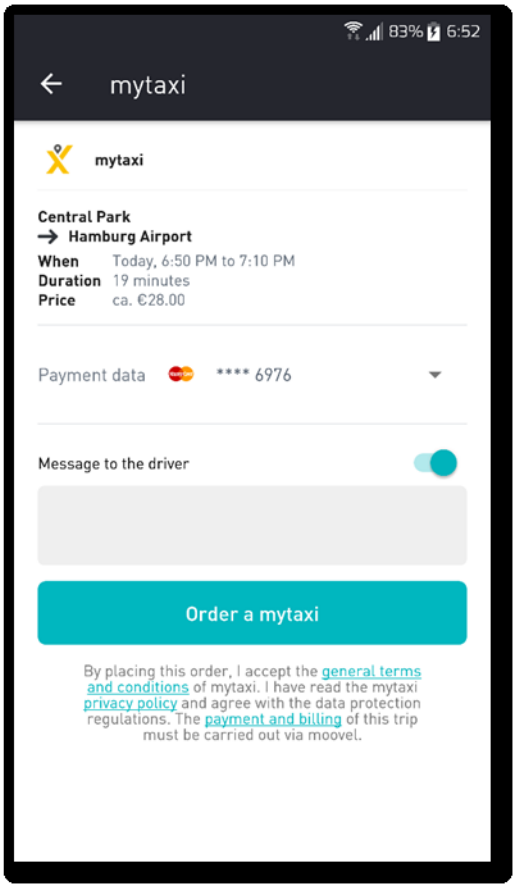

Figure 22: Adding a message to the order.

Public Transport: Moovel offers its users Public Transport option as a mean to move from point A to B. This includes using Bus, Metro, and Trains. The service provider in Hamburg is HVV and in Stuttgart is VVS. Users can plan their journey by entering the destination and the app guides them about how, when, and which public transport they should use. Travellers can purchase the ticket they need within the app and after selecting the mode. In Hamburg, users can choose between a single or day ticket, however, such an option is not available for the Stuttgart service. In addition to that, Moovel estimates the time of arrival and offers other path or time options depending on user needs (Figure 23 and 24).

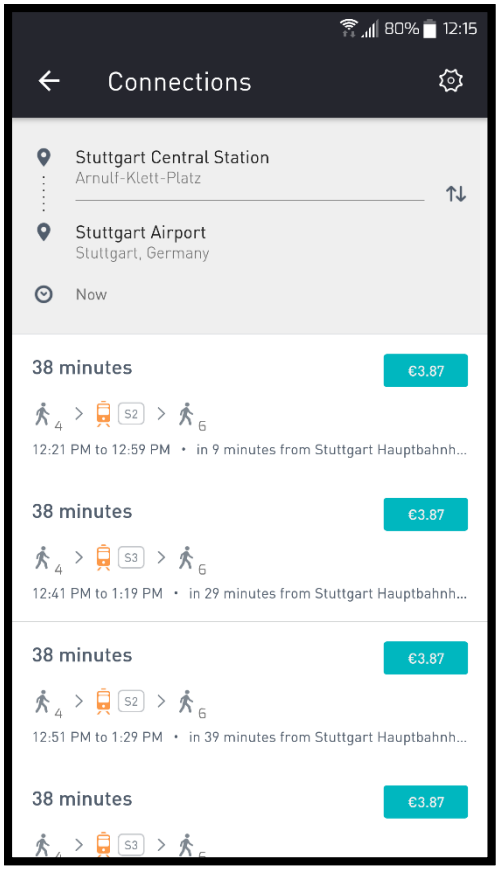

Figure 23: Available connections.

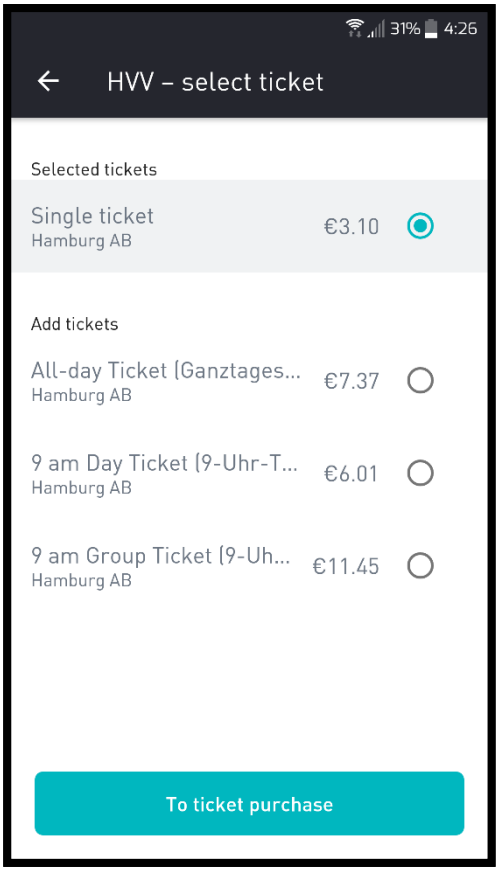

Figure 24: Choosing the type of ticket.

Car-Sharing: Moovel provides its user with a car-sharing service named Car2Go. This service is offered within the app, however, for using the car-sharing service, the user must have entered valid information about their address and driving licence. Depending on the requested location, the app guides the user regarding where to access the car. In addition, the estimated price of using the car-sharing service is shown to the user. If a user decides to use the car-sharing service, the can simply reserve the car and unlock its door within the app. The type and number of cars can vary based on starting point of the trip. While reserving the car, the user can see the type of car and the amount of available fuel inside the car's fuel tank (Figure 25 and 26).

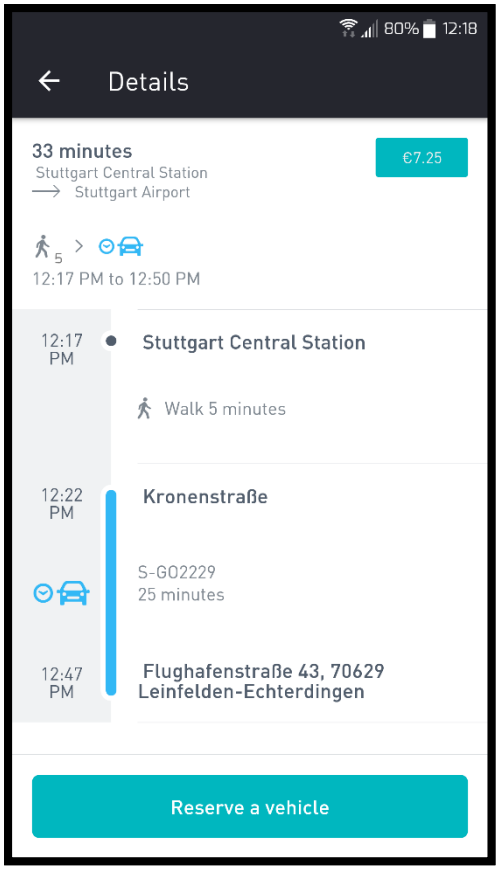

Figure 25: Reserving a vehicle.

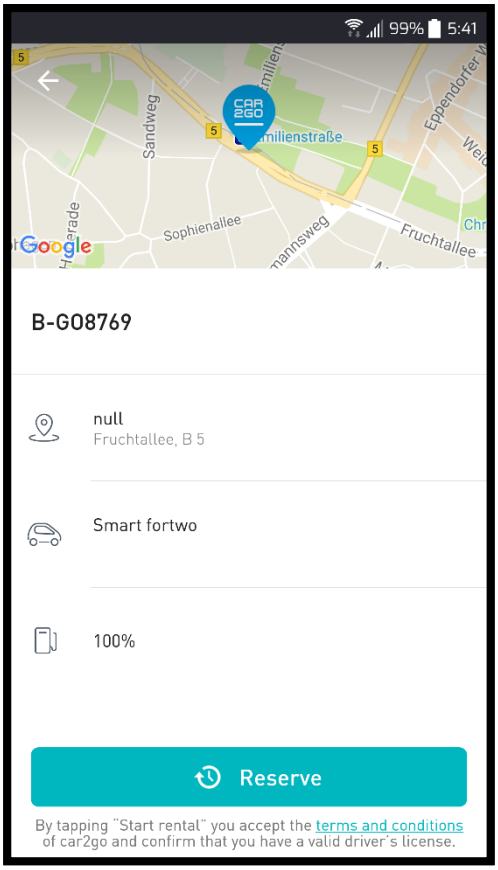

Figure 26: Vehicle detail.

4.2.3.2 Service Availability: In terms of accessing the service, Moovel is currently available only as an application to be installed on iOS and Android devices. Until now, there is no web application for accessing the service and there is no announcement regarding launching a web application for the service.

In terms of geographical area of service availability, Moovel is available mainly in Stuttgart and Hamburg in Germany. Users are able to purchase the tickets of public transportation, reserve a car from car-sharing service, and order a taxi from third-party companies within the app. In other cities, such as Amsterdam, Barcelona, Helsinki, Kiev, Lviv, Madrid, Oslo, and Vienna in Europe; and Austin, Boston, and Portland in North America; and Sydney in Oceania, Moovel offerings are limited to Journey planning, estimated price (some cities), real-time data of taken trip (some cities), and is some cities link to Uber service as an added option.

4.2.3.3 Service Reliability: The reliability and functionality of Moovel can be studied from two perspectives. First, the service that is offered by Moovel which is the focus of the test and the study and second, is the service that is offered by mobility providers that are integrated into the Moovel service, such as public transport, car-sharing services, and taxi companies.

Moovel: A two weeks test period was planned and conducted for measuring the simple functionality of the service, such as planning, pricing, and responsivity in Hamburg and Stuttgart region (7th to 20th November). During this two weeks, every day from 8:00 AM to 10:00 PM, planning a journey by using public transport, requesting a taxi, and reserving a car were tested seven times every two hours. The service was available and responsive in all tests without any problem. Regarding, planning and schedule to use public transport, path and transport mode suggestion were same as the provider's own platform such as "HVV" journey planner in Hamburg region and "VVS" journey planner in Stuttgart area.

Mobility Providers: Moovel main offering is to integrate available mobility modes and offer them into a single service. Despite the fact that changes in schedule or estimations can affect user experience but it is more public transport or taxi companies responsibilities to fulfil the traveller's needs in respect of schedule and being on time, due to the fact that Moovel is unable to have a major impact on the performance of these third-party companies.

4.2.3.4 Price: The price of using the Moovel service in Hamburg and Stuttgart is the indicator for doing the price comparison. The service offers only Pay-Per-Ride, meaning there is no option to subscribe to the service or select a package based on the travellers' need. This mode of pricing applies to all the public transport, car-sharing, and taxis. In respect of price comparison, the cost of using the any available service is exactly the same as purchasing a ticket, reserving a car, and ordering a taxi from the third-parties own platform, meaning considering the price, Moovel offers no extra benefits to the users (Figure 27 and 28).

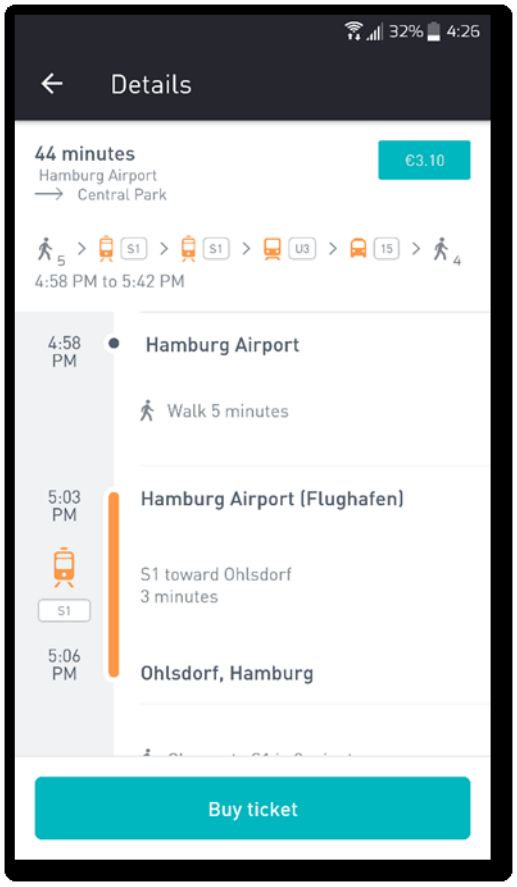

Figure 27: Ticket detail.

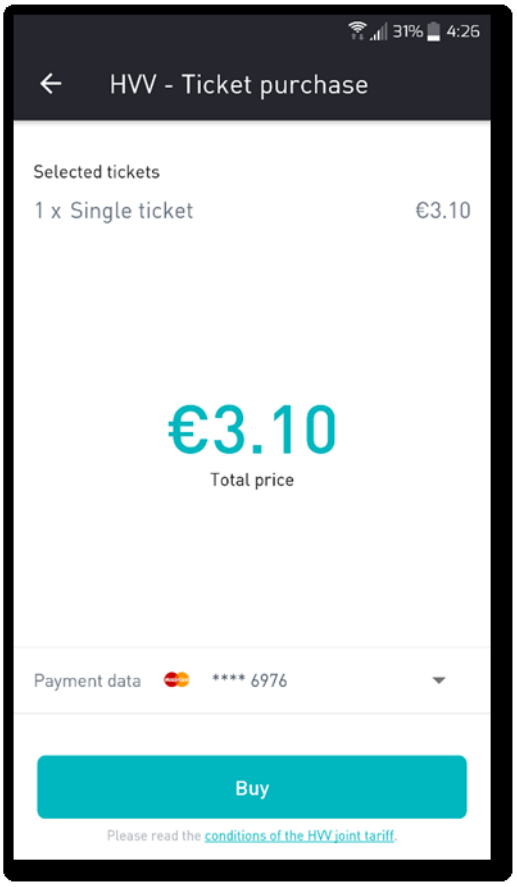

Figure 28: Purchasing the ticket.

4.2.3.5 Information: The process of planning a trip starts with entering the destination on the main page of the Moovel app. After that, all the available transport options are shown on the screen. These options briefly give information about duration of the journey, departure and arrival time, estimated duration of walking, and the public transport Name/ Number which the user needs to take. The user may select one of these options which fit they need.

By selecting an option, a detailed journey plan is presented to the user. These details include estimated time of journey and arrival, Name/ Number and locations of a transfer (if any), and a detail about the duration of walking for instance 5min. However, before purchasing the ticket, the route that the traveller needs to take is not shown on the map (Figure 29 and 30).

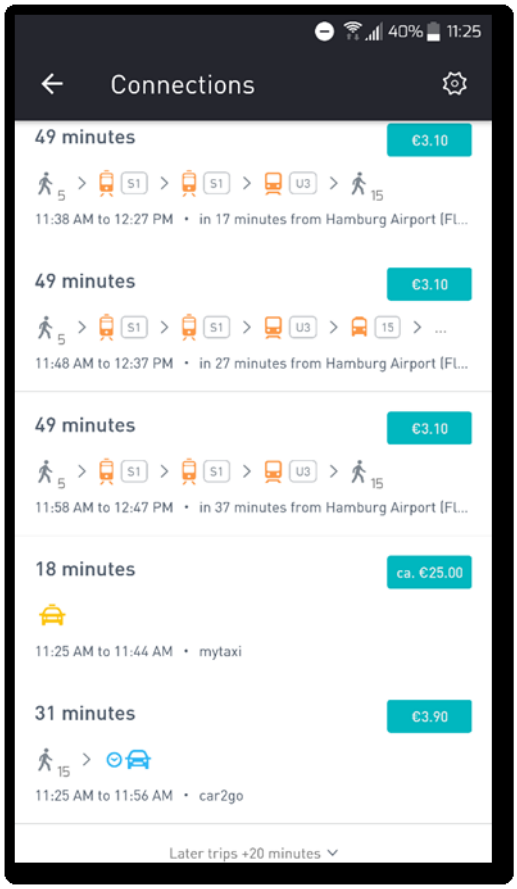

Figure 29: Available mode.

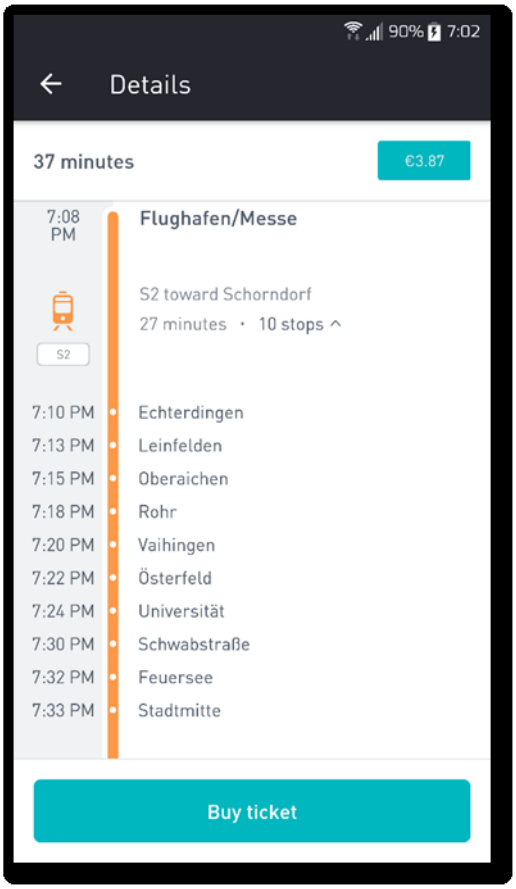

Figure 30: Routing guide.

4.2.3.6 Payment Options: Moovel offers PayPal and debit/ credit cards including Visa, Master, and Amex as a method for payment. Payments are being accepted as Euros. The user can add their PayPal and debit/credit card information into the app and use for later payments. (Figure 31 and 32).

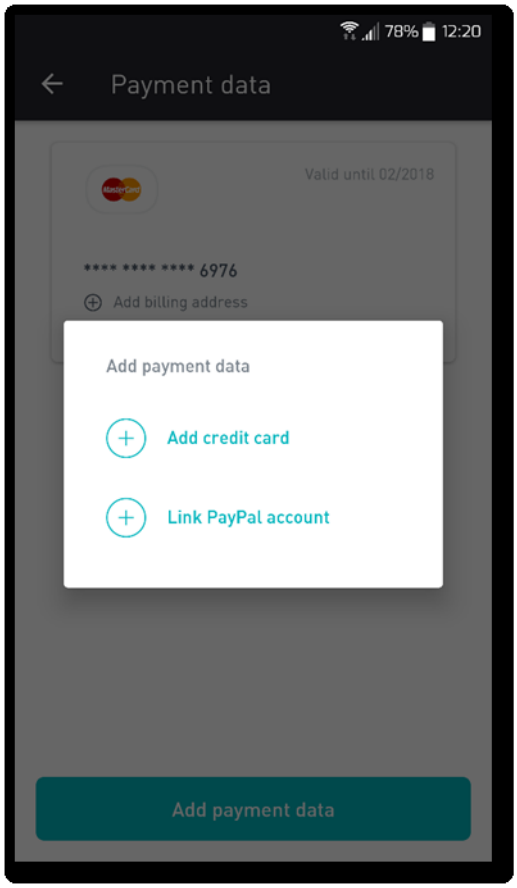

Figure 31: Selecting a payment method.

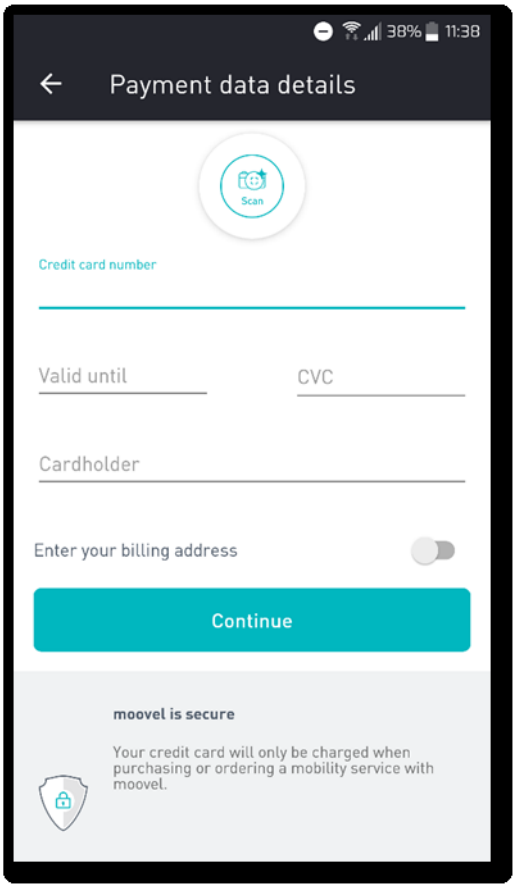

Figure 32: Payment data details.

4.2.3.7 Seamlessness: Moovel app offers a seamless user experience for planning, taking, and paying for a journey in Hamburg and Stuttgart for all the available transport mode. It is being handled within the app with a simple and user-friendly process. However, in other countries, where Uber is available as a mode to transport within the app, the user will be redirected to a link for ordering Uber.

4.2.3.8 Customer Support: Moovel offers customer support through 24/7 phone service and email. A phone call was made and response time was less than a minute. The number can be used for customer support and business enquiries. To test the customer support responding time with email, a message was sent and the reply received after four hours (Figure 33 and 34).

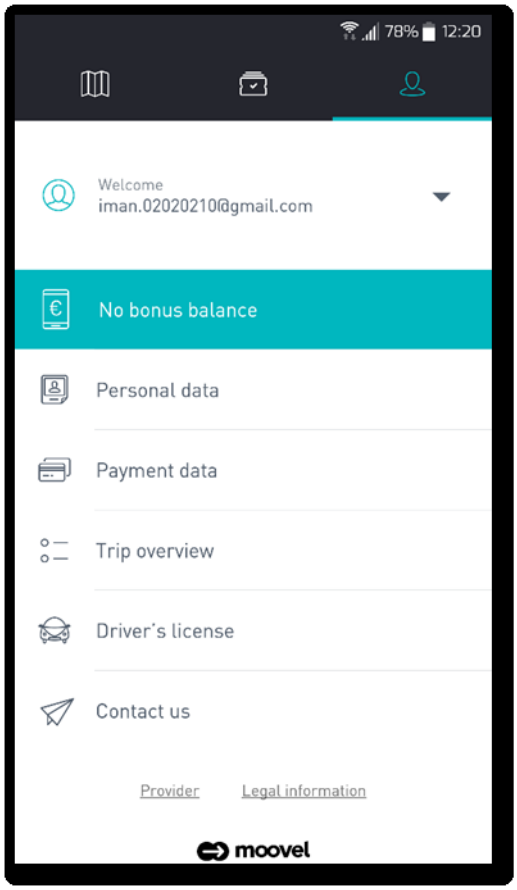

Figure 33: Customer support in account setting.

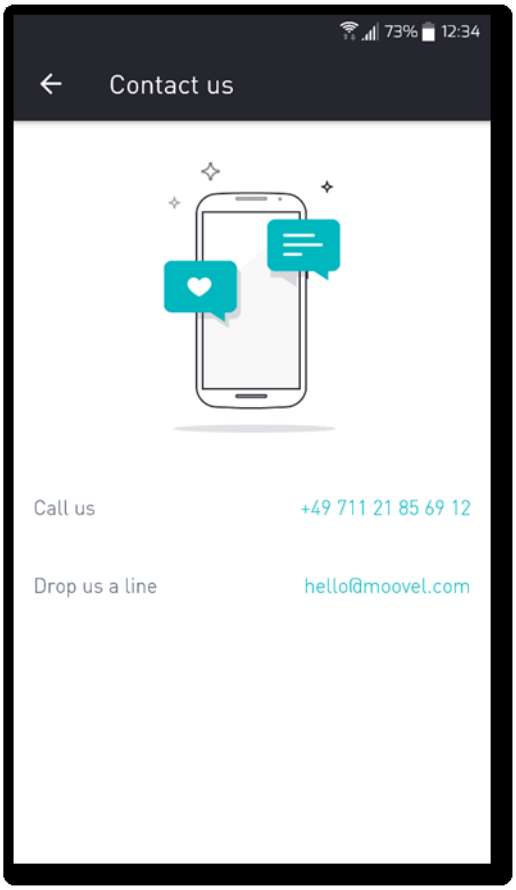

Figure 34: Contact information.

4.2.3.9 Environmental, Health Impacts, and Extra Features: Moovel app provides no information regarding the environmental and health impacts of taking a specific mode of transport.

4.3 Case: Go LA

4.3.1 Company and its Services

Go LA is a product of the city of Los Angeles and is powered by Conduent. Go LA offers a new way of planning and taking a journey by integrating all the available mode of transport to get around in the second largest metro area in the US. As this service is changing the old

way of moving around in Los Angeles, it is an interesting case to be benchmarked in this study.

The Go La service calculates and aggregates the time, cost, health impact, and carbon emission of each transport mode that travellers decide to take. The app shows all forms of transportation options and computes the fastest, cheapest, and greenest way to get to the destination. It covers this information for walking, biking, motorcycling, driving private car, public transport, several ride-sharing and car-sharing options, and parking.

4.3.2 Summary of Benchmarking

Go LA app provides real-time information about how to take a journey from point A to B by using almost all available modes of transport. However, it offerings are limited to information on pricing and pathing, meaning travellers are not able to purchase or book their trip by using the service. Service is available on smartphone and web application. Go LA provides a platform for travellers to decide and plan a journey according to their needs, however, regarding booking and paying, the app only provides a link to each individual mobility providers, thus the process of booking and payments go through third-party providers' own platform. Currently, the service is available in the LA Metro area.

It is reliable and responsive, however, there is no customer support available to handle issues while using the service. By providing detailed data about transport mode emission impact, in addition to the health impact of taking a specific mode of transport, Go La provides comprehensive platform featuring monthly and daily report for the traveller to monitor their environmental and health impact of deciding how to move from point A to B.

4.3.3 Benchmarking

4.3.3.1 Transit Mode Options: Go LA guides on how to take a journey by walking, biking, driving, taxi, public transport, ride-sharing, car-sharing (Figure 35 and 36).

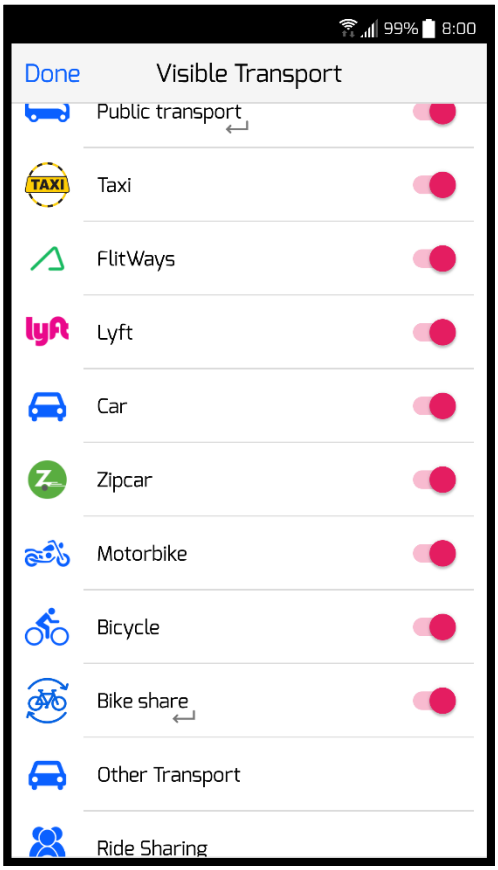

Figure 35: Available mode for transport.

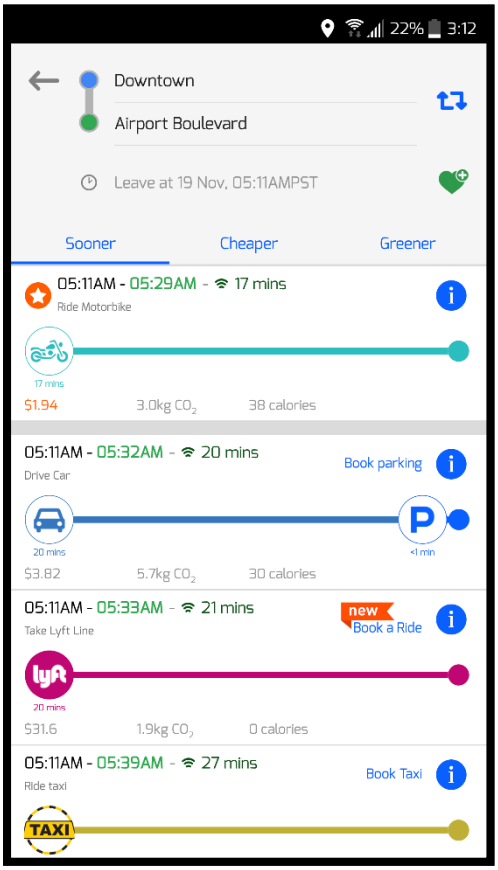

Figure 36: Planning a journey.

Mode of Transport: Go LA main offering is planning and guiding users on how to move from point A to B by considering all the available modes within that area. This method applies to all the mode with the same approach. It offers third parties taxi services within the app. when a user enters starting and destination location, the service searches for all the possible mode to get to the destination. it includes several modes from walking to car-sharing. Then user can see more detail for each result (Figure 37).

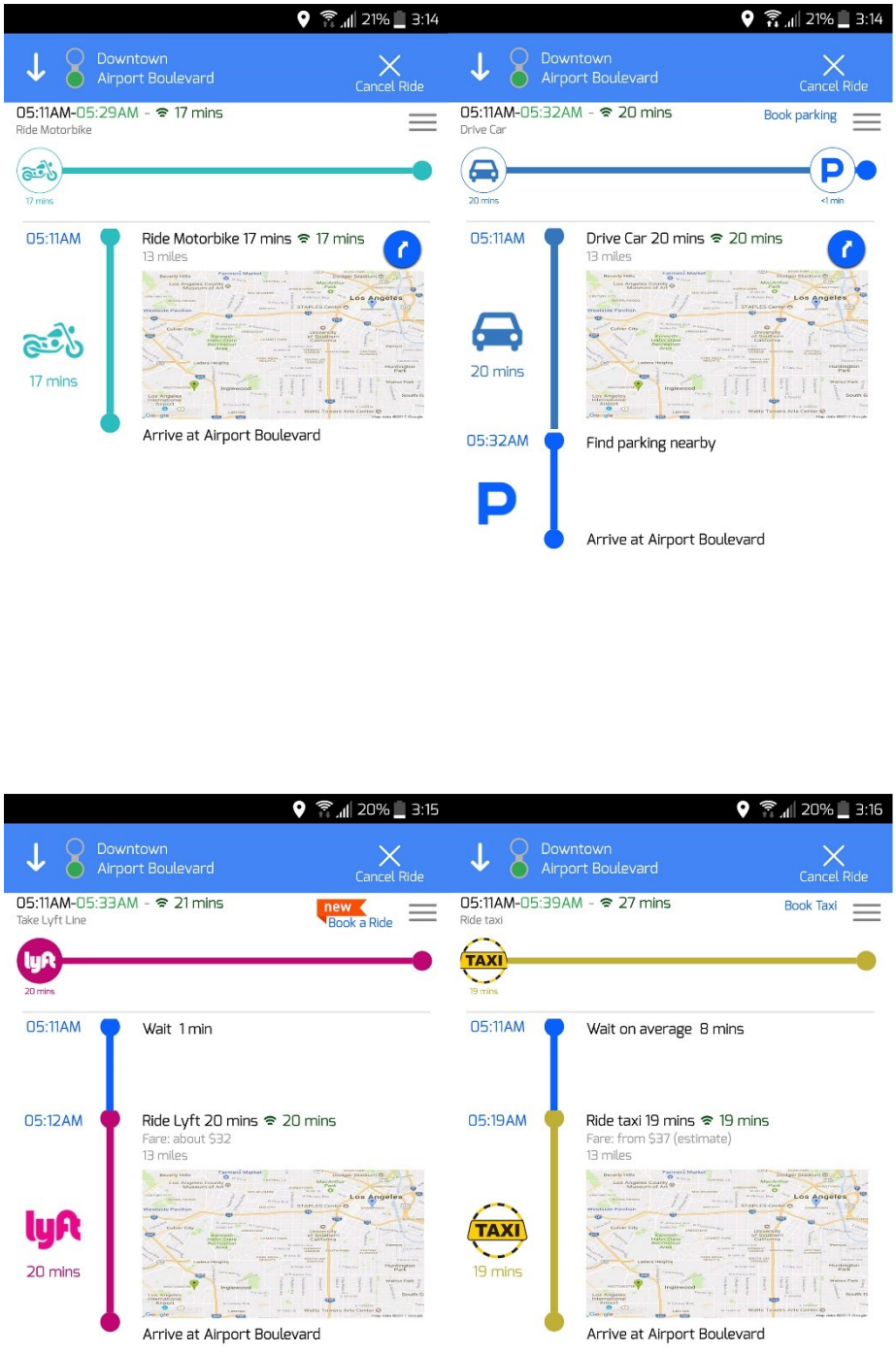

Figure 37. Transport mode in detail.

4.3.3.2 Service Availability: In terms of accessing the service, Go LA is currently available as an application to be installed on iOS and Android devices. In addition to the mobile application, the service can be accessed through web application with PC.

In terms of geographical area of service availability, Go LA Trip planning is built for LA Metro area. The service covers most of Los Angeles County, except for north of Angeles National Forrest (Palmdale, Lancaster or Gorman), Catalina Island and San Clemente Island. It also covers all of Orange County and parts of Riverside County, San Bernardino County, and Ventura County (Go LA 2016).

4.3.3.3 Service Reliability: The reliability and functionality of Go LA can be defined by the accuracy of the provided trip planning data, in addition to service responsivity in providing the data. For accuracy of the data, a comparison with Google Maps service was performed and the results for planning a trip were similar together. They both suggested several options to move from point A to B, and starting time, duration, and estimated arrival time were exactly the same for any particular mode and route.

A two weeks test period was planned and conducted for measuring the responsivity of the service in Los Angeles (7th to 20th November). During this two weeks, every day from 8:00 AM to 10:00 PM, planning a trip from point A to B were tested seven times every two hours. The service was available and responsive in all tests without any problem. Regarding, planning and schedule to use public transport, path and transport mode suggestion were same as the provider's own platform and Google Maps.

4.3.3.4 Price: Go LA provides its user with the exact price of public transport such as metro and bus ticket, and an estimated price for using car-sharing, ride-sharing, and taxi. In addition to that, it estimates the cost of driving a private car or using a motorcycle, however, the metrics for this calculations are unclear (Figure 38 and 39).

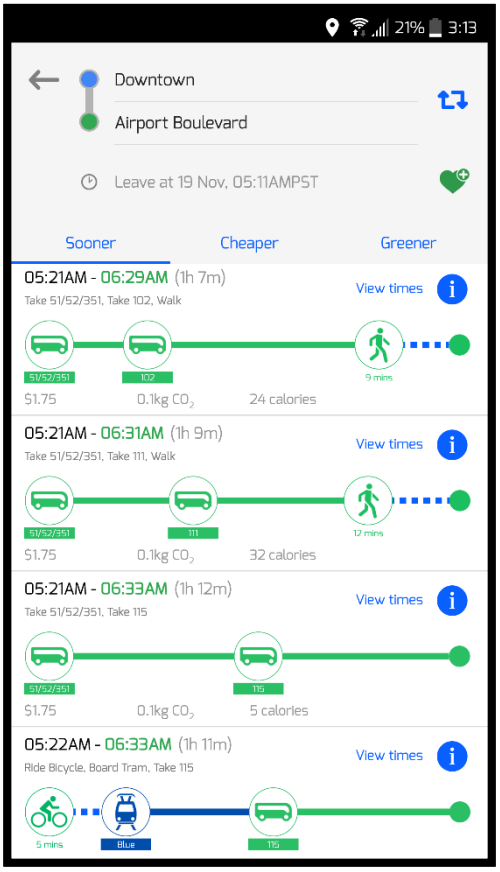

Figure 38: Price estimation of public transport.

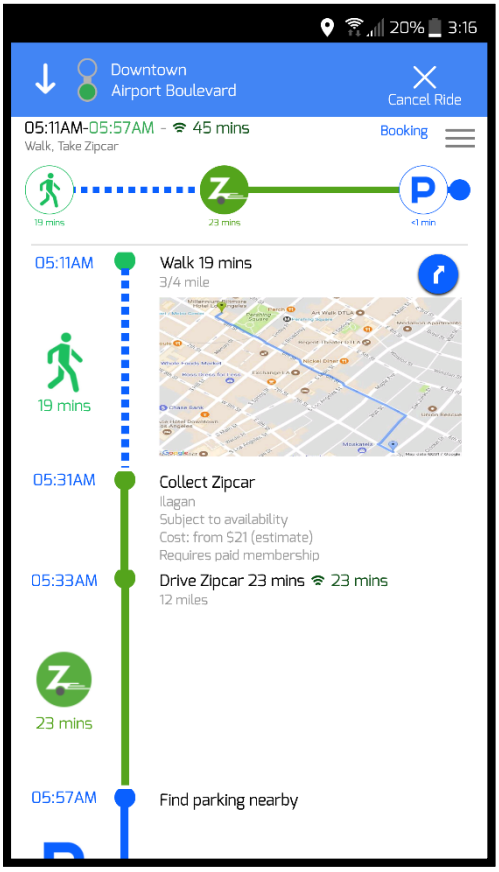

Figure 39: Price estimation of car-sharing.

4.3.3.5 Information: The process of planning a trip starts with entering the destination on the main page of the Go LA app. After that, all the available transport options are shown on the screen. These options briefly give information about duration of the journey, departure and arrival time, estimated duration of walking, amount of Carbon Dioxide produced, burned calories, and the public transport Name/ Number the user needs to take. The user can sort this results by Sooner, Cheaper, and greener mode of transport and select one of these options fitting their need.

By selecting an option, a detailed journey plan is presented to the user. These details include estimated time of journey and arrival, routing on the map, Name/ Number and locations of a transfer (if any), a detail about the duration of walking for instance 19 min, cost of transport mode, option to book a car or purchase the ticket (using transport providers' own platform), and navigation toward the destination (opens Google Maps) (Figure 40 and 41).

Figure 40: Routing Guide.

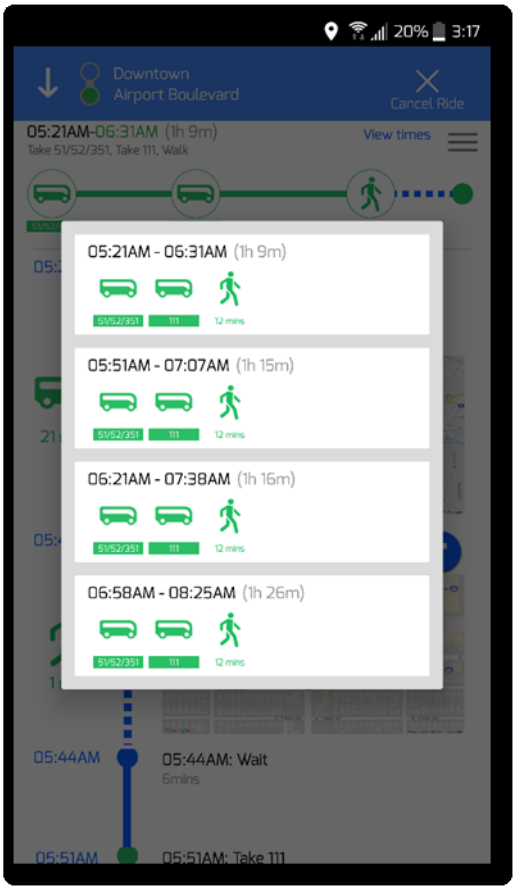

Figure 41: Available time.

4.3.3.6 Payment Options: As booking, purchasing, and payment are all handled by transport providers and Go LA app only provides transit information for the travellers, the service doesn't provide any payment option.

4.3.3.7 Seamlessness: Go LA main offer is to provide information and guide on how to go from point A to B, from transit mode to where to buy the ticket. However, except finding the path and available transit mode, all other user needs are redirected to other

mobile or web applications. Thus, Go LA cannot be defined as a seamless app that integrates and addresses all the user needs within itself (Figure 42 and 43).

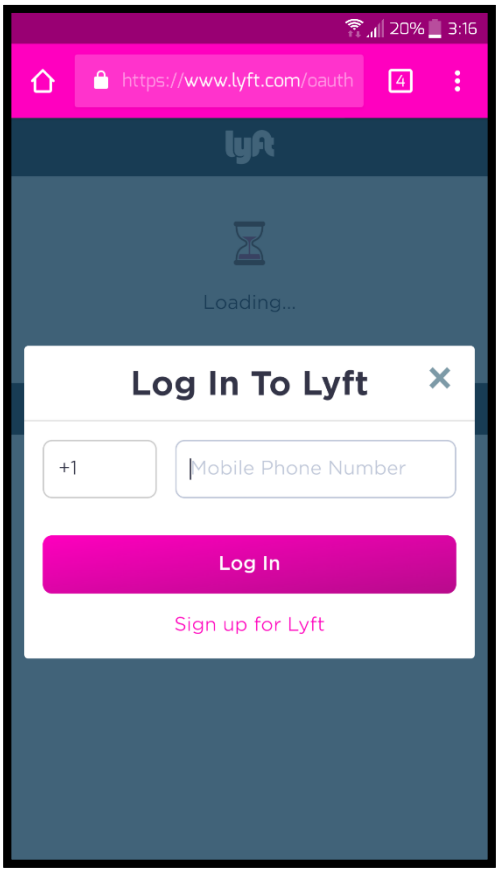

Figure 42: Redirected to Lyft web application.

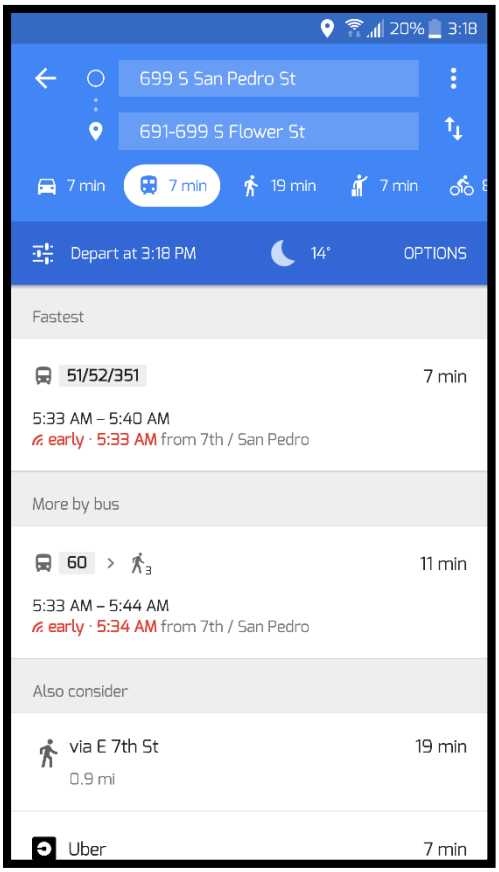

Figure 43: Redirected to Google Maps.

4.3.3.8 Customer Support: Go LA only offers a feedback option as a mean to be connected to its users. A message was sent through the form to find out about supports that are being offered to the users by this form, however, no reply was received in return. (Figure 44 and 45).

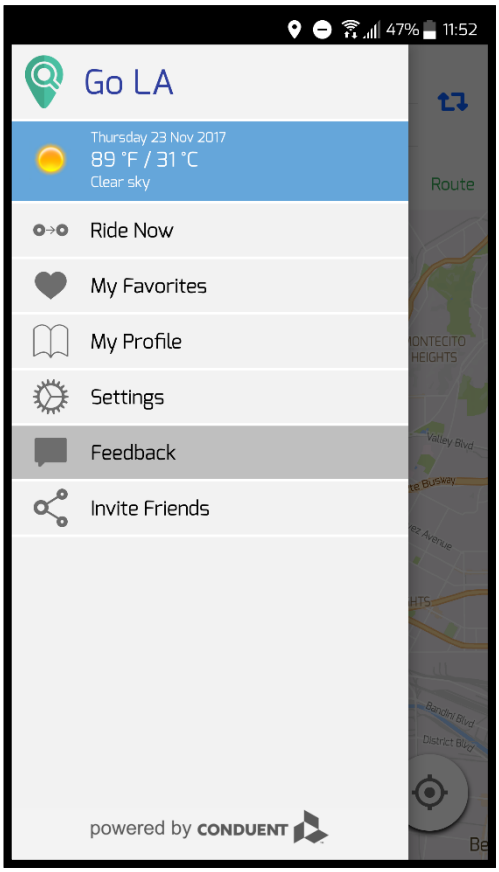

Figure 44: Feedback in the setting.

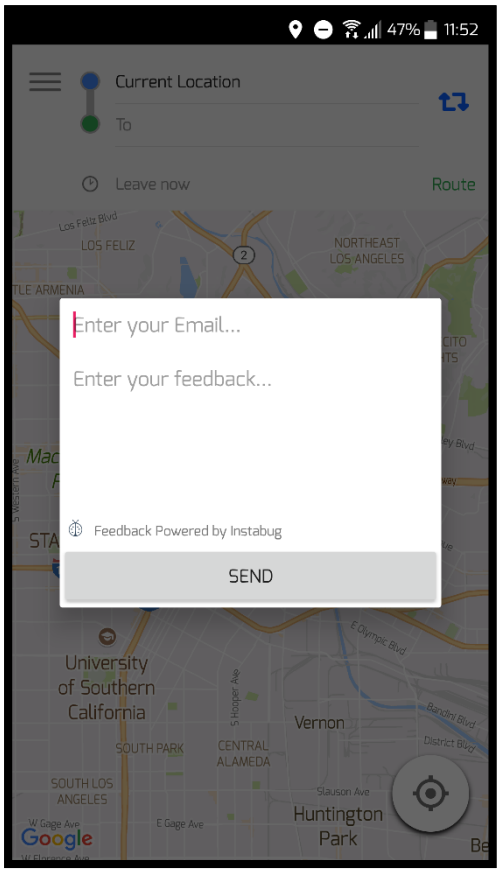

Figure 45: Sending feedback.

4.3.3.9 Environmental, Health Impacts, and Extra features: Go LA enables the user to sort the result of the available transit mode from point A to B by Greener Mode. This option sort modes based on the lowest Carbon Dioxide produced by using a specific mode, for instance, using a bicycle to get to a destination produces 0.0 KG CO_2 or choosing public transport produces less emission than driving a private car. In addition to CO_2, the number of calories burned by using any available transit is displayed. All the above information are displayed as small numbers on the main page of the results when the user searches for the available transit mode (Figure 46 and 47).

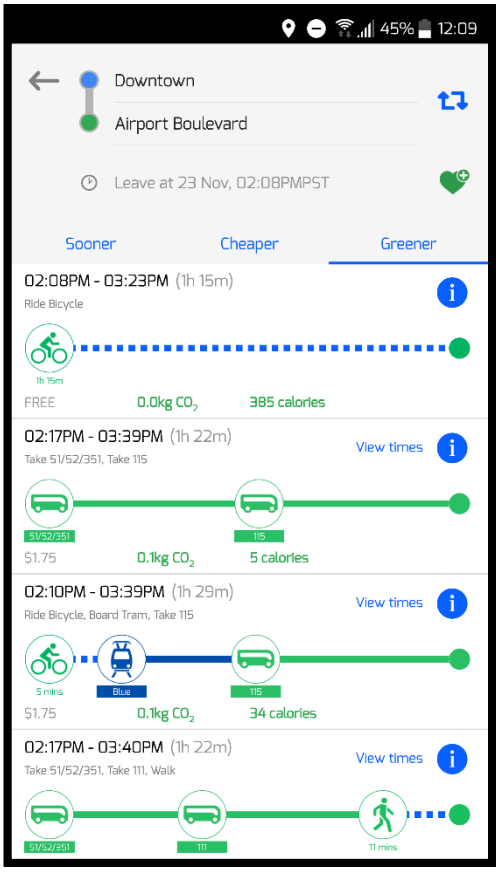

Figure 46: Sorting by Greener mode.

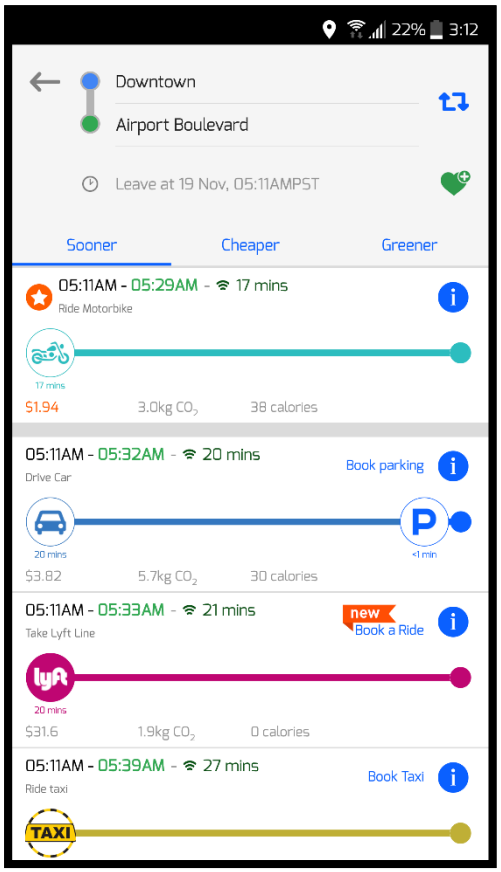

Figure 47: Sorting by Sooner mode.

Go LA provides a platform for the user to monitor their transport activities and then, makes a monthly report related to time, cost, mode, and health impacts of the monthly transits taken by the user is available. This report can be compared with the defined goal by the user and enables them to monitor their performance for different parameters mentioned above (Figure 48 and 49).

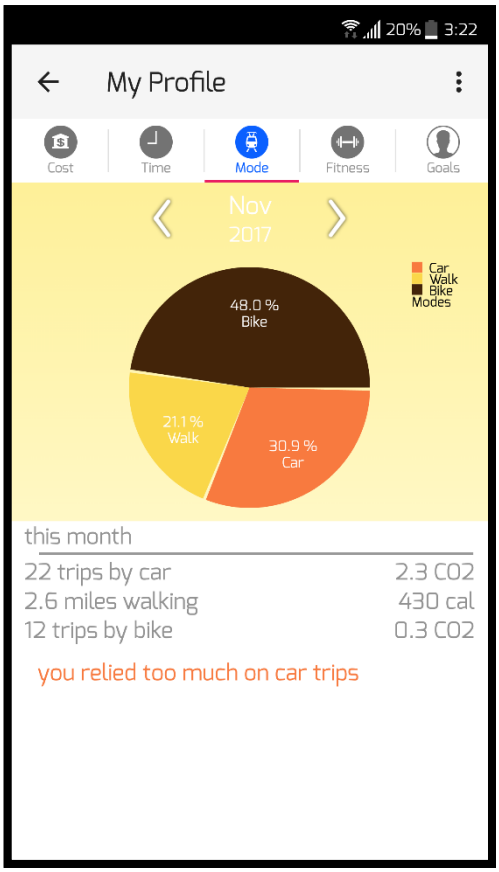

Figure 48: Used mode monthly report.

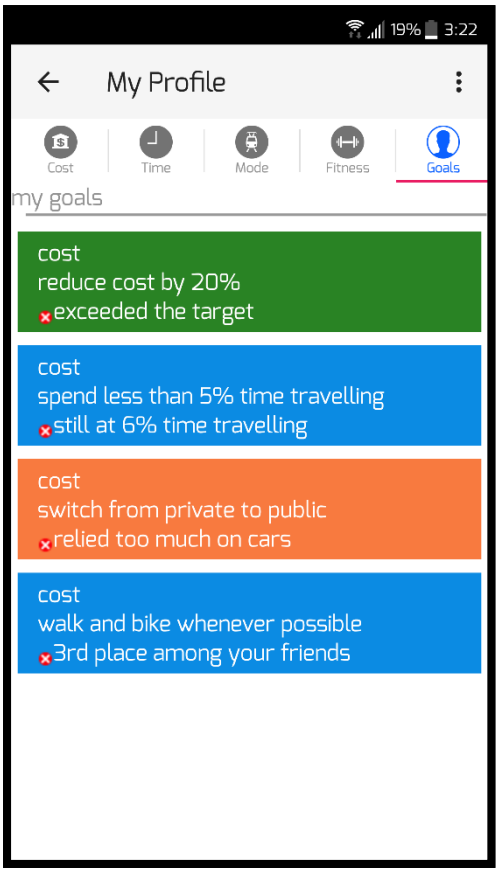

Figure 49: Defined goal by the user.

4.4 Case: Moovit

4.4.1 Company and its Services

Moovit app is a product of Moovit Inc, a transit data and analytics company originated from Israel. By combining data from authorities and public transit operators with live information gathered from users, Moovit provides real-time guide while moving from point A to B. It collects anonymous data points and adds it to a repository of transit data. The data gathering is aided by Moovit's network local editors called Mooviters. Users can enter their destination and start a journey. The app guides traveller with real-time alerts about the trip and steps need to take to move around.

4.4.2 Summary of Benchmarking

Moovit app provides real-time information about how to take a journey from point A to B by using almost all available modes of transport. However, its offerings are limited to information on pathing and step by step guide while taking a journey, meaning travellers are not able to purchase or book their trip by using the service. The app essentially consists of three different parts: planning a trip, looking up stations and tracking commute lines. By getting updates from users, the service is featured to update existing condition of lines, as well as crowdsource new data about stations. Service is available on smartphone and web application. It is reliable and responsive, however, there is no customer support available to handle issues while using the service and it is only limited to sending feedback through email. Moovit provides no information about environmental and health impact of daily commuting of the travellers.

4.4.3 Benchmarking

4.4.3.1 Transit Mode Options: Moovit available transport mode varies based on the city. For this indicator, transport mode in Helsinki is studied (Figure 50 and 51).

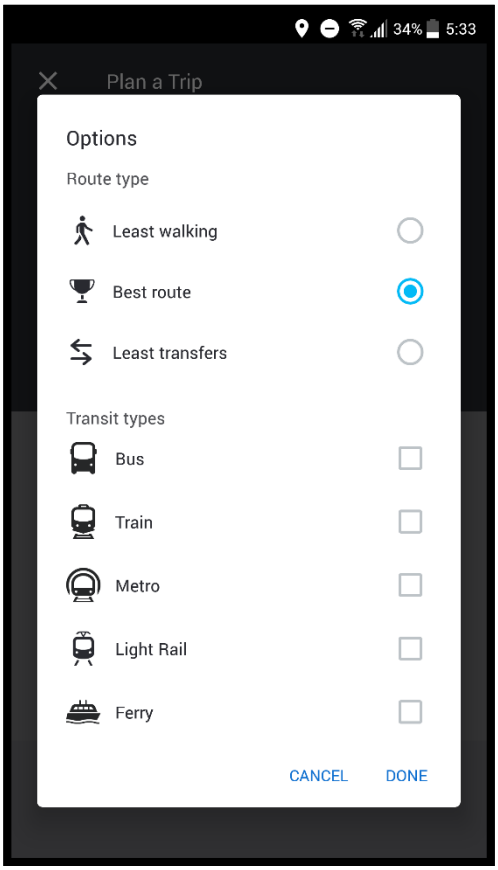

Figure 50: Available mode for transport.

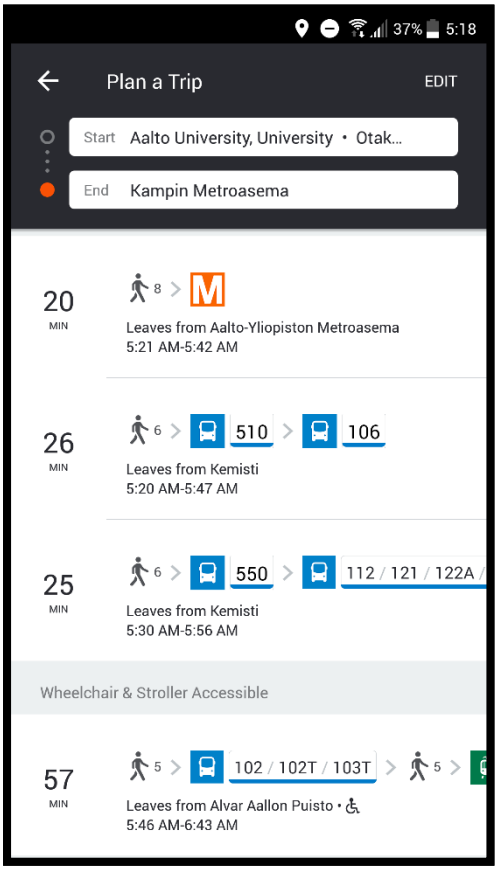

Figure 51: Planning a journey.

Mode of Transport: Moovit main offering is real-time guiding users on how to move from point A to B by considering all the available modes within that area. This method applies to all the mode with the same approach. In Helsinki, Moovit offerings are limited to public transports, meaning there is no taxi, car rental, and car-sharing mode integrated into the service offerings.

4.4.3.2 Service Availability: In terms of accessing the service, Moovit is currently available as an application to be installed on iOS and Android devices. In addition to the mobile application, the service can be accessed through web application with PC.

In terms of geographical area of service availability, Moovit offerings are available in more than 1,700 cities, across 79 countries, and can be used in 44 languages (Moovit 2017).

4.4.3.3 Service Reliability: The reliability and functionality of Moovit can be defined by the accuracy of the provided trip planning data, in addition to service responsivity in providing the data. For accuracy of the data, a comparison with Google Maps service was performed and the results for planning a trip were similar together. They both suggested several options to move from point A to B, however, duration of the journey differs in some cases as Moovit receives more data from Moovitors enabling the service to consider traffic speed leading to a more accurate estimation.

A two weeks test period was planned and conducted for measuring the responsivity of the service in Helsinki (17th to 30th December). During this two weeks, every day from 8:00 AM to 10:00 PM, planning a trip from point A to B were tested seven times every two hours. The service was available and responsive in all tests without any problem. Regarding, planning and schedule to use public transport, path and transport mode suggestion were same as the providers own platform and Google Maps.

4.4.3.4 Price: Moovit main service is planning and guiding travellers in real-time to move from point A to B. Thus, there is no estimation for the price of taking a specific mode of transport.

4.4.3.5 Information: The process of planning a trip starts with entering the destination on the main page of the Moovit app. After that, all the available transport options are shown on the screen. These options briefly give information about duration of the journey, departure and arrival time, estimated duration of walking, and the public transport Name/ Number the user needs to take. The user can sort this results by Least Walking, Best Route, and Least Transfer mode of transport and select one of the options fitting their need.

By selecting an option, a detailed journey plan is presented to the user. These details include estimated time of journey and arrival, routing on the map, Name/ Number and locations of a transfer (if any), a detail about the duration of walking, wheelchair or stroller accessible and navigation toward the destination (Figure 52 and 53).

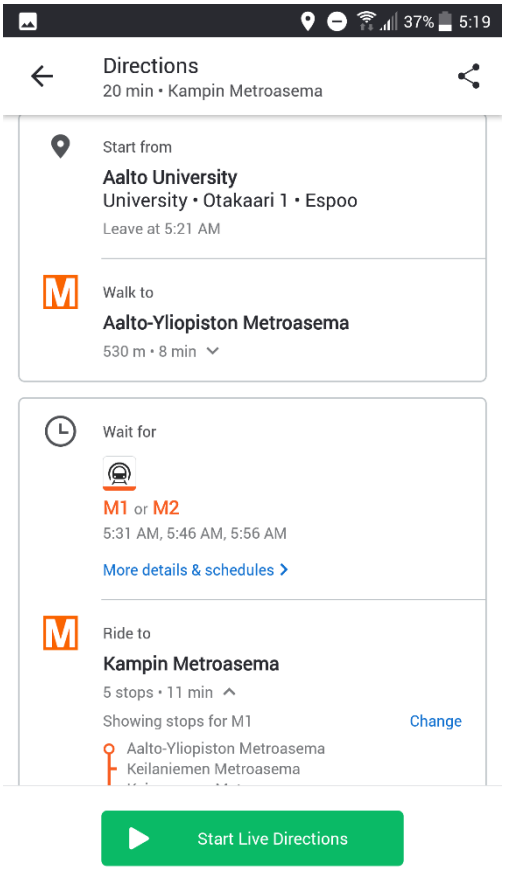

Figure 52: Routing Guide.

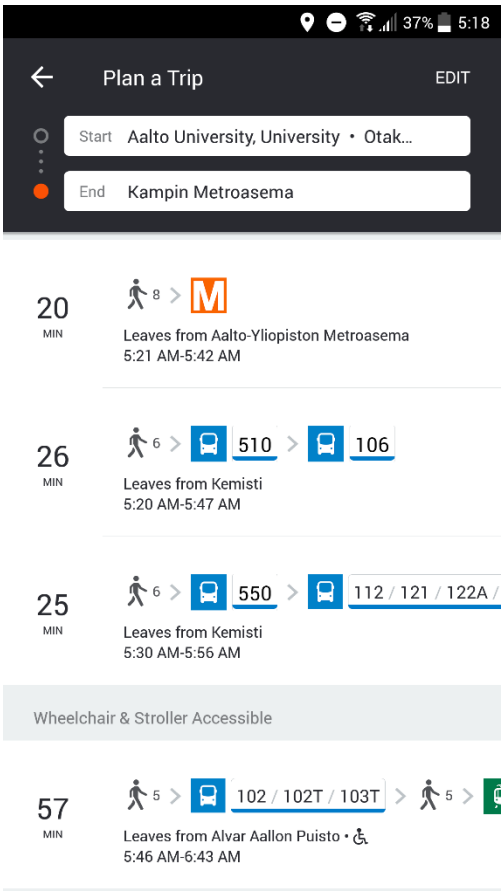

Figure 53: Available time.

In addition to planning a trip in direction tab, Moovit provides information about Stations and Lines where traveller finds the map of stations around them and search for lines. For each station, the list of lines that stops there and their next arrivals in real-time are shown,

and for each line, its list of stops, route on map, full schedule of a station, and next arrivals for all of them is available to check (Figure 54 and 55).

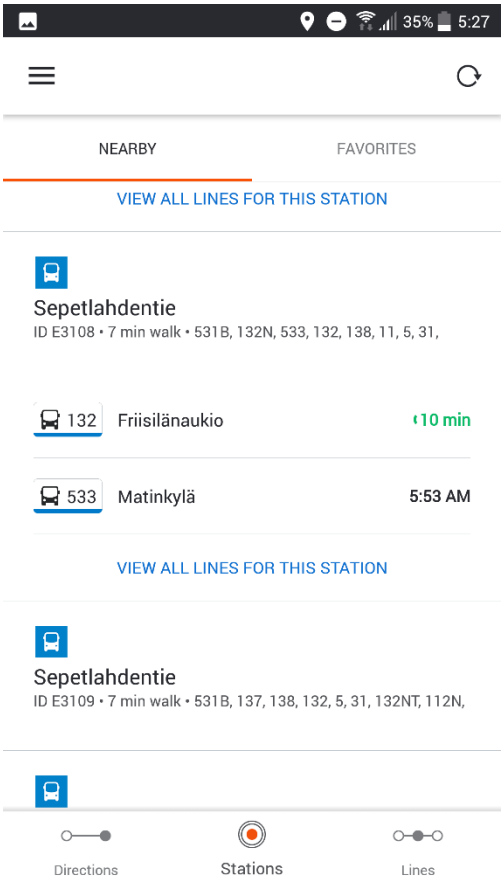

Figure 54: Station info.

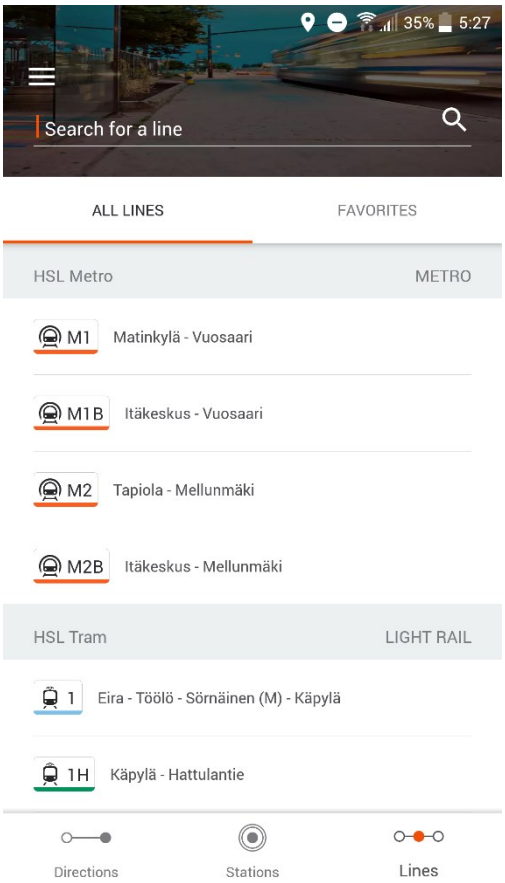

Figure 55: Line info.

Users can start Live Direction mode where they will be updated both by pop-up and voice notification on how to continue the trip.

4.4.3.6 Payment Options: Moovit only provides transit information for the travellers, the service doesn't provide any payment option.

4.4.3.7 Seamlessness: Moovit main offer is to provide real-time information and guide on how to go from point A to B by using available transit mode and integrating it with user data. Every step is being done within the app and all its offerings are accessible in its platform, however, it fails to address booking and purchasing ticket for a journey.

4.4.3.8 Customer Support: Moovit only offers a feedback option as a mean to be connected to its users. To send feedback, the user needs to send an email. An email was sent through the app to find out about supports that are being offered to the users, however, no reply was received in return. (Figure 56 and 57).

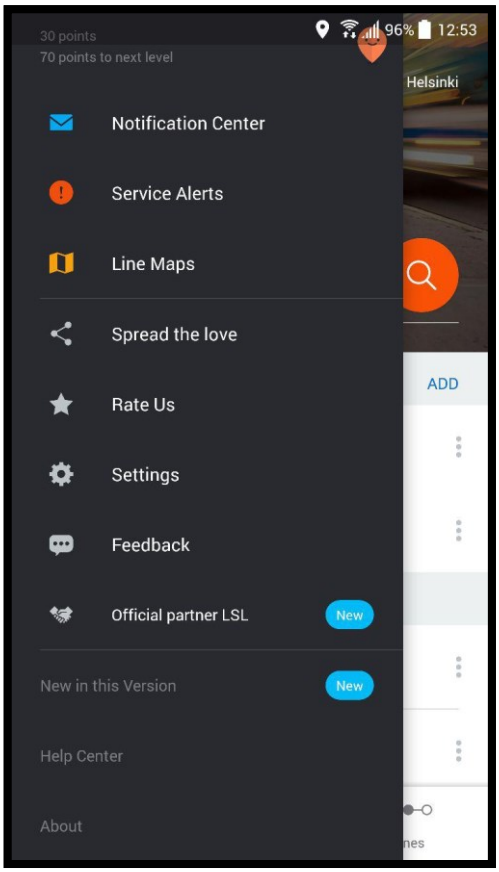

Figure 56: Feedback in the setting.

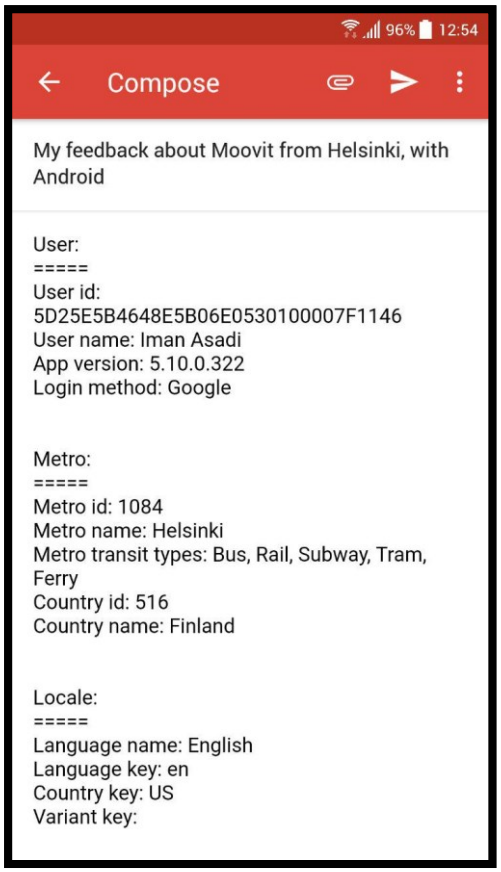

Figure 57: Sending feedback.

4.4.3.9 Environmental, Health Impacts, and Extra Features: Moovit provides no information regarding the environmental and health impacts of taking a specific mode of transport. Instead, it provides a platform for its community "Moovitors" to get involved in improving the service by reporting the real-time condition of a line or station. This reports can be related to crowdedness, temperature, cleanliness, driver's rating, incident, and a line in which the transport mean didn't stop (Figure 58 and 59).

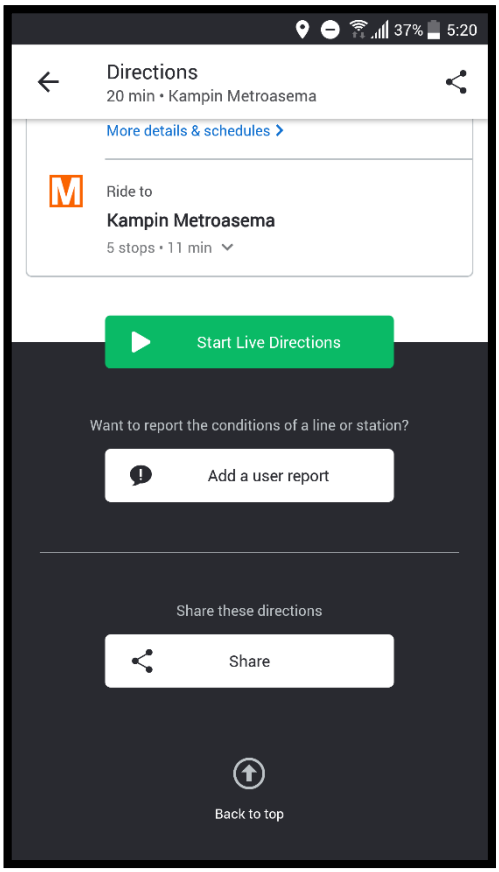

Figure 58: Add a user report.

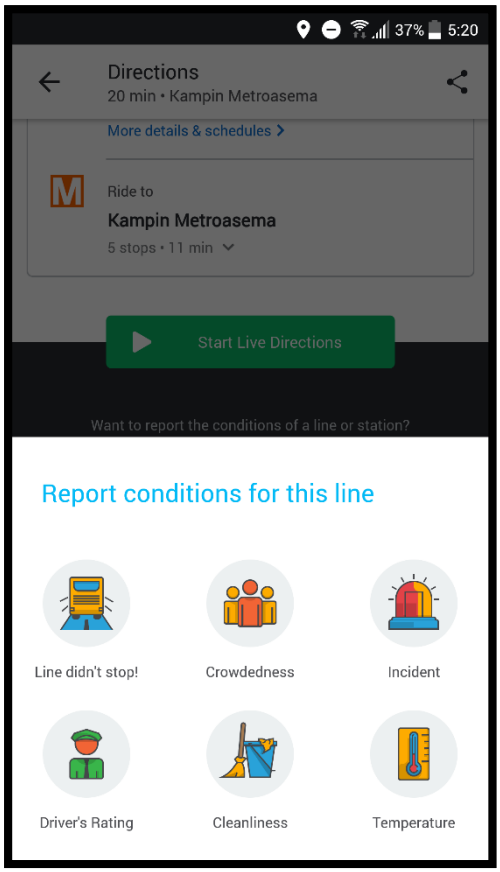

Figure 59: Report a condition.

In addition to reporting a condition of a line, Moovitors can edit, or write a report about a specific station. This is done by selecting a station on the map and filling up a report or suggest an edit for it. This edit could be adding a picture of the station, changing its location on the map, changing its name, and updating the existence of the station in case it is unavailable (Figure 60 and 61).

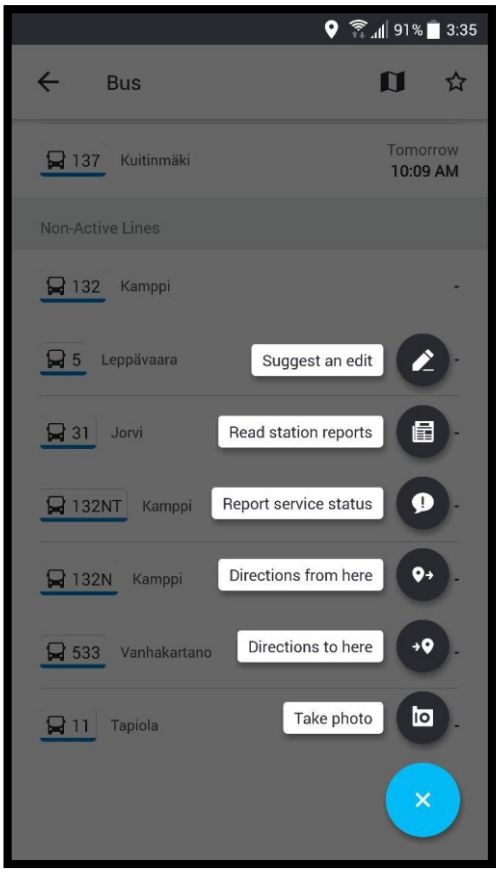

Figure 60: Editing a station information.

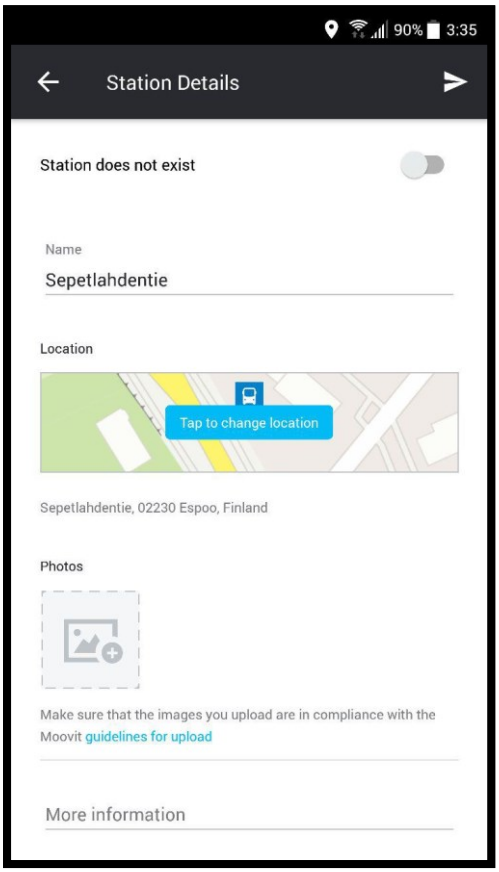

Figure 61: Entering updates.

4.5 Cross-Case Analysis

Table 1: Benchmark summary

	Whim	Moovel	Go LA	Moovit
Transit Mode Options	- Taxi - Public Transport - Car Rental	- Taxi - Public Transport - Car-Sharing	- Taxi - Public Transport - Car-Sharing - Ride-Sharing - Bike-Sharing - Motorbike - Private Car - Bicycle	- Public Transport
Service Availability	**Platform:** - iOS - Android **Location:** - Helsinki	**Platform:** - iOS - Android **Location:** - Stuttgart - Hamburg	**Platform:** - iOS - Android - Web Application **Location:** - Los Angeles	**Platform:** - iOS - Android - Web Application **Location:** - 79 Countries - 1700 Cities
Service Reliability	Accurate and responsive in two weeks test period	Accurate and responsive in two weeks test period	Accurate and responsive in two weeks test period	Accurate and responsive in two weeks test period
Price	- Pay-Per-Ride - Monthly Plans - Cheaper than standard price	- Pay-Per-Ride - Same as the standard price	- Limited to price estimation only - Booking and purchasing is unavailable	Does not offer any price or booking method
Information	- Available transit - Journey duration - Departure and arrival time - Walking duration - Walking distance - Transport name and number - Routing on map - Name, number, location of transfer	- Available transit - Journey duration - Departure and arrival time - Walking duration - Walking distance - Transport name and number - Name, number, location of transfer	- Available transit - Journey duration - Departure and arrival time - Walking duration - Walking distance - Transport name and number - Routing on map - Name, number, location of transfer - Produced CO_2 - Burned Calorie - Transport Cost - Link to book or purchase ticket	- Available transit - Journey duration - Departure and arrival time - Walking duration - Walking distance - Transport name and number - Routing on map - Name, number, location of transfer - Wheelchair and stroller availability - Navigation - Stations and Lines information

Payment Options	- Debit/ credit card Visa, Master, American Express	- PayPal - Debit/ credit card Visa, Master, Amex	Not available	Not available
Seamlessness	Seamless. Planning, booking, purchasing, and taking the journey within the app	Seamless. Planning, booking, purchasing, and taking the journey within the app	Not seamless. Only planning within the app. Other offering on 3rd parties apps	Not Seamless. Offers are only limited to planning a journey
Customer Support	- Yes. In-app ticket. - Not responsive.	- Yes. Email and 24/7 over phone - Responsive. Four hours through email. Immediate over phone	Not available	Not available
Environmental, Health Impacts, and Extra Features	Sort by Greenest mode	Not Available	- Sort by Greener mode based on produced CO_2 - Burned calorie - Monthly report for time, cost, mode, the health impact of transit	- Real-time community updates about transit condition: Crowdedness, cleanness, driver's rating, incident, lines, stations, pictures, location updates.

4.5.1 Transit Mode Options: In the four cases that were studied, Go La provides more options to choose while planning a trip in contrast to Moovit only providing a guide on planning a trip by using public transport. However, both Go La and Moovit fail to fulfil the characteristic of an integrated mobility provider in which all the required steps for planning and taking a trip are done within a single app. Thus, despite the fact that services such as Whim and Moovel provide a fewer mode of transport to plan and take a trip, they provide a seamless and integrated service in which all the required steps to move from point A to B can be taken within a single application.

In addition to taxi and public transport, Moovel provides car-sharing and Whim offers car rental services, however, they both miss what the other one offers. For instance, in Helsinki DriveNow is operating but it is not possible to book and use the service in Whim. On the other side, there are several car rental companies in Stuttgart and Hamburg such as Hertz but Moovel fails to provide such services to its users. This indicates despite the fact that

Moovel and Whim offers a seamless experience for planning and taking a trip, they both can improve their service by adding what is missing compared to the other. This could be achieved by negotiation and a better collaboration with car rental and car-sharing services in the city where they are operating.

4.5.2 Service Availability: In terms of service availability on devices, all four cases are accessible on iOS and Android with Moovit and Go La offering web application as an additional platform. In terms of geographical coverage, as the aim of Moovit is to guide travellers to move around cities and its offerings is limited to planning a trip by using public transport, it offers a wider covering area around the world with availability in 1700 cities in 79 countries. On the other side, Go La with similar functionality to Moovit, is only available in Los Angeles metropolitan area.

Moovel main offerings as mobility as a service provider is limited to Stuttgart and Hamburg, however, planning a trip is available in several other cities around the world. By studying the roadmap and plans for future of these four cases, Whim seems to have a more global approach in term of providing a seamless mobility as a service. Despite the fact that currently it's full service is only available in Helsinki, Whim is actively growing and the service is being tested and piloted in several other countries to launch the full service in 2018.

4.5.3 Service Reliability: All four cases have successfully passed the tests that were designed to evaluate their responsivity and accuracy. For services such as Whim, Moovel, and Go La, in addition to evaluating the accuracy of planning a trip in terms of time and route, price estimation accuracy for a specific mode of transport were evaluated, and for all of them, the mentioned factors were accurate. This indicates that current service providers, in addition to be responsive and running 24/7, can provide reliable information for their users to plan and take a journey.

4.5.4 Price: By comparing the available pricing of the four cases, Whim stands out by providing a wide range of options. Users of Whim can benefit from monthly packages by subscribing to the one that meets their need. These are combined mobility packages that can include from limited to the unlimited use of all available mode of transport within the service

and in some cases it is cheaper. In addition to that, users can go with a Pay-per-ride option. However whim provides a variety of options to choose from, it still fails to provide group discounts. For instance, students who can benefit from a monthly discount if they use the travel card offered by the public transport provider, are not able to receive the same benefits if they decide to use Whim. This is a major downside for Whim as it loses all the young generation who are more likely to use these new type of integrated services and meanwhile want to stay on budget.

Moovel can be named as the second winner in this category as it provides pricing and a mean to purchase or book ticket based on Pay-per-ride but not any kind of monthly subscription. It is impossible to book or purchase a ticket in Go La and Moovit app as Go La offering is limited to price estimation only and Moovit fails to provide any information even on pricing.

4.5.5 Information: All four cases provide similar information in respect of planning and taking a trip. General information such as available transit, journey duration, departure and arrival time, walking duration, walking distance, transport name and number, and name, number, the location of transfer are common for all the studied cases. However, Go La provides more information regarding how choosing a specific mode of transport to move from point A to B can affect environmental and health-related factors. On the others side, Moovit gives a clear information about lines and stations information. In contrast, Moovel and Whim fail to provide such information. As nowadays being aware of the impacts that each individual choices have on the environment becomes important for many people, it is crucial for more integrated services such as, Whim and Moovel to provide a detailed information on these issues.

4.5.6 Payment Options: As Moovit and Go La do not offer any booking or purchasing within their service, they provide no payment option. On the other side, while Whim only provides debit and credit card as a method of payment, Moovel offers PayPal in addition to that and stands in a better position compared to Whim.

4.5.7 Seamlessness: Whim and Moovel provide a seamless experience for their users, meaning a user can plan, book, purchase a ticket, take a taxi, and rent or hire a car within a

single application without being required to use any other application or services. This can be defined as one of the main goals of MaaS. Thus, Whim and Moovel stand out in this category compared to Moovit or Go La where both of them fail to provide such an experience, for instance, Go La redirect its users to Google Map application if they decide to use the navigation.

4.5.8 Customer Support: Go La and Moovit offer no customer support through their application, however, it is possible to contact with them through email to send feedback. On the other side, Whim offers in-app support where users can open a ticket and wait for a response, however in practice, Whim fails to handle tickets y not responding to them. In contrast, Moovel offers customer support through 24/7 phone service in addition to email. Thus, Moovel provides a better user experience for the travellers in respect of handling their issues. Customer support can highly affect users decisions making while choosing a provider or switching to another and a service like Whim needs to improve their support services to gain the trust of its users.

4.5.9 Environmental, Health Impacts, and Extra Features: In this category Whim only offers “sort by greenest mode” mode and Moovel has no offerings. While Moovit and Go La provides a variety of features from the amount of burned calories while using a specific mode of transport in Go La app, to enabling travellers to update data and send feedback about the real-time condition of public transport in Moovit, Whim and Moovel have no feature to compete with the other two cases.

Chapter 5 – Discussion and Conclusion

5.1 Theoretical Implication

The transportation sector is rapidly changing. Technology advancement and superior megatrends are transforming the way we used to commute and travel. This conversion has resulted in new ways of providing transportation service. The primary objective of this thesis was to understand and benchmark the values that these new type of mobility services provide for the travellers.

Four cases were selected to conduct the benchmark. This benchmark was done based on a theoretical framework created by the study. Currently, there is a lack of a concrete framework to use for benchmarking MaaS services, thus based on several studied kinds of literature, this study built a theoretical framework consisting of nine different indicators and categories. This framework can, later on, be used in other studies to compare and benchmark mobility providers in terms of their user experience design in addition to value offerings.

From four cases, two considered as mobility service providers (Whim and Moovel) where travellers could plan, book, take, and pay for a trip within a single app experience, and the other two (Go LA and Moovit) were mostly addressing the planning phase by providing information on how a traveller can move from point A to B.

After the benchmark, it was clear each of these services has some advantages and disadvantages compared to others. Although it is difficult to name a service as the best among the others, Whim service in Finland fits better into the MaaS concept. It is the only service that offers several mobility modes as a monthly subscription to the user. In fact, it is the only service that in addition to providing a seamless experience to move from point A to B, it includes all the transportation options that are available in Helsinki city. It is understood Whim has done a better job in collaboration with mobility providers in Finland while meanwhile, it is expanding its services by targeting a lot more cities in Europe for launching the service.

The wide range of available mobility modes and payment options in these four cases indicates the fact that MaaS biggest challenge for being adopted and integrated into the current transport system, is difficulties and challenges of bringing different stakeholder and competitors to share their data and work together. It seems countries that are more open to support such phenomena and force or make this collaboration possible are better places for MaaS to be implemented and fully available.

5.2 Practical Implication

The research shows that each of studied cases is missing some features and offerings that are available in the others, meaning if you borrow some features from each service, in the end, we can have a service fulfilling all the criteria of the MaaS. For instance, Whim can look at Moovel on how it handles customer supports and how it offers more payment options. On the other side, Moovel can benefits from Whim business model by understanding how it became possible to provide monthly subscription packages for the travellers in addition to having more transportation modes in the service.

Whim, Moovel, and Moovit can improve their trip planning phase by learning from Go La service. Meaning by providing more information on how a specific choice of transport mode can affect environments, travellers who aim to select or choose transportation mode based on environmental factors are clearly informed about that information. In addition to that, service such as Whim and Moovel which are more focused on offering a seamless mobility experience can integrate the option of booking parking lots for private car owners or those who rent a car from their services.

Go La needs to improve the user experience by providing a seamless travel experience. It currently offers a variety range of transport mode with detailed information on health and environmental impacts, however, users are unable to book or pay within the service itself. This is clearly due to either lack of collaboration with service providers, or willing to offer such a service.

Moovit can be a great example for all other three cases on how travellers can run and improve a service quality by themselves. Enabling users to participate in improving the service can dramatically improve the information flow and real-time updates on the service quality and possible incidents. Although the purpose and mission of Moovit highly differ from the rest of the cases, it would be more beneficial for the travellers if it simply provides information about pricing and possible ways of booking or purchasing a ticket.

As mentioned before, all studied cases have their own advantages and disadvantages, however, without a doubt they can learn from each other due to the fact that what is missing in one, can be found in another one.

5.3 Limitations of the Research

MaaS is relatively a new concept and is not widely available. This created some challenges for doing this research. The main challenge was finding case studies that could be considered as MaaS. In the beginning, the aim was to only focus on services offering a seamless experience for taking a trip, meaning the service makes it possible for the traveller to plan, pay, and take a trip only by using a single application without being redirected to another service.

However, only Whim and Moovel were fitting into that category. Due to the fact it didn't make sense to research only about two services for a case study, Moovit and Go La were added to cases although they lacked some of the basic fundamentals of MaaS concept.

In addition to the limited number of available cases, study was looking to conduct the research and benchmarking not only on B2C offering but also to B2B offerings. That could dramatically increase the benefits of the study in the end. As one of the biggest challenges of implementation MaaS is the collaborations between businesses.

It is crucial to understand the kind of partnership proposals and business models are being offered by MaaS providers to mobility providers, such as taxi companies and public

transportation providers. However, it was almost impossible to interview and ask any of studied cases about this information as they were not willing to share such a data.

Another limitation of the study was not having access to real users for conducting interviews and learning the traveller's point of view on the service. As the service just launched in 2017 in Finland, the number of users is limited and finding those who are using it and willing to be interviewed was impossible.

5.4 Future Studies

MaaS as a new concept has a great potential to be implemented into daily commuting. However, there are several areas of MaaS that are unclear and makes it difficult to define a concrete approach for its implementation. From the user point of view, it is clear that if everything goes smoothly, users prefer to deal only with one service for their daily commuting but for stakeholder the story might be different, however, for the business side things are not as clear as for users.

The future studies of MaaS should focus on the B2B side of the phenomena. This study was unable to conduct B2B research due to the limitations mentioned above. Defining a concrete business model for MaaS to give a clear idea of how it benefits the stakeholders competing each other, makes it easier for those businesses involving in MaaS to decide on implementing it into their services. Thus, conducting research on a clear business model can truly help in growth and future implementation of Mobility as a Service.

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