Public transport and mobility on-demand

Research on the efficiency of on-demand taxi service Abel

Daphne van der Veer

Bachelorthesis Geography, Planning and Environment (GPE)
Nijmegen School of Management
Radboud University Nijmegen
June 2017

Radboud University Nijmegen

Public transport and mobility on-demand

Research on the efficiency of on-demand taxi service Abel

Author:	Daphne G. M. van der Veer
Student number:	s4472802
E-mail:	d.vanderveer@student.ru.nl

Concerns:	Bachelor thesis of Geography, Planning and Environment (GPE)
Supporting institution:	Nijmegen School of Management Radboud University Nijmegen The Netherlands
Program:	Geography, Planning and Environment (GPE)
Supervisor and first reader:	Dr. F. Sharmeen
Second reader:	K. Kerkman
Date:	June 2017
Number of words:	37363 (including headings and references in text)

Preface

Dear readers,

In front of you, you see my bachelor thesis about the efficiency of on-demand and demand responsive transport services from a users perspective. For this research a case study in Amsterdam was chosen, namely: on-demand taxi service Abel.

This bachelor thesis is the final piece handed in before finishing my bachelor study Geography, Planning and Environment (GPE). This piece of work can be seen as something I have prepared myself for in the last three years by learning a lot more about the areas of geography, planning and environment and furthermore, about doing proper scientific research and how to write academically. I also feel I have further developed myself in a positive way as I learned to be a student in a previous unknown city where I started my adventure at the Radboud University all by myself.

I have worked on this thesis with pleasure, but I also came across some difficulties along the way, as this was the first time I had to write a thesis of this size. But, looking at the final product I am very pleased with the result. I would not have been able to present you the final product that you have in front of you without a few people, which I therefore would like to thank in special. First of all, I want to thank my parents and my brother who have always supported me with my decisions and during my three years of studying in Nijmegen. Thank you for keeping my head high at certain moments, when I was not able to believe in myself. Second of all, I want to thank the two employees of Abel and post-doctoral researcher Peraphan Jittrapirom for answering all my questions, by means of having an interview with me. Third of all, I want to thank all my respondents for the time and effort they have put in answering my survey. Without them, I would not have been able to write my thesis. And last of all, I would like to thank my thesis supervisor Fariya Sharmeen, for helping me during the process I have gone through to write this final piece of work.

I hope you enjoy reading my thesis!

Daphne van der Veer
Nijmegen, June 2017

Summary

Framework of the research

Transport, as a form of (physical) mobility, is something that is fundamental to our economy and society (Litman, 2015). Mobility is something that most people come into contact with daily, since mobility gives people the freedom to travel: it matters to people, whether this is getting to work or school with ease, visiting friends and family or simply exploring the surroundings (Hannon et al., 2016). Furthermore, transport enables economic growth and job creation, which makes mobility and transport critical economic factors (EU, 2011). But, mobility is seldom an end in itself, since the ultimate goal of most transport activity is accessibility, which refers to people's ability to reach desired services and activities by using a mode of transport (Litman, 2015). One form of transport is public transport, which includes all transport modes available to the public, such as buses, coaches, taxis and domestic air and rail operators. But it excludes private owned cars (White, 2016).

Looking at the public transport sector in specific, it can be seen that this sector is facing a number of challenges and opportunities, caused by changes in the sector itself and external trends that affect its wider socio-economic environment (UITP, 2015). Trends as climate change and the growing world population (what leads to an growing urbanization) put an ever growing pressure on urban passenger transport systems (Finnish Transport Agency, 2015) and many urban areas already have to deal with tremendous traffic problems, causing congestion, pollution, noise and increase of road causalities (Grotenhuis et al., 2007). Therefore, urban planners and residents are putting liveability and sustainability in the cities higher on their agendas than ever before (Hannon et al., 2016): cities are facing the challenging task to harmonize a sustainable and livable urban development (Benevolo, Dameria & D'Auria, 2016). One thing governments and local authorities are doing to create a better urban environment is persuading people to switch transport modes, from private to public transport (Grotenhuis et al., 2007). Therefore, the demand for new and innovative solutions to increase the efficiency, attractiveness and sustainability of the urban passenger transport systems is rising (Finnish Transport Agency, 2015).

A trend that brings opportunities to cities and their transport systems is the emergence of the Digital Age, which has brought technical innovation. Those innovations have caused devices to be increasingly connected to each other and enabling large amounts of data to be collected and analysed, which allows transport systems to be better understood and planned (Houses of Parliament, 2015). Transport is one of the areas where the explosion in the availability of data and the connectivity of devices can enable new ways to provide service more quickly, efficiently and cost effectively than ever before (IET & ITS, 2014).

One urban movement that puts the use of ICT at its core is the Smart City movement (Hollands, 2008). This concept is considered like a winning urban strategy using technology to increase the quality of life in urban space, improving the environmental quality and delivering better services to the citizens (Benevolo, Dameri & D'Auri, 2016). A part of the Smart City movement is the Smart Mobility movement, which is often presented as one of the main options to seek more sustainable and efficient transport systems, by a number of initiatives characterized by the use of ICT (Benevolo, Dameria & D'Auri, 2016). One form of smart mobility is flexible transport services (FTS), which can be summarised as flexible, integrated and customer centric, adaptive transport options that sit somewhere between private car ownership and fixed route

traditional transit (Ferreira et al., 2007). There is a variety of FTS concepts, where demand responsive transport systems (DRT) is one of. DRT services provide transport 'on-demand' for passengers, using vehicles scheduled to pick up and drop off people in accordance with their needs. Since DRT is a transportation service that is responsive to the requests of passengers, it can be seen as part of the demand side of public transport that puts 'the user' at the centre (Mageean & Nelson, 2003). This mobility on-demand delivers transport via a combination of shared vehicles and high-quality public transit as the backbone. Electrical cars will become more common, due to economics, consumer interest, sustainability and the creation of low-emission zones. All of this is enabled through the use of smart software platforms and mobile applications that manage multimodal traffic flows (Hannon et al., 2016).

Purpose of the research

One example of an on-demand and demand responsive service is shared taxi service Abel (which is located in Amsterdam), which has been chosen as the case study of this research. Although the literature provides some information about those kind of services (e.g. Hannon et al., 2016 and Davison et al., 2014), there has not been done much research. However, since those new forms of transport are gaining more interest and since they are highly important for the future of public transport and cities, more research needs to be done to solve the knowledge gap and provide the society with more insights into services that are important to lower the pressure on the urban environment. Since the users are central to on-demand services (Hannon et al., 2016), the quality of service that is offered (the service performance) and the experiences of the users are very important.

Therefore the users are put at the centre of this research: in this research the efficiency of taxi service Abel from a users perspective has been researched. Efficiency may be analysed based on several factors relating the quality of service that is offered, such as: accessibility, trustworthiness, vehicle characteristics, mobility in accordance with necessities, equity/justice, travel time, adequate information and (un)happiness/(dis)satisfaction (Santos, 2000 in Sampaio et al., 2008). The better/higher the valuation of those factors (except for unhappiness/dissatisfaction) the better/higher the valuation of efficiency.
Those factors have also been analysed in this research by means of both open-ended and closed-ended questions in a web-survey. Important to remember is that this research has been carried out independently from Abel and in the name of the Radboud University.

Research questions

In order to achieve the purpose of the research, the following main question has been answered:

How efficient are mobility on-demand, Demand Responsive Transportation modes, in specific shared taxi service 'Abel', from a users perspective?

To answer this main question the following sub questions were answered:

1. What are the motives of Abel to provide their service?
2. How is Abel taxi going to distinguish/distinguishing itself from other taxi services?
3. How does Abel see the future of their services (what are the future perspectives)?
4. What are good and bad things of Abel and what can be improved, according to the users?
5. How efficient do the users of Abel taxi think this service is overall?

Results

To obtain the necessary data both qualitative and quantitative research methods have been used. First of all two face-to-face interviews have been carried out: one with two employees of Abel to get more background information on the company and another interview with post-doctoral researcher at the Radboud University, Peraphan Jittrapirom, who is researching smart city and sustainable public transport. The aim of this interview was obtaining more academic knowledge on demand responsive transport systems.

Furthermore, the efficiency of Abel has been researched quantitatively via a web-survey that has been distributed online. This survey was accessible for everyone, but the criteria was that respondents needed to be users of Abel. In the end this survey was filled in by 26 users of Abel.

From the interview with the two employees of Abel and some news articles about Abel (Krabbendam, 2017, Van Oerle, 2016, Abel, 2017 & Pals, 2016) the following information was obtained: Abel is an on-demand, shared taxi service which operates in Amsterdam and its surroundings. Abel was launched in January 2016 after the mother company of Connexxion and Veolia, Transdev Nederland, came up with the idea to develop an on-demand and cheap service that could be booked via a mobile application. The unique thing about Abel is that they provide a shared taxi service: different rides of different customers can be combined in one taxi, since customers only book a seat in a taxi, instead of a whole taxi. This sharing also makes the ride cheaper than a ride with a regular taxi. Furthermore, Abel only uses electrical cars, with the eye on sustainability and the policy of the municipality of Amsterdam to ban all diesel vehicles from the city by 2018. Last of all, Abel provides a cheaper service against a fixed price, which will only be calculated based on distance and not also on travel time (Employee 1, personal communication, April 13, 2017).

According to Peraphan Jittrapirom a demand responsive transport service (DRT) comes with some form of flexibility: “It is not completely fixed, but also not completely flexible. It is the middle of two extremes” (P. Jittrapirom, personal communication, May 10, 2017). Looking at Abel they do meet the criteria for a DRT service: Abel provides a service against a fixed price, but the timetable is flexible and the route is semi-flexible. People can book an Abel whenever they want and in turn, Abel determines the route, but the route can be changed when needed (Employee 1, personal communication, April 13, 2017). Another criteria for a DRT service is that it is, as is in the name of DRT, on the demand side and not on the supply side of mobility: “DRT allows the users to receive the services at their own request (demand), at the route they request and at the time they request” (P. Jittrapirom, personal communication, 10 May 2017). This is exactly what Abel does, it provides their service to people that request their service at the time their customers want: only if people book a ride via the mobile application they provide their service. They do not, such as regular taxis, wait for customers at taxi stands (Employee 1, personal communication, April 13, 2017). Thirdly, Abel provides it service via a mobile application (Pals, 2016), which makes Abel meeting the third criterion: the use of ICT in the system. “The digitalisation has breathe new life into DRT” (P. Jittrapirom, personal communication, May 10, 2017). Last of all, DRT services often try to reduce costs by combining different rides so their customers share a vehicle (P. Jittrapirom, personal communication, 10 May 2017). This is also what Abel is providing: a shared taxi service (Employee 1, personal communication, April 13, 2017). So, looking at the criteria found both in the literature and in the interview with Peraphan Jittrapirom, it can be concluded that Abel can be

called a demand responsive (on-demand) transport system and therefore is suitable as case study for this research.

Other than the qualitative analysis of the interviews, to be able to answer the main question, the results of the web-survey have been analysed statistically with the help of SPSS. As said before, each factor of efficiency has been questioned in the survey and this has been done by multiple questions.

Therefore, first of all, for each factor of efficiency (accessibility, trustworthiness etc.) the Cronbach's Alpha has been calculated, to see if all questions on one specific factor would form a reliable scale. It turned out that all questions on each item could form a reliable scale: the Cronbach's Alpha was higher than the needed 0.7. After the calculation of this Alpha, the mean scores for each factor have been calculated with the help of the questions that together form a reliable scale of a specific item. Since those questions had answer options in the form of a 5 point Likert scale, the mean scores had a score from 1 to 5. In turn, those mean scores could be categorised into three categories: high/good (scores 1-2.99), neutral (scores 3-3.99), low/bad (scores 4 -5). Based on the mean scores for each factor the respondents had an overall high/good, neutral or low/bad valuation of that specific factor, which in turn contributed to a high/good, neutral or low/bad valuation of efficiency.

Conclusion

In the end, eight out of the nine factors of efficiency had a high/good valuation, which contributed to a high/good valuation of efficiency. But, the strength of this positive valuation has been reduced a little, because one of the factors had an overall neutral valuation. However, in the end, the respondents gave the efficiency of Abel an average mark of 7.6, which leads to the conclusion that the efficiency has been valued by the users of Abel as sufficient. Other than that, the overall service of Abel was graded with an average mark of 7.7.

Furthermore, the respondents were also asked to mention some good things about Abel and things that could be improved. Good points that were mentioned are the cheap price of a ride with Abel (in comparison to regular taxis), the price-quality ratio, the sustainability of the service, the friendly drivers, the fast and reliable service Abel provides. Also, 61.5% of the respondents (strongly) agreed on the statement 'I want to use this service regularly' and one of users said: "The only ride app you want to use in Amsterdam: full electrical cars, great drivers, a fair choice in pricing and a great app!". Other than the good points, there are also points of improvement, such as the availability of a taxi when needed, the waiting time before the taxi is at your pick up point (punctuality) and the availability of bigger taxis, so groups bigger than 3 can also book an Abel together. Despite the points of improvement, overall Abel is doing great and they are getting more and more customers: "Abel has a lot of potential and is already delivering a good service" (a user of Abel on Facebook).

Remarks and future research

Important to keep in mind is that the conclusions of this research are based on a data set of 26 respondents, which is quite a small sample size. Due to this small sample size, the findings/conclusions are not generalizable to all users of Abel or to DRT services in general, which can be seen as a limitation of this research. But, this does not mean those results are not useful: with the obtained insights on efficiency, good points and points of improvement, Abel can further develop and improve their service. Furthermore, despite different operating contexts, also similar services can learn from those insights: they can improve their service with the aim to provide a better service in the current urban society. Other than that, despite the small sample size of this research, cities and municipalities that want to develop such a service, can take into consideration the findings of this research. But it is important that cities apply the findings to their own specific context, since each DRT service works different in a different context (Hannon et al., 2016).

Furthermore, the efficiency from a users perspective can differ per DRT service, since each DRT service has its own characteristics and operates in a different context. Besides efficiency, other aspects of services can also differ per DRT service, due to the context. Therefore, other DRT services also need to be researched to be able to get more academic knowledge on DRT services and similarities and differences between services can be found.

When looking at the contribution to the science, it can be said that this research was a starting point for obtaining more knowledge on demand responsive and on-demand services. As Peraphan Jittrapirom said in the interview: “There are a lot of studies on how a private vehicle is being used and how public transportation works. But there is a gap in the research: there are not as much studies on DRT as on public and private transportation” (P. Jittrapirom, personal communication, 10 May 2017). More research is still needed, since this research has its limitations, but despite those limitations the findings are still useful and can form a starting point for further research. Questions like ‘How do those services actually work?’, ‘Do those services have the wished outcomes or do they replace the use of public transport modes as buses?’ and ‘Do those services improve accessibility?’ still need to be answered.

Table of contents

List of abbreviations

DRT	Demand Responsive Transport
DOT	Department Of Transport
FTS	Flexible Transport Services
GHG	Green House Gas
GPS	Global Positioning System
ICT	Information and Communication Technology
MaaS	Mobility as a Service
PSQ	Perceived Service Quality
STS	Satisfaction with Travel Scale
SWB	Subjective well-being
TOD	Transit Oriented Development

List of figures and tables

Front page: Abel taxi Amsterdam (https://rideabel.com/)

1. Introduction

1.1 Framework of the research

1.1.1 Mobility and transport

Mobility, something where most people come into contact with daily, is a concept that makes it able for transport to 'exist': transport is a form of (physical) mobility (Litman, 2015). Mobility is often defined as the physical travel of people. But, mobility is seldom an end in itself, since the ultimate goal of most transport activity is accessibility, which refers to people's ability to reach desired services and activities by using a mode of transport (Litman, 2015). Various factors can affect this accessibility including mobility, transport network connectivity and affordability, the geographic distribution of activities, and mobility substitutes such as telecommunications and delivery services (Litman, 2015).

As such, transport is fundamental to our economy and society and mobility is vital for the internal market and for the quality of life of citizens, as it gives them the freedom to travel. Mobility matters to people, whether this is getting to work or school with ease, visiting friends and family, or simply exploring the surroundings (Hannon et al., 2016). Besides that, transport, as a form of mobility, enables economic growth and job creation, which makes mobility a critical economic factor (EU, 2011). It is therefore important in its own right and as the means of providing the goods and services that are the foundation of economic life (Hannon et al., 2016).

Recent analyses of global transport have found that vehicular passenger travel is continuing its growth of recent decades. Therefore, the literature on the future of transport is dominated by two assumptions: first, that global vehicular travel demand can, would and should increase indefinitely and second, that the increasingly acknowledged global oil depletion and climate change challenges to travel growth are capable of technological solutions. These solutions include improved vehicular fuel efficiency, alternative fuels and new and innovative ways of transport (Moriarty & Honnery, 2008). Those new and innovative ways of transport will be the focus of this research. In particular, a new and innovative public transport service in Amsterdam will be researched.

Public transport

One form of transport is public transport, which is often defined as all transport modes available to the public, which are not owned by the travellers themselves. This includes buses, coaches, taxis and domestic air and rail operators. This public transport can be on the local level and national level (e.g. buses, taxis and railway transport), but also on the international level (e.g. domestic air travel). According to this definition, journeys made by private owned cars are not covered in 'public transport' (White, 2016).

In this research there will be looked at one specific mode of public transport, namely a new and innovative form: the on-demand and shared taxi service Abel, which is located in Amsterdam. There will be conducted a research, individually from Abel, to analyse the efficiency of this service from a users perspective. The focus on the users comes from the fact that users are central to on-demand mobility services (see section 1.1.5.2). Since it is a recently developed service with a new and innovative service, there has not been done much research on the efficiency from a users perspective. By getting more information and obtaining more knowledge on the users perspective, first of all advise/recommendations can be given to Abel itself. Second of all, also other on-demand transport services can learn from those insights, since the future of

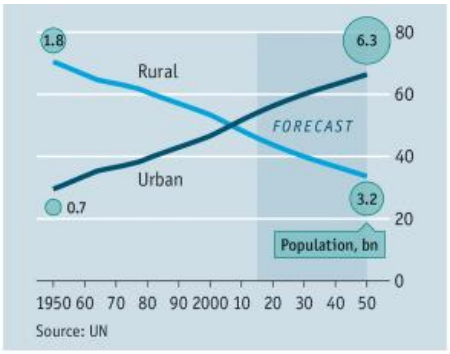
those services is in the hand of the users. Those services are demand driven and if there is no demand, because of the lack of a good and efficient service, the on-demand mobility services will not be able to offer an on-demand service. Besides that, with the obtained insights, cities which do not (yet) have such a service might get interested in developing one after finding out what the users of current mobility on-demand services think about those services. When users show that the services need improvement, cities who are going to develop such a service can take those points of improvement into consideration. This users perspective on efficiency can be researched through the lens of, among other things, transport justice, equity and accessibility since Abel is a privately run taxi service.

1.1.2 Trends in public transport

As said before, transport is a key driver of economic growth, since it links people to their workplaces and connects businesses. Besides that is also affects health, the environment and societal well-being (Houses of Parliament, 2015). But, change is coming to transport, which can be seen in public sector investments in intelligent streets and digital railways, in the cities implementing policy to repulse cars out of the city and in the automakers' focus on next-generation vehicles and smart mobility services (Deloitte, 2015). Besides improving and further developing the infrastructure and transport services, public transport itself is facing a number of challenges and opportunities, caused by changes in the sector itself and external trends that affect its wider socio-economic environment (UITP, 2015). The most important trends are:

First of all, the changing world demographics: those demographics show an ever growing world population, which will cause a higher demand for (public) transport. The United Nations expect that by 2050, over two-third of the growing global population will live in urban areas, what will cause a growing urbanisation. This urbanisation is expected to increase the average city density by 30 percent over the next 15 years (see figure 1). This in turn will lead to stretching existing systems and a rising demand for transport (Hannon et al., 2016).

Figure 1 Global population expectations % of total



Anonymous. (2016). Transport as a service. It starts with a single app. *The Economist, 1 October 2016*

Due to this growing urbanisation, many cities and urban areas already have to deal with tremendous traffic problems, causing congestion, pollution, noise and increase of road casualties (Grotenhuis et al., 2007). Nearly all researchers into the future of global passenger transport (e.g. Ausubel & Marchetti, 2001 and Schafer & Victor, 2000) assume that overall vehicular travel will continue to rise, with all its consequences (Moriarty & Honnery, 2008). This urbanisation will not only result in a higher demand for public transport, but also in a higher car use. Both developments will worsen the congestion and traffic jams that are already apparent in cities (Deloitte, 2015): commuters in Brussels and London waste more than 50 hours a year in traffic jams, which is more than a full week of work (Neumann, 2015). Therefore, urban planners and residents are putting liveability and sustainability in the cities higher on their agendas than ever before (Hannon et al., 2016).

A second trend which influences the transport sector is the Digital Age, which has brought technical innovation. Those innovations have caused devices to be increasingly connected to each other and enabling large amounts of data to be collected and analysed, which allows transport systems to be better understood and planned (Houses of Parliament, 2015). Transport is one of the areas where the explosion in the availability of data and the connectivity of devices can enable new ways to provide service more quickly, efficiently and cost effectively than ever before (IET & ITS, 2014). Operators, therefore, would like to gather faster and more individualised information on their customers in order to improve operations, as well as to maximise the profitability of commercial spaces in stations (UITP, 2015). Also new mobile applications are emerging, which show the traveller the best way to get from A to B, such as 9292 OV (Anon., 2016).

Thirdly, climate change also affects the public transport sector. To prevent further climate change and unsustainable trends, greenhouse gas (GHG) emissions from transport are the target of both national and international policy (UITP, 2015): the EU framework on emissions to 2020 requires GHG emissions from transport (not only public transport) to be cut by 10% from 2005 levels. It also requires 10% of transport fuels to come from renewable sources and it requires transport modes to get more sustainable (Hannon et al., 2016). Ambitious and visionary actions and strategies are essential to radically change current mobility patterns and to avoid dangerous climate change, as well as worsening air quality in cities across the world (UITP, 2015).

Those trends put a growing pressure on urban passenger transport systems, which has increased the demand for new and innovative solutions to increase its efficiency, attractiveness and its sustainability (Finnish Transport Agency, 2015). Grotenhuis et al. (2007) suggest to promote public transport to reduce the inconvenience of congested roads and to repulse the car use in cities. According to Spieser et al. (2015) cities face the challenge of maintaining the services and infrastructure necessary to keep the transportation demands of a growing population. And when the returns from investments in existing technologies, e.g. road expansion, more bus services, new subway lines etc., begin to diminish, it is appropriate, perhaps necessary, to consider new and potentially transformative transportation solutions (Spieser et al., 2014).

To tackle the growing pressure, both national government and local authorities are trying to persuade people to switch transport modes, from private to public transport. Therefore, there are more and more initiatives to make public transport more attractive and efficient (Grotenhuis et al., 2007). One approach to do this, has been the shift towards shared mobility services, such as car-sharing and bike-sharing. This sharing service especially came up in combination with traditional public transport so that various transport modes can join together and be integrated, to serve as substitute to private vehicles. Nevertheless, the complexity of using different transport modes (i.e. different payment methods, different mobile applications for each operator and lack of integrated information) discourages many people from taking advantage of them. As such, integrating different transport modes and providing seamless door-to-door mobility is one of the priorities of decision makers and transport authorities (Grotenhuis et al., 2007). New services, such as car sharing, ride sharing and city bikes, will not only increase the options and flexibility of mobility, but will also increase the use and thus efficiency of underutilised resources, and cut down environmental and congestion effects (Finnish Transport Agency, 2015).

One of the novel mobility concepts that could assist in achieving this seamless mobility is 'mobility on-demand' (see section 1.1.7.2). As the use of private vehicles starts approaching its limits to effectively meet the demand for personal mobility in densely populated cities, mobility on-demand systems seem to be a more economical and sustainable alternative (Chong et al., 2013). New and improved mobility services, are making transportation ever more multimodal, on-demand, and shared, increasing consumer choice and convenience (see figure 2) (Bouton et al., 2015).

Figure 2 The present and future of urban mobility

From . . .	Toward . . .
Individual car ownership as dominant form of transport	Individual car ownership as one form of multimodal, on-demand, and shared transport
Limited consumer choice and few service levels	More consumer choice and many service levels
Government-funded public transit	Public and private transit operate in parallel
Unconnected, suboptimal, transportation systems	On-demand, connected systems that use data to unlock efficiencies

Bouton, S., Knupfer, S. M., Milhov, I. & Swartz, S. (2015). *Urban mobility at a tipping point.*

1.1.3 Car-free cities

1.1.3.1 Car free zones and charges

Many cities are nowadays pedestrianizing parts of their city centres to improve the liveability and sustainability in the city. These efforts often include not only restricting access to cars, but also making the streets themselves more attractive to pedestrians. Examples of such cities are London, New York, Paris and Singapore. Other cities are experimenting with closing certain streets on weekends: e.g. a part of central Jakarta is closed on Sunday morning to allow residents to exercise. Those efforts can have positive implications for urban mobility (Bouton et al., 2015).

Figure 3 London congestion charge zone

Leape, J. (2006). The London Congestion Charge. *Journal of Economic Perspectives, 20(4),* 157-176.

Besides that, cities around the world are opening car-free zones to pedestrians and bikers. Those cities seek to curb congestion and pollution by limiting the number of cars, by restricting parking (or make it more expensive) and creating car-free zones (Bouton et al., 2015).

To keep cars out of the city, cities like London (see figure 3), Singapore and Stockholm have had congestion charges for years, which resulted in decreasing and smoothing out traffic. London, for example, imposed a £11.50 daily charge for driving or parking a vehicle on public roads within the congestion charging zone between

7:00 a.m. and 6.00 p.m., Monday to Friday. The goal of this policy is to reduce cars in the city and stimulating the use of public transport to improve the traffic conditions and sustainability (Leape, 2006).

1.1.3.2 A car-free city?

The question is if there will ever be a city that is completely car-free, since it is impossible to imagine not having cars in the current society. However, there are cities that are trying out car-free initiatives, since around 7 million people globally are estimated to die from air pollution every year. Also climate change will be challenged by those 'car-free' cities, which are less polluting than cities where cars are still allowed. An example of such an initiative can be found in Paris, where 'car-free days' where introduced. Another example is Oslo, which revealed plans in November 2015, to ban all private vehicles from the centre by 2019. By then, it joined a lengthening list of cities seeking to shift the focus away from cars and towards greener, citizen-focused mobility solutions (Cathcart-Keays, 2015).

Other initiatives to make cities less polluting and more sustainable is to ban diesel-powered vehicles. Four of the world's biggest cities are banning diesel vehicles from their centres within the next decade. The mayors of Madrid, Paris, Mexico City and Athens announced plans in November 2016 to take diesel cars and vans off their roads by 2025 (Harvey, 2016).

Also Amsterdam tries to ban polluting vehicles from the city. To do this they have introduced the 'environmental zone' in October 2008. This special zone includes the area inside the highway the A10 and was initially created in 2008 to repulse polluting lorries from the specific area. Only lorries with a Euro 2 or 3 diesel engine and a soot filter and lorries with a Euro 4 or 5 diesel engine were allowed in the specific area at that time (ICOVA, n.d.). In 2010 the municipality of Amsterdam sharpened the rules of the 'environmental zone' and since then only lorries with a Euro 4 or 5 diesel engine are allowed in the zone (ICOVA, n.d.). This specific zone is created to improve the air quality in Amsterdam so the liveability and health of the citizens can be improved and to prevent the stagnation of creating new buildings, due to not coming up to the European norms for fine particles and nitrogen dioxide (ICOVA, n.d.).

Figure 4 The 'environmental zone' for lorries and vans (and taxis from 2018) in Amsterdam

https://www.amsterdam.nl/parkeren-verkeer/milieuzone/

With the eye on the idea of "Schone lucht voor Amsterdam: op weg naar uitstootvrij 2025" the city council agreed on 22 June 2016 to expand the 'environmental zone'. With this agreement they decided to ban all vans with a diesel engine and a date of issue before 1 January 2000 per 1 January 2017 in the 'environmental zone'. Besides that, per 1 January 2018 taxis with a diesel

engine, touring cars and mopeds are not allowed anymore in the 'environmental zone' (see figure 4 and 5). Last of all, diesel vehicles older than 1 January 2005 and gasoline vehicles older than 1 July 1992 do not get a new parking permit. This is because of the policy on 'Schoner parkeren' (cleaner parking) (Gemeenteraad Amsterdam, 2016).

Figure 5 The 'environmental zone' for touring cars and mopeds in Amsterdam (from 2018)

https://www.amsterdam.nl/parkeren-verkeer/milieuzone/uitbreiding/#h3e48477a-0434-4584-afa0-890f94538efb

When cities are implementing policy to repulse cars out of the cities, the urgency to improve public transport is higher than ever before. And this is exactly what cities are doing: worldwide cities are pouring investment into public transit as a way to improve mobility and give travellers a good and efficient replacement of the car (Bouton et al., 2015).

1.1.4 Transit oriented development

One of the strategies to make a city more focused on pedestrians and public transport and less focused on cars is transit oriented development (TOD) (Holmes & van Hemert, 2008).
Transit oriented development refers to the commercial and residential districts built around mass transit stations or corridors and is designed to encourage ridership on buses, trains and other forms of public transport. It is a mixed-use residential or commercial area intended to maximise access to public transport (Holmes & van Hemert, 2008). TODs are also designed to encourage cycling and walking, control the flow of automobile traffic and reduce the amount of land devoted to parking, by locating the transit station within a radius of half a mile from the transit zone, as this is generally considered a reasonable walking distance for pedestrians (Brendel & Molnar, 2010).

However, geographic proximity of public transport alone does not make development transit oriented. Indeed, many developments can be said to be transit adjacent (i.e. within close physical proximity to transit), but are not necessarily designed to promote access and use. Therefore, cities that are focussing on developing car-free zones, developing new forms of transport and public transportation and improving public transport, can be seen as cities that are

implementing TOD, since they are focussing on public transport and pedestrians (Holmes & van Hemert, 2008).

Various planners have identified three essential zoning strategies for transit oriented development, known as the ABC's of TOD-zoning, which are as follows:

- **A**ctive pedestrian friendly streets
- **B**uilding intensity and scale
- **C**areful transit integration

(Holmes & van Hemert, 2008).

TOD can provide many benefits to regions, local governments, households and individuals. With careful planning, TOD can support local businesses and retail and replace the large amounts of surface parking lots and auto-related infrastructure with uses that provide more revenue to local governments and more desirable neighbourhoods for residents.
On the regional level TOD, resulting in the convenience of walking, biking and transit use can provide for more sustainable travel behaviour and development patterns. It can also promote healthy lifestyles and minimize traffic congestion. Studies show that mixed-use places, which allow for daily trips to be made on foot or bike are good complements to transit, if designed properly, can ensure a sustainable base of transit riders who arrive at the stations (Belzer et al., 2006).

1.1.5 Smart cities and smart mobility

1.1.5.1 Smart city

As said before, cities are facing a lot of challenges and are both places of opportunities and places of diseases. Opportunities, because cities are places where people live and meet, where companies are settled and schools and universities are most present. Diseases, because in cities traffic, pollution and waste production are worse than elsewhere. Therefore cities are facing a challenging task to harmonize a sustainable urban development. The 'smart city' concept is considered like a winning urban strategy using technology to increase the quality of life in urban space, improving the environmental quality and delivering better services to the citizens (Benevolo, Dameri & D'Auria, 2016). The smart city topic has its roots in different urban strategies, derived from different streams of study which merges into the Smart City vision. The three main topics that can be seen in a smart city vision are:

1. The digital city: it regards the use of ICT to support the creation of a wired, ubiquitous, interconnected network of citizens and organizations, sharing data and information and joining online services. Internet, broadband and smart devices are at the basis of this urban vision.
2. The green city: it regards an ecological vision of the urban space, based on the concept of sustainable development. A city usually is conceived like a potentially polluting system of infrastructure, buildings, transport facilities and so on, but it should also be seen as a natural space to preserve. Green policies in cities regard both reducing the city footprint on the environment, reducing pollution waste and energy consumption, and preserving or creating public green areas, like gardens and parks.
3. The knowledge city: it regards the policies aiming at enforcing and valuing data, information and knowledge available and produced in the city. This is especially produced

by cultural institutions such as universities, research centres, theatres and libraries, but also produced and used by companies, innovative districts and technological parks. (Benevolo, Dameri & D'Auri, 2016).

The concept of Smart City embraces multiple definitions depending on the meanings of the word 'smart'. This 'smart' can refer to: intelligent city, knowledge city, ubiquitous city, sustainable city, digital city etc. (Cocchia, 2014). Cocchia (2014) found that Smart City and Digital City are the most used terminologies in the literature to indicate the smartness of a city.

One of the key elements obtained from the smart (intelligent) city literature is the utilisation of networked infrastructures to improve economic and political efficiency and enable social, cultural and urban development. This key element involves the use of a wide range of infrastructures including transport, business services, housing and a range of public and private services (including leisure and lifestyle services), but it is ICT in particular that is the basis of all these networks and which lie at the core of the smart city idea (Hollands, 2008).

1.1.5.2 Smart mobility

The recent progress in ICT technologies in the 'digital city' has led to the emergence of a broad area of research in Intelligent Transportation Systems (ITS). ITS in general represents the most advanced way to establish real-time transportation management, by using ICT technologies to better address users mobility needs and to support urban authorities decisions. ITS aim to improve urban transport performance and can address in the problems and issues of pedestrians, cyclists, private vehicles, public transports and roadside infrastructures (Sassi & Zambonelli, 2014). However, the application of ITS is often limited to the provisioning of on-demand web-services, with little or no interactions between users. Therefore, the shift from ITS to 'Smart Mobility' services must pursue the desired comfort for citizens and the satisfaction for urban authorities at the same level. This should be done by improving traffic efficiency and road capacity on the transportation network at an integrated and global level (Sassi & Zambonelli, 2014).

Looking at Smart Mobility (as a part of the Smart City movement) Benevolo, Dameri & D'Auri (2016) derived the most important Smart Mobility objectives through a literature analysis. Those objectives are summarized in the following six categories:

1. Reducing pollution
2. Reducing traffic congestion
3. Increasing people's safety
4. Reducing noise pollution
5. Improving transfer speed
6. Reducing transfer costs

Smart Mobility is often presented as one of the main options to seek more sustainable transport systems, but it could also be seen as a set of coordinated actions to improve the efficiency, the effectiveness and the environmental sustainability of cities. In other words, Smart Mobility could consists of an infinite number of initiatives often characterized by the use of ICT (Benevolo, Dameri, D'Auri (2016). According to Staricco (2013, in Benevolo, Dameri, D'Auri (2016)) there are two meanings of Smart Mobility with respect to the use of ICT. The first meaning refers to an efficient and effective mobility system, which is independent from the role played by ICT, but is

rather connected to the use of appropriate technologies, while the second meaning related to a mobility system characterized by a consistent and systematic use of ICT.

Some examples of possible smart mobility services are (Sassi & Zambonelli, 2014):

- Parking match, which works as follows: a driver is approaching his/her destination and tries to find a vacant parking space. Earlier, another driver has left a parking lot in the same area and therefore a parking match takes place and the driver, which is looking for a parking space, is reached by a parking recommendation. Data involved in the matching process can come directly from the users involved, from parking sensor installed on the infrastructure or on user's vehicles.
- Itinerary match, which works as follows: consider the presence of the same users in a given set of locations at different times. When a spatio-temporal analysis on the data reveals that co-location happens regularly it identifies a possible pool of commuters that make similar trips. The system then should persuade them to switch to carpooling and making them aware of the benefits they have.
- Multimodal Rides match, which works as follows: a person explicitly declares a destination from his/her starting location, asking for directions. A selection of a spatio-temporal portion of data streams occurs and multimodal directions can be provided to reach that destination. Current traffic level and rides availability (from multiple means of transports) on the transport network is evaluated and several complex pattern matching mechanisms are put in place to shape the best multimodal way to reach the destination.
- Chaperone match, which works as follows: parents cannot bring their children to school every morning and they might find difficult to bring them back home when classes are over as well. When no other relatives or friends can look after a child, one can consider to share the path the child is going to follow, at a certain time, to look for someone that takes charge of assessing the presence of the child at intermediate checkpoints (e.g., a bus stop, a crossing, a public display, a store). Hardware sensors and reliable citizens located close the checkpoints can act as proximity probes and thus they can send actual feedback in real-time to the parents, and of course they send alerts when an unexpected event will occur.
- Taxi match, which works as follows: a taxi is hailed on the street by a person. While the driver is moving towards client's destination, he/she shares his route with other people that are looking for a ride. If someone with a compatible trip ask for a ride, then taxi service becomes shared. Thus, its cost is lower for the clients and the revenue increase for the taxi driver. This service could seem similar to the previous one, but it mainly differs in terms of how the matches take place.

1.1.6 Flexible transport services (FTS) and demand responsive transport (DRT)

1.1.5.1 FTS

As said before, increasing road congestion and the general pressure on public transport have prompted an interest in smart mobility. One form of smart mobility are flexible transport services (FTS) (Ferreira et al., 2007). According to Waters (2003, in Ferreira et al., 2007) the concept of flexible transport can be summarised as a flexible, integrated and customer centric, adaptive transport option that sits somewhere between private car ownership and fixed route traditional transit. There is a variety of FTS concepts, such as car sharing and carpooling schemes, community and special needs transport and demand responsive transport (DRT) (Ferreira et al., 2007).

1.1.6.2 DRT

Demand responsive transport (DRT) (also called on-demand transport) has been defined as a service that adapts to suit specific transport needs. Ever since the 1970s, there have been moments where DRT has been seen as the solution to a variety of transport problems (Davison et al., 2014).

Public transport can be categorised as being demand responsive transport if:

- the service is available to the general public (i.e. it Is not restricted to particular groups of user according to age or disability criteria or place of employment);
- the service is provided by low capacity road vehicles such as small buses, vans or taxis;
- the service responds to changes in demand by either altering its route and/or its timetable. And;
- the fare is charged on a per passenger and not a per vehicle basis
  (Davison et al., 2014).

DRT services provide transport on-demand for passengers, using vehicles scheduled to pick up and drop off people in accordance with their needs. Since DRT is a transportation service that is responsive to the requests of passengers, is can be seen as part of the demand side of public transport, which puts the user (the travellers) at the centre. On the other hand, a flexible, integrated and innovative scheme that is part of the supply side is Mobility as a Service (MaaS) (Mageean & Nelson, 2003).

1.1.7 Mobility on-demand vs. Mobility as a Service

1.1.6.1 Mobility as a Service

Mobility as a Service (MaaS) provides new opportunities to improve customer travel choice and support greater efficiency in how transport services are provided. MaaS Global is the start-up and tech firm behind the most ambitious of Finland's schemes. MaaS Global, located in Helsinki, developed an app, Whim, which will show the best way to get from A to B by combining public transport and a variety of options from participating private firms. It is an integrated form of providing public transport from door-to-door (Anon., 2016). MaaS, as a concept, is broader in scope than seeking to improve just one aspect of the travel experience, such as ticketing or journey planning information. Instead, MaaS seeks to transform the way in which travellers choose how to travel from A to B and it provides an opportunity for policy makers to secure benefits for the society. MaaS frames the mobility systems around the customer's preferences and needs and therefore is an initiative for the supply side of public transport, since this service is

offered to the travellers and is not based on the demand of the travellers (Transport Systems Catapult, 2016).

1.1.7.2 Mobility on-demand

Since the traditional policy responses to the growing congestion – building more roads and expanding public transport – are sometimes too expensive for the current financial times, urban planners are positive about combining existing mass-transit schemes with a growing variety of private services. It offers a way to attract private capital into public transport and by enabling a closer and better link between supply and demand, mass transport will be more efficient. Also, congestion at peak hours will fall as travellers are diverted from crowded routes to less-packed ones and also varying prices by time of day could help here (Anon., 2016).

One approach to tackle the challenge of growing pressure on urban passenger transport has been the slow, but steady shift towards shared mobility services (car-, bike-sharing etc.). Building on these shared modes and developments in information and communication technologies (ICT) is one of the novel mobility that could assist in achieving seamless door-to-door mobility: mobility on-demand (Kamargianni et al., 2016; Davison et al., 2014).

This mobility on-demand is an initiative for the demand side of public transport, since it puts the users of the service at the centre. For the near future of urban areas Hannon et al. (2016) envision three mobility trajectories: clear and shared, private autonomy and seamless mobility. This mobility on-demand delivers transport via a combination of shared vehicles and high-quality public transit as the backbone. Electrical cars will also become far more common, due to economics, consumer interest, sustainability and the creation of low-emission zones. All of this will be enabled through the use of smart software platforms and mobile applications that manage multimodal traffic flows (Hannon et al., 2016).

One example of an on-demand, demand responsive and shared service is taxi service Abel, which is located in Amsterdam and which will be the case study of this research (see section chapter 4).

In short the above can be summarised as follows: there are three trends that affect the transport sector and therewith also urban areas. This in turn leads to a lot of challenges for cities, for which solutions are needed to keep the cities liveable and sustainable. An urban strategy that uses technology to increase the quality of live and the environment and aims to deliver better services to citizens is the Smart City movement, where Smart Mobility is a part of. A form of smart mobility are Flexible Transport Services (FTS), where Demand Responsive Transport (DRT) and on-demand services are example of. Those services can be found on the demand side of the transport sector and therefore, put the users at the centre of their service. To research the efficiency of DRT and on-demand services from a users perspective the case study of taxi company Abel, located in Amsterdam has been chosen.

1.1.8 Taxi policy in the Netherlands

Since the case study is a taxi service located in Amsterdam, the Netherlands, there can be looked into the taxi policy in the Netherland: in May 2015 the policy on the future of taxis was announced by the Ministry of Infrastructure and Environment, in a letter to the Representatives of the Netherlands. Central to this policy is the optimisation from door-to-door service for travellers. According to the Ministry of Infrastructure and Environment, taxis can contribute to this goal by providing small-scaled, flexible and demand-driven taxi services. And new initiatives,

like mobile applications, can increase the competitiveness of the sector and improve the quality of transport of people (Mansveld, 2015). According to Mansveld, the former Minister of State of the Ministry of Infrastructure and Environment, taxis can develop themselves to a high standing complement to the public transport in the Netherlands (Mansveld, 2015).

In the letter to the Representatives of the Netherlands send in January 2016, current Minister of State of the Ministry of Infrastructure and Environment, Sharon Dijksma (2016) gives an overview of the progress made since the policy of 2015 was conducted. She states that in the last few years, there have been new innovative and competitive taxi services that offer services way below the prevailing rates. She also names Abel in her letter and states that she is happy with those new and innovative services. This shows the government is accepting and stimulating private innovative projects (Dijksma, 2016).

Those innovative, new, flexible and on-demand transport services are interesting to look at, since they are new and will continue to develop and improve. This research will therefore focus on the shared-taxi service Abel in Amsterdam. Since this service is a new service and just celebrated his first birthday in January this year, no research has been done to look at the efficiency of this service from the user's perspective.

1.2 Research objective

The objective of this research is to gain insight in the efficiency of demand responsive and on-demand transport services, by carrying out a case study research into the experiences of users of such a service, namely: taxi service Abel (see chapter 4). The research is conducted individually from Abel and in name of the Radboud University.

This research has been done so advise/recommendations can be given on whether or not this specific service, but possible also other mobility on-demand services need to be improved according to the users of these services. It is important to look at the perspective of the users, since users are central to on-demand services: the focus is on the demand coming from the travellers. But, since it is a recently developed and therefore new form of mobility, there has not been done much empirical research on demand responsive transport services: there is still a gap in the research. Therefore, it is important and needed to understand the efficiency of this service from a user perspective. This can be researched through the lens of, among other things, transport justice, equity and accessibility.

When researching this, new insights can lead to improvement of this particular service in Amsterdam and possibly also to improvement of other on-demand services. Besides the possibility to give advice/recommendations to existing mobility on-demand services, the obtained insights can also be interesting for cities that not (yet) have such a service. If the results of the analysis are positive such services might be able to be implemented in more cities as a new form of efficient, innovative and attractive public transport. Cities who are going to develop such a service can take the points of improvement the users have into consideration during the development. What is important to recognize here is that copying a service will not work, since each DRT service works differently, due to the different contexts (P. Jittrapirom, personal communication, May 10, 2017).

To reach the goal of this research, there has first been generated more knowledge about the case study that has been chosen for this research: the taxi company Abel, which is located in

Amsterdam. Via an interview with two employees of Abel there has been obtained more background information about the service. Secondly, to obtain more academic knowledge on demand responsive transport services an interview with post-doctoral researcher at the Radboud University, Peraphan Jittrapirom, has been held (for interview guides, see appendix I and II).

Last of all, there has been focused on fulfilling the goal of this research, which is finding out how efficient this specific service is, by researching the users opinion on efficiency. This has been done via an online web-survey (see appendix III).

1.3 Research questions

In order to achieve the purpose of the research, the following main question will be answered:

How efficient are mobility on-demand, Demand Responsive Transportation modes, in specific shared taxi service 'Abel', from a users perspective?

To answer this main question the following sub questions will be used:

1. What are the motives of Abel to provide their service?
2. How is Abel taxi going to distinguish/distinguishing itself from other taxi services?
3. How does Abel see the future of their services (what are the future perspectives)?
4. What are good and bad things of Abel and what can be improved, according to the users?
5. How efficient do the users of Abel taxi think this service is overall?

1.4 Research model

This research has been conducted in several steps. As a first step, a literature review has been carried out on the issue of trends in public transport and new forms of (public) transport that are developing because of those trends. This has been done to get some background and context information about the specific topic of new and innovative forms of public transport, in specific demand responsive and on-demand taxi services.

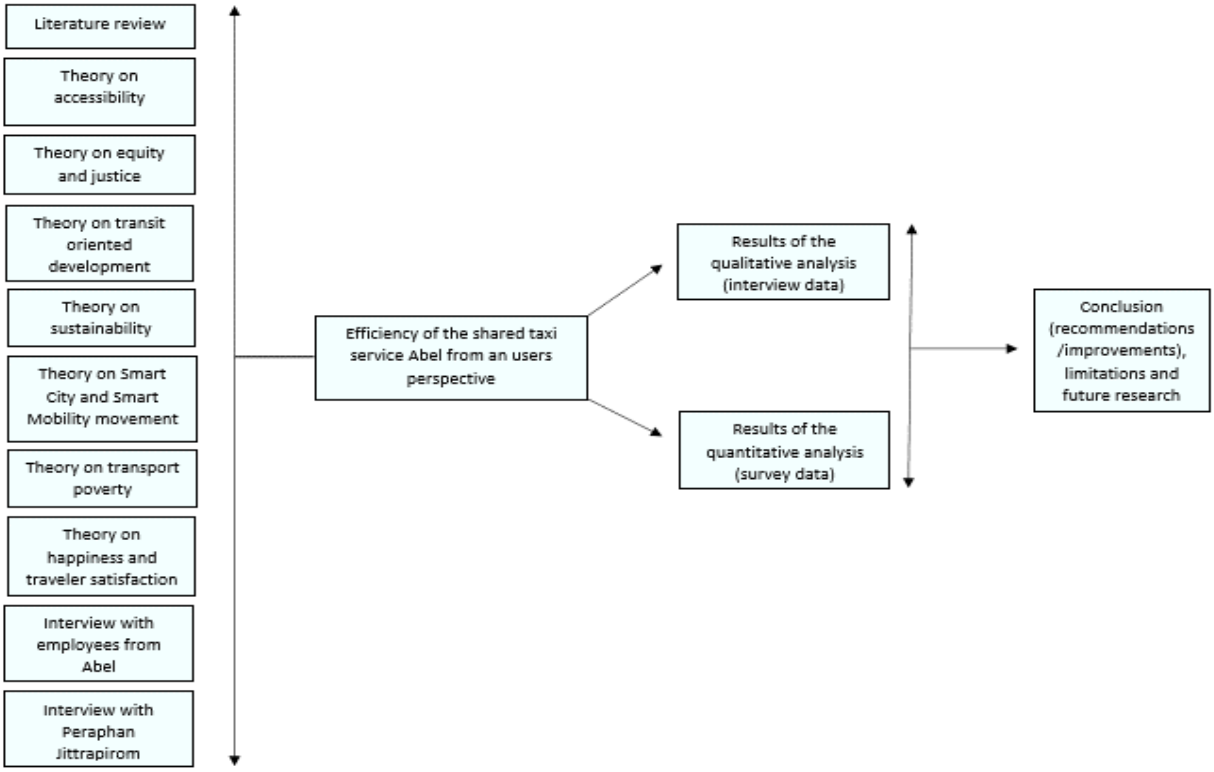
The second step relates to finding relevant theories which will help answering the main question and sub-questions and determine the focus of this research. Those multiple theories are processed in the theoretical framework and conceptual model (see chapter 2). The third step consisted of obtaining the necessary data. To obtain more background knowledge on the case study an interview with two employees of Abel has been conducted and to obtain more academic knowledge on demand responsive transport an interview with post-doctoral researcher at the Radboud University, Peraphan Jittrapirom, which is doing research on smart city sustainable transport, has been conducted. To obtain the necessary data on efficiency a web-survey has been distributed which, in the end, was filled in by 26 users of Abel.

The survey questions were based on the operationalisation that followed from the theoretical framework (see section 2.2.2) and the interview questions for the interview with the employees of Abel were based on both the sub-questions mentioned at section 1.3 and on the operationalisation. The interview questions for the interview with post-doctoral researcher Peraphan Jittrapirom were based on the theoretical framework.

After obtaining the necessary data, the data has been analysed: the data obtained via the web-survey is analysed with the help of statistical program SPSS and the interviews were transcribed with the help of program Atlas.ti.

In the end a conclusion has been written wherein the main question and sub-questions have been answered with the help of the obtained empirical data. Furthermore, the contribution of this research to the science and society has been explained, limitations of the research have been highlighted and possibilities for future research have been mentioned.

Figure 6 Research model



1.5 Social and scientific relevance

1.5.1 Social relevance

Although the literature provides some information about innovative, demand responsive and on-demand transport systems and the implementations of those services in cities (e.g. Hannon et al., 2016 and Davison et al., 2014), there has not been done research on how efficient those recently developed services are from a users perspective. The literature mainly focuses on the trends and developments that caused interest in those new forms of mobility, but the literature does not provide a lot of knowledge on how users see the efficiency of those new services and how those services can be improved according to the users, while the users are the key to on-demand services.

Since those new forms of mobility are gaining more and more interest and since they are highly important for the future of public transport and cities to create a harmonized sustainable and liveable urban environment, it is needed to obtain more knowledge about those services and their efficiency, in specific from a users perspective. This research, therefore, can form a starting

point of the research that still needs to be done. This research can lead to new insights of the efficiency of a new form of mobility. With those insights, existing mobility on-demand services, in specific Abel, can improve their service. Although this research focusses on a case study of a mobility on-demand service, other on-demand services can also learn from the insights and recommendations. Going even further, cities that do not have such a service, can consider to develop such a service and implement a mobility on-demand strategy, taking into consideration the obtained insights of this research. Those cities can learn from the obtained insights of this research and they can decide, or at least consider whether or not they see the benefits of these services and want to develop such a service and with this contribute to the Smart City movement and create a more liveable and sustainable urban environment, with less traffic congestion and air pollution.

1.5.2 Scientific relevance

Even though this research is not really solving a scientific problem, it can obtain more scientific and academic knowledge about a new form of mobility, with which it can help to (partly) fill the knowledge gap. The literature mainly focuses on the trends that, mostly negatively, influence the area of transport (UITP, 2015; Hannon et al., 2016; Ausubel & Marchetti, 2001; Schafer & Victor, 2000). Due to those trends, the literature focuses on ways to further prevent negative effects and solve existing problems, caused by growing urbanisation (Anon., 2016; Holmes & van Hemert, 2008). For example, some cities are creating car-free zones (Bouton et al., 2015) and other cities are focussing on creating new, innovative and sustainable forms of public transport, such as mobility on-demand and demand responsive transport services (DRT) (Davison et al., 2014.; Kamargianni et al., 2016, Hannon et al., 2016) as a part of the Smart City movement (Benevolo, Dameri & D'Auri, 2016). This makes the literature mainly focus on the context wherein the interest in innovative transport modes grows, but it does not really focus on the performance of the already existing services. Because it is quite a new phenomenon, there is not much information about how efficient those services actually are, focussing on the perspective of the users. Therefore it can be said there is knowledge gap in the academic literature: the extent of academic research on private transport and public transport is way bigger than on the middle way of on-demand transport. Therefore, this research will try to solve this scientific knowledge gap, by obtaining scientific, in-depth and detailed knowledge on the efficiency of mobility on-demand services from an users perspective.

2. Theory

2.1 Theoretical and analytical framework

2.1.1 Efficiency and accessibility in transport

Since the main goal of this research is to investigate the efficiency of taxi service Abel, efficiency is an important concept to explain further. The efficiency of public transport systems may be analysed based on several factors relating to the quality of the service that is offered – service performance – and to the performance of the agencies and companies in charge of it.

Santos (2000, in Sampaio et al., 2008, p. 446) gives several characteristics required for a good performance and efficiency:

a) System accessibility, which is determined by the distance between user's origin and the initial station and between the last station and final destination. The shorter this distance, the higher the route availability, and as a consequence, geographical coverage increases, making it easy and better for people to move from one place to the other. Another form of accessibility relates to social inclusion, which means that all individuals are actually able to use the public transport provided: equity/justice is part of this. So, the higher/better the accessibility, the higher/better the efficiency.
b) Travel time, which is determined by velocity and geometry of routes. Velocity is a function of distances, of traffic conditions and road quality. The geometry of routes is a function of the development of a complex connection of more direct and subsidiary routes. So, the shorter and the more accurate the travel time, the higher/better the efficiency.
c) Trustworthiness, determined by uncertainty of time schedules. Punctuality brings users trust and fidelity. And also the availability of the service when needed brings trust. So, the higher/better the trustworthiness, the higher/better the efficiency.
d) Frequency, determined by the time interval between each trip. Users must know the timetables, and its changes along the day, during weekends and other special occasions.
e) Vehicle characteristics, including age, conservation, and technology all bringing users comfort. By technology one also understands door size, steps, and adoptions required by special passengers. So the better the characteristics of the vehicles, the better the efficiency.
f) Adequate information and support facilities, e.g. covered stations, schedule and timetable information, clear indications of stations and vehicles.
g) Mobility in accordance with necessities, that is, routes must be planned to cover the whole area and allow flexibility in choosing an appropriate route. In addition, adaptations are required to attend passengers with motion restrictions.

Almost all criteria for efficiency mentioned above can be applied on the case of taxi service Abel. E.g. when looking at the efficiency of Abel we can look at accessibility, equity/justice, travel time, trustworthiness, vehicle characteristics and mobility in accordance with necessities (e.g. people with special needs). The one criteria that will not be researched in this study is the 'frequency', since Abel does not provide a fixed timetable with time intervals between different trips. Booking an Abel is possible at almost any time of the day, whenever it suits you. So, travellers do not have to take into account fixed timetables.

Accessibility

The concept 'accessibility' is an important concept when talking about efficiency: it has often been used in a diversity of scientific studies focusing on mobility issues (Bocarejo & Oviedo, 2012). Accessibility is also increasingly identified as a key criterion to assess transport policies, land use developments and urban service delivery policies. The growing emphasis on accessibility in transport policy is in part based on the long-standing understanding that transport is a derived need: what counts ultimately is the accessibility provided by the transport system (Benenson et al., 2011). When starting from transport as a derived need, accessibility is used as an indicator of the extent to which all groups, and thus all individuals, can participate in activities considered 'normal' to their society, such as access to essential services and employment (Benenson et al., 2011).

Many methods of defining and putting into practice the notion of accessibility have been developed over the years. Interpretations of accessibility generated within the scientific community include, among others, the following definitions: the potential opportunities for interaction (Hansen, 1959, in Bocarejo & Oviedo, 2012), the overall benefits provided by a given transport system (Ben-Akiva & Lerman, 1979, in Bocarejo & Oviedo, 2012) and the ease of reaching any area of activity using a specific transport system (Dalvi & Martin, 1979, in Bocarejo & Oviedo, 2012).

Social exclusion

Accessibility to transport is affected by affordability, the physical ability to board transport, the distance to the nearest public transport pick-up and the availability of transport that can pick up directly from people's homes, such as taxis (Houses of Parliament, 2015). Besides being affected by affordability, accessibility is expressed in either inclusion or exclusion. The concept of social exclusion in its different dimensions has become an important element in social policy discourse. An individual is socially excluded when he or she lives geographically in a society, but cannot be involved in the normal activities of this society (Witter, 2010, in Bocarejo & Oviedo, 2012). Kenyon et al. (2002, p.209) define social exclusion as follows:

"The unique interplay of a number of factors, whose consequence is the denial of access, to an individual or group, to the opportunity to participate in the social and political life of the community, resulting not only in diminished material and non-material quality of life, but also in tempered life chances, choices and reduced citizenship".

And according to Preston & Rajé (2007) social exclusion does not exist due to a lack of social opportunities, but a lack of access to those opportunities. This means that if someone is excluded, the accessibility is influenced in a negative way and that if someone is included, the accessibility is influenced positively.

Mobility related social exclusion

Relationships between transport and social exclusion have been studied more recently and mobility-related social exclusion is defined as follows:

"It is the process by which, due to an insufficiency or inexistence of adequate means to travel, people are preventing from participating in the economic, political and social life of the community, as a result of reduced accessibility to mobility opportunities" (Kenyon et al., 2002, p. 210).

When people experience conditions of exclusion, i.e. disabled people who cannot use the regular transport modes, while no special service is provided, travel choice is removed as a result of an urban environment built around the notion of high mobility in order to access goods, services and participate in society. The notion of policy makers of a social exclusion approach to transport disadvantage forces one to concentrate not only on the disadvantages of being excluded as a result of transport-related inequalities, but also on the economic and social outcomes that result from them (Bocarejo & Oviedo, 2012). Research has shown that when there is a lack of access to transport, the quality of life reduces (Houses of Parliament, 2015).

The above means that if there is social exclusion in the area of public transport, the accessibility will be influenced negatively, which in turn will also have a negative influence on the efficiency of the public transport services. When there is social inclusion both accessibility and efficiency will be influenced positively.

2.1.2 Transport equity and justice

Accessibility also has to do with equity. Equity refers to the distribution of impacts (benefits and costs) and whether that distribution is considered fair and appropriate (Litman, 2015). Equity issues have been examined in the literature under a variety of disciplines, but a primary focus has been on the distribution of services around a region or among a population. For example, in geography to examine the accessibility or economic activity, or the distribution of particular services (Welch, 2013). When those services are unequally distributed and there is social exclusion transport poverty can be seen (see section 2.1.4).

Also in transportation equity is an important concept: transport planning decisions often have significant equity impacts. Most practioners and decision-makers want to achieve equity objectives (Litman, 2015). But, despite several federal mandates, there is no generally accepted standard framework for measuring equity in transport (Welsh & Mishra, 2013).

Despite this, there can be distinguished three main types of transportation equity:

1. Horizontal equity: horizontal equity (also called fairness and egalitarianism) concerns the distribution of impacts between individuals and groups that are equal in ability and need. According to this form of equity, equal individuals and groups should receive equal shares of resources, bear equal costs, and in other ways be treated the same. This means public policies should avoid favouring one individual/group over others, and that consumers should 'get what they pay for and pay for what they get' from fees and taxes, unless a subsidy is specifically justified. When there is no specific group that is favoured and everyone user of public transport is treated the same way, this will also positively influence the efficiency.

2. Vertical equity with regard to income and social class: vertical equity (also called social justice, environmental justice and social inclusion) is concerned with the distribution of impacts between individuals and groups that differ in abilities and needs, by income and social class. According to this equity, transport policies are equitable if they favour economically and socially disadvantaged groups, therefore compensating for overall inequities. Policies that favour disadvantaged groups are called 'progressive', while those that burden disadvantaged people are called 'regressive'. This definition insure that disadvantaged groups do not bear excessive external costs (financial costs, pollution, accident risk etc.).

3. Vertical equity with regard to mobility need and ability: this equity is concerned with the distribution of impacts between individuals and groups that differ in mobility ability and need, and therefore the degree to which the transportation system meets the needs of travellers with mobility impairments. This definition is used to support universal design (also called accessible and inclusive design), which means that transport facilities and services accommodate all users, including those with special needs. The alignment of the public transport services with the needs of different individuals will have a positive influence on the efficiency, since this also has to do with social inclusion.

These three types of equity often overlap or conflict. For example, horizontal equity requires that users bear the costs of their transport facilities and services, but vertical equity often requires subsidies for disadvantaged people. This makes transport planning often involving making trade-offs between different equity objectives (Litman, 2015).

2.1.2.1 Equity issues with sustainability

In sustainable transport, which is becoming more and more important in the current era, there are also some equity issues. By definition, intergenerational equity is a central element of sustainability: if there were no future generations, climate change and finite resources would not be issues. In addition to that, most environmental impacts of transport also have a strong social or distributional dimension with respect to the current generation. As the definition of externality makes clear, the people who cause environmental effects are usually not the ones that are most affected. Another equity dimension of environmental impacts of transport is a global one. Around the world, millions of motorised transport are having an increasingly negative impacts on the environment: globally expanding motorised transport has made urban air pollution a worldwide problem (Greene & Wegener, 1997).

Social justice

Equity, in particular vertical equity according to Litman (2015), is linked to the concept of 'social justice'. Social justice has a long history in humanities since Aristotle, Hobbes, Rousseau, Hume and Kant. But it is not possible to talk about a single meaning of justice, due to the complexity of the subject. In transport context, social justice refers the fairness in the physical distribution of goods, accessibility for people and affordability of all types of services. Social justice literature has brought forward the importance of the notions, such as equal rights and shares, freedom,

capabilities, opportunities, choices, and distributional issues which are essential to create a more just society (Beyazit, 2011).

One of the early contributions which highlighted the importance of transport systems in social justice can be found in *Social Justice and the City* by Harvey (1973, in Beyazit, 2011). Harvey mentioned transport facilities as a need in terms of reaching other services and the job market. Although the 1950s is regarded as the starting point for thinking about social issues related to transport, only from the mid-1990s growing interest in the relationship between social justice and transport has appeared. The social justice debate in transport has been mainly on the issue of distributional effects of transport: distributional feature of transport systems might create contrasting effects on different groups of a society. These effects can be beneficial for one interest group, but not for the other. Verhoef (1997, p. 31, in Beyazit, 2011) states that transport infrastructure investments are "likely to cause some groups to be better off, but also some to be worse off. The incidence of gains and losses over different interest groups will generally vary over space". These gains and losses might be physically effective from local to regional and national level by concentrating benefits on specific locations which would then, as Harvey (2006, in Beyazit, 2011) suggested, create uneven geographical development. Socially it would cause having different perceptions of gains and losses among society.

Transport, therefore, plays a crucial role in assuring social justice to societies in two ways. First, transport is an important tool to distribute the social and economic benefits that are created by both means of transport itself and other facts. Secondly, transport acts like a catalyser in supporting capabilities by linking them and thus, enhancing functioning's of individuals (Beyazit, 2011).

When looking at the distribution of access to transport among individuals of differing economic wealth, we are looking at an issue closely related to Environmental Justice (EJ). The US department of transportation (DOT) defines what constitutes EJ in the context of transportation in three parts:

1. To avoid, minimise, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.
2. To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
3. To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

(USDOT, 1997 in Welch, 2013).

2.1.3 Transport poverty

When talking about accessibility, equity, equality and justice in the area of transport, also the phenomenon of 'transport poverty' should be mentioned. What precisely constitutes transport poverty has never been fully defined within academic or policy literatures (Lucas et al., 2016). According to Lucas et al. (2016) it is very difficult to construct one concise definition for transport poverty. First of all, this is because transport poverty resides with individuals rather than the whole household (i.e. one household member may experience it, whilst another member of the same household does not) and transport poverty is particularly polarised around gender differences (Booth et al., 2000; Robinson & Thagesen, 2004 in Lucas et al., 2016).

Secondly, mobility is largely associated with the benefit of providing accessibility to goods, services and activities. These activities are all highly socially, temporally and geographically context-specific, making it more difficult to construct a single definitive indicator of transport poverty. Therefore, it is unclear whether transport poverty relates to a deficiency in transport supply, and/or to some minimum level of available mobility, and/or to a level of accessibility to goods, services and daily activities (Lucas et al., 2016).

The various academic literatures on transport poverty also show that, next to the difficulty of giving one unambiguous definition for transport poverty different terminologies have been used interchangeably to describe transport poverty. For example, Ahrend et al. (2014) and Martens (2013) talk about 'transport/mobility poverty', while Martens and Bastiaanssen (2014) and Scheiner (2008) talk about 'accessibility poverty'. Furthermore, Hine (2009) talks about 'transport-related social exclusion', while Currie et al. (2009) talks about 'transport disadvantage'. These terms are used with often very different, but also overlapping definitions of transport poverty.

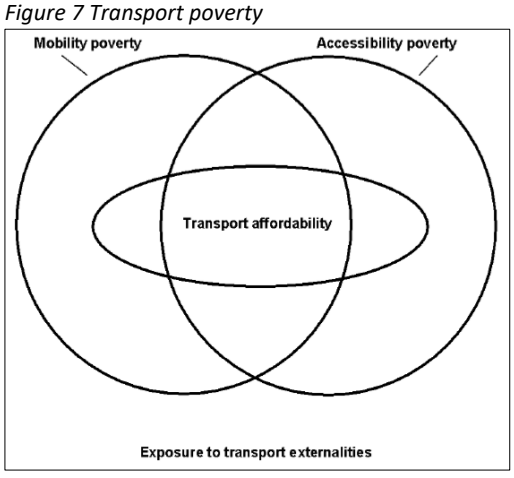
Lucas et al. (2016) come up with a combined definition wherein transport poverty itself is explained as an overarching combination of the subset of:

- Transport affordability, which is the lack of individual/household resources to afford transportation options, typically with reference to the car and/or public transport
- Mobility poverty, which is a systematic lack of motorised transport that generates difficulties in moving, often linked to a lack of services or infrastructure.
- Accessibility poverty, which is the difficulty of reaching certain key activities, such as education, employment, healthcare services, shops etc.
- Exposure to transport externalities. In its broadest definition, transport poverty can also been seen to include the disproportionate negative exposures to the transport system itself, such as road traffic casualties and chronic disease and deaths from traffic related pollution. This also has to do with environmental justice (Booth et al., 2000 in Lucas et al., 2016).

Lucas et al. (2016) say that an individual is transport poor if, in order to satisfy their daily basic activity needs, at least one of the following conditions apply:

- There is no transport option available that is suited to the individual's physical capabilities and condition.
- The existing transport options do not reach destinations where the individual can fulfil his/her daily needs, in order to maintain a reasonable quality of life.
- The necessary weekly amount spent on transport leaves the household with a residual income below the official poverty line.

Figure 7 Transport poverty



Lucas, K., Mattioli, G. & Verlinghieri, E. (2016). Transport poverty and its adverse social consequences. Proceedings of the Institution of Civil Engineers – Transport, 169(6), 353-365.

- The individual needs to spend an excessive amount of time travelling, leading to time poverty and social isolation.
- The travel conditions are dangerous, unsafe or unhealthy for the individual.

Each of these phenomena can also be a subset of the other (see figure 7).

With this 'combined' definition Lucas et al. (2016) tries to make clearer what transport poverty actually is and what it consists of, but they also want to make clear that there is no such thing as one correct and unambiguous definition. Therefore this combined definition is a good definition to work with in this research.

Important to mention is that transport poverty does not only exist in developing countries, but also in developed countries. Even in developed countries, such as the United Kingdom, with an extensive road network, high levels of car ownership and good public transport, some groups in the population (mostly the poorest and most vulnerable) are affected by transport poverty. Most notably, problems of affordability, transport costs, accessibility and exposure to externalities are very present, even in developed countries (Lucas et al., 2016).

Even though the transport reality in developing countries is full of contrasts, which makes it hard to compare the transport poverty in developed and developing countries, there are some generalizable similarities. First of all, in both developed and developing countries low-income groups usually spend a high percentage of their income on transport, but have the lowest quality transport systems available to them, whereas higher income groups spend a much lower amount of their income on transport, but do have the highest quality transport systems available to them (Lucas et al., 2016).

Secondly, both in developed and developing countries transport poverty is mostly apparent in rural areas: rural communities face a range of challenges associated with accessibility and connectivity (Velaga et al., 2012). For people living and working in rural areas access to health care, education, work and other services (e.g. shopping facilities) is a key issue around the world, since many rural areas have limited or no connection to public transport. This lack of transport accessibility and connectivity has a strong impact on those with limited access to private motorised transport, such as children, older people and disabled people (Velaga et al., 2012).

What could be a (partial) solution for transport poverty in rural areas is a flexible transport system (FTS). This kind of system is identified as one of the more promising solutions. The FTS concept builds on the principles of demand responsive transport (DRT) and can provide flexibility in choosing route, time, mode of transport, service provider, payment system etc. A well-designed FTS aims to integrate different modes of transport to provide more sophisticated, comfortable and cost effective transport options (Velega et al., 2012). But developing such a system in rural areas comes with some challenges, such as scalability issues, challenges of transport service co-ordination, technological issues and economic viability. The Flexible Integrated Transport Services research activity explored how to overcome some of these challenges and a local level flexible, demand responsive and on-demand transport system (such as Abel) with a focus on passenger centric scheduling could be a solution (Velega et al., 2012).

2.1.4 Happiness and satisfaction in travel

Now, more than ever, public transport operators are forced to place emphasis on the monitoring and improvement of the services provided in an attempt to address the increasing rate of car ownership and the deterioration of traffic conditions and ultimately to contribute to sustainable urban mobility (Tyrinopoulus & Antoniou, 2008). Therefore, an important aim of transport and traffic policy is to influence people to travel in societally beneficial ways. Some policies aim at promoting a shift away from car use towards more sustainable travel modes, while other policies aim at changing car drivers' decisions about departure times or routes, which will lead to a reduction of congestion and local pollution. As a consequence, the research on travel behaviour has placed a strong emphasis on the factors that influence people's decisions about behaviour and behavioural change (Ettema et al., 2013).

But, much less attention has been given to the issue of how people experience the trips they make as a result of their decisions. The research that has been done suggest that travellers' anticipated trip utility (the perception they have based on previous experiences and information obtained from others) may differ from the utility they actually experience when making the trip. This implies that it is important to not only look into the factor underlying trip decision making, but also the actual experience and satisfaction with the trip (Ettema et al., 2013). According to Fellesson & Friman (2012) satisfaction is an important concept since it is known to be of great value in understanding customers' perception and evaluations: satisfaction is repeatedly showing itself to be an important indicator of future customer behaviour. Customer satisfaction, therefore, highlights and explains the link between what a company does (in terms of the products and services offered) and how the customers react. For public transport, this link is a key concern (Fellesson & Friman, 2012).

Another reason satisfaction is an important concept in public transport is that in many countries, investments are being made in public transport systems in order to make them more competitive with other means of transport, for example private cars. Old services are being improved and new services are being developed. But, an increase in supply (qualitatively or quantitatively) will not automatically lead to a corresponding increase in demand and satisfaction (Fujii & Katimura, 2003 in Fellesson & Friman, 2012). To make sure that new and improved services really attract existing and potential customers, knowledge of satisfaction should provide policymakers and operational managers in the public transport system with valuable information. Satisfaction studies can provide information about what customers consider important when traveling, as well as information about how the existing public transport services are perceived (e.g. in terms of quality) (Fellesson & Friman, 2012).

Looking at the quality of a service, this quality reflects the passengers' perception of transit performance. There are a number of approaches and techniques used in research to define and assess the quality of a service, such as:

- Customer satisfaction – in public transport this can be defined as the overall level of attainment of a customer's expectations, measured as the percentage of the customer expectations, which have actually been fulfilled.
- Customer loyalty – is reflected by a combination of attitudes and behaviour. It is usually driven by customer satisfaction. It also involves a commitment on the part of the customer to make a sustained investment in an ongoing relationship with transit service.

- Benchmarks – can also be used for comparing quality either in different time frames, or at the same time among different routes or even among different public transport operators

So (customer) satisfaction partly defines the quality of a service, which makes it important to look at when wanting to improving services and attract customers (Tyrinopoulos & Antoniou (2008).

2.1.4.1 Perceived Service Quality

The review of Edvardsson (1996) wherein more than 30 studies of customer perceived service quality (PSQ) were examined, showed that how the employees treat the customer, the reliability of the service, simplicity (e.g. the clarity and availability of information) and recovery when something goes wrong are all factors that are of importance when looking at satisfaction (Fellesson & Friman, 2012). Also dell'Olio, Ibeas & Cecin (2011) say that analysing and improving the quality and efficiency of services is important when changing the daily transport habits of customers. Policies require an ever more personalised attention to the desires of customer, to know and quantify the most influential variables on their decision to travel in public transport. The quality of a public system is covered by many factors, such as considerations relative to comfort and safety within the vehicle, the time taken to cover the routes and the convenience and existence of supporting infrastructure (dell'Olio, Ibeas & Cecin, 2011).

Tyronipoulos & Antoniou (2008) show with their research on public transfer user satisfaction that satisfaction, besides influencing service quality, also is a part of efficiency. To measure the satisfaction of travelers among different operators they have looked at 23 different attributes, based on the Handbook for Measuring Customer Satisfaction and Service Quality (TRB, 1999 in Tyronipoulus & Antoniou, 2008). Examples of these attributes are: service frequency, on-time performance, network coverage, waiting time for the service, service provision hour, information provision, accessibility of the service and vehicle characteristics. All of the mentioned attributes are also important when measuring efficiency (see section 2.1.1).

2.1.4.2 Satisfaction with Travel Scale

A way to measure traveler's satisfaction with a service is via the satisfaction with travel scale (STS). STS measures travel satisfaction in two affective (positive activation versus negative de-activation and positive de-activation versus negative activation) and one cognitive dimension. The STS is based on methods developed to measure subjective well-being (SWB), wherein SWB is defined as an individual's cognitive and emotional well-being.

Cognitive well-being refers to an individual's assessment of his/her life in general, based on his/her objective life circumstances. It is a judgement of one's life in terms of how good it is, rather than directly expressing one's emotions or mood. However, it has been empirically demonstrated (Jakobsson Bergstad et al., 2012 in Ettema et al., 2013) that cognitive well-being is in part based on memory for emotional experiences, so one's emotions or mood cannot be ruled out (Ettema et al., 2013). Affective well-being, on the other hand, refers to an individual's emotional state. It may be measured by self-reports of emotions or mood during an activity or travel. It is assumed that emotions can be decomposed into two underlying dimensions: valence (positive versus negative) and activation (versus de-activation) (Ettema et al., 2013).

The STS is designed using similar dimensions as SWB, since satisfaction with travel can be regarded as SWB with regard to a specific domain (travel). Ettema et al. (2013) therefore assume that satisfaction with travel involves both cognitive (reasoned) and affective (emotional)

dimensions. Based on this Ettema et al. (2013) created a set of items enabling respondents to evaluate their trip on both cognitive and affective dimensions and thus to measure travelers' satisfaction (see figure 8). A part of the questions for the survey conducted is based on this satisfaction with travel scale.

Figure 8 The satisfaction with travel scale

Negative activation—positive de-activation (items 1–3)	
Hurried	*Relaxed*
Worried	*Confident*
Stressed	*Calm*
Negative de-activation—positive activation (items 4–6)	
Tired	*Alert*
Bored	*Enthusiastic*
Fed up	*Engaged*
Cognitive evaluation (items 7–9)	
Travel was worst I can think of	*Travel was best I can think of*
Travel was low standard	*Travel was high standard*
Travel worked well	*Travel worked poor*

Ettema, D., Gärling, T., Olsson E. L., Friman, M. & Moerdijk, S. (2013). The road to happiness: Measuring Dutch car drivers' satisfaction with travel. Transport Policy, 27, 171-178.

The above shows that it is very important to look at traveler's satisfaction with public transport. Specifically looking at on-demand services the satisfaction of the travelers/customers should be seen as something very important, since on-demand services put the customer at the center of their service.

2.1.5 Sustainable transportation

Something that will not affect the efficiency of a service, but is still highly important when looking at the future of public transport is sustainability, which has been a well-known and often used term when talking about the future of our planet and cities. Sustainable development is generally defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Black, 1996, p. 151). In the context of sustainability we can also talk about sustainable mobility/sustainable transportation, which is becoming more and more needed in an era of global warming and climate change.
Although no common accepted definition of sustainability, sustainable development or sustainable transport is available, it is generally accepted that sustainable transport, implies finding a proper balance between (current and future) environmental, social and economic qualities (Steg & Gifford, 2005).

Daly (1991, in Greene & Wegener, 1997) defines sustainable development as something that satisfied three basic conditions:

1. Its rates of use of renewable resources do not exceed their rates of regeneration.
2. Its rates of use of non-renewable resources do not exceed the rate at which sustainable renewable substitutes are developed.
3. Its rates of pollution emission do not exceed the assimilative capacity of the environment.

Black (1996, p. 151) defines sustainable transportation in his paper as follows: 'satisfying current transport and mobility needs without compromising the ability of future generations to meet

these needs'. Since needs can change over time, what is sustainable can also change over time, but general thoughts about what is unsustainable will be the same:

1. Petroleum reserves are finite.
2. Petroleum-based emissions are detrimental to global environment.
3. Petroleum-based emissions impact on urban air quality.
4. Many current transport facilities are congested.

When looking at the future of petroleum, is that it has no future. Petroleum is the source for all the fuel used in transport, but it is a finite resource and the finite source of these fuels. And all the exhaust gases coming from the transport industry are detrimental to, firstly, the air quality and secondly the global environment. The use of petroleum-based fuels is exacerbating problems, whether it is acid deposition, global warming or urban air pollution (Black, 1996).
And also congestion, due to the unstoppable urbanisation is a problem. Congestion, has traditionally been viewed as a problem of inadequate capacity, for which the solution has been to build additional capacity, but in the current times, additional capacity no longer seems like the solution. Some cities are approaching gridlock and this will make the transport systems unsustainable (Black, 1996).

These problems have to be solved and are asking for sustainable transportation. Often solutions are divided into four broad classes (Black, 1996):

1. Regulatory mechanisms to control emissions.
2. Tax increases that would favour energy-efficient transport modes.
3. Support for new technologies and alternative fuels.
4. Planning approaches that would lessen the need for automobile travel.

Those strategies, according to Steg & Gifford (2005), can be distinguished into behavioural and technological changes. Behavioural changes are aimed to reduce the level of car use, e.g. by shifting to less polluting modes of transport or combining trips. Technological solutions are aimed at reducing the negative impact per car and per kilometre. Examples include increasing the energy efficiency of cars and developing new forms of transport technology.

Something that is a new technology, a new form of mobility, which would lessen the need for automobile travel is mobility on-demand and Demand Responsive Transport. Taxi service Abel, for example, uses electrical, and with this, less polluting cars.

2.1.6 The public and private sector

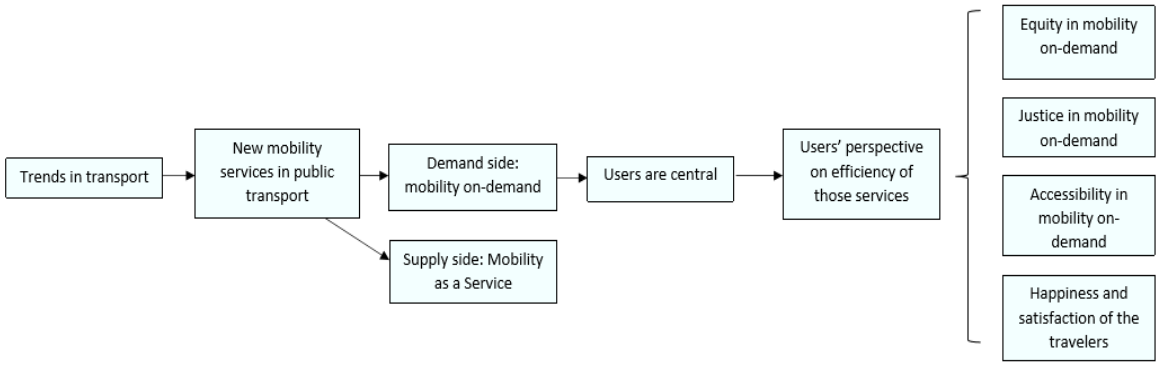
A public sector organisation is an organisation which is subsidised by the government, while a private sector organisation is led by (a group of) individuals and is not subsidised by the government. Therefore, both public and private sector organisations have their own motivations for delivering their service. Reviews of the literature on the divide between public and private sector organisations reveal that work motivation among public sector employees and managers are very different from that of the private sector employees and managers (Buelens & van den Broek, 2007). Organisations in the public sector often make a choice to deliver a worthwhile service to society: they are motivated by a strong desire to serve the public interest, by a sense of service to the community and by an urge to promote the public interest. The motivation in the public sector comprises elements such as the opportunity to have an impact on public affairs, commitment to serving the public interest, and an interest in achieving social justice (Buelens & van den Broek, 2007). On the other hand, the research has consistently found that private sector

employees and managers value economic rewards much higher than organisations in the public sector do, since they are not subsidised by the government. Public sector organisations show a stronger drive to deliver service, while private organisations are focussing on making money (Cacioppe & Mock, 1985; Crewson, 1997; Houston, 2000; Karl & Sutton, 1998; Khojasteh, 1993; Rainey, 1982; Rawls, Ulrich, & Nelson, 1976; Schuster, Colletti and Knowles, 1973; Solomon, 1986; Wittmer, 1991 in Buelens & van den Broek, 2007). Besides that, there is a broad consensus that public sector organisations are more intrinsically motivated than private sector organisations (Beulens & van den Broek, 2007). The differences in motivation behind public and private services can possible have different impacts on the quality of the service they are providing.

2.2 Conceptual model and operationalisation

2.2.1 Conceptual model

Figure 9 Conceptual model



This conceptual model illustrates the information derived from the research framework, research objectives and the theoretical framework. The theory is applied with regards to the concept of transport, since the taxi service that is going to be researched is part of (public) transport.

It all starts with the fact that mobility is something we cannot imagine not having in our society. According to Litman (2015) transport is a form of mobility and therefore, the existence of mobility and the ever changing world lead to new trends in transport (Hannon et al., 2016). Those trends, in turn, lead to, among other things, resistance to cars in the cities, new interest in and developing of new and innovative forms of transport and a bigger focus on (improving) public transport, to solve the growing pressure on urban passenger transport systems (Finnish Transport Agency, 2015): Grotenhuis et al. (2007) suggest to promote public transport to reduce the inconvenience of congested roads. Besides that, the Smart City movement tries to increase the quality of life in urban space, improve the environmental quality and deliver better services to citizens of cities that cope with growing urbanisation (Benevolo, Dameri & D'Auria, 2016). A part of the Smart City movement is the Smart Mobility movement that seeks to create more sustainable transport systems, but also to increase the efficiency, effectiveness and environmental sustainability of cities in general, often characterized by the use of ICT (Benevolo, Dameri, D'Auri (2016). Two forms of 'smart mobility' services are (1) Mobility as a Service on the supply side and (2) mobility on-demand and DRT on the demand side (Kamargianni et al., 2016; Davison et al., 2014). The implementation and development of these new mobility on-demand are focussed on the users, since they provide the demand. Those new services can cause equity, justice and accessibility impacts, which in turn have a negative or positive impact on the main

concept of this research, efficiency. Whether it has a positive or negative impact, depends on how equity, justice and accessibility are impacted by the quality of performance of those new services. Besides that, it is also important to look at the happiness and travellers satisfaction, since public transport operators are forced to place emphasis on the monitoring and improvement of the services provided, to make sure people are willing to (partly) replace the car for public transport, which will help to improve the traffic conditions and liveability in the city (Tyrinopoulus & Antoniou, 2008). Tyronipoulos & Antoniou (2008) show that happiness/satisfaction is 'part of' efficiency, such as accessibility and trustworthiness. Therefore the 'feeling of happiness' will influence the overall evaluation of the efficiency of a transport service.

2.2.2 Operationalization

Based on the theoretical framework and the characteristics of a good efficiency (Santos, 2000, in Sampaio et al., 2008, p. 446) the following operationalisation scheme has been made:

Table 1 Operationalization

Concept	Aspects	Dimensions
Transport efficiency	Equity/justice	Equal opportunities for all individuals
		Accommodating all users (justice)
		The service is accessible
	Accessibility	Service in according with necessities (help from drivers)
		Service available in area needed
		Service available at moment needed
		Availability to bring wheelchairs, prams and animals
	Travel time	Travel time is in accordance with the time given on the app
		Waiting time for the taxi
		Time of trip compared with public transport (E.g. bus, train)
	Trustworthiness	Punctuality of service
		Service available in area needed
		Service available at moment needed
	Vehicle characteristics	Cars adapted to needs
		Cars adapted to preferences
		Sustainable cars
		Easily recognizable cars
		Comfortability of the cars
		Maximum number of passengers
	Adequate information	Correct information on the app
		All information needed is given by the app (amount)
		Flexibility and easiness of the app (user friendly)
		The possibility to adapt trip to preferences
		Easily recognizable cars
	Mobility in accordance with necessities	Service available in area needed
		Service available at moment needed
	Happiness/satisfaction	Affective (emotional)
		Cognitive (reasoned)

3. Methodology

3.1 Research strategy

This research started with the interest in mobility and the recent developments that are taking place in the area of mobility. Looking into these developments the emergence of both mobility on-demand services and Mobility as a Service (MaaS) was found, which awakened an interest in those topics. Both concepts are very broad topics, which first of all, asked to choose one of the two topics. Secondly, a case study needed to be chosen to be able to get valid and in-depth insights on the topic. Since there are no highly developed MaaS schemes implemented in the Netherlands, the decision was made to do research on mobility on-demand services, since there was a preference to do research in the Netherlands (mainly due to the time frame). Doing some research on mobility on-demand services in the Netherlands led to two possible research options: either 'BrengFlex' in Nijmegen or 'Abel' in Amsterdam. Since there was a fellow student, who was also interested in the topic of mobility on-demand, the two possible case studies were divided. In the end, the case study of Abel taxi in Amsterdam has been chosen for this research.

To obtain the necessary data a combined research strategy was used: both an empirical quantitative and qualitative approach were used to obtain data. Nevertheless, the quantitative approach has been the main strategy and the qualitative approach has been complementary to this. To get the necessary data, there has been chosen to do a survey-research, since this approach makes it easy to get a lot of data on a specific case. There was not chosen for a case study research, since the concept of efficiency does not lend itself for a qualitative way of measuring, while measuring efficiency quantitatively via a survey is easier. Because of this there has been conducted a cross-sectional survey, whereby data has been collected from a number of respondents, about a range of subjects, at one time.

The necessary quantitative data has been obtained via a web-survey that users of Abel could fill in online. The choice for a survey has been based on the fact that the research focuses on the efficiency of the service of Abel, from the perspective of their users. The different aspects that determine efficiency can be easily questioned by a survey with closed questions and some open-ended questions, while qualitatively researching those items would not have been as easy. Therefore there has been chosen for a survey, that was made available online. The decision to use web-survey instead of a face to face interview, telephone survey or written survey has been made since there was no data base with contact details of the users of Abel, so the other three forms of a survey were not possible. One advantage of a web-survey, in comparison to a face to face interview or telephone survey is that people can fill in the survey at a moment suitable for them and at their own pace. Distributing the survey online, therefore, was the best option to reach as much as possible users.

The aim of this research was to get at least 50 respondents, via a random sample. Pulling a sample was needed since it was not possible to research the whole population of users. The results of the population that was included in the random sample can be generalised, provided that the sample size is big enough (Korzilius, 2008).

The data that has been obtained via the survey has been analysed quantitatively with the help of statistical computer program SPSS. First of all descriptive statistics have been given on variables that do not influence the main concept of this research (efficiency) but are still

interesting to look at. Secondly, for each aspect of efficiency (accessibility, trustworthiness etc.) a Cronbach's Alpha analysis has been carried out, since those aspects were measured by multiple questions. The Cronbach's Alpha tells whether or not those different questions can be combined to a reliable scale of the specific item. Thirdly, the mean scores on each item were calculated and divided into three categories of 'valuation' (high/good, neutral, low/bad valuation). In turn, the valuation either has a positive, neutral or negative impact on the overall valuation of efficiency.

Last of all, the open-ended questions asked in the survey have been analysed based on key words and categories, which in turn also led to statistical information.

Besides the survey there has also been used a qualitative method for obtaining data, namely interviews. To get some further background information about the company Abel a face-to-face interview was held with two employees of the company. Employee 1 was an assistant operational manager and employee 2 was a master student who writes his thesis at Abel. And secondly, an interview with post-doctoral researcher at the Radboud University, Peraphan Jittrapirom, who is working on adaptive policies for smart city public transport, was held to get more academic knowledge on demand responsive and on-demand public transport services.
By combining the survey results with the information obtained from the two interviews, was attempted to get a more in-depth view of DRT, on-demand services in general and of Abel taxi service in specific. Therefore this research can be considered as in-depth, but also broadly based.

3.2 Research material

When starting a research, it is of importance to know from what or whom to get your information, since this is your needed research material. There are many sources of research material and maybe different kinds of sources are needed to get different kinds of information.

In this research, the main focus has been on getting quantitative data. This data are the answers given by the users of Abel taxi in a web-survey (see appendix III). To obtain reliable data a random survey has been conducted: finding respondents has been done via an a-select/random sample, to make sure all potential research units have had an equal chance of being questioned. The only thing that has been 'select' is the fact that the survey has only been made available online. So people who do not have access to internet have been automatically left out of this survey. Before publishing the survey via an anonymous internet link, the survey questions where checked by the first reader of this research, where after some adjustments were made. Once this was done, the survey was filled in by multiple family members to test it and after this testing, again, a few adjustments were made. After this testing and the adjustments, the survey was made available both in Dutch and English to make the scope for possible respondents bigger. At the end of the online survey a message was posted wherein people that filled in the survey where asked to forward the survey to other users of Abel.

In a first attempt to find suitable respondents employees of Abel were asked if they could help in any possible way, but unfortunately they were not able to. Secondly, a Facebook message was posted wherein friends and family were asked if they could forward the survey to users of Abel. Thirdly, personal messages were send to people that posted a review on the Facebook page of Abel, asking if they wanted to fill in the survey and/or forward it to other users. Furthermore, multiple messages were posted on different Facebook pages dedicated to citizens of Amsterdam

and its surroundings (pages as “Je weet dat je een rasechte Amsterdammer bent al…”). Other than that, a message was posted on the internal network of employees of RAI Amsterdam and a total of 400 flyers were hang up in supermarkets, at train stations, (student) sports club, student complexes in Amsterdam and at the two universities of Amsterdam. These flyers both included the online link of the survey and a QR code and they were both distributed in Dutch and in English (see appendix IV). Furthermore, an e-mail has been send to the student association of Geography and Spatial Planning of the University of Amsterdam, with the question if they could help finding respondents in some way, but unfortunately they did not reply. Last of all, a message on the social network Linked-inn was posted.

Once the survey was made publicly available via an internet link, the survey was adjusted once. Before the adjustment respondents were able to continue with the next question in the survey without answering the previous question, but after the adjustment this was not possible anymore. This has been done to make sure respondents fill in each question and that the change of having ‘missing values’ in the data would be prevented.

Besides getting quantitative data, qualitative data was also obtained via two face-to-face interviews. There has been conducted one interview with two employees of Abel and one interview with post-doctoral researcher, Peraphan Jittrapirom, from the Radboud University.

The interview with the two employees of Abel was arranged via Facebook and was supposed to be with the director of Abel, but in the end he was not able to conduct this interview so two employees helped with answering the questions. The questions for this interview were based on the first three sub-questions (mentioned in section 1.3). Keeping in mind the purpose of this interview, which was getting more background knowledge on the company the questions were divided into different sections, such as: the establishment of Abel, Abel in comparison to other taxi services, the service of Abel, their vehicles, the mobile application, their pricing system and their future perspectives (see appendix I)

The second interview, which was with Peraphan Jittrapirom, was arranged via the thesis supervisor of this research. The interview questions for this interview were mostly based on the theoretical framework (see chapter 2) with a main focus on the development of and growing interest in DRT and on-demand services. Since Peraphan focusses on new forms of transport in his research and therefore knows a lot about this topic, the interview questions were sharpened on these topics (see appendix II). The intention of this interview was to get more specific and deeper academic knowledge on the topic of DRT and on-demand services, also taking into consideration the main concept of this research: efficiency.

Once the interviews were held, both have been transcribed with the help of computer program Atlas.ti. The information obtained from the interviews has been used to write chapter 4 and 5. The information obtained from the interview with the two employees of Abel was used to complement the chapter on Abel taxi (see chapter 4) and the information obtained from the interview with Peraphan Jittrapirom was used to write chapter 5 on the empirical evidence on DRT services.

4. The case study: Abel

4.1 Connexxion, Transdev Nederland and Abel

Abel is a completely new, privately run and shared taxi service that operates in Amsterdam and its surroundings. It provides a shared-taxi service, which can be designed to travellers' wishes. 'Sharing' means that customers only book a seat in a taxi, and not a whole taxi. In turn, different rides of different customers will be combined, which make that customers 'share' a taxi (Van Oerle, 2016). Abel was lanced on the 12th of January 2016 by Transdev Nederland, the parent company of Veolia and Connexxion. Transdev Nederland is investor, 100% shareholder of the start-up and it provided Abel with the first 50 licensed taxi (Pals, 2016). Transdev's main idea behind the launch of this service was to provide a cheaper taxi service in the area of Amsterdam with the extra of new social contacts with people you share your ride with (Verlaan, 2016).

In the interview with the two employees of Abel (for interview guide, see appendix I) appeared that Transdev Nederland came up with the idea to design a service such as Abel and they, as investors, were looking for an idea for such a service (Employee 1, personal communication, April 13, 2017). Connexxion itself has a similar service as Abel, wherein different rides are combined and passengers are sharing a car. But this 'combining' is not done via an app (as is the case with Abel), but you need to call to book a ride, where after employees will combine your ride with other people's rides. So based on this already existing system Transdev Nederland came up with the idea to provide a similar taxi service via a mobile application (Employee 2, personal communication, April 13, 2017). In turn, the business plan for Abel was designed by R. Everhardt. As strategy consultant, Everhardt was hired by Connexxion and in the technology that Connexxion uses to arrange their transport he saw opportunities for creating a 'shared' transport mode for a broader target group. Eventually this plan was elaborated with D. Baars for the operational side, with A. Kruijer for the commercial aspect and the parent company of Connexxion, Transdev Nederland, as investor and shareholder. Transdev Nederland gave Abel one year to prove itself (until January 2017), but after eight months there was already decided to end the trial period and to continue with the service (Krabbendam, 2017).

4.2 Abeltje

The name Abel is coming from the children's book 'Abeltje' from writer Annie M. G. Schmidt, which is about an elevator boy called Abeltje. Abeltje operates the elevator of a big warehouse and helps customers getting in and out the elevator. This is the first idea behind the reference to 'Abeltje': Abel expects from its drivers that they, as host or hostess offer quality and service, such as Abeltje does in the warehouse. Especially in the taxi world, whose image is sometimes under pressure, quality and service are very important (Krabbendam, 2017). Secondly, the reference to 'Abeltje' also has to do with the core of the concept of Abel: sharing a taxi. Usually an elevator goes up and down and on the way up/down the elevator stops to let people in and out. This 'going in and out' of the elevator is the idea behind taxi Abel: "If you are on your way, people can get into, but also out of the taxi" (Employee 1, personal communication, April 13, 2017).

4.3 Sharing a taxi

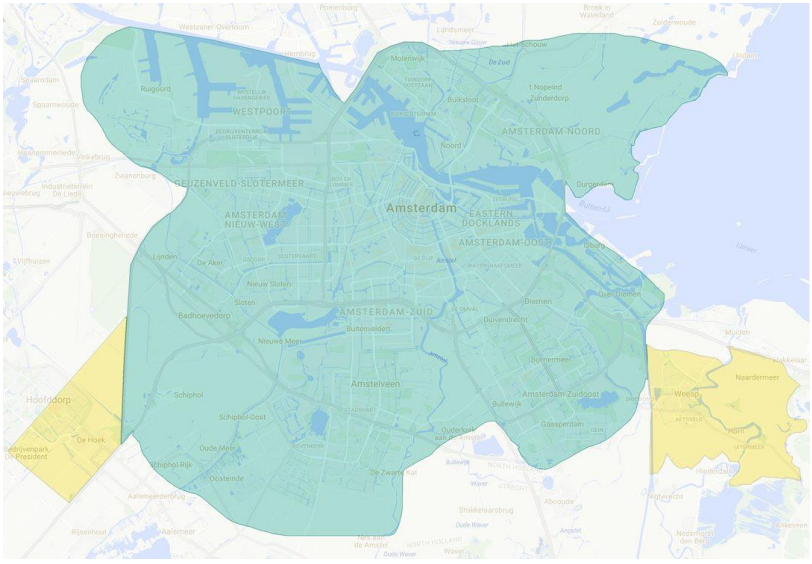
In the development of the service the founder of Abel has been inspired by taxi service Uber. But, Abel is putting the customer even more at the centre of their service by better looking at the wishes of the customers (van Oerle, 2016). Their customers are mainly people from the age of 18 to 35 (the 'millennials'), which makes that Abel has a young target group. They mainly focus on people from this age, because they believe younger people are more willing to share a ride and younger people have a smaller budget, which makes a cheaper taxi service more attractive for them (Employee 1, personal communication, 17 April 2017). Besides that, younger people (especially students) often attach less and less value to, for example, owning a car, while it gets more and more common to share things: if you are able to get from A to B in a comfortable way, a lot of people are okay to share a ride with others (Krabbendam, 2017).

Moreover, this does not mean that people younger than 18 or older than 35 are not able to use the service: everyone who has the mobile application, independent from the age, can book a ride with Abel (Employee 1, personal communication, April 13, 2017). Also older people, who are not as familiar with mobile phones and applications as the current generation is, are still able to book an Abel if they really want to. From the interview with the two employees of Abel appeared a funny story about an older lady without a smartphone, who does not like public transport anymore and really enjoys the social contacts she has during a ride with Abel. Therefore, her daughter books an Abel so her mother can still enjoy a ride in the mint-green Abel cars (Employee 1, personal communication, April 13, 2017). Abel also does not only focus on citizens of Amsterdam and its surroundings, but they also try to attract tourists, by offering codes for discounts at different hotels in Amsterdam (Employee 1, personal communication, April 13, 2017).

4.4 The service provided

Abel provides its service seven days a week in the area of Schiphol, Amsterdam, Amstelveen, Duivendrecht, Ouderkerk aan de Amstel and parts of Weesp and Hoofddorp (see figure 10). From Sunday to Thursday you can order an Abel from 7 am till 1.30 am and Friday and Saturday you can order one from 7 am till 4 am (Pals, 2016). In the interview employee 1 told that the busiest moments for Abel are the evenings and nights during the weekend (Employee 1, personal communication, April 13, 2017).

Figure 10 The area where Abel is provided (including the yellow areas)



https://rideabel.com/

To provide their flexible, door-to-door and shared service Abel designed a mobile app called 'Abel' (see figure 11), where people can fill in where they are coming from, where they want to go and how flexible they are. Then the app will show the price of the ride, the taxi that is the closed to you, a picture and name of the taxi driver, how long you have to wait before the taxi picks you up and at what time you will be at your destination (Pals, 2016). From the interview with appeared that with knowing in advance who is coming to pick you up (by providing a phone number and picture of the taxi driver) and giving you the exact license plate numbers of the specific taxi that is coming to pick you up Abel tries to offer customers a lot more certainty and safety, in comparison to a regular taxi (where you do not have this information in advance) (Employee 1 & employee 2, personal communication, April 13, 2017).

Figure 11 The logo of the mobile app

https://rideabel.com/

Something else that appeared from the interview with is that Abel decided not to provide their service by being able to hail a taxi on the street, but to only provide their service via a mobile application. This decision was made to be able to provide their shared service, because the whole computer system that combines different rides won't be able to do this when passengers are able to hail a taxi. When this would have been possible the system does not know when someone is getting on and of a taxi and calculating a fixed price in advance would not be as easy as it is now. For those reasons, there are no plans for further expanding Abel by providing a booking service via the telephone or internet (Employee 2, personal communication, April 13, 2017). Besides that, employee 1 says that providing a service via a mobile application is also a logical choice, looking at their target group (people from the age of 18-35): "Who of that age does not have a smartphone?". Also looking at other taxi services, for example Uber, providing an app is a logical choice, since more and more taxi companies are creating a mobile application (Employee 1, personal communication, April 13, 2017).

4.5 What makes Abel unique?

As said before, the unique thing about Abel is that you do not book a car, but only a seat in a car and therefore you can share your ride with others. According to the founder, sharing a ride is trendy at the moment and people are willing to share when this makes a ride cheaper and better for the environment (Van Oerle, 2016). And this is exactly what Abel provides: a cheaper, sustainable and shared taxi service. But not only sharing makes the ride cheaper, the ride also gets cheaper when you are more flexible by choosing to what extent you are in a hurry or not. In the mobile app you can choose how much you are in a hurry by clicking one of the options of 'in a hurry', 'neutral' and 'not in a hurry'. The less you are in a hurry, the cheaper your ride gets. This makes that for the most flexible customer a ride can be 60% cheaper than a regular taxi (Pals, 2016). When you are 'in a hurry' your timeframe is 15 minutes, when you are 'neutral' it is 20 minutes and when you are 'not in a hurry' your timeframe is 30 minutes. For example, for 'not in a hurry' this means you are at your final destination between 12.30h and 13.00h, while for 'in a hurry' this means you are at your destination between 12.30h and 12.45h. Abel gives you this timeframe to give you a clear indication of your arrival time and with this they always guarantee you that you are at your final destination in the timeframe given in advance. This also means that

if you would not be at your final destination on time because you have to share your ride with someone else, your ride will not be shared (Employee 1, personal communication, April 13, 2017). According to employee 2 this 'sharing' is what Abel makes unique and special and what really attracts people: the special meetings you can have during your ride with Abel (Employee 2, personal communication, April 13, 2017).

Besides the concept of 'sharing' that makes Abel unique, Abel also distinguishes itself from regular taxis and services like Uber, by the colourful, easily recognizable and, most important, electrical cars (see figure 12) (Van Oerle, 2016). They have consciously chosen for electrical cars, because they want to provide and stand for a sustainable service. Secondly, since the municipality of Amsterdam is slowly banning all diesel vehicles from the city centre and since most taxis are diesel vehicles, they have chosen for electrical cars, so they are still allowed to deliver their service in the centre of Amsterdam in the future (Employee 1, personal communication, April 13, 2017). From the interview with appeared that they even have some customers that specifically chose Abel because of the electrical cars (Employee 2, personal communication, April 13, 2017).

Figure 12 The electrical taxis of Abel are easily recognizable

http://www.kia.com/nl/content/abel-taxi/

A third thing that makes Abel unique is the fixed price they have: the final price is shown in advance on the mobile application and is fixed. The customer pays this amount via the mobile application, which is connected to a credit-card or iDeal or PayPal account. Having a fixed price means that the price for the same ride will stay the same at any given moment of the day: the ride will not get more expensive during evening hours or when there is a traffic jam, as is often the case with regular taxis which calculate the final price based on distance and time. Abel only calculates its price based on distance and since people in advance notify their starting point and final destination, a fixed price can be calculated in advance (Van Oerle, 2016). This final price is made up of the entry fee, which is €2.50 per person and from that moment on you only pay around €1-2 per kilometre. But, if a customer wants a whole taxi for itself, the entry fee is €7.50 plus the price per kilometre (Van Oerle, 2016). With this fixed price Abel does not use a dynamic price system, such as services like Uber do. Uber only gives an estimation of the price in advance and still uses the time of the ride to calculate the final price. A ride with Uber also gets more expensive when there is more demand than supply, while this is not the case when you book an Abel: the price always stays the same (Employee 2, personal communication, April 13, 2017).

Looking at the possible ways of paying, from the interview appeared that Abel has chosen to only offer the possibility to pay via the application and not also by cash, due to safety reasons.

According to them it gets saver for the taxi driver, because the chance of robbery is reduced and it is easier for the customers to not have to have cash with them (Employee 1, personal communication, April 13, 2017).
The taxi drivers of Abel are all selected and trained by Abel itself and all of the taxi drivers have finished the taxi driver education program before starting at Abel (Van Oerle, 2016). Currently, at peak moments, there are around 70 vehicles in use to provide the Abel-rides. And meanwhile, the company has around 150-200 drivers at its disposal (Krabbendam, 2017).
Besides the drivers that are employed by Abel, since February this year drivers can also become a franchise driver. Those drivers have a taxi license themselves, lease a car via Leaseplan Nederland and drive for Abel (Krabbendam, 2017). Those self-employed taxi drivers do not drive in an electrical mint-green Abel, but in an electrical white or black car with a mint-green logo of Abel on it (Employee 1, personal communication, April 13, 2017). The aim is to have around 50 franchise drivers at the end of 2017 and the future will tell if Abel is only going to work with drivers employed by Abel, only with franchise drivers or a mix of the two (Krabbendam, 2017).

4.6 The future of Abel

Looking at the future of Abel there are a number of things that Abel is focussing on. First of all, they started with franchise taxi drivers and they try to attract more franchise drivers in the future (Krabbendam, 2017).

Secondly, for this year (2017), the goal is to reach break-even. Until now, the model of Abel has proven itself, but it has to keep on doing this in the future so external investors can be attracted. This is also needed to be able to meet the ambition to extend the area wherein Abel provides its service. Abel would like to expand: this can be in the Netherlands, but also abroad (Krabbendam, 2017). Although, expanding in the area of Amsterdam and its surroundings will not continue for ever: “When expanding too much, combining different rides will not be possible” (Employee 2, personal communication, April 13, 2017). To make the model behind Abel profitable, either in the Netherlands or abroad, it does need the density of an urban area, but it does not always have to be about the Abel-platform itself. Certain municipalities in the Netherlands use the software of Abel to design their own on-demand service. For example, in Arnhem and Nijmegen, BrengFlex uses the software of Abel to provide their service. Something similar happens in Tampa, Florida (Krabbendam, 2017). The preference for a dense urban area comes from the fact that the revenue only gets attractive when rides can be shared, which is less possible in rural areas. However, outside the urban areas are also opportunities, but then the government partly needs to subsidise. Besides that, services like Abel can be a solution to the rural areas that are (getting) transport poor, due to the fact there are less and less regular bus lines. Still providing certain bus lines in the rural areas also costs money, so if this money is invested in substitute transportation on-demand, it can be a solution. If this will happen in the future, Abel will only provide the software, but for now the most important thing is to reach break-even. (Krabbendam, 2017).

Thirdly, recently there has been released an update for the mobile app, which is called ‘Abel in Advance’ (Employee 2, personal communication, April 13, 2017). Due to this update customers are able to book a ride up to one month in advance, instead of at the moment itself, to make sure that there is a taxi available at the moment you need it. With this update Abel also expects to become more interesting for the business market, because it offers certainty that you

are going to be picked up at a certain time and that you are at your destination at a certain time. Besides that, soon it will be made possible for business customers to pay per month, instead of immediately after the ride (Krabbendam, 2017 and employee 2, personal communication, April 13, 2017). Also, with this update people can select the size of the luggage they are bringing with them. A big suitcase costs €3 extra and a small one costs €1 extra (Abel, 2017).

Something else Abel wants to improve in the further future is the maximum number of passengers that can book an Abel together. At this moment three people can share an Abel (excluding the driver), but in the future they might want to higher this maximum by offering small vans. But they only want to do this when this can be done electrical and, unfortunately, electrical vans are rare at the moment (Employee 1, person al communication, April 13, 2017).

4.7 Abel and regular public transport

Comparing Abel with regular public transport, such as buses, trams, metro's and trains, of course a ride with Abel is not cheaper, but choosing for regular public transport modes is choosing for overcrowded vehicles, having to transfer at different stations, less sociability and less comfort. Besides that, Abel also offers a door-to-door service, which is not possible by using the bus, tram, metro or train (Van Oerle, 2016). The interview with confirms this idea: "When using public transport, you basically pay for a place to stand, instead of a seat" (Employee 1, personal communication, April 13, 2017). Besides the certainty of having a seat, Abel also brings you from door to door, which public transport does not and you are also not dependent on certain times, as is the case with public transport (Employee 1, personal communication, April 13, 2017).

Thus, Abel promotes itself as a unique, cheaper, sustainable and shared taxi service that provides a social and personal, sustainable, safe, reliable and cheap service under the slogan "Abel, the ride you want to share" (Pals, 2016).

5. Demand Responsive Transport Systems

5.1 Empirical evidence

5.1.1 Smart City and Smart Mobility movement

Just as stated in the literature, also from the interview with Peraphan appeared that cities are attractive places to live in: "… this for many reasons: there are more activities, more opportunities and more interactions with other people, which all in turn, brings opportunities for the citizens. This attractiveness leads to urbanisation". The question the Smart Mobility movement therefore focusses on is how to manage cities in a better way in today's society. As Peraphan mentioned, Smart Mobility is a part of the Smart City movement, because mobility uses a lot of energy and produces a lot of externalities like CO_2, accidents and congestion. Therefore, the Smart City movement is, among other things, trying to deal with the negative effects mobility in urban areas produces, while keeping the positive side that mobility brings (P. Jittrapirom, personal communication, May 10, 2017). "This positive side is the fact that mobility enables us to go somewhere and to do certain activities: mobility itself is not a goal, but we use it do go somewhere and to be able to do something" (P. Jittrapirom, personal communication, May 10, 2017).

5.1.2 Demand Responsive Transport systems: the middle of two extremes

As mentioned in section 1.1.6, Demand Responsive Transport systems (DRT) are part of the Smart Mobility movement. But before going into DRT systems it is important to define what a DRT system is. From the interview with Peraphan appeared that DRT is the middle of two extremes. First of all, we can look at the public side of transportation, wherein almost all services have a certain fixation: "They have fixed timetables, fixed routes, fixed vehicles and a fixed fare and with those elements the system is controlled. An example of such a public transport service is the bus, which has a fixed timetable, fixed vehicle, fixed fare and fixed route" (P. Jittrapirom, personal communication, May 10, 2017). On the other side you have the private side of transportation, such as cars. Those modes of transport are the most flexible: "You can determine the route and the time" (P. Jittrapirom, personal communication, May 10, 2017). In between those two extremes DRT systems can be found. Peraphan said: "Most DRT systems are not completely flexible, but also not completely fixed: you can often determine the time and change the route. DRT allows the users to receive the services at their own request, at the route that they request and the time they request" (P. Jittrapirom, personal communication, May 10, 2017). Peraphan also emphasised that there are differences between different DRT systems: "Certain systems allow you to change the time, but certain systems do not allow you to do this. They have a fixed time, but then you can, for example, determine the route".

Despite talking about DRT services as something new, they are not completely new: "DRT services already existed in the 1960's/1970's, although they did differ from the current DRT services" (P. Jittrapirom, personal communication, May 10, 2017). DRT services back in the days where not able to use the technology we have nowadays, so they used other methods to provide their 'on-demand' service. People could book a ride by calling a call center, where after the person on the other side of the telephone line would make a manual booking. Going back even further, when the telephone was not as common as it is now, people could send a letter, postcard or fax to a certain address to book a ride in advance. "Obviously booking a ride on the day itself was not

possible by sending a letter or postcard." (P. Jittrapirom, personal communication, May 10, 2017). As Peraphan said: "Those systems where pretty primitive in their way of booking" (P. Jittrapirom, personal communication, May 10, 2017). An example of an 'old' DRT service that, at that time, was seen as something unique and new was a DRT service in Germany. This DRT service was the first to use a kind of phone boot, a certain point where you can go to and put in your request to a call center, where after a taxi will come to pick you up at that certain point, a few minutes after you forwarded your request (P. Jittrapirom, personal communication, May 10, 2017).

In the past DRT services where mainly operating in rural areas, where DRT was seen as a way to increase the efficiency of the transport system: "Running a bus in a very remote area is very expensive, because you do not have a lot of ridership. So DRT is seen as a way to provide accessibility to people in rural areas, by lowering the costs" (P. Jittrapirom, personal communication, May 10, 2017). Mainly in the United States DRT services focussed on older and disabled people that were living in rural areas, but this is not the case with every DRT service: "For example in Europe, DRT was more seen as an open system, meaning that everyone can access it, while in the United States they mainly focussed on more specialised groups, like disabled and older people. So the idea behind DRT is mixed" (P. Jittrapirom, personal communication, May 10, 2017).

5.1.3 Trends and the modern DRT

Comparing current DRT systems with the DRT systems back in the days, it can be seen that the current services are way more advanced and use a lot more sophisticated technology. But the question is what trends have led to this modern form of DRT systems?

According to Peraphan there are three main trends that have led to the development of current DRT services. The first trend that has led to both the improvement and more importance of DRT is urbanization. "Due to urbanization cities produce a lot of externalities and therefore there needs to be found a way in which cities can be managed in a more sustainable and better way. The movement focusing on this is the Smart City movement, where the Smart Mobility (and DRT as a form of smart mobility) is a part of" (P. Jittrapirom, personal communication, May 10, 2017).

The second trend is the digitalisation, which has led to the development of mobile internet, which you can access through your smartphone and to the development of GPS (Global Positioning System). This allows the identification of a location in a very accurate manner. Those two technologies together with the smartphone allow DRT to 'pinpoint' where a taxi should pick you up. This in turn also gives flexibility, since the points where people want to be picked up can be anywhere (P. Jittrapirom, personal communication, May 10, 2017). As Peraphan said it: "The digitalization has breathe new life into DRT".

The last trend, according to Peraphan, that has led to the growing importance of DRT is the aging society. This means that people are getting older and life longer. Citing Peraphan: "Why is getting older a problem? Because, when you are older, the ability to ride your own car becomes less and you become more dependent, while older people also still want to be as mobile as possible. They want to be active to maintain quality of life. But, with the new wave of DRT and the digitalisation, the DRT systems tend to be more open systems, accessible to everyone" (P. Jittrapirom, personal communication, May 10, 2017).

5.1.4 Positive and negative effects of DRT

Since the current DRT systems are quite new, the research is facing some challenges. According to Peraphan, the question is whether or not DRT is really positive, with other words: what is the contribution of DRT to the broader transport system? Another question is whether or not DRT really lead to a positive contribution in terms of sustainability, less energy use and less pollution. To explain this Peraphan uses an example: "If, for example BrengFlex in Nijmegen becomes really popular. Would this lead to the fact that people cycle less, walk less and use other public transport less? Would there be a point in the future that DRT services replace walking, cycling and 'normal' public transport modes (such as buses)? When people walk less, cycle less and use the bus less, will that really contribute to sustainability and a lower energy use? When this uncertainty becomes reality, DRT can cause certain negative effects" (P. Jittrapirom, personal communication, May 10, 2017).

Despite those uncertainties and possible negative effects, there are also some positive effects of DRT that can be noticed already. First of all, it can improve the accessibility, not only in rural areas, but also in certain urban areas. Secondly, DRT tries to reduce costs by letting people share vehicles. Third of all, some DRT services do contribute to sustainability by only using electrical vehicles (such as Abel does) (P. Jittrapirom, personal communication, May 10, 2017).

Transport poverty: DRT as a solution?

As said before, back in the days DRT mainly used to be apparent in rural areas, while nowadays DRT services also exist in urban areas. However, DRT can still be a solution for transport poor rural areas, even in the Netherlands. Peraphan explained: "Transport poor areas are areas that are not or very irregularly covered by public transport". According to Peraphan, there does exist transport poverty in the Netherlands, but is it less present in comparison to other countries, due to the fact that the Netherlands has a bicycle culture: "If you have the ability to ride a bicycle you can go almost anywhere, but if you do not live in a country with a bicycle culture or you do not have the ability to ride a bicycle because you are sick of old, you do not have any mobility. In those areas, that are not covered by public transport, DRT can be seen like a solution to make that area less transport poor and DRT then will have a positive effect on those areas" (P. Jittrapirom, personal communication, May 10, 2017).

5.1.5 What makes a DRT system successful or a failure?

Every new launched DRT service has the aim to become successful, but to become successful a service needs to focus on different factors that will contribute to the successfulness. According to Peraphan the first important factor is marketing: "If people do not know about your service, then it is pretty hard for them to get access and use the service. Therefore the service requires a certain drive behind it from the company side. Once people use the service, companies give less weight to marketing, but if people do not know about your service in the beginning it is hard for companies to gain ridership".

Secondly, Peraphan stated that the element of flexibility within the system is also very important. This flexibility should be adapted to the local area where the service is provided.

Thirdly, there also has to be a 'trial and run' phase, to see how the service operates and to be able to adapt is as good as possible to the local area (P. Jittrapirom, personal communication, May 10, 2017).

Furthermore, it is important to be able to adjust the vehicle size to the demand, so a service can reduce the operation costs: “If, for example, the demand is for four people, a service should not use a mini bus, but just a normal taxi. The ability to adjust the vehicle fleet is important, but most of the services do not have this flexibility, simply because their vehicle fleet does not allow them to do this” (P. Jittrapirom, personal communication, May 10, 2017).

Last of all, what is important for the success if the number of users within the platform and the number of drivers within the platform: “If these two are reaching up to the level of optimization, then a service will get more successful” (P. Jittrapirom, personal communication, May 10, 2017).

An example of a DRT service that was very successful is of course Uber, but also the Region Taxi in the Netherlands is very successful. Peraphan explained: “At some train stations within the Netherlands you can call this particular taxi, which have a fixed price based on the area you want to go to. So it helps people who do not have access to a car or any other mode of transport to get to the train station”. Interesting to hear was that they released a similar service in the UK, but this service failed and does not exist anymore: “It is interesting to see that certain services can have different outcomes in different contexts” (P. Jittrapirom, personal communication, May 10, 2017).

An example of a DRT service that was not really successful can be found in Scandinavia. This service, from which Peraphan could not remember the exact name, was gaining popularity as the ridership was going up, but in the end it costed too much for the authority so they decided to stop with the service and not to continue with the funding, even though the ridership was going up. In this case there was enough ridership, but in the end not enough funding, but it can also be the other way around: “Then there is funding, but the service is not getting enough ridership” (P. Jittrapirom, personal communication, May 10, 2017). When a service is achieving the goal of improving the accessibility, but it becomes so popular that a lot of people are going to use it, it gets more expensive to run and the subsidy levels have to go up. “The question then is whether or not the authority can cope with this: if not, then the service will fail” (P. Jittrapirom, personal communication, May 10, 2017).

5.1.6 Opportunities and the future of DRT

Besides factors that influence the success or failure of DRT, DRT itself is also facing some opportunities. As said before, the technology is there to enable DRT to respond to the need or request, which is a real opportunity. Secondly, the aging society also brings an opportunity, since the elderly people need to be driven more. Looking even further into the future, DRT can really benefit from autonomous vehicles: “A driver is normally a high cost of any service. So if you remove the driver from the vehicle, companies can save a lot of money. This in turn can lead to reducing the cost of a ride” (P. Jittrapirom, personal communication, May 10, 2017).

According to Peraphan, when looking into the future, demand responsive services will become more important due to the three trends mentioned earlier (digitalisation, urbanisation and aging society) and “At the same time it will become a trend for public transportation itself” (P. Jittrapirom, personal communication, May 10, 2017). Peraphan mentioned it is very important to look into the way DRT services are functioning at the moment: “Because there are a lot of studies on how a private vehicle is being used and how public transportation works. But there is a gap in the research: there are not as much studies on DRT as on public and private transportation”.

5.1.7 Public and private services

Such as stated in the literature (Buelens & van den Broek, 2007) Peraphan also highlighted the difference between companies that are either privately or publicly run: “Public services mainly focus on the customer satisfaction and accessibility, while private services focus on making profit”. What is important to mention here is that customer satisfaction in the end will give companies money as well. But according to Peraphan you have to go back to the intention of the company: “If your intention is money in the beginning, no matter what way you look at it, you finally derive customers’ satisfaction, equal more money. But then, if you look at it like, providing accessibility to people, maybe that does not mean that you get more ridership, so maybe that does not mean that you get more money. If you focus on accessibility, then the format and the way you run your service is different. You might even say that accessibility is more improved by a public service than by a private service” (P. Jittrapirom, personal communication, May 10, 2017).

5.2 Can Abel be called a smart mobility, demand responsive and on-demand service?

5.2.1 Academic literature

Interesting to look at is whether or not the case study of this research, Abel taxi, can be defined as a demand responsive and on-demand service according to the characteristics found in the academic literature and mentioned by Peraphan.

To start with there will be looked at the characteristics mentioned in the academic literature. As mentioned in section 1.1.5, Smart Mobility is part of the overarching Smart City movement that focusses on improving the quality of life in urban space, improving the environmental quality and delivering better services to citizens of cities (Benevolo, Dameri & D’Auria, 2016). Looking at Smart Mobility in particular Benevolo, Dameri & D’Auri (2016) have derived important objectives of Smart Mobility services. Looking at those categories it can be seen that Abel does not meet all of those six objectives:

1. Reducing pollution: from the interview with the two employees of Abel did not directly appear that they try to reduce pollution by providing their service, but they do only use electrical cars, which do not produce any air pollution (Employee 1, personal communication, April 13, 2017). So even though this is not their main objective, they do contribute to the reduction of pollution with their service.
2. Reducing traffic congestion: no empirical evidence has been found that Abel has the aim to reduce traffic congestion with their service.
3. Increasing people’s safety: also no empirical evidence has been found that Abel is focussing on increasing people’s safety with their service.
4. Reducing noise pollution: lastly, there also was not empirical evidence found that Abel wants to reduce pollution with their service, but since they only use electrical cars (Employee 1, personal communication, April 13, 2017) they do not produce any noise. This is, since electrical cars do not produce the amount of noise a ‘normal’ car produces. So indirectly they do contribute to the reduction of the noise pollution.
5. Improving transfer speed: there is also no direct empirical evidence found on that Abel wants to improve the transfer speed, but they do adjust their transfer routes to the traffic conditions. So, for example, if there is a traffic jam or an accident happened on the original route, the taxi driver will try to find an alternative route, to make sure the

customer is still at his destination on time (Employee 1, personal communication, April 13, 2017).

6. Reducing transfer costs: from the interview with the two employees of Abel did appear that Abel tries to offer a cheaper service in comparison to a regular taxi. By combining different rides of different customers, which leads to different people sharing a taxi, they are able to reduce the transfer costs (Employee 1, personal communication, April 13, 2017).

But, even though Abel does not has all of those six objectives, the literature did not mention that a Smart Mobility service has to have all six objectives, it can also only focus on some of the objectives. So this does not mean that Abel cannot be defined as a Smart Mobility service.

Furthermore, as described in section 1.1.5.2, in specific, a public transport service needs to meet certain criteria before it can be called 'demand responsive' and 'on-demand' (Davison et al., 2014). Looking at the criteria found in the literature it can stated that Abel can be categorised as being a demand responsive and on-demand service:

- First of all, the service needs to be available to the general public. This means that it is not restricted to particular groups of user according to age or disability criteria or place of employment. Looking at Abel it can be seen that, even though they focus their service on people from the age of 18 to 35, everyone, irrespectively age, can use their service as long as they are able to book a ride via the mobile application. They do not exclude people younger than 18 or older than3 35 from their service (Employee 1, personal communication, April 13, 2017).
- Secondly, the service needs to be provided by low capacity road vehicles such as small buses, vans or taxis. Since Abel is a taxi service they only provide their service in small electrical cars with a maximum of three passengers, excluding the taxi driver (Employee 1, personal communication, April 13, 2017).
- Thirdly, the service needs to respond to changes in demand by either altering its route and/or its timetable. Abel changes their route when there, for example, are traffic jams or when an accident happened on their original route. They do this so the passenger is still on time at his final destination (Employee 1, personal communication, April 13, 2017).
- Last of all, the fare should be charged on a per passenger instead of on a per vehicle basis. In comparison to other taxi services, this is something that makes Abel unique since they only let their customers pay for a seat in a taxi and not for a whole taxi (Pals, 2016).

5.2.2 Empirical evidence

Besides the criteria that make a service demand responsive mentioned in the literature, from the interview with Peraphan Jittrapirom also appeared some criteria that make a service 'demand responsive' and 'on-demand'.

First of all, a DRT service comes with some form of flexibility: "It is not completely fixed, but also not completely flexible" (P. Jittrapirom, personal communication, May 10, 2017). Looking at Abel they do meet this criteria: they provide a fixed price, but the time is flexible and the route is semi-flexible, since Abel does determine the route, but can changes it when needed (Employee 2, personal communication, April 13, 2017).

Secondly, as is in the name of DRT, DRT is part of the demand side and not of the supply side of mobility: "DRT allows the users to receive the services at their own request (demand), at the route they request and at the time they request" (P. Jittrapirom, personal communication, 10 May 2017). This is exactly what Abel does, it provides their service to people that request their service at the time their customers want: only if people book a ride via the mobile application they provide their service. They do not, such as regular taxis do, wait for customers at taxi stands (Employee 1, personal communication, April 13, 2017).

Thirdly, Abel provides its service via a mobile application (Pals, 2016). Therefore they also meet the third criteria of a DRT service: the use of ICT in the system. Even though the older DRT services did not use ICT, modern services do: "The digitalisation has breathe new life into DRT" (P. Jittrapirom, personal communication, May 10, 2017).

Last of all, DRT services often try to reduce costs by combining different rides so their customers share a vehicle (P. Jittrapirom, personal communication, 10 May 2017). This is also what Abel is providing: a shared taxi service, whereby people are only able to book a seat in a taxi, instead of the whole vehicle (Employee 1, personal communication, April 13, 2017).

Furthermore, Peraphan mentioned some things that often can be found at DRT services. First of all, most DRT services are open systems, which are accessible for everyone. Looking at Abel, even though their target group are people from the age of 18 till 35, everyone, irrespectively age, who has the mobile application can use Abel (Employee 1, personal communication, April 13, 2017).

Secondly, some DRT services, as a part of smart mobility, also focus on sustainability: "But this really depends on how the DRT is been used in that spectrum of transportation" (P. Jittrapirom, May 10, 2017). Also Abel tries to contribute to sustainability by only using electrical cars as they really want to stand for 'a sustainable service' (Employee 1, personal communication, April 13, 2017).

So, looking at the criteria found both in the literature and in the interview with Peraphan Jittrapirom, it can be concluded that Abel meets the criteria and therefore can be called a demand responsive and on-demand transport system.

6. The user response

Where chapter 5 mainly presented and analysed the qualitative empirical findings, in chapter 6 the focus will be on the quantitative data obtained from the survey that has been filled in by 26 users of Abel.

6.1 Descriptive statistics

Even though the main purpose of the survey was to research the efficiency of the service Abel provides, from a users perspective, at the beginning of the survey some general questions were included. Therefore, to start with, there will be given some general descriptive statistics of variables that, based on the literature findings and based on the focus of this research, will not be researched in relation to efficiency. However, these variables do provide some general information about the respondents, therefore it is of added value to analyse these variables.

6.1.1 Gender

First of all, there can be looked at the gender of the 26 respondents.

Table 2 Statistics on the gender of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	9	34,6	34,6	34,6
	Female	17	65,4	65,4	100,0
	Total	26	100,0	100,0	

Analyzing table 2, the following can be seen:

- The total amount of respondents was 26;
- Each respondent answered the question on gender, since there are no missing values;
- From those 26 respondents, 9 (34.6%) were male and 17 (65.4%) were female.

6.1.2 Age

Besides the gender of the respondents there can also be looked at the age of the respondents, to see if the respondents belong to the target group of Abel, namely people from the age of 18 till 35 (Employee 1, personal communication, April 13, 2017).

Table 3 Statistics on the age of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 24	14	53,8	53,8	53,8
	25 - 34	6	23,1	23,1	76,9
	35 - 44	3	11,5	11,5	88,5
	45 - 54	2	7,7	7,7	96,2
	55 - 64	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

N	Valid	26
	Missing	0
Mean		2,85
Median		2,00
Mode		2

Based on table 3, the following can be stated:

- There are no missing values, which means that each respondent answered this question in the survey;
- 76.9% of the respondents (20 respondents) have an age between 18 and 35: so, the greater part of the respondents falls within the target group;
- Only 23.1% of the respondents (6 respondens) are older than 35 and fall outside of the target group;
- The majority of the respondents (14 respondents, 53.8%) have an age between 18 and 24;
- The avarage age is between 25 and 34, since the mean is 2.85. This means the avarage age falls in category 2 (25-34).

6.1.3 Education

Furthermore, there can also be looked at the highest level of education of the respondents.

Table 4 Statistics on the highest level of education of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary education	1	3,8	3,8	3,8
	HAVO or VWO	4	15,4	15,4	19,2
	Secondary vocational education (MBO)	2	7,7	7,7	26,9
	Higher education (college or university)	19	73,1	73,1	100,0
	Total	26	100,0	100,0	

Analyzing table 4, it shows the following:

- All 26 respondents answered this question in the survey, so there are no missing values;
- 19 out of the 26 respondents got a 'higher education (college or university)' as the highest level of education. With 73.1% this is the majority;
- 4 out of the 26 respondents (15.4%) have HAVO or VWO (high school) as the highest level of education;
- 2 out of the 26 respondents (7.7%) have MBO as the highest level of education;
- 1 out of the 26 respondents (3.8%) has primary education as the highest level of education;
- The majority of the respondents (21, 80.8%) has finished an education program after high school, since they either finished college or university or MBO.

6.1.4 Work status and average monthly income

Work status

To continue, there can also be looked at the work status and average monthly income of the respondents.

Table 5 Statistics on the work status of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I work fulltime	8	30,8	30,8	30,8
	I work parttime	5	19,2	19,2	50,0
	Unemployed and not seeking employment	1	3,8	3,8	53,8
	Student	12	46,2	46,2	100,0
	Total	26	100,0	100,0	

Table 5 shows the following statistics about the work status of the respondents:

- All 26 respondents answered this question in the survey, so there are no missing values;
- The majority of the respondents (46.2%) are students;
- 50% of the respondents is working (either fulltime or part time);
- The other 50% is either unemployed or student;
- 30.8%, which equals 8 respondents, are working full time.

Something to mention here is that there might have been some difficulties answering this question, since the answer 'student and working' was not provided, while students can also be working part time while still studying. Therefore, some of the 12 students could also be working, while the option of 'student and working' was not provided in the survey. Therefore the answer categories can be seen as not exhaustive, which is something to learn from for the future.

Monthly income

Table 6 Statistics on the average monthly income of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Up to €1000	9	34,6	34,6	34,6
	€1000 to €1500	7	26,9	26,9	61,5
	€1500 to €2000	3	11,5	11,5	73,1
	€2000 to €2500	2	7,7	7,7	80,8
	€2500 to €3000	2	7,7	7,7	88,5
	€3000 or more	2	7,7	7,7	96,2
	I do not want to answer this question	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

N	Valid	26
	Missing	0
Mean		2,65
Median		2,00
Mode		1

From table 6 the following information can be obtained:

- There are no missing values, which means each of the 26 respondents answered the question on monthly income in the survey;
- The majority, 9 out of the 26 respondents (34.6%) has an average monthly income up to €1000 (the mode is in category 1);
- Thereafter, 7 out of the 26 respondents (26.9%) have an average monthly income of €1000 to €1500;
- 2 out of the 26 respondents (7.7%) have an average monthly income of €2500 to €3000;

- 2 out of the 26 respondents (7.7%) have an average monthly income of €3000 to €3500;
- 2 out of the 26 respondents (7.7%) have an average monthly income of €3500 or more;
- One respondent (3.8%) did not wanted to answer this question;
- The mean income is in the category of €1000 to €1500 (category 2), because the mean is 2.65.

6.1.5 Household composition and marital status

Household composition

Two other variables that can be analysed descriptively are 'household composition' and 'marital status'.

Table 7 Statistics on the household composition of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single without children	11	42,3	42,3	42,3
	Single with children	2	7,7	7,7	50,0
	(Married) couple with children	2	7,7	7,7	57,7
	Housemates	11	42,3	42,3	100,0
	Total	26	100,0	100,0	

Table 7 shows the following:

- There are no missing values, which means each respondent answered the question on the composition of their household in the survey;
- 42.3% of the respondents is single without children (so lives alone) or has housemates;
- In total 84.6%, the majority of the respondents has no children and either lives alone or has housemates;
- Only 4 of the respondents (15.4%) are single or a (married) couple with children.

Marital status

Table 8 Statistics on the marital status of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unmarried	24	92,3	92,3	92,3
	Married	1	3,8	3,8	96,2
	Divorced	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

From table 8, the following information can be obtained:

- There are no missing values, which means each respondent answered the question on 'marital status' in the survey;
- Only one respondent (3.8%) is married and one respondent is divorced (3.8%);
- The rest of the respondents (the majority), 92.3% is unmarried.

6.1.6 Car ownership

Something notable when looking at car ownership, is that the majority of the respondents (76.9%) does not own a car. Only 6 out of the 26 respondents (23.1%) owns a car (see table 9).

Table 9 Do the respondents own a car?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	23,1	23,1	23,1
	No	20	76,9	76,9	100,0
	Total	26	100,0	100,0	

Previous research shows that once car ownership rises, the demand for public transport modes declines. On the other hand, once car ownership declines, the demand for public transport modes rises (Paulley et al., 2006). Those findings can partly be seen in table 9, since this table shows the majority of the respondents does not own a car, but they do use a public transport mode, namely Abel. Subsequently, there can be looked into if respondents that do not own a car, use Abel more often than the respondents that do own a car. To answer this question a crosstab analysis has been carried out (see table 10).

Table 10 Crosstab analysis for car ownership and frequency of use of Abel

		The use of Abel - How often do you use this service?				
		Once a week	Once a month	2 to 3 times a month	A few times a year	Total
General questions - Do you own a car?	Yes	0	2	1	3	6
	No	1	8	4	7	20
Total		1	10	5	10	26

From this analysis it appears that 3 out of 6 (50%) people that do own a car use Abel a few times a year, while the majority, 8 out of 20 (40%) people that do not own a car use Abel more often, namely once a month. So, at this point, these findings support the findings of previous research: once car ownership decreases, the demand for public transport mode becomes higher (Paulley et al., 2006) and the respondents that do not own a car use Abel more often than the respondents that do own a car.

But, to make sure there is a cohesion between the two variables (car ownership and use of Abel) a 'Compare Means' test has been done, since the dependent variable is ratio and the independent variable is nominal (see table 11). The hypotheses that are tested are:

H_0: there is no difference in use of Abel taxi between people that do own a car and people that do not own a car.
H_a: there is a difference in use of Abel taxi between people that do own a car and people that do not own a car.

Table 11 Compare means analysis: do respondents that do not own a car use Abel more often?

			Sum of Squares	df	Mean Square	F	Sig.
The use of Abel - How often do you use this service? * General questions - Do you own a car?	Between Groups	(Combined)	,463	1	,463	,475	,497
	Within Groups		23,383	24	,974		
	Total		23,846	25			

	Eta	Eta Squared
The use of Abel - How often do you use this service? * General questions - Do you own a car?	,139	,019

Looking at table 11 it can be concluded that:

- The correlation between the two variables is not very high, since Eta is 0,139. If Eta is 0, this means there is no cohesion and if Eta is 1 there is a perfect cohesion (te Grotenhuis & Matthijssen, 2013);
- Looking at Eta Squared, only 1.9% of the variance is explained, which is a low percentage;
- The significance (Sig.) is with its 0.497 a lot higher than the alfa of 0.05 and therefore there is no significant cohesion between car ownership and the frequency of use of Abel;
- Therefore H_a is rejected and H_0 has been accepted, which means there is no significant difference in use of Abel taxi between people that do own a car and people that do not own a car.

6.1.7 Public transport chip card and frequency of use

Public transport chip card

Something else to notice is that 25 of the 26 respondents (96.4%) use Abel, despite having a public transport chip card (see table 12). A good following-up question in the survey would have been to ask why those people still use Abel, despite having a public transport card they can use to travel cheaper. Unfortunately, this question was not asked, so it is only a speculation that 96.4% of the respondents (sometimes) prefer Abel over another mode of public transport, for certain reasons.

Table 12 Do the respondents have a public transport chip card?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	25	96,2	96,2	96,2
	No	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

Subscription on public transport chip card

In turn, the respondents that have a public transport chip card had to answer the question on whether or not they have a subscription on their public transport chip card (see table 13). The one respondent that does not have a public transport chip card (see table 12), did not have to fill in this question, therefore there is one missing value.

Table 13 Do the respondents have a subscription on their public chip card?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	18	69,2	72,0	72,0
	No	7	26,9	28,0	100,0
	Total	25	96,2	100,0	
Missing	999	1	3,8		
Total		26	100,0		

Table 13 shows the following descriptive statistics:

- There is one missing value, because the one person that does not have a public transport chip card (see table 12) never had to answer the question about having a subscription;
- Out of the 25 people that do have a public transport chip card 18 (72%) have a subscription on their public transport chip card;
- 28% of the respondents (7 respondents) does not have a subscription, despite having a public transport chip card.

In turn, the 18 respondents with a transcription on their public transport chip card were asked to fill in what kind of subscription they have (see table 14).

Table 14 Statistics on the type of subscription

	Frequency	Percent	Valid percent	Cumulative percent
40% discount	2	11,1	12,4	12,4
GVB only	1	5,6	6,3	18,7
Student subscription	12	66,6	75	93,7
Train	1	5,6	6,3	100
Missing	2	11,1		
Total	18	100	100	

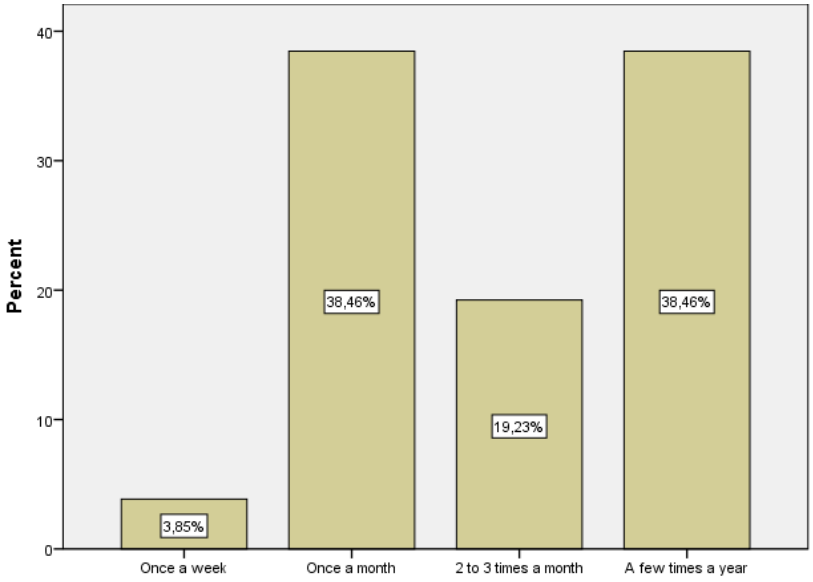
Analysing table 14 the following statistics can derived:

- 2 out of the 18 respondents (11.1%) that do have a subscription on their public transport chip card did not fill in what kind of subscription they have (missing values);
- 12 out of the 16 (75%) that filled in the question on the type of subscription have a student transcription, which is the majority;
- 2 out of the 16 respondents (12.4%) have a 40% discount subscription;
- 1 out of the 16 respondents (6.3%) has a train subscription and another one (6.3%) has a GVB only subscription.

Frequency of use of the service

How often the respondents use Abel can also be looked into (see figure 13).

Figure 13 Statistics on the frequency of use of Abel



Analysing figure 13 the following can be stated:

- Only 23.3% (19.2% + 3.8%) uses Abel 2-3 times a month or once a week.
- This means, the majority of the respondents, which is 76.7% (38.5% + 38.5%) only uses Abel once a month or a few times a year.

6.1.8 Special requirements and help

Table 15 Statistics on special requirements and help getting in and/or out of the car

Do you have special requirements for your trip?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	26	100,0	100,0	100,0

Do you need help getting in and/or out of the car?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	26	100,0	100,0	100,0

Besides the descriptive statistics given above, it is also interesting to know whether or not the respondents have any special requirements or need help getting in and/or out of the car. It could have been that people with special requirements value the efficiency different, based on to what extent they can use Abel in the same way as people without any special requirements. But, as table 15 shows none of the respondents has special requirements, such as a wheelchair, a pram or a service dog. Also none of the respondents needs help getting in and/or out of the car when traveling. So there cannot be researched if there is a difference in valuation of efficiency between people with and without special requirements.

6.1.9 Price and payment

Something else that does not influence efficiency in a way, but where respondents do have an opinion about, are the available payment methods and the pricing of a ride with Abel. Since the results of this research will be forwarded to Abel, it is interesting to analyse these questions. In total, there were asked four questions on the price and payment methods.

'The available payment methods are sufficient'

Table 16 Statistics on the statement 'the available payment methods are sufficient'

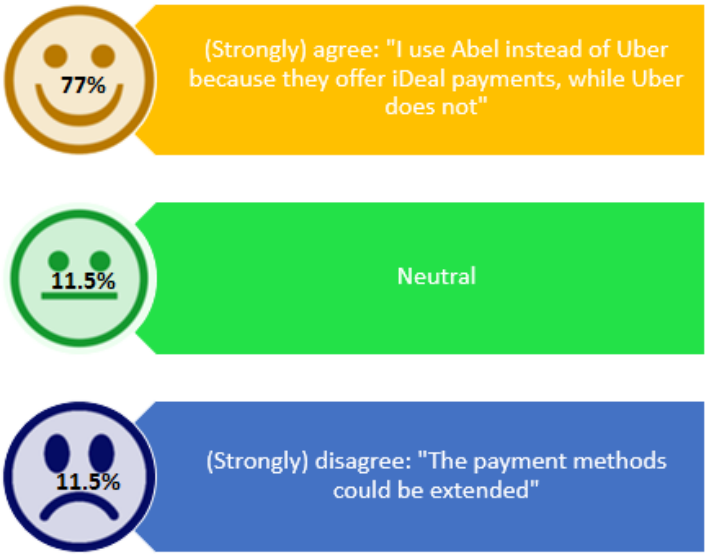
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	8	30,8	30,8	30,8
	Agree	12	46,2	46,2	76,9
	Neutral	3	11,5	11,5	88,5
	Disagree	2	7,7	7,7	96,2
	Strongly disagree	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

Based on table 16 the following can be said:

- There are no missing values, which means each respondent answered the question on 'available payment methods' in the survey;
- 76.92% of the respondents (20 respondents) agree or strongly agree with the available payment methods being sufficient;
- 11.54% of the respondents (3 respondents) are neutral about whether or not the available payment methods are sufficient;
- 11.54% of the respondents (3 respondents) disagree or strongly disagree with the available payment methods being sufficient;
- So, the majority of the respondents does agree with statement that the available payment methods are sufficient.

About the statement 'the available payment methods are sufficient' some quotes can be given to clarify the answers respondents gave (see figure 14). Those quotes are obtained from the multiple open-ended questions in the survey. Unfortunately, not for each answer category a quote has been found.

Figure 14 Quotes on the available payment methods



'Paying via the mobile application is easy'

Table 17 Statistics on the statement 'paying via the mobile application is easy'

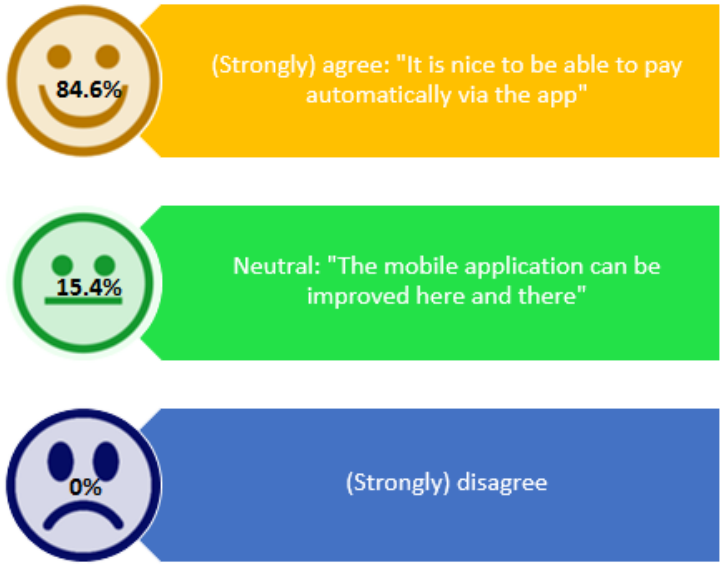
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	11	42,3	42,3	42,3
	Agree	11	42,3	42,3	84,6
	Neutral	4	15,4	15,4	100,0
	Total	26	100,0	100,0	

Analysing table 17 the following can be stated:

- There are no missing values, which means each respondent answered this question;
- None of the respondents (strongly) disagrees with the statement that paying via the mobile application is easy;
- 84.62% of the respondents (22 respondents) strongly agree or agree with the statement that paying via the mobile application is easy;
- Only 4 respondents (15.38%) are neutral about this statement;
- So, the majority of the respondents does agree with the statement that paying via the mobile application is easy.

Again some quotes can be given to clarify the answers (see figure 15). The quotes are obtained from the open ended questions of the survey. Unfortunately there has not been found a quote for each answer category.

Figure 15 Quotes on paying via the mobile application



'The price-quality ratio is good'

Table 18 Statistics on the statement 'the price-quality ratio is good'

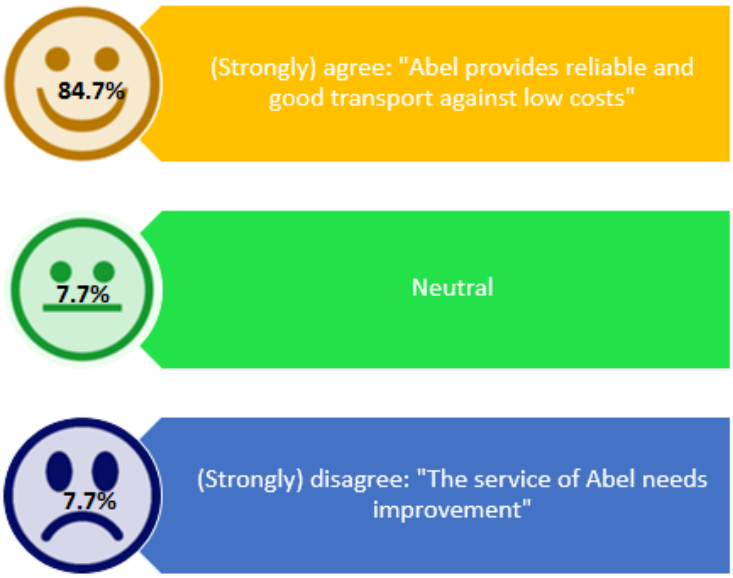
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	10	38,5	38,5	38,5
	Agree	12	46,2	46,2	84,6
	Neutral	2	7,7	7,7	92,3
	Disagree	1	3,8	3,8	96,2
	Strongly disagree	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

From table 18, the following information can be obtained:

- There are no missing values, which means each respondent answered this question;
- 84.62% of the respondents (22 respondents) agree or strongly agree with the statement that the price-quality ratio is good;
- 2 respondents (7.7%) are neutral about this statement;
- 2 respondents (7.7%) disagree or strongly disagree with the statement that the price-quality ratio is good. They find the service too expensive for the quality of service that is delivered by Abel;
- So the majority of respondents agrees with the statement that the price-quality ratio of Abel is good.

Again some quotes can be given to clarify the answers given by the respondents (see figure 16). These quotes are obtained from the open ended questions of the survey. Unfortunately, only for two answer categories quotes have been given by respondents.

Figure 16 Quotes on the price-quality ratio



'Abel is cheaper than other taxi services'

Table 19 Statistics of the statement 'Abel is cheaper than other taxi services'

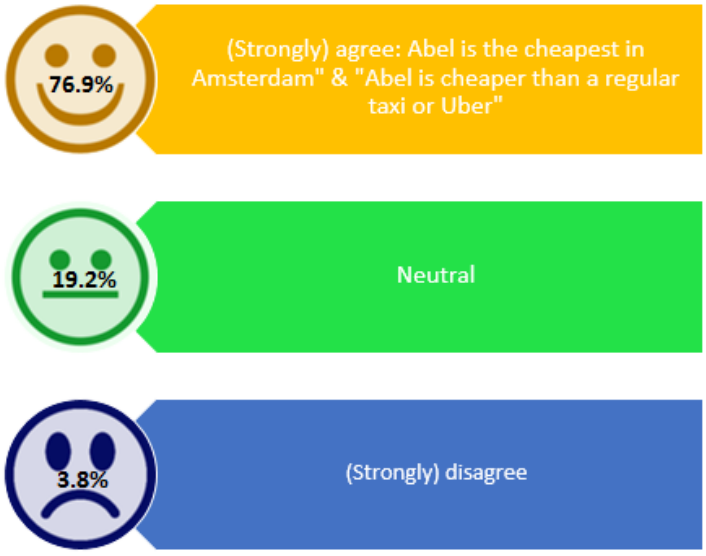
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	14	53,8	53,8	53,8
	Agree	6	23,1	23,1	76,9
	Neutral	5	19,2	19,2	96,2
	Disagree	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

Analyzing at table 19, the following can be said:

- There are no missing values, which means each respondent answered this question;
- Most of the respondents (14, 53.8%) strongly agree with the statement that Abel is cheaper in comparison to other taxi services;
- 6 out of the 26 respondents (23.1%) agree with the statement that Abel is cheaper than other taxi services;
- 5 respondents (19.2%) are neutral about this statement;
- 1 respondent (3.8%) disagrees with the statement that Abel is cheaper than other taxi services;
- So, the majority of the respondents (20 out of the 26) (strongly) agree with the statement that Abel is cheaper than other services.

Also in this case some quotes can be given to clarify the answers of the respondents (see figure 17). Those quotes, again, are obtained from the open ended questions of the survey. Unfortunately the respondents gave a limited amount of quotes.

Figure 17 Quotes on whether or not Abel is cheaper than other taxi services



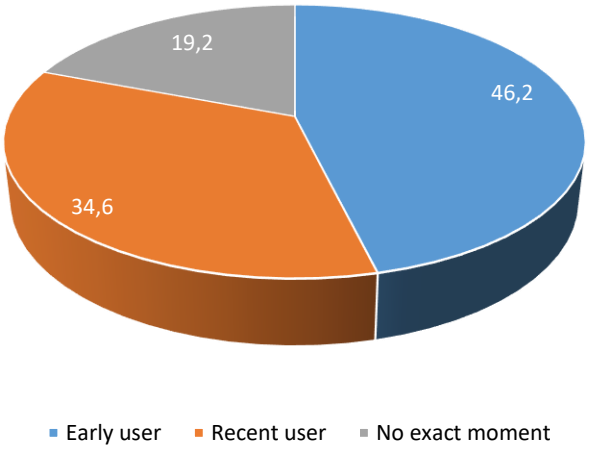
6.2 The use of Abel

Besides the descriptive statistics something else interesting to look into, even though it does not contribute to efficiency, are the reasons why people started using Abel, when people started using Abel and if the respondents are willing to use Abel more regularly in the future.

6.2.1 When did you start using Abel?

The first question asked was *when* the respondents started using Abel. The answers of the respondents have been categorized into three categories (early user, recent user and no exact moment). The answers of the respondents can be found in appendix V.1.

Figure 18 Statistics of categories on 'when respondents started using Abel?'



From figure 18 the following information can be obtained:

- 46.2% (12 out of 26) of the respondents are early users. This means they started using Abel in 2016, the first year Abel provided their service ;
- 34.6% (9 out of 26) of the respondents are recent users, which means they started using Abel in 2017;
- 19.2% (5 out of 26) of the respondents did not provide an answer with an exact moment on when they started using Abel.

6.2.2 Why did you start using Abel?

Following the question on *when* the respondents started using Abel, the question about *why* the respondents started using Abel has been asked. The answers of the respondents can be found in appendix V.2. Some respondents gave more than one answer, which means the total amount of answers is higher than 26: there are 30 answers. The given answers have been divided into different categories based on key words. Categories 'recommendation', 'reliable', 'fast', 'easy' and 'payment methods' have been combined to the category of 'good reputation'.

Figure 19 Statistics of categories on 'why did you start using Abel?'

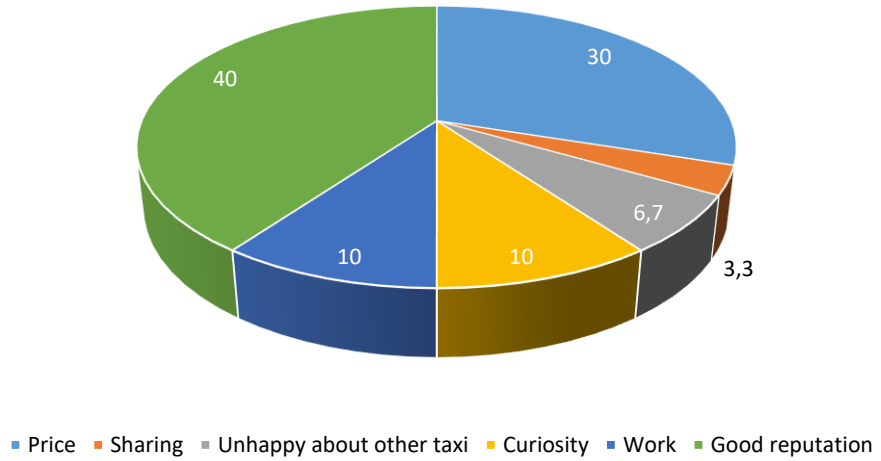


Figure 19 shows that the most common reason for the respondents to start using Abel was either the cheap(er) price (30%) or the good reputation of Abel (40%). Other reasons respondents gave where that they saw the cars of Abel what made them curious (10%), that respondents were not happy about other taxi companies (6.7%) or that respondents had to use it for work (10%). Furthermore one respondents started using Abel because he/she liked the idea of sharing (3.3%).

6.2.3 'I want to use this service regularly'

Last of all, the respondents were asked to answer if they want to use Abel regularly (in the future). Table 20 shows the answers respondents gave to this closed-question.

Table 20 Statistics on the statement 'I want to use this service regularly'

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	5	19,2	19,2	19,2
	Agree	11	42,3	42,3	61,5
	Neutral	9	34,6	34,6	96,2
	Strongly disagree	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

Looking at table 20 the following can be seen:

- There are no missing values, so each respondent filled in this question;
- 16 out of the 26 respondents (61.5%) strongly agree or agree with the statement that they want to use this service regularly. It can be speculated they want this because they are satisfied with the service of Abel;

- 9 respondents (34.62%) are neutral about this statement. It can be speculated these respondents are nog fully satisfied with the service or they do not need to use a taxi more regularly than they do now;
- 1 respondent (3.85%) strongly disagrees with the statement that he/she wants to use the service of Abel regularly. It can be assumed that this respondent is dissatisfied with the service of Abel;
- So, the majority of the respondents strongly agree or agree on wanting to use the service of Abel regularly.

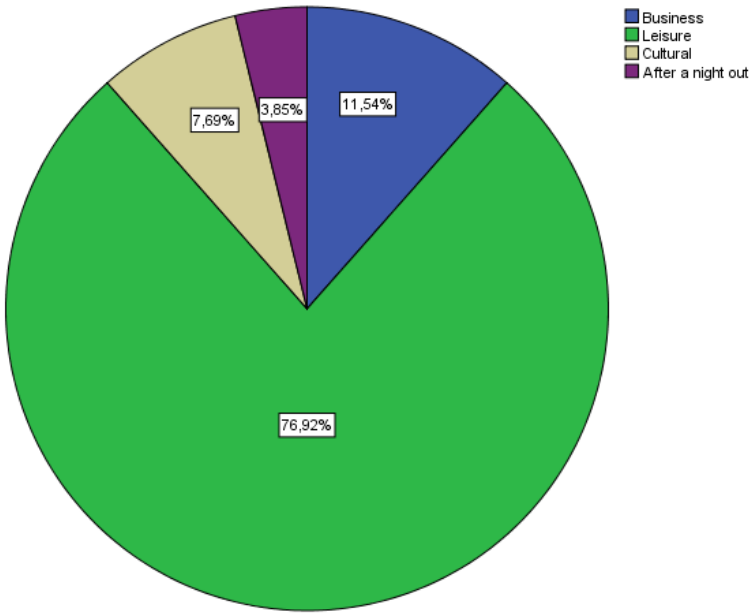
6.3 The most recent ride

Before starting the statistical analysis needed to analyse the main concept of this research: efficiency, the four questions that focus on the last ride respondents had with Abel, will be analysed. Important to remember here is that those questions only focussed on the respondents last ride (the most recent ride) with Abel. Thus, those questions were not answered based on a general/on average perspective of Abel, as is the case with the other questions in the survey.

6.3.1 Kind of ride

To start with we can have a look at the question "What kind of ride was your last ride with Abel?". Since Abel mainly focusses on 'millennials' (people in their 20's and 30's) (Employee 1, personal communication, April 13, 2017) it can be assumed that Abel is mainly used for leisure purposes and maybe also for business purposes. Therefore, the answers to this question can be used to check whether or not this assumption can be substantiated by the statistical data.

Figure 20 Statistics on the kind of ride with Abel



When analysing figure 20 it can be stated:

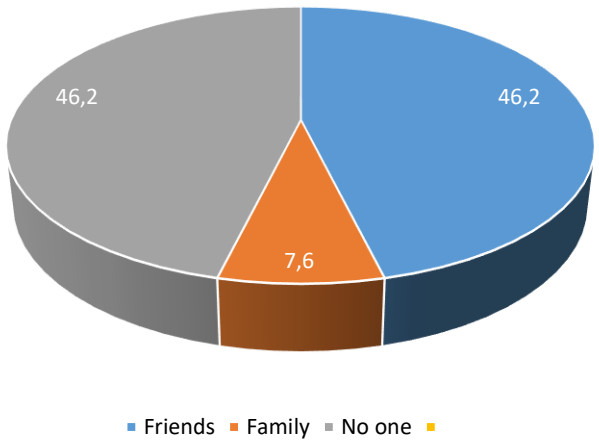
- There are no missing values, which means each respondent answered this question in the survey;
- The last ride of the majority of the respondents, 20 out of the 26 respondents (76.92%), was a ride for 'leisure'. This can also be seen when looking at the mean (2.04), which is in answer category 2 'leisure';
- 3 out of the 26 respondents (11.54%) had a 'business' ride as their last ride;
- 2 out of the 26 respondents (7.69%) had a 'cultural' ride as their last ride;
- The last ride of 1 out of the 26 respondents (3.85%) was a ride after a night out. Important to mention here is that this answer was given under the answer option of 'Other, namely…';
- Therefore it could have been that respondents that answered 'leisure' also used it after a night out, but it may be they have counted this for 'leisure'.

Based on the above findings, the assumption that most of Abel's users (looking at their target group) use Abel for leisure can be statistically substantiated: the majority (76.92%) of the 26 respondents had a last ride for 'leisure'. But, important to remember here is that this finding cannot be generalised to statements about all users of Abel, due to the small sample size. It can only be said that the assumption can be statistically substantiated for the respondents, but not for all users of Abel.

6.3.2 Abel, the ride you share?

Secondly, we can have a look at the question on whether or not the respondents were accompanied by someone during their last ride with Abel. With this question it can be checked if Abel really delivers what they are standing for and what makes them unique, namely a shared service. Since this was an open-ended question, the answers given on the question "Who was with you in the car your last ride?" can be found in appendix V.3. Those answers have been categorised into the categories of 'friends', 'family' and 'no one'. Based on those categories it has been determined whether or not the last rides where shared (see figure 21).

Figure 21 Who was with the respondents on their last ride with Abel?



When analysing figure 21 it can be seen that 53.8% (46.2% + 7.6%) of the last rides of the respondents was with someone else, which means they shared their ride (this can also be seen in figure 22). Based on figure 21 and 22 it can be said, based on the 26 answers, that Abel does provide a shared service. But, again, those results cannot be generalized, due to the small sample size.

When looking at the answers given by the respondents something to remark is that none of the respondents said something about sharing their ride with an unknown person, but only about sharing it with people they knew. Therefore, it can be that they misinterpreted the question and understood it as "who was traveling with you?" instead of whether or not the ride was shared, either with an unknown or known person. Therefore, this question better could have been formulated as "Did you share your last ride with someone?".

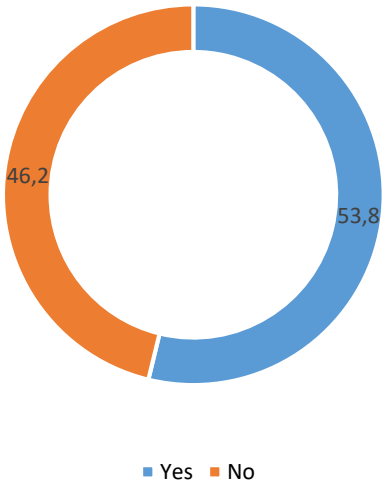


Figure 22 Where the last ride of the respondents shared?

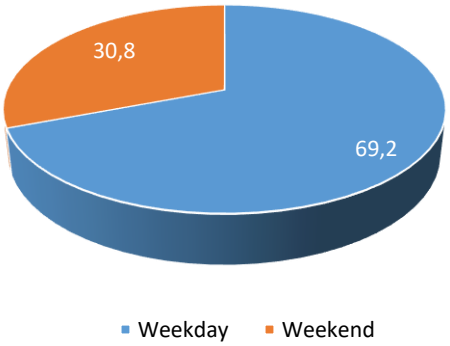
6.3.3 Day of the week and time of the day

Last of all there can be looked into what day of the week and what time of the day the last ride of the respondents took place. Since from the interview with the two employees of Abel appeared they have the most bookings during the weekends and in the evening, those results can be used to see if this can be statistically substantiated or not.

Day of the week

First of all, the answers to the question "What day of the week was your last ride?" can be analysed. The answers given (see appendix V.4) were divided into the categories of 'weekday' and 'weekend' to be able to conclude whether or not the most rides took place during the weekend.

Figure 23 Statistics on day of the week



Based on figure 23 the following can be concluded:

- Most of the respondents (69.2%) used Abel for the last time during the week;
- The other respondents (30.8%) used Abel on a Saturday or Sunday (during the weekend).

So, based on these findings it cannot be statistically substantiated that Abel is the busied in the weekend. But, since those findings are not generalizable it can only be said that based on the answers the 26 respondents this cannot be substantiated. With a bigger sample size there might have been found other and more generalizable results.

Time of the week

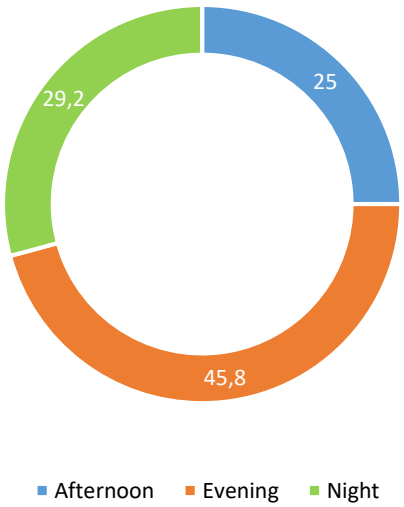
Secondly, the answers to the question "At what time of the day was your last ride?" can be analysed. With the answers provided to this question it can be checked if it can be statistically substantiated that Abel has the most bookings during the evening/night, as appeared from the interview with the two employees.

The answers provided by the respondents (see appendix V.5) have been be categorised into the following categories:

- Morning (6.00 till 12.00)
- Afternoon (12.00 till 18.00)
- Evening (18.00 till 00.00)
- Night (00.00 till 6.00)

Important to mention here is that two respondents did not answer this question, which means there are two missing values and thus, figure 24 is based on 24 answers.

Figure 24 What time of the day took the last ride of the respondents place?



Based on figure 24 the following can be stated:

- None of the respondents used Abel the last time in the morning;
- The majority of the respondents (11 out of the 24, 45.8%) used Abel for the last time in the evening;
- 29.2% (7 out of the 24 respondents) used Abel for the last time during the night;
- 25% (6 out of the 24 respondents) used Abel for the last time in the afternoon;

- 75% of the users used Abel for the last time in the evening or during the night.

Based on these findings it can be statistically substantiated that most customers use Abel during the evening or night. Therefore it can be concluded that this is the busied time of the day for Abel, such as appeared from the interview with the two employees. But, again, this can only be said for the 26 respondents and cannot be generalized, due to the small sample size.

6.4 Analysis of efficiency

Now the statistical analysis that is needed to answer the remaining sub-questions and main-question will be conducted. The main purpose of this research is to find out to what extent the users of Abel find the service that Abel provides efficient. Since efficiency is something that is not uniformly measurable, the scale of efficiency has been measured with the help of different items which are: accessibility, travel time, adequate information, trustworthiness, mobility in accordance with necessities and equity/justice (for explanation of those factors, see section 2.1.1). Besides that, something else important when looking at efficiency is the happiness/satisfaction of travellers (see section 2.1.4).

Those different items are not measured in the survey by one single questions, but by multiple questions. For example, the item 'accessibility' was measured by eight questions in the survey and the items 'happiness/satisfaction' and 'unhappiness/dissatisfaction' where also both measured by nine questions. Important to keep in mind here is that all the closed-questions are answered based on the average/general perspectives of the users.

Since the different items of efficiency are questioned by multiple questions, first of all, the reliability of the different questions on one item needs to be calculated. This has been done for each different item with the help of a Cronbach's Alpha analysis. Cronbach's Alpha is a way of testing the reliability of a certain scale that exists of different variables: the closer the alpha is to 1, the more reliable the scale with the different variables is. A Cronbach's alpha higher than 0,7 is considered as a sufficient reliability and an alpha higher than 0,8 is considered as a good reliability (Korzilius, 2008). When looking at the output of a Cronbach's Alpha analysis, the first Cronbach's alpha employs the covariances among the items of a scale, whereas the alpha based on standardized items employs the correlations among items. The latter alpha is based on the assumption that all of the items of a scale have equal variances and means, which is often not the case in practice (Vennix, 2006). Therefore, we look at the first alpha and not the 'Cronbach's Alpha Based on Standardised Items'.

What is very important to keep in mind when looking at the Cronbach's Alpha's of the different items is that those Cronbach's Alpha's are statistically not very significant, due to the small sample size of this research, what will lower the reliability and the validity of the research. Because of this small sample size, the results are not universal and not generalizable, which means only statements can be made about the people that are part of the sample. Korzilius (2008, p. 22) says: "The bigger your sample, the bigger the reliability of your research" and "Your research becomes more valid once it is generalizable" (Korzilius, 2008, p. 29). So a smaller sample size lowers the reliability and validity.

After the calculation of the Cronbach's Alpha for each item that influences efficiency, a mean score of each of these items has been calculated by 'Compute Variables'. This mean score was calculated by adding the different variables (questions) on the items together and then dividing this score by the total amount of variables. Since this analysis provides a mean score for each respondent, those mean scores were recoded and divided into three categories (see table 21), to make the analysis easier and more meaningful.

Table 21 Categories of mean scores

Mean scores	Answer category	New category
1 to 2.99	Strongly agree and agree	High/good
3 to 3.99	Neutral	Neutral
4 to 5	Strongly disagree and disagree	Low/bad

6.4.1 Accessibility

Cronbach's Alpha

The first item that influences/is part of efficiency is accessibility. For the eight questions that were asked to determine the scale of accessibility the Cronbach's Alpha was calculated (see table 22).

Table 22 Cronbach's Alpha for accessibility

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,001	,780	8

The standard rule for Cronbach's Alpha is that it has to be higher than 0.7 to be able to combine the different questions to one scale (Korzilius, 2008). In this case, this would not be possible, because the Cronbach's Alpha is 0.001.

But, table 23 shows when the question 'accessibility – the service is accessible' will be deleted the Cronbach's Alpha will rise up to 0.831, which means that the reliability will become higher and that the remaining questions can be combined to one reliable scale of 'accessibility' after deleting that item. Since deleting this item will cause the Cronbach's Alpha to rise from 0.001 (not reliable) to 0.831 (good reliability), removing this item will create a reliable scale of 'accessibility'.
Table 24 shows the new Cronbach's Alpha after deleting the item of 'accessibility – the service is accessible'. As Vennix (2011) says it: "When 'bad' items are deleted, the reliability of the scale increases" (Vennix, 2011, p. 187). Since this new Cronbach's Alpha is higher than 0.8, it can be said that the reliability of the remaining seven questions is good.

To keep in mind here is that the Cronbach's Alpha, despite being quite high, still does not say a lot statistically, due to the small sample size. So only things can be concluded on the people that were part of the sample size.

Table 23 Cronbach's Alpha if item deleted

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Accessibility and necesities - Extra "luggage" such as a suitcase, a pram or wheelchair can be carried on the taxi without any problem.	95,52	76357,593	-,103	,186	,002
Accessibility and necesities - A pet or assistance dog can be taken on the taxi without any problem.	95,16	76333,223	-,070	,266	,001
Accessibility - The service is accessible.	16,24	21,940	,019	,596	,831
Accessibility and equity/justice - I can use this service without any problem.	95,88	76376,593	-,144	,644	,002
Accessibility and equity/justice - Anyone can use this service without any problem.	95,32	76384,060	-,126	,666	,002
Accessibility and trustworthiness + necesities - The service is available at any desired moment of the day.	95,04	76181,707	,188	,585	-,001[a]
Accessibility and trustworthiness + necesities - The service is available at any desired point of departure.	95,68	76076,060	,405	,764	-,003[a]
Accessibility and trustworthiness + necesities - The service is available at the desired destination.	96,04	76351,707	-,116	,530	,002

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Table 24 The new Cronbach's Alpha for accessibility

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,831	,830	7

Mean score for all questions on accessibility

After the calculation of the Cronbach's Alpha, the mean scores on accessibility were calculated. Those mean scores are based on the seven questions that were asked to measure the scale of accessibility. The variable 'accessibility – the service is accessible' has not been included in this calculation, since it was deleted at the Cronbach's Alpha analysis.

From this 'compute variables' analysis, there have been derived 26 mean scores. But those mean scores do not say a lot, therefore they have been recoded and divided into three categories (high/good, neutral and low/bad).

Table 25 Statistics on the valuation of accessibility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	22	84,6	88,0	88,0
	Neutral	3	11,5	12,0	100,0
	Total	25	96,2	100,0	
Missing	System	1	3,8		
Total		26	100,0		

N	Valid	25
	Missing	1
Mean		1,1200
Median		1,0000
Mode		1,00

Table 25 shows the following about the valuation of accessibility:

- There is one missing value on the mean scores of accessibility. This is because one respondent did not fill in all the seven questions on accessibility, so therefore the answers of this respondent were not included in the calculation of the mean scores;
- None of the respondents valued the accessibility as low/bad;
- Only three respondents (12%) value the accessibility as 'neutral';
- All other respondents, (22 out of the 25, 88%) value the accessibility as good/high;
- This is also the majority since the mode is in category 1 (high/good);
- The mean of the mean scores on accessibility is with its 1.12 in category 1, which represents a good/high value of accessibility.

Based on the above findings it can be concluded that the respondents, despite the three respondents that valued the accessibility as 'neutral', overall value the accessibility of Abel taxi as high/good (the mean of the mean scores is in category 1). This positive valuation of accessibility will contribute to a high/good valuation of the efficiency of Abel.

6.4.2 Travel time

Cronbach's Alpha

Secondly, the same Cronbach's Alpha analysis that has been carried out for the different questions on the scale of accessibility has also been carried out for the three different questions that were asked to measure the item 'travel time' (see table 26).

Table 26 Cronbach's Alpha for travel time

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,758	,779	3

Since the Cronbach's Alpha is higher than 0.7 (0.758) the different questions measuring travel time can be combined to the reliable scale of 'travel time'. Since the Cronbach's Alpha is higher than 0.7, but under 0.8, it can be said that the reliability is sufficient.

Mean score for all questions on travel time

In the same way the mean scores for the items on accessibility were calculated, the mean scores were also calculated for travel time. But, since those mean scores do not say a lot, they were also recoded and divided into the three categories (high/good, neutral and low/bad).

Table 27 Statistics on the valuation of travel time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	20	76,9	76,9	76,9
	Neutral	4	15,4	15,4	92,3
	Low/bad	2	7,7	7,7	100,0
	Total	26	100,0	100,0	

N	Valid	26
	Missing	0
Mean		1,3077
Median		1,0000
Mode		1,00

From table 27 the following findings can be obtained:

- There are no missing values, which means that each respondent filled in all questions on the item 'travel time';
- 2 out of the 26 respondents (7.7%) valued the category of 'travel time' as low/bad;
- 4 out of the 26 respondents (15.4%) valued travel time as neutral;
- The majority of the respondents (20 out of the 26, 76.9%) valued travel time as high/good (the mode is in category 1 (high/good));
- The mean of the mean scores on travel time is with its 1.3077 in category 1. This equals a good/high value of the item 'travel time'.

Based on the above findings it can be concluded that the respondents overall value the travel time of Abel taxi as good/high, which means that it contributes to a positive and high/good valuation of efficiency. What is important to mention is that in this case there are two respondents that value the item of travel time as low/bad. Unfortunately it is not possible to find out why those two respondents valued it as low/bad, since no open questions were asked on the item of travel time. But despite those two low/bad values, the overall, average value of the travel time is in category 1, which equals a good/high value.

Average waiting time

Since the question on the average waiting time for the taxi has been measured with another 5 point scale than the other questions on travel time it could not be included in the previous analysis on the item of travel time.

Table 28 Statistics on the average waiting time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 to 5 minutes	1	3,8	3,8	3,8
	5 to 10 minutes	6	23,1	23,1	26,9
	10 to 15 minutes	10	38,5	38,5	65,4
	15 to 20 minutes	7	26,9	26,9	92,3
	20 minutes or longer	2	7,7	7,7	100,0
	Total	26	100,0	100,0	

N	Valid	26
	Missing	0
Mean		3,12
Median		3,00
Mode		3

Table 28 shows the following findings:

- There are no missing values, which means each respondent answered this question;
- Most respondents (10 out of 26, 38.5%) wait, on average, 10 to 15 minutes before an Abel taxi picks them up (the mode is in category 3);
- 26.9% (3.8% + 23.1%, 7 out of the 26 respondents) of the respondents have an average waiting time of less than 10 minutes;
- 34.6% (26.9% + 7.7%, 9 out of the 26 respondents) of the respondents have an average waiting time of more than 15 minutes;
- The mean (3.12) shows that the average waiting time is in category 3, which is 10 to 15 minutes.

Experience of travel time during the last ride

Besides the closed questions about the average/general perspective on travel time, the respondents were also asked to describe their last ride with Abel in terms of travel time. For this description the following explanation was provided: “For travel time you should think about the real travel time corresponding to the predetermined time, the waiting time for taxis and if your ride with Abel taxi is faster or slower compared to public transport like tram/metro, train and bus”. This instruction was given so each respondent would have the same understanding of ‘travel time’. The answers given by the respondents (see appendix V.6) were divided based on key words.

Table 29 Statistics on travel time experience

Key word/category	Frequency	Percent	Valid Percent	Cumulative percent
Good	10	29.4	29.4	29.4
Direct (no detour)	3	8.8	8.8	38.2
On time	1	3	3	41.2
As predicted	3	8.8	8.8	50
Fast	5	14.6	14.6	64.6
Faster than public transport	7	20.6	20.6	85.2
Horrible	1	3	3	88.2
Longer	4	11.8	11.8	100
Total	34	100	100	

First of all it needs to be mentioned that the total amount of answers is higher than 26, since some respondents gave more than one answer to this question. Looking at table 29 it can be said that the majority of the answers of the respondents (29.4%) was about a 'good' travel time during the most recent ride of the respondents. Furthermore they experienced their ride in genersl as fast (14.6%) and some respondents experienced it as faster than public transport (20.6%). Furthermore 8.8% of the answers was about a direct service, without detour. Other than that 8.8% of the answers was about the final travel time being the same as predicted in advance.

Despite the overall positive answers, there are also some negative experiences, which resulted in respondents that experienced the travel time of their last ride not as positive as others: it took longer than public transport (11.8%) and it was 'horrible' (3%). Where some respondents experienced their last ride with Abel as faster than public transport, others did not. This shows that as long as it comes to the users the experience is very subjective.

6.4.3 Trustworthiness

Cronbach's Alpha

Thirdly, a Cronbach's Alpha test was carried out for the multiple questions that were asked to measure the item of 'trustworthiness' (see table 30).

Table 30 Cronbach's Alpha for trustworthiness

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,855	,862	4

Also this Cronbach's Alpha is higher than 0.7 (0.855), which means all four questions that were asked to measure the item of 'trustworthiness' can be combined to one reliable scale. Since the Cronbach's Alpha is even higher than 0.8 it can be said that there is a good reliability.

Mean score for all questions on trustworthiness

In turn, since the scale of trustworthiness is reliable, the mean scores on the item of trustworthiness were calculated and those mean scores were also divided into the same 3 categories as used before with the help of 'recode into different variables'.

Table 31 Statistics on the valuation of trustworthiness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	20	76,9	76,9	76,9
	Neutral	5	19,2	19,2	96,2
	Low/bad	1	3,8	3,8	100,0
	Total	26	100,0	100,0	

N	Valid	26
	Missing	0
Mean		1,2692
Median		1,0000
Mode		1,00

From table 31 the following findings can be obtained:

- There are no missing values, which means that each respondent filled in all questions on trustworthiness;
- Only 1 out of the 26 respondents (3.8%) valued the item of 'trustworthiness' as low/bad;

- 5 out of the 26 respondents (19.2%) valued the trustworthiness as neutral;
- The majority of the respondents (20 out of the 26, 76.9%) valued the trustworthiness as high/good (the mode is in category 1 (high/good));
- The mean of the mean scores on trustworthiness is with its 1.2692 in category 1, which means a good/high value.

Based on the above findings it can be concluded that, despite the one respondent that values the trustworthiness as low/bad, the rest of the respondents overall value the trustworthiness of Abel taxi as good/high, which means that it contributes to a positive view on efficiency. This can also be seen when looking at the mean, which is with its 1.2962 in category 1 'high/good'.

Experience of trustworthiness during the last ride

Also for trustworthiness the respondents were asked to describe their last ride in terms of trustworthiness. For this description the following instruction was provided: "For trustworthiness you should think about punctuality and taxis available at the appropriate time and in the desired area". This instruction was given so each respondent would have the same understanding of 'trustworthiness'. The answers given by the respondents (see appendix V.7) have been divided based on key words.

Table 32 Statistics on trustworthiness experience

Key words/categories	Frequency	Percent	Valid percent	Cumulative percent
Fast	5	13.9	13.9	13.9
On time	8	22.2	22.2	36.1
Reliable	6	16.7	16.7	52.8
Bad	3	8.3	8.3	61.1
Good	6	13.9	13.9	75
Not available	4	11.1	11.1	86.1
Not on time	2	5.6	5.6	91.7
Safe	1	8.3	8.3	100
Total	36	100	100	

First of all it needs to be mentioned that the total amount of answers is higher than 26, since some respondents gave more than one answer to this question.

Looking at table 32 it can be said that of the answers on the experience of trustworthiness 22.2% (the majority) were about the taxi being on time. Furthermore respondents described the trustworthiness as reliable (16.7%) and good (13.9%). Besides that, they also said that Abel provides a fast service (13.9%). Furthermore one respondents (8.3%) mentioned he felt safe during his/her last ride with Abel.

However, some respondents had a negative experience during their last ride and gave answers as 'not on time' (5.6%) and 'bad service' (8.3%). Furthermore 4 respondents experienced there was no taxi available at the moment they wanted to book one (11.1%), which also led to a negative experience.

But, when looking at the findings of table 32 it can be said that the overall general/average value of trustworthiness which was 'high/good' (see table 31) can be supported by the findings of this table since the experience of trustworthiness was mainly positive.

6.4.4 Vehicle characteristics

Cronbach's Alpha

Fourth of all, a Cronbach's analysis has also been done for the six questions that measure the item of 'vehicle characteristics' (see table 33).

Table 33 Cronbach's Alpha for vehicle characteristics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,810	,820	6

Also in this case the Cronbach's Alpha is higher than 0.7 (0.810) which means that the different questions that were asked to measure vehicle characteristics can be combined to a reliable scale of 'vehicle characteristics'. In this case, since the Cronbach's Alpha is even higher than 0.8, it can be said that there is a good reliability.

Mean score for all questions on vehicle characteristics

Furthermore, the mean scores for the questions that were asked to measure the item of 'vehicle characteristics' were calculated. Again, because those mean scores do not say a lot, they were divided into the three categories (high/good, neutral and low/bad).

Table 34 Statistics on the valuation of vehicle characteristics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	23	88,5	92,0	92,0
	Neutral	2	7,7	8,0	100,0
	Total	25	96,2	100,0	
Missing	System	1	3,8		
Total		26	100,0		

N	Valid	25
	Missing	1
Mean		1,0800
Median		1,0000
Mode		1,00

Table 34 shows the following:

- There is one missing value, which means that one respondent did not answer all the questions on the scale of 'vehicle characteristics'. Therefore this respondent was deleted from the data set;
- None of the 25 respondents valued the scale of vehicle characteristics as low/bad;
- 2 out of the 25 respondents (8%) valued the scale of vehicle characteristics as neutral;
- The majority of the respondents (23 out of the 25, 92%) valued the scale of vehicle characteristics as high/good;
- The mean of the mean scores on vehicle characteristics is with its 1.0800 in category 1, which means a good/high value.

Based on the above findings it can be concluded that most of the respondents overall value the scale of vehicle characteristics as good/high (the mean is in category 1). This means that this valuation contributes to a positive and high/good valuation on efficiency.

6.4.5 Adequate information

Cronbach's Alpha

As for the other items, also a Cronbach's Alpha was calculated for the four questions that were asked to measure 'adequate information' (see table 35).

Table 35 Cronbach's Alpha for adequate information

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,775	,773	4

This Cronbach's Alpha is also higher than 0.7 (0.775) which means that the different questions asked to measure 'adequate information' can be combined to one reliable scale of adequate information. Since the Cronbach's Alpha is higher than 0.7, but lower than 0.8, the reliability is sufficient.

Mean score for all questions on adequate information

As for the previous items also the mean scores for the reliable scale of 'adequate information' were calculated. In turn, also these mean scores were divided into the three categories used before (high/good, neutral, and bad/low).

Table 36 Statistics on the valuation of adequate information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	22	84,6	84,6	84,6
	Neutral	4	15,4	15,4	100,0
	Total	26	100,0	100,0	

N	Valid	26
	Missing	0
Mean		1,1538
Median		1,0000
Mode		1,00

From table 36 the following information can be obtained:

- There are no missing values, which means that each respondent answered all questions that were asked to measure the item of 'adequate information';
- None of the 26 respondents valued the scale of adequate information as low/bad;
- 4 out of the 25 respondents (15.4%) valued the scale of adequate information as neutral;
- The majority of the respondents (22 out of the 26, 84.6%) valued the scale of adequate information as high/good;
- The mean of the mean scores on adequate information is with its 1.1538 in category 1, which means a good/high value.

Based on the above findings it can be concluded that most of the respondents overall value the scale of adequate information as good/high (the mean is in category 1). The overall good/high valuation of the item 'adequate information' contributes to a positive valuation of efficiency.

6.4.6 Mobility in accordance with necessities

Cronbach's Alpha

Furthermore, the Cronbach's Alpha was also calculated for the three questions on the item of 'mobility in accordance with necessities' (see table 37).

Table 37 Cronbach's Alpha for mobility in accordance with necessities

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,807	,821	8

Table 37 shows that also this Cronbach's Alpha is higher than 0.7 (0.807) which means that the different questions that were asked to measure 'mobility in accordance with necessities' can be combined to one scale, which is reliable. This reliability can be seen as good, since the Cronbach's Alpha is higher than 0.8.

Mean score for all questions on mobility in accordance with necessities

As has been done with the previous aspects of efficiency, also the mean scores for the scale of 'mobility in accordance with necessities' was calculated. In turn, these mean scores of also recoded and categorized into the three previous used categories (high/good, neutral and low/bad).

Table 38 Statistics on the valuation of mobility in accordance with necessities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	21	80,8	84,0	84,0
	Neutral	4	15,4	16,0	100,0
	Total	25	96,2	100,0	
Missing	System	1	3,8		
Total		26	100,0		

N	Valid	25
	Missing	1
Mean		1,1600
Median		1,0000
Mode		1,00

Table 38 shows the following:

- There is one missing value, which means that one respondent did not answer all the questions on the scale of 'mobility in accordance with necessities'. Therefore this respondent was deleted from the data set;
- None of the 25 respondents valued the scale of mobility in accordance with necessities as low/bad;
- 16% of the respondents (4 out of 25 respondents) valued the scale of mobility in accordance with necessities neutral;
- The majority of the respondents, 84% (21 out of the 25) valued mobility in accordance with necessities as high/good;
- The mean of the mean scores on mobility in accordance with necessities is with its 1.16000 in category 1, which means a good/high value.

Based on the above findings it can be concluded that, despite the missing value, most of the respondents overall value the scale of mobility in accordance with necessities as good/high (the mean is in category 1). This in turn will contribute to a high/good valuation of efficiency.

6.4.7 Equity/justice

Cronbach's Alpha

As was done for the other items that influence efficiency, also a Cronbach's Alpha was calculated for the two questions on the item 'equity/justice' (see table 39).

Table 39 Cronbach's Alpha for equity/justice

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,742	,755	2

As table 39 shows, the Cronbach's Alpha is 0.742 and thus higher than the minimum needed 0.7. This means that the two items that measure 'equity/justice' can be combined to a reliable scale of equity/justice. Since the Cronbach's Alpha is higher than 0.7, but lower than 0.8 the reliability can be seen as sufficient.

Mean score for all questions on equity/justice

Also for the scale of equity/justice the mean scores were calculated. In turn, those mean score were recoded and divided into the three categories (high/good, neutral and low/bad).

Table 40 Statistics on the valuation of equity/justice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	19	73,1	76,0	76,0
	Neutral	4	15,4	16,0	92,0
	Low/bad	2	7,7	8,0	100,0
	Total	25	96,2	100,0	
Missing	System	1	3,8		
Total		26	100,0		

N	Valid	25
	Missing	1
Mean		1,3200
Median		1,0000
Mode		1,00

Analyzing table 40, the following can be stated:

- There is one missing value, which means that one respondent did not answer all the questions on the scale of 'equity/justice'. Therefore this respondent was deleted from the data set;
- 2 of the 25 respondents (8%) valued the scale of equity/justice as low/bad;
- 4 out of the 25 respondents (16%) valued the scale of equity/justice neutral;
- The majority of the respondents (19 out of the 25, 76%) valued the scale of equity/justice as high/good;
- The mean of the mean scores on equity/justice is with its 1.32 in category 1, which means a good/high value.

Based on the above findings it can be concluded that, despite the missing value and the two respondents that valued it as low/bad, most of the respondents overall value the scale of equity/justice as good/high (the mean is in category 1). Therefore it can be concluded that the high/good valuation of equity/justice contributes to a high/good valuation of efficiency.

6.4.8 Happiness/satisfaction

Cronbach's Alpha

To measure the traveler's satisfaction (as mentioned in section 2.1.6) the respondents had to answer multiple questions on both happiness/satisfaction and unhappiness/dissatisfaction. For both scales a Cronbach's Alpha analysis has been carried out (see table 41 and 44).

Table 41 Cronbach's Alpha for happiness/satisfaction

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,904	,900	9

Table 42 Case processing summary happiness/satisfaction

		N	%
Cases	Valid	24	92,3
	Excluded[a]	2	7,7
	Total	26	100,0

a. Listwise deletion based on all variables in the procedure.

As table 41 shows, the Cronbach's Alpha for the questions that were asked to measure the scale of 'happiness/satisfaction' is with its 0.904 higher than the minimum needed 0.7, which means that the nine 9 questions together form a reliable scale of 'happiness/satisfaction'. This reliability is good, since the Cronbach's Alpha is higher than 0.8.

What needs to be kept in mind is that there are 2 answers of respondents deleted list-wise, because of missing values (see table 42). SPSS deletes these items to only run the analysis with cases that have a complete set of data, to make sure the analysis gives a representative result (Vennix, 2011).

Mean score for all questions on happiness/satisfaction

Also for the nine questions asked to measure 'happiness/satisfaction' the mean scores were calculated. In turn, those mean scores were recoded and categorized into the three categories used before (high/good, neutral and low/bad).

Table 43 Statistics on the valuation of happiness/satisfaction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	22	84,6	91,7	91,7
	Neutral	1	3,8	4,2	95,8
	Low/bad	1	3,8	4,2	100,0
	Total	24	92,3	100,0	
Missing	System	2	7,7		
Total		26	100,0		

N	Valid	24
	Missing	2
Mean		1,1250
Median		1,0000
Mode		1,00

Table 43 shows the following:

- There are two missing values, what means that two respondents did not answer all the questions on the scale of 'happiness/satisfaction'. Therefore these respondents were deleted from the data set;
- 1 of the 24 respondents (4.2%) valued the scale of happiness/satisfaction as low/bad;
- 1 out of the 24 respondents (4.2%) valued the scale of happiness/satisfaction neutral;
- The majority of the respondents (22 out of the 24, 91.7%) valued the scale of happiness/satisfaction as high/good;
- The mean of the mean scores on happiness/satisfaction is with its 1.125 in category 1, which means a good/high value.

Based on the above findings it can be concluded that, despite the missing values and the one respondents that valued it as low/bad, most of the respondents overall value the scale of happiness/satisfaction as good/high (the mean is in category 1). This good/high value of happiness/satisfaction will contribute to a high/good valuation of efficiency.

6.4.9 Unhappiness/dissatisfaction

As said before, also the Cronbach's Alpha was calculated for the questions that were asked to measure the scale of 'unhappiness/dissatisfaction' (see table 44).

Table 44 Cronbach's Alpha for unhappiness/dissatisfaction

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,922	,922	9

Table 45 Case processing summary unhappiness/dissatisfaction

Cases	Valid	24	92,3
	Excluded[a]	2	7,7
	Total	26	100,0

a. Listwise deletion based on all variables in the procedure.

Table 44 shows that Cronbach's Alpha for the questions that were asked to measure the scale of 'unhappiness/dissatisfaction'. This Cronbach's Alpha is with its 0.922 higher than the minimum needed 0.7, which means that the 9 items can be combined to a reliable scale of 'unhappiness/dissatisfaction'. Since this Cronbach's Alpha is higher than 0.8 the reliability can be seen as good. Also here two answers were deleted list-wise, because of missing values in the data set (see table 45).

Mean score for all questions on unhappiness/dissatisfaction

In turn, since the scale of 'unhappiness/dissatisfaction' is reliable the mean scores for this scale were calculated. Also these mean scores were divided into the three categories (high/good, neutral and low/bad).

Table 46 Statistics on categories of unhappiness/dissatisfaction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High/good	3	11,5	12,5	12,5
	Neutral	11	42,3	45,8	58,3
	Low/bad	10	38,5	41,7	100,0
	Total	24	92,3	100,0	
Missing	System	2	7,7		
Total		26	100,0		

N	Valid	24
	Missing	2
Mean		2,2917
Median		2,0000
Mode		2,00

From table 46 the following information can be obtained:

- There are two missing values, what means that two respondents did not answer all the questions on the scale of 'unhappiness/dissatisfaction'. Therefore these respondents were deleted from the data set;
- 10 of the 24 respondents (41.7%) valued the scale of unhappiness/dissatisfaction as low/bad;
- 11 out of the 24 respondents (45.8%) valued the scale of unhappiness/dissatisfaction neutral;

- 3 out of the 24 respondents (12.5%) valued the scale of unhappiness/dissatisfaction as high/good;
- The mean of the mean scores on unhappiness/dissatisfaction is with its 2.29 in category 2, which means a neutral value.

Based on the above findings it can be concluded that, despite the missing values, most of the respondents overall value the scale of happiness/satisfaction as neutral (the mean is in category 2). This means it does not contribute to a negative, but also not a positive view on efficiency.

While for all other items an overall low/bad value was something negative, for this scale it is something positive. The low/bad value of unhappiness/dissatisfaction means that the respondents overall do not experience feelings of unhappiness/dissatisfaction when traveling with Abel. This low/bad value therefore means they are feeling happy/satisfied, instead of unhappy/dissatisfied.

6.5 How efficient is Abel?

Based on the analysis of the different items that influence efficiency that were carried out, the following table can be created:

Table 47 Overall valuation of efficiency

Aspect/item of efficiency	Overall valuation	High/good	Neutral	Low/bad	Total	Missing values	Mean category
Accessibility	High/good	22	3	0	25	1	1
Travel time	High/good	20	4	2	26	0	1
Trustworthiness	High/good	20	5	1	26	0	1
Vehicle characteristics	High/good	23	2	0	25	1	1
Adequate information	High/good	22	4	0	26	0	1
Mobility in accordance with necessities	High/good	21	4	0	25	1	1
Equity/justice	High/good	19	4	2	25	1	1
Happiness/satis-faction	High/good	22	1	1	24	2	1
Unhappiness/dis-satisfaction	Neutral	3	11	10	24	2	2

In short, from the above table it can be concluded that 8 out of the 9 items have an overall, mean valuation of high/good, which in turn contributes to a good/positive valuation of efficiency. Only one item has a neutral valuation, which will lower the strength of the positive valuation of efficiency a bit, but not as much as if the valuation would have been low/bad.

6.5.1 Valuation of efficiency

At the end of the survey, the users of Abel were also asked to give the overall efficiency (based on the previous questions in the survey) a mark from 1 to 10, where 1 was 'very bad' and 10 'very good'.

Table 48 Statistics on the rating of efficiency of Abel

N	Valid	26
	Missing	0
Mean		7,58
Median		7,00
Mode		7

Table 48 shows the following:

- There are no missing values, which means that each respondents has answered this question in the survey;
- The average mark for the efficiency is a 7.58 (see mean);
- The most frequent mark is a 7, which can be seen at 'mode';
- Since the 'median' is a 7, it means that 50% of the answers lies above 7 and 50% below 7.

Table 49 Rating of efficiency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	3,8	3,8	3,8
	6	1	3,8	3,8	7,7
	7	12	46,2	46,2	53,8
	8	5	19,2	19,2	73,1
	9	5	19,2	19,2	92,3
	10	2	7,7	7,7	100,0
	Total	26	100,0	100,0	

Looking at table 49, the following things can be seen:

- The majority of the respondents (46.2%) gave the efficiency of Abel a 7;
- 92.3% of the users gave the efficiency of Abel a 7 or higher;
- One respondent (3.8%) gave the efficiency a 2.

In short it can be concluded that the majority of the respondents value the efficiency as good, since 25 out of the 26 respondents (96.8%) gave the efficiency a 6 or higher on a scale of 1 to 10, wherein 1 is very bad and 10 is very good (so a 5.5 would be a 'neutral' rate).

6.6 Good things and things to improve about Abel

At the end of the survey the respondents were also asked to mention positive/good things and things that can be improved about the service of Abel. This was asked via the following two open-ended questions: “What are positive things about Abel?” and “What can be improved at Abel?”. Those questions were asked to get more complete answers, since the closed question did not provide the respondents the opportunity to explain their given answers. Most respondents gave more than one answer to this question, which means the total amount of answers is more than 26. Since the respondents both gave different, but also similar answers there has been decided to divide the answers into categories, to make the analysis of the answers easier.

6.6.1 Good things about Abel

The answers given by the respondents on the question “What are positive things about Abel?” (see appendix V.8) have been categorized based on key words.

Figure 25 Statistics on 'good things about Abel'

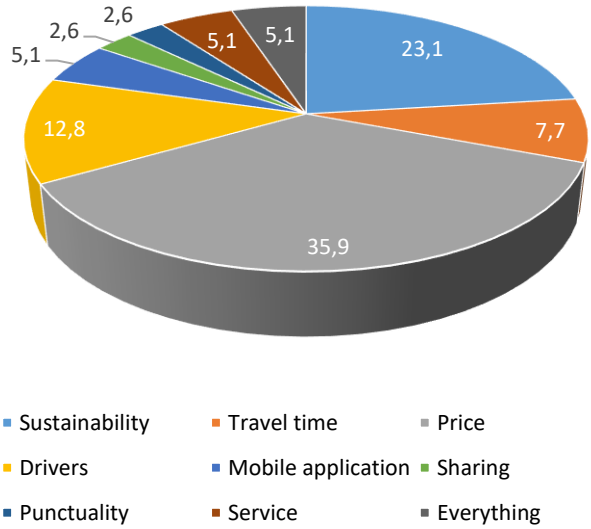


Figure 25 shows the following:

- There are two missing values, which means two respondents did not answer this question. Therefore, they were deleted from the data set;
- The given answers have been divided into 9 categories of ‘good/positive things’:
    - The sustainability of the service of Abel (sustainability) (23.1%)
    - The fast service of Abel (travel time) (7.7%)
    - The cheap price of Abel (price) (35.9%
    - The nice and friendly drivers (drivers) (12.8%)
    - Having a mobile application and being able to pay through this (mobile application) (5.1%)
    - The aspect of ‘sharing’ in the service of Abel (sharing) (2.6%)
    - The punctuality of Abel (punctuality) (2.6%)
    - The overall service Abel delivers (service) (5.1%)
    - Everything Abel does/delivers is good (everything) (5.1%)

Even though the percentages are given, this does not mean that the good/positive points of Abel with a lower percentage, have a lower value. Each opinion has the same value and is evenly interesting and important, irrespectively the amount of respondents that do or do not have the same opinion. What can be said is that good/positive things about Abel that are mentioned more often need less improvement than the good/positive things that are mentioned less often.

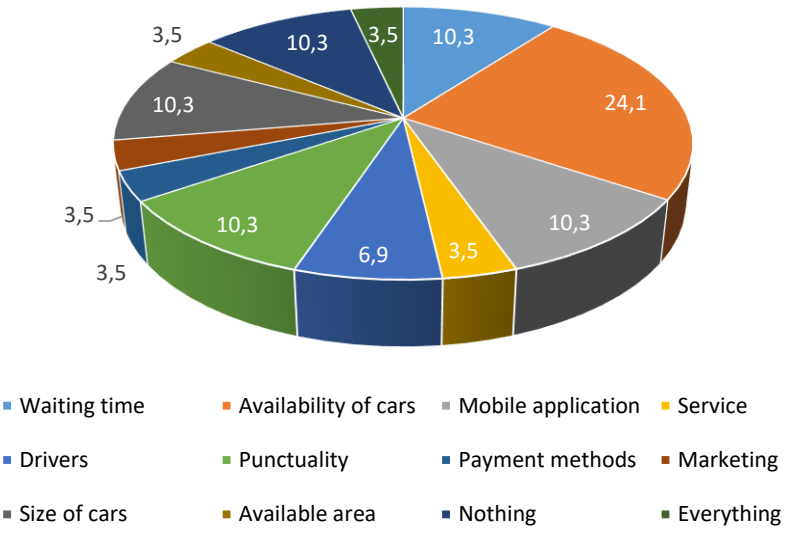
Overall, the two things the most respondents are happy about are the sustainability and price of a ride with Abel (respective frequency of 9 and 14). A user of Abel posted on their Facebook: “Very nice drivers and the app is great! Simple and fast. And your trip is cheaper and green! I am a big fan”. Another user of Abel values Abel in general as very good: “Abel, you are amazing! You are changing Amsterdam and I love you for that!”. Besides the sustainability and price of Abel which are mentioned as positive things about Abel a lot of respondents are also very happy with the drivers, since they are ‘so nice and friendly’. Some other quotes found on Facebook are: “Abel is a fantastic taxi company. Environmental friendly with electrical cars, which are very comfortable. And also not expensive! On top of that, I had a very friendly driver. A 10!”, “Fast, clean, new cars, friendly drivers and most of all finally reasonable price for this service!” and “Very happy with Abel in Amsterdam! Always on time, friendly drivers and new/clean cars”.

So over all the respondents are very happy with the sustainability, the price and the friendly drivers of Abel, besides the punctuality, mobile application, sharing the rides and the overall service they deliver. But again the opinions are subjective, so what one person experiences as good, someone else might experience this as a point of improvement.

6.6.2 Things to improve about Abel

The answers the respondents gave on the question “What can be improved at Abel?” (see appendix V.9) were also categorised based on key words. As said before, the total amount of answers is higher than the total amount of respondents (which is 26), since some respondents gave more than one answer to this question. The points of improvement ‘being able to book in advance’ and ‘telling if you bring luggage or not’ have not been included in the analysis, since Abel recently has made booking in advance possible and customers can also tell whether or not they are brining luggage with them and the size of the luggage (see chapter 4).

Figure 26 Statistics on 'things to improve about Abel'



Based on figure 26, the following can be said:

- The given answers have been divided into 12 categories of 'things to improve':
    - The waiting time before the taxi picks you up, from the moment you book an Abel (waiting time) (10.3%)
    - No available cars when trying to book an Abel (availability of cars) (24.1%)
    - The mobile application that is showing wrong information and the mobile application in general (mobile application) (6.9%)
    - The overall service Abel provides (service) (3.5%)
    - The drivers, which need to be more professional and friendlier (drivers) (6.9%)
    - The punctuality of the service (punctuality) (10.3%)
    - The available payment methods (payment methods) (3.5%)
    - More marketing (marketing) (3.5%)
    - The maximum amount of passengers in one car (size of cars) (10.3%)
    - Service available in more areas (available area) (3.5%)
    - Nothing can be improved (nothing) (10.3%)
    - Everything can always be improved (everything) (3.5%)
- That 'nothing' has to be improved has been mentioned three times (out of the 29, 10.3%);
- That 'everything' has to be improved has been mentioned once (out of the 29, 3.5%).

As said before, even though the percentages are given, this does not mean that the things to improve about Abel with a lower percentage, have a lower value. Each opinion has the same value and is evenly interesting and important, irrespectively the amount of respondents that do or do not have the same opinion. What can be said is that points of improvement that are mentioned more often need more improvement than the points of improvement that are mentioned less often.

Overall, the one thing that was mentioned the most is the availability of cars at the moment needed. This means that respondents often experience that there is no taxi available at the moment they need a taxi. One respondent even says that this leads him to use Uber instead, while he wishes to use Abel. Another user of Abel posted on their Facebook page: "Cheap and nice service, but I have already had 5 times that there was no driver available, very disappointing!". Something else mentioned quite often are the punctuality of the service and the time users have to wait before the taxi picks them up. One user said that the pick-up time shown on the mobile application does not match the actual pick-up time and another user said on Facebook: "It is time Abel gets their pick-up time under control. Don't promise a taxi to be there in 3 minutes if it eventually takes 30 minutes". Other than that there are a few respondents that wish they provided bigger cars, so they also can book an Abel with a group of people bigger than three.

So, as with most new services, there are still things that can be improved, but this does not have to affect the current quality of service in a negative way. As one user said on Facebook: "Abel still has a lot of potential and is already delivering a good service".

Furthermore, what is interesting to mention is that there are respondents who mentioned (e.g.) the punctuality at the question on good/positive things about Abel, while other respondents mentioned (e.g.) the punctuality at things to improve. This shows that the questions on opinions

are always subjective and that one person can experience something as good/positive, while someone else experiences it as something that can be improved.

6.6.3 Overall rating

At the end of the survey, the respondents were also asked to give Abel an overall rating from 1 to 10, wherein a 1 was 'very bad' and a 10 was 'very good'. Table 50 shows that the average overall rating for Abel is a 7.69.

Table 50 Statistics on the overall rating of Abel

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	3,8	3,8	3,8
	7	10	38,5	38,5	42,3
	8	9	34,6	34,6	76,9
	9	4	15,4	15,4	92,3
	10	2	7,7	7,7	100,0
	Total	26	100,0	100,0	

N	Valid	26
	Missing	0
Mean		7,69
Median		8,00
Mode		7

Looking at table 50 the following things can be seen:

- Out of the 26 respondents (38,5%) gave Abel an overall rating of 7;
- 9 out of the 26 respondents (34,6%) gave Abel an overall rating of 8;
- The most common mark is a 7 (38.5%), which can be seen when looking at the 'mode', which shows the observation with the highest frequency (Vennix, 2011);
- The majority (73,1%) gave Abel an overall rating of 7 or 8;
- 96,8% of the respondents gave Abel a 7 or higher;
- Only 1 respondent (3,8%) gave Abel an overall rating of 2.

In short, it can be concluded that the majority of the respondents value the overall service of Abel as good, since 25 out of the 26 respondents (96.8%) rated Abel overall with a 7 or higher on a scale of 1 to 10, wherein 1 is very bad and 10 is very good (so a 5.5 would be a 'neutral' rate). Furthermore, the average score is a 7.7, which on a scale of 1 till 10 is a more than sufficient score.

7. Conclusion

7.1 Answering the main question and sub-questions

Now all data has been analyzed, the sub-questions and main question can be answered with the results of this analysis. First of all, the first three sub questions will be answered with the obtained qualitative data. To start with, the first sub-question can be answered:

What are the motives of Abel to provide their service?

From the interview with the two employees of Abel (assistant operational manager and master research student) appeared that there are multiple motives for providing their shared taxi service. First of all, the initiative for providing a new and shared taxi service in Amsterdam came from Transdev Nederland, the mother company of Connexxion and Veolia (Employee 1, personal communication, April 13, 2017). In turn, strategy consultant R. Everhardt, who was hired by Connexxion, saw the opportunity to create a shared transport mode for a broad target group and he designed the business plan of Abel. This plan then was elaborated with D. Baars (operational side) and A. Kruijer (commercial side) (Krabbendam, 2017. The motive of Transdev Nederland for the launch of Abel was to provide a cheaper taxi service in the area of Amsterdam with the extra of possible new social contacts with people you share your ride with (Verlaan, 2016). This sharing make it possible for Abel to provide a cheaper service: combining different bookings lowers the costs. So, both the motive of providing a cheaper service and the concept of sharing, what makes Abel unique, go hand in hand. As employee 1 said especially younger people attach less value to owning a car, while sharing things gets more comfortable. If people are able to get from A to B in a comfortable and cheap way, people are okay with sharing, which brings new social experiences (Employee 1, personal communication, April 13, 2017).

Furthermore, besides the will to provide a cheaper and shared service, Abel also focusses on providing a sustainable taxi service, by only using electrical vehicles. They have consciously chosen for a focus on sustainability, since sustainability gets more and more important in the current society. And this bears fruits since they even have customers that chose Abel because of their electrical cars (Employee 1, personal communication, April 13, 2017). Thus the aim for Abel is to deliver a unique, cheaper, sustainable and shared taxi service.

To continue, the second sub-question can be answered:

How is Abel taxi going to distinguish/distinguishing itself from other taxi services?

The first thing that makes Abel unique and with which they try to distinguish themselves, is the fact that their customers are booking a seat in a taxi and not a whole taxi, so rides of different customers can be combined in one taxi. This sharing, which is becoming hip and happening, will make the ride cheaper and can bring surprisingly nice social experiences (Employee 1, personal communication, April 13, 2017).

Secondly, Abel only uses electrical vehicles, with the eye on sustainability and the future policy of the municipality of Amsterdam (which will ban diesel vehicles from the city centre). With this, Abel also distinguishes itself from other taxi services, since they are one of the few

companies that only uses electrical vehicles (Employee 1, personal communication, April 13, 2017).

Third of all, Abel tries to distinguish itself by giving the customer a fixed price for their ride, which will be shown in advance on the mobile application. Working with a fixed price means they do not use a dynamic pricing system, such as regular taxi services do: the price, irrespectively the traffic conditions, will always stay the same and will only be based on the distance, not on the travel time. Therefore, a ride will not get more expensive during the evening hours or when a taxi needs to adjust his route: the price for the same ride will always stay the same. Other than that, it does not matter whether or not you share your ride in the end, the price stays the same (van Oerle, 2016).

Last of all, Abel distinguishes itself from regular taxi services by providing a lot of information about the taxi driver that will pick you up. Once you have booked a ride via the mobile application you will get a picture, phone number and name of the driver. Furthermore, you also get the license plate number of the vehicle that is coming to pick you up and at what time you will be picked up. With providing all this information, Abel tries to offer customers a lot more safety and certainty, in comparison to regular taxis you hail on the street, which do not provide this information (Employee 2, personal communication, April 13, 2017).

Last of all, the third sub-question can be answered with the obtained qualitative data:

How does Abel see the future of their services (what are the future perspectives)?

Even though Abel already made a lot of progress since their launch, they are constantly focussing on improving their service with the eye on the future. Therefore, first of all, they are focussing on attracting more franchise drivers in the upcoming time. The first few franchise drivers already started working at Abel this year, but they want to attract more franchise drivers to increase the number of drivers (Krabbendam, 2017).

Secondly, in May this year Abel launched an update for their mobile application, which allows people to book a ride in advance. This 'Abel in Advance' update has been created to make their service more attractive for the business market (Krabbendam, 2017). Besides that, with the update of the mobile application customers are also able to indicate whether or not they are bringing luggage, and what size the luggage has. To improve their service even more soon it will be possible for business customers to pay per month instead of immediately after the ride (Krabbendam, 2017 and employee 2, personal communication, April 13, 2017). So Abel also constantly tries to improve their mobile application, since this is where all the booking happens.

Thirdly, looking at this year, the goal for 2017 is to reach break-even. Looking into the further future, they also want to provide a service for groups bigger than 3 people. At the moment the maximum number of passengers in one taxi is three, excluding the taxi driver. Groups bigger than three need to book more than one Abel. But, at the moment, Abel is not able to provide vehicles of a bigger size, since electrical mini vans are hard to find. So this is something that will be kept in mind for the future (Employee 1, personal communication, April 13, 2017).

To continue, the two remaining sub-questions can be answered with the help of the data obtained from the survey. First of all the following sub-question can be answered:

What are good and bad things of Abel and what can be improved, according to the users?

As from the interview with Peraphan Jittrapirom appeared, demand responsive transport services (DRT) will become more and more important due to the trends of digitalisation, urbanisation and the aging society. Furthermore, besides urbanisation, also climate change puts a growing pressure on the urban environment, which asks for innovative and sustainable solution to provide a liveable urban area for people. Since DRT services can help creating this better urban environment it is important to look into the way DRT services are functioning at the moment to see if they really contribute to creating a better urban environment and what points of improvement there are. Focussing on the case study of this research, it is therefore important to look into the quality of the service Abel is providing at the moment: what are good things about their service and what are things that can be improved, according to the users? It is important to value the opinion of the users, since users are central to on-demand services (Hannon et al., 2016). Something to keep in mind is that when it comes to questions about opinions, it is always a matter of subjective experiences: some people might find something good, while others find the same thing something to improve.

From the statistical analysis of the questions in the survey appeared that 35.9% of the answers on the question 'What are good things about Abel?' were about the cheap price of Abel and 76.9% of the respondents (strongly) agreed with the statement that Abel is cheaper than other taxi services. 30% of the answers on the question 'Why did you start using Abel?' was therefore about the pricing of Abel. One respondent said: "Abel is the cheapest in Amsterdam". Besides that, 84.6% of the respondents valued the price-quality ratio of the service Abel delivers as good: "Abel provides a reliable and good service, against low costs" stated a user of Abel.

Secondly, 23.1% of the answers on 'good things about Abel' were about the sustainability of the service. A user of Abel posted the following on their Facebook page: "Abel is a great taxi company! Environmental friendly with electrical cars. I would give it a 10!". Also from the interview with the two employees of Abel appeared that they have customers that especially choose Abel because of the electrical and sustainable cars (Employee 1, personal communication, April 13, 2017).

Other good things that emerged from the survey are the trustworthiness and travel time of a ride with Abel. Respondents described the service of Abel in terms of trustworthiness as a reliable, fast, good and on-time service. In terms of travel time the service of Abel was described as a direct service without detours, a service faster than public transport and the travel time was as predicted in advance. 7.7% of the answers on the question about 'good things about Abel' included the fast service Abel provides.

Last of all, 12.8% of the answers on the question about 'good things about Abel' was about the friendly drivers of Abel. Some quotes about the drivers are: "I had a very friendly drivers this morning, he made my day!" and "Very friendly drivers who ride perfect, very professional".

What is also interesting to mention is that of the 26 respondents 96.4% has a public transport chip card, which allows those respondents to travel with regular public transport (e.g. bus, tram, metro) in a cheaper way than with Abel. Despite this those respondents still use Abel, possibly because of one of the good points mentioned above. What exactly drives people to use Abel instead of public transport lends itself for further research, but 20%, 7 out of the 35 answers, on the question of describing the service of Abel in terms of travel time was about the opinion that Abel delivers a service that is faster than public transport. Also from the interview with employee 1 and 2 appeared they do not try to provide a service which is cheaper than public transport, but Abel does guarantee you a place to sit, while "When using public transport, you basically pay for a place to stand, instead of a seat" (Employee 1, personal communication, April 13, 2017). Besides the certainty of having a seat, Abel also brings you from door to door, which public transport does not and you are also not dependent on certain times, as is the case with public transport (Employee 1, personal communication, April 13, 2017).

Furthermore, 61.5% of the respondents (strongly) agreed that they want to use the service of Abel regularly (in the future). 34.6% of the respondents were neutral about this, but overall is can be said that Abel has got positive feedback: "The only ride app you want to use in Amsterdam: full electrical cars, great drivers, a fair choice in pricing and a great app!".

Logically, there are also still points of improvement for the service of Abel. Even though Abel 'passed' his trial phase, it is still a quite new service that still needs improvement here and there. The one thing that was mentioned the most by the respondents as point of improvement was the availability of a taxi when needed. A lot of respondents (20% of the answers) mentioned that there were no taxis available at the moment they wanted to book one. One respondent even mentioned that this led him to use Uber instead, while he wished to use Abel. Another user commented: "Cheap and nice service, but I have already had 5 times that there was no driver available, very disappointing!". But, as mentioned before, Abel is trying to attract more franchise drivers, what will lead to more available cars. This can, at least partly, solve the problem of not having a car available. But as employee 1 mentioned in the interview: "It can always happen that at busy moments there is no taxi available. We are trying to prevent this as much as possible, but it can happen sometimes. Besides that, it may also be that not each taxi is fully booked, but that different rides are not combinable due to different final destinations of customers" (Employee 1, personal communication, 13 April, 2017).

Two other points of improvement mentioned are 'the waiting time before the taxi picks you up' and something that comes with this, 'the punctuality of the service'. Respondents mentioned that they had to wait longer for their taxi than was shown on the mobile application: "The mobile application often shows wrong information about the time". But as employee 1 of Abel said: "A delay can always happen due to unforeseen traffic conditions. If this happens we advise the driver to contact the customer" (Employee 1, personal communication, 13 April, 2017).

Furthermore, some respondents mentioned (10.7% of the answers) they would like to have bigger taxis available. At the moment the maximum number of passengers is three (excluding the driver), so if you are with a group bigger than three, you need to book more than one Abel, but Abel does want to improve the maximum number of passengers. However, this is not possible at the moment, since electrical mini vans are rare, while Abel only uses electrical vehicles.

In short, there are still things that can be improved, but this does not have to affect the current quality of service in a negative way. As one user said on Facebook: “Abel still has a lot of potential and is already delivering a good service”.

To continue, the last sub-question can be answered:

How efficient do the users of Abel taxi think this service is overall?

To answer this question, for each of the factors that influences efficiency (accessibility, trustworthiness, travel time, vehicle characteristics, equity/justice, adequate information, mobility in accordance with necessities and (un)happiness/(dis)satisfaction) an analysis of the mean scores on the questions measuring those factors has been carried out. Based on this analysis, a good/high, neutral or bad/low valuation of these factors has been found. In turn, based on this valuation there has been a contribution to a good/high, neutral or bad/low valuation of efficiency (this can also be seen as a positive, neutral or negative influence on efficiency).

Aspect/item of efficiency	Overall valuation	Influence on efficiency
Accessibility	High/good	Positive
Travel time	High/good	Positive
Trustworthiness	High/good	Positive
Vehicle characteristics	High/good	Positive
Adequate information	High/good	Positive
Mobility in accordance with necessities	High/good	Positive
Equity/justice	High/good	Positive
Happiness/satisfaction	High/good	Positive
Unhappiness/dissatisfaction	Neutral	Neutral

Table 51 Influence of the items on efficiency

Based on table 51 it can be said that 8 factors of efficiency have a positive influence on efficiency and one factor has a neutral influence. This means that the valuation of efficiency overall can be seen as high/good, but that the strength of this positive influence and high/good valuation has been reduced due to the neutral valuation of one of the factors.

Besides this the respondents also valued the overall service and the efficiency of Abel with a mark. They gave the overall service an average mark of 7.7 and 96.8% of the respondents gave the overall service a 7 or higher. For the efficiency they gave an average mark of 7.6 and 92.3% of the respondents gave the efficiency a mark of 7 or higher.

As a final step, the main question of this research can be answered:

How efficient are mobility on-demand, Demand Responsive Transportation modes, in specific shared taxi service 'Abel', from a users perspective?

Again, it is important to do more research on demand responsive, on-demand transport systems, since those services are gaining more importance in creating a harmonized, sustainable and liveable urban environment of the current society. Furthermore, since those services are quite new there is a knowledge gap: there is has been done a lot more research on public and private services than on DRT. Therefore, the efficiency of DRT and on-demand taxi service Abel has been researched. The focus has been on the users of the service, since they are what on-demand services put at the centre of their service.
Based on the obtained data it can be said that the efficiency of the service of Abel overall has been valued as good/high, since almost all items that that are all relating to the quality of service that is offered had an overall value of high/good. The strength of this positive influence has been reduced a little because of the neutral valuation of the item 'unhappiness/dissatisfaction', which in turn also has a neutral effect on the efficiency. But, since the average mark respondents gave to the efficiency of Abel is a 7.6, it can be said that the efficiency is sufficient, despite there are still points of improvement.

Important to keep in mind here is that this conclusion can only be made based on the data retrieved from the 26 respondents. Due to this small sample size, the findings/conclusions are not generalizable to all users of Abel or to DRT services in general. To be able to do this, further research, with a bigger sample size and more case studies is needed.

7.2 Contribution to society and science and future research

New forms of mobility, such as DRT and on-demand services are getting more and more interest, due to the growing pressure on the urban environment. Because those services, with the eye on the Smart Mobility and Smart City movement, can be a solution to this growing pressure and the growing need to harmonize a sustainable urban environment, it is important to get as much as possible information on how those services perform and what can still be improved. As a starting point, therefore, this research focussed on the efficiency of a DRT, on-demand service from a users perspective. With the obtained insights on efficiency, good points and points of improvement, the company itself can further develop and improve their service. Furthermore, despite different operating contexts, also similar services can learn from those insights: they can improve their service with the aim to provide a better service in the current urban society. Other than that, despite the small sample size of this research, cities and municipalities that want to develop such a service, can take into consideration the findings of this research. But it is important that cities apply the findings to their own specific context, since each DRT service works different in a different context.

When looking at the contribution to the science, it can be said that this research was a starting point for obtaining more knowledge on demand responsive and on-demand services. As Peraphan Jittrapirom said in the interview: "There are a lot of studies on how a private vehicle is being used and how public transportation works. But there is a gap in the research: there are not as much studies on DRT as on public and private transportation" (P. Jittrapirom, personal

communication, 10 May 2017). More research is still needed, since this research has its limitations, but despite those limitations the findings are still useful and can form a starting point for further research. Questions like 'How do those services actually work?', 'Do those services have the wished outcomes or do they replace the use of public transport modes as buses?' and 'Do those services improve accessibility?' still need to be answered.
Other than doing more research on DRT services in general, looking specifically at this case study research, there can be done more research on the efficiency of the service of Abel, since the number of respondents of this research was quite low, so generalization is not possible.

Furthermore, the efficiency from a users perspective can differ per DRT service, since each DRT service has its own characteristics and operates in a different context. Besides efficiency, other aspects of services can also differ per DRT service, due to the context. Therefore, other DRT services also need to be researched to be able to get more academic knowledge on DRT services and similarities and differences between services can be found.

7.3 Critical reflection and limitations

As with almost all research, also this research has its limitations and point of improvement. For both the quantitative as the qualitative data the limitations will be discussed.

7.3.1 Quantitative data

Looking back at the process of getting enough respondents, this process was much harder and took much more time than expected in advance. It took over 4 weeks to get 26 respondents, while the target was to get more respondents in a shorter period of time. But unfortunately, because of the limited time and the slow process of getting respondents this was not possible, despite the effort to find as many respondents as possible. Therefore, the amount of respondents can be seen as a limitation, since this influences the validity and of the research. Validity is about to what extent your research results can be translated to a bigger population. With other words, are the results representative for a bigger population than the population researched? (Vennix, 2011). When looking at this research, due to the limited amount of respondents, the validity is lower than aimed. This means that it is not very representative for a bigger population, in this case all the users of Abel taxi and also due to this questionable validity, generalization is not possible. Therefore, further research is needed to obtain representative and generalizable data, for which the research methods and the data obtained in this research can be a starting point.

The fact that only 26 of all users of Abel completed the survey leads to the assumption that there is quite a high non-response: a high percentage of users did not fill in the survey (Korzilius, 2008). The web-survey also showed that another 25 people were filling in the survey, but never completed it. This non-response may have different reasons:

- People did not have time to fill in the survey
- People did not feel like filling in the survey
- Not every user was reached
- People who started filling in the survey found it taking too long
- People who started filling in the survey did not like the questions

Unfortunately, the exact reasons why people did not to fill in the survey cannot be discovered. The relative small amount of respondents and quite big non-response can be seen as a limitation of this research, since the results are not generalizable. However, this does not have to affect the

quality of the research negatively, since the findings are still useful to build upon in future research.

Besides the process of getting enough respondents for the survey, something where also needs to be reflected on is the distribution of the survey and the possible respondents. First of all, the survey was only distributed online by an anonymous link, since a distribution by e-mail was not possible, due to a lack of e-mail addresses of users of Abel. Besides that, distribution on the street was also not possible, because Abel has quite a big area wherein they provide their service, but they do not have one central point where there taxis are waiting, such as regular taxis do at Schiphol. Choosing for a web-survey can come with the disadvantage of excluding people that do not have access to internet (Vennix, 2011). Only distributing the survey online could have led to the exclusion of certain people, such as elderly people that are not as familiar with the internet as younger people are. But, since the target group of Abel are people from the age of 18 till 35, it is assumed that the exclusion has been minimal. Due to this young target group it can be expected that those people are familiar with internet and have access to it. What can be a disadvantage of distributing an anonymous survey is that it is not possible to check if the people that filled in the survey, are also really using or have used Abel. There is a possibility that people who never used Abel, still filled in the survey. This can be seen as a limitation of an online survey, since regulating exactly who is filling in the survey via an link that is accessible to everyone, is not possible, unless people would fill in their name. But, asking people's names would not help to regulate the process, since, first of all, people may be inclined to not fill in the survey due to the fact they have to fill in their name, which makes them not anonymous anymore and secondly, if people do fill in their name, checking if they really use Abel is not possible, since there is no publicly available customers file of all the customers of Abel.

7.3.2 Qualitative data

To obtain the necessary qualitative data two interviews were arranged: one interview with two employees of Abel and one interview with postdoctoral researcher at the Radboud University, Peraphan Jittrapirom, who is working on adaptive policies for smart city public transport.

The interview with employee 1, assistant operational manager and employee 2, who is doing his master internship at Abel, was supposed to be with the director of Abel, but unfortunately, on the day of the interview it seemed that the director was not available for an interview, so two other employees were so kind to try to answer all interview questions. Unfortunately they could not answer all the questions and also an interview with someone with a similar function as the director was not possible. Therefore, afterwards a colleague of employee 1 forwarded me a news article about Abel with a lot of useful information in it. Even though it can be seen as a limitation that the director was not able to answer the interview questions, it does not really have to be seen as a limitation, since employee 1 and 2 were still able to answer a lot of questions and in combination with the news article almost all interview questions were answered in the end. The fact that the two employees were able to answer a lot of questions also shows that the employees of Abel really know the ins and outs of the company.

Looking at the interview with P. Jittrapirom, there are no limitations, since the interview went well and all information needed was obtained during the interview.

8. References

Abel. (2017). *Abel lanceert Abel in Advance.* Retrieved on 30 May 2017 from: https://www.emerce.nl/wire/abel-lanceert-abel-advance.

Ahrend, C., Schwedes, O., Daubitz, S., Böhme, U., & Herget, M. (2014) Kleiner Begriffskanon der Mobilitätsforschung. *Discussion Paper Fachgebiet Integrierte Verkehrsplanung,* Technische Universität Berlin. Retrieved on 21 April from: https://www.ivp.tu-berlin.de/fileadmin/fg93/Dokumente/Discussion_Paper/DP1_Ahrend_et_al.pdf.

Anonymous. (2016). Transport as a service. It starts with a single app. *The Economist,1 October 2016*. Retrieved on 2 February 2017 from: http://www.economist.com/news/international/ 21707952-combining-old-and-new-ways-getting-around-will-transform-transportand-cities-too-it.

Ausubel, J. H. & Marchetti, C. (2001). The evolution of transport. *The Industrial Physicist,* 20-24. Retrieved on 5 February 2017 from: https://web.archive.org/web/20071030185205 /http://www.aip.org/tip/0401.html.

Belzer, D., Bernstein, S., Gorewitz, C., Makarewicz, C., McGraw, J., Poticha, S., Thorne-Lyman, A. & Zimmerman, M. (2006). *Preserving and Promoting Diverse Transit-Oriented Neigborhoods* [report]. Retrieved on 14 February 2017 from: http://ctod.org/pdfs/2006PreservingPromotingDiverseTOD.pdf.

Benenson, I., Martens, K. Rofé, Y. & Kwartler, A. (2011). Public transport versus private car GIS-based estimation of accessibility applied to the Tel Aviv metropolitan area. *The Annals of Regional Science, 47(3),* 499-515. DOI: 10.1007/s00168-010-0392-6.

Benevolo, C., Dameri, R. P. & D'Auri, B. (2016). Smart Mobility in Smart City: action taxonomy, ICT intensity and public benefits. *Lecture Notes in Information Systems and Organisation, 11,* 13-28. http://dx.doi.org/10.1007/978-3-319-23784-8_2

Beyazit, E. (2011). Evaluating the Social Justice in Transport: Lessons to be Learned from the Capability Approach. *Transport Reviews, 31(1)*, 117-134. http://dx.doi.org/10.1080/01441647.2010.504900

Black, W. R. (1996). Sustainable transportation: a US perspective. *Journal of Transport Geography, 4(3)*, 151-159. http://dx.doi.org/10.1016/0966-6923(96)00020-8

Brendel P. & Molnar, J. (2010). *City plans commuter rail TOD*. Retrieved on 14 February 2017 from: gatewayplanning.com.

Bocarejo, J. P. S. & Oviedo, D. R. H. (2012). Transport accessibility and social inequalities: a tool for identification of mobility needs and evaluation of transport investments. *Journal of Transport Geography, 24,* 142-154. http://dx.doi.org/10.1016/j.jtrangeo.2011.12.004

Bouton, S., Knupfer, S. M., Milhov, I. & Swartz, S. (2015). *Urban mobility at a tipping point.* Retrieved on 4 February from: http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/urban-mobility-at-a-tipping-point.

Buelens, M. & van den Broek, H. (2007). An Analysis in Differences in Work Motivation between Public and Private Sector Organizations. *Public Administration Review*, *67(1)*, 65-74.

Cathkart-Keays, A. (2015). Will we ever get a truly car-free city? *The Guardian, 9 December 2015*. Retrieved on 5 February 2017 from: https://www.theguardian.com/cities/2015/dec/09/car-free-city-oslo-helsinki-copenhagen.

Chong, Z. J., Qin, B., Bandyopadhyay, T., Wongpiromsarn, T., Rebsamen, B., Dai, P., Ranking, E. S. & Ang, M. H. (2013). Autonomy for Mobility on Demand. In S. Lee et al. (Red.), *Intelligent Autonomous Systems* 12 (671-682). Berlin: Springer. Retrieved on 8 February 2017 from: http://link.springer.com/chapter/10.1007/978-3-642-33926-4_64#page-1.

Cocchia, A. (2014). Smart and Digital City: A Systematic Literature Review. *Progress in IS*, 13-43. Retrieved on 18 May 2017 from: https://link.springer.com/chapter/10.1007%2F978-3-319-06160-3_2.

Currie, G., Richardson, T., Smyth, P., Vella-Brodrick, D., Hine, J., & Lucas, K. (2009) Investigating links between transport disadvantage, social exclusion and well-being in Melbourne—Preliminary results. *Transport Policy, 16(3),* 97-105. http://doi.org/10.1016/j.tranpol.2009.02.002

Davison, L., Enoch, M., Ryley, T., Quddus, M. & Wang, C. (2014). A Survey of Demand Responsive Transport in Great Britain. *Transport Policy, 31*, 47-54. http://dx.doi.org/10.1016/j.tranpol.2013.11.004

Deloitte. (2015). *Transport in the Digital Age. Disruptive Trends for Smart Mobility* [report]. Retrieved on 2 February 2017 from: https://www2.deloitte.com/uk/en/pages/business-and-professional-services/articles/transport-in-the-digital-age.html.

Dell'Olio, L., Ibeas, A. & Cecin, P. (2011). The quality of service desired by public transport users. *Transport Policy, 18(1)*, 217-227. http://doi.org/10.1016/j.tranpol.2010.08.005.

Dijksma, S. (2016). Taxibeleid [kamerbrief]. Retrieved on 8 February 2017 from: https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2016Z01546&did=2016D03247&utm_content=buffer83db0&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer.

Ettema, D., Gärling, T., Olsson E. L., Friman, M. & Moerdijk, S. (2013). The road to happiness: Measuring Dutch car drivers' satisfaction with travel. *Transport Policy, 27,* 171-178. http://doi.org/10.1016/j.tranpol.2012.12.006.

European Commission (EU). (2011). *White paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system.* Retrieved on 4 February 2017 from: https://ec.europa.eu/transport/themes/strategies/2011_white_paper_en.

Fellesson, M. & Friman, M. (2012). Perceived Satisfaction with Public Transport Service In Nine European Services. *Journal of the Transportation Research Forum, 47(3)*, 93-103. http://dx.doi.org/10.5399/osu/jtrf.47.3.2126

Finnish Transport Agency. (2015). *MaaS Services and Business Opportunities* [report]. Retrieved on 2 February 2017 from: http://www2.liikennevirasto.fi/julkaisut/pdf8/lts_2015-56_maas_services_web.pdf

Ferreira, L., Charles, P. & Tether, C. (2007). Evaluating Flexible Transport Solutions. *Transportation Planning and Technology, 30(2-3),* 249-269. http://dx.doi.org/10.1080/03081060701395501

Fountain, H. (2016). A Slow Ride Towards the Future of Public Transportation. *The New York Times*. Retrieved on 4 February 2017 from: https://www.nytimes.com/2016/11/08/science/finland-public-transportation-driverless-bus.html?&__hstc=93203906.2b7bdb1219cee65b3b8ac1077e3b6f57.1486203994452.1486203994452.1486203994452.1&__hssc=93203906.1.1486203994456&__hsfp=3893811004&_r=0.

Gemeenteraad Amsterdam (2016). *Vaststellen van het maatregelpakket "Schone lucht voor Amsterdam: op weg naar een uitstoot vrij 2025"* [Raadsbesluit]. Retrieved on 4 May 2017 from: https://www.amsterdam.nl/parkeren-verkeer/milieuzone/uitbreiding/#h3e48477a-0434-4584-afa0-890f94538efb.

Greene, D. L. & Wegener, M. (1997). Sustainable transport. *Journal of Transport Geography, 5(3),* 177-190. http://dx.doi.org/10.1016/S0966-6923(97)00013-6

Grotenhuis, J., Wiegmans, B. W. & Rietveld, P. (2007). The desired quality of integrated multimodal travel information in public transport: Customer needs for time and effort savings. *Transport policy, 14,* 27-38. http://dx.doi.org/10.1016/j.tranpol.2006.07.001

Hannon, E., McKerracher, C., Orlandi, I. & Ramkumar, S. (2016). *An integrated perspective on the future of mobility* [report]. Retrieved on 4 February 2017 from: http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/an-integrated-perspective-on-the-future-of-mobility.

Hine, J. (2009) *Transport and Social Exclusion.* Elsevier, Newtownabbey, UK. Retrieved on 21 April 2017 from: https://www.scribd.com/document/66034158/Transport-and-Social-Exclusion.

Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City, 12(3)*, 303-320. http://dx.doi.org/10.1080/13604810802479126.

Holmes, J. & van Hemert, J. (2008). *Transit Oriented Development*. Retrieved on 14 February 2017 from: http://www.law.du.edu/images/uploads/rmlui/rmlui-sustainable-transitorienteddevelopment.pdf.

Houses of Parliament, Parliamentary Office of Science and Technology. (2015). *Trends in transport* [report]. Retrieved on 2 February 2017 from: http://researchbriefings.parliaent.uk /ResearchBriefing/Summary/POST-PN-0496.

ICOVA (n.d.). *Op 1 oktober 2008 stelt Amsterdam een milieuzone in*. Retrieved on 4 May 2017 from: http://www.vanloenenmilieu.nl/web/Icova-afval-nieuws/nieuwsbericht/Op-1-oktober-2008-stelt-Amsterdam-een-milieuzone-in.htm.

Kamargianni, M., Li, W., Matyas, M. & Schäfer, A. (2016). A critical review of new mobility services for urban transport. Transport Research Procedia, 14, 3294-3303. http://dx.doi.org/10.1016/j.trpro.2016.05.277

Kenyon, S., Lyons, G., Rafferty, J., 2002. Transport and social exclusion: investigating the possibility of promoting inclusion through virtual mobility. *Journal of Transport Geography 10(3),* 207–219. http://dx.doi.org/10.1016/S0966-6923(02)00012-1

Korzilius, H. (2008). *De kern van survey-onderzoek.* Assen: Van Gorcum.

Krabbendam, V. (2017). Abel richt zich met vooruit boeken ook op zakelijke markt. Retrieved on 17 May 2017 from: https://www.taxipro.nl/ondernemen/2017/05/15/abel-richt-zich-met-vooruitboeken-ook-op-zakelijke-markt/.

Leape, J. (2006). The London Congestion Charge. *Journal of Economic Perspectives, 20(4),* 157-176. Retrieved on 5 February 2017 from: https://www.aeaweb.org/articles?id=10.1257/jep.20.4.157.

Litman, T. (2015). *Evaluating Transportation Equity: Guidance for Incorporating Distributional Impacts in Transportation Planning* [report of Victoria Transport Policy Institute]. Retrieved 15 February 2017 from: https://pdfs.semanticscholar.org/fa6c/6421f37a60cb8d4bde401ebd 384ac174bc40.pdf.

Lucas, K., Mattioli, G. & Verlinghieri, E. (2016). Transport poverty and its adverse social consequences. *Proceedings of the Institution of Civil Engineers – Transport, 169(6)*, 353-365. https://doi.org/10.1680/jtran.15.00073.

Mageean, J. & Nelson, J. D. (2003). The evaluation of demand responsive transport services in Europe. *Journal of Transport Geography, 11,* 255-270. http://dx.doi.org/10.1016/S0966-6923(03)00026-7.

Mansveld, W. J. (2015). Evaluatie taxibeleid [kamerbrief]. Retrieved on 8 February 2017 from: https://www.rijksoverheid.nl/documenten/kamerstukken/2015/05/05/evaluatie-taxiwet.

Moriarty, P. & Honnery, D. (2008). Low-mobility: The future of transport. *Elsevier Futures, 40(10),* 865-872. http://dx.doi.org/10.1016/j.futures.2008.07.021

Martens, K. (2013) Role of the Bicycle in the Limitation of Transport Poverty in the Netherlands. *Transportation Research Record: Journal of the Transportation Research Board, 2387*, 20-25. http://dx.doi.org/10.3141/2387-03.

Martens, K. and Bastiaanssen, J. (2014) An index to measure accessibility poverty risk. *Paper presented at Colloquium Vervoersplanologisch Speurwerk.* Eindhoven. Retrieved on 21 April 2017 from: http://s3.amazonaws.com/academia.edu.documents/36524705/Martens-Bastiaanssen_2014_-_Index_of_accessibility_poverty__Version_for_academia.edu.pdf

Neumann, C. (2015). *Big data versus big congestion: Using information to improve transport*. Retrieve on 4 February 2017 from: http://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/big-data-versus-big-congestion-using-information-to-improve-transport.

Van Oerle, P. P. (2016). *Wat heeft Abel dat Uber niet heeft?* Retrieved on 25 April 2017 from: https://www.emerce.nl/interviews/wat-heeft-abel-dat-uber-niet-heeft

Pals, B. (2016). Nieuwe Amsterdamse taxidienst van Transdev gelanceerd: Abel. Retrieved on 8 February 2017 from: http://www.taxipro.nl/straattaxi/2016/01/12/nieuwe-amsterdamse-taxidienst-van-transdev-gelanceerd-abel/.

Paulley, N., Balcombe, R., Mackett, R., Titheridge, H., Preston, J. M., Wardman, M. R., Shires, J. D. & White, P. (2006). The demand for public transport: The effects of fares, quality of service, income and car ownership. *Transport Policy, 13(4),* 295-306. https://doi.org/10.1016/j.tranpol.2005.12.004

Preston, J. & Rajé, F. (2007). Accessibility, mobility and transport-related social exclusion. *Journal of Transport Geography, 15(3),* 151-160. http://dx.doi.org/10.1016/j.jtrangeo.2006.05.002

Sampaio, B. R., Neto, O. L. & Sampaio, Y. (2008). Efficiency analysis of public transport systems: Lessons for institutional planning. *Transportation Research Part A: Policy and Practice, 42(3),* 445-454. http://dx.doi.org/10.1016/j.tra.2008.01.006

Sassi, A. & Zambonelli, F. (2014). Towards an Agent Coordination Framework for Smart Mobility Services [conference paper]. Retrieved on 17 May 2017 from: https://www.researchgate.net/publication/265020292_Towards_an_Agent_Coordination_Framework_for_Smart_Mobility_Services.

Schafer, A. & Victor, D. (2000). The future mobility of the world population. *Elsevier, 34(3)*, 171-205. http://dx.doi.org/10.1016/S0965-8564(98)00071-8

Scheiner, J. (2008) Accessibility, Spatial Context and Location Preferences: Is There Evidence for Accessibility Poverty? *Transport Series of Dresden Institute for Transportation and Environment (DIVU), 7,* 193-225. http://doi.org/10.1016/j.landurbplan.2012.06.003.

Spieser, K., Treleaven, K., Zhang, R., Frazzoli, E., Morton, D. & Pavone, M. (2014). Towards a Systematic Approach to the Design and Evaluation of Automated Mobility-on-Demand Systems: A case study in Singapore. *Springer*, 229-245. Retrieved on 5 February 2017 from: http://hdl.handle.net/1721.1/86228.

Steg, L. & Greg, R. (2005). Sustainable transportation and quality of life. *Journal of Transport Geography, 13,* 59-69. http://dx.doi.org/10.1016/j.jtrangeo.2004.11.003

The Institution of Engineering and Technology (IET) & Intelligent Transport Systems (ITS). (2015). Local Authority Guide to Emerging Transport Technology [report]. Retrieved on 2 February 2017 from: http://www.theiet.org/factfiles/transport/emerging-trans-page.cfm.

Te Grotenhuis, M. & Matthijssen, A. (2013). *Basiscursus SPSS*. Assen: Van Gorcum.

Transport Systems Catapult. (2016). *Exploring the Opportunity for Mobility as a Service in the UK* [report]. Retrieved on 2 February 2017 from: https://ts.catapult.org.uk/intelligent-mobility/im-resources/maasreport/.

Tyrinopoulos, Y. & Antoniou, C. (2012). Public transit user satisfaction: Variability and policy implications. *Transport Policy, 15(4)*, 26-272. http://doi.org/10.1016/j.tranpol.2008.06.002.

Union Internationale des Transports Publics (UITP). (2015). *Public Transport Trends* [report]. Retrieved on 2 February 2017 from: http://www.uitp.org/public-transport-trends.

Velaga, N. R., Beecroft, M., Nelson, D. J., Corsar, D. & Edwards, P. (2012). Transport poverty meets the digital divide: accessibility and connectivity in rural communities. *Journal of Transport Geography, 21,* 102-112. http://doi.org/10.1016/j.jtrangeo.2011.12.005.

Vennix, J. A. M. (2011). *Theorie en praktijk van empirisch onderzoek.* Pearson Education.

Verlaan, D. (2016). *Amsterdamse taxidienst Abel gaat strijd aan met de fiets*. Retrieved on 13 June 2017 from: https://www.rtlnieuws.nl/economie/home/amsterdamse-taxidienst-abel-gaat-strijd-aan-met-de-fiets.

Welch, T. F. (2013). Equity in transport: The distribution of transit access and connectivity among affordable housing units. *Transport Policy, 30,* 293-293. http://dx.doi.org/10.1016/j.tranpol.2013.09.020

Welch, T. F. & Mishra, S. (2013). A measure of equity for public transit connectivity. *Journal of Transport Geography, 33,* 29-41. http://dx.doi.org/10.1016/j.jtrangeo.2013.09.007

Appendix

I Interview guide for the interview with the two employees of Abel

Introductie
Allereerst wil ik u bedanken voor uw tijd en wil ik u vragen of u er bezwaar tegen heeft als ik het interview opneem.

Dan zal ik eerst verder uitleggen wie ik ben en waar ik op het moment onderzoek naar doe. Ik ben Daphne van der Veer, 22 jaar en 3e jaars Bachelor student aan de Radboud Universiteit in Nijmegen. Voor de studie Geografie, Planologie en Milieu doe ik op het moment onderzoek naar de efficiëntie van nieuwe, innovatieve en on-demand openbaar vervoer diensten. Deze nieuwe vormen van vervoer zijn op het moment erg actueel en zullen steeds verder ontwikkelen met het oog op de toekomst. Eén vorm van deze innovatieve en on-demand openbaar vervoer diensten zijn gedeelde taxi diensten en omdat ik zelf uit Amsterdam kom en de taxi's van uw bedrijf steeds vaker langs zie rijden in de stad heb ik als case-study gekozen voor het onderzoeken van uw bedrijf, aangezien Abel taxi een voorbeeld is van een nieuwe on-demand dienst.

Naast dit interview zal ik enquêtes afnemen onder de gebruikers van Abel taxi en de resultaten hiervan zal ik vertrouwelijk verwerken in mijn onderzoek. Zodra mijn onderzoek voltooid is zal ik het gehele onderzoek met u delen.

Ik heb 40 vragen voor u opgesteld en dit interview zal maximaal een uur duren.
Heeft u op het moment nog vragen voordat we beginnen met het interview?

Dan zullen we beginnen. Mochten er vragen zijn die u niet wilt beantwoorden, dan mag u dit aangeven en zullen we verder gaan met een andere vraag.

Interviewvragen
> Om te beginnen heb ik een aantal vragen over de oprichting van Abel taxi.

<u>Oprichting Abel</u>
1. Hoe bent u op het idee gekomen om een taxi-service als Abel op te richten?
    - Wat zijn de beweegredenen om Abel taxi op te richten?
2. Ik las dat Transdev Nederland heeft geïnvesteerd in Abel:
    - Hoe bent u opzoek gegaan naar investeerders?
    - Hoe heeft u er voor gezorgd dat Transdev Nederland wilde investeren in Abel?
3. Ik las iets over dat uw service vernoemt is naar een liftjongen Abel, kunt u dit toelichten?
4. Vanwaar de keuze voor het aanbieden van de service in Amsterdam en omstreken?
5. Wat is het doel van Abel?

> Oké, dan zal nu verder gaan met een aantal vragen over Abel in vergelijking met andere taxi diensten.

Abel en andere taxi services

6. Hoe concurreert Abel met andere taxi-services?
7. Hoe onderscheidt Abel zich van andere taxi-services?
8. Wat maakt Abel speciaal?
9. Zijn er toekomstplannen voor Abel om de service nog verder onderscheidend te maken van de 'normale' taxi diensten?
10. Hoe zorgen jullie er voor dat mensen mogelijk eerder voor Abel kiezen dan voor het standaard openbaar vervoer als bussen, trams, metro's en treinen?
11. Waarom kan een Abel taxi niet ook op straat aangehouden worden zoals bij gewone taxi's?

> Dan heb ik ook een aantal vragen over de taxi rit zelf en de reizigers die gebruik maken van Abel taxi.

De rit en reizigers

12. Op welke doelgroep is uw service gericht?
    - Wordt er ook rekening gehouden met ouderen? Deze zullen bijvoorbeeld minder bekend zijn met mobiele telefoons en apps.
13. Kan elke reiziger gebruik maken van de service? Bijv. ook met rolstoel, kinderwagen, rollator of andere handicap?
14. Kan een reiziger van tevoren aangeven dat hij bijv. een rolstoel, kinderwagen of koffer meeneemt zodat hier rekening mee gehouden kan worden?
15. Wanneer een passagier haast heeft, betekent dit dan dat hij/zij de auto niet deelt met andere personen?
16. Hoe wordt er voor gezorgd dat de service zo toegankelijk mogelijk is voor de reizigers?
17. Zijn er momenten geweest waarop er geen vrije taxi beschikbaar was terwijl er wel vraag naar was vanuit de reiziger?
    - Hoe gaan jullie om met (zulke) drukke momenten?
18. Kan de vooraf aangegeven reistijd uiteindelijk afwijken van de echte reistijd?
19. Komt het voor dat de taxi te laat is?
    - Zo ja, krijgt de reiziger hier een compensatie voor? Of hoe wordt hier mee om gegaan?
20. Jullie slogan is 'Abel, de reist die je wilt delen'. Hoe wordt er voor gezorgd dat een reiziger het niet hinderlijk of vervelend vindt zijn/haar rit te delen?
21. Hoe zorgen jullie er voor dat verschillende reizigers uiteindelijk een auto delen met elkaar in één rit?
    - Hoe wordt dit georganiseerd?

> Abel taxi wordt via een mobiele app aangeboden, dus om verder te gaan heb ik daar heb ik ook een aantal vragen over.

De app

22. Waarom is er voor gekozen om Abel alleen via de mobiele app aan te bieden en niet bijvoorbeeld ook telefonisch of via internet?
23. Wilt u in de toekomst de app nog verder uitbreiden? Zo ja, hoe?
24. Wilt u in de toekomst de service ook buiten de app aan gaan bieden?

> Ik zie de taxi's van Abel tegenwoordig steeds vaker rondrijden in Amsterdam en omstreken, dus ik heb ook een tweetal vragen over de voertuigen opgesteld.

Voertuigen

25. Vanwaar de keuze voor alleen maar elektrische voertuigen?
    - Is dit met het oog op duurzaamheid?
26. De meeste taxi's hebben slechts een taxi bord op hun dak en een blauw nummerplaat, dus welke gedachte zit er achter de auto's in een opvallende kleur met een groot logo?

> Abel taxi wordt aangeboden als een goedkoper alternatief voor taxi diensten als Uber of een gewone straattaxi, dus ik zal nu verder gaan met een aantal vragen over de prijzen van Abel.

Prijzen

27. Is Abel voor een reiziger echt goedkoper dan andere services, zoals Uber?
28. Wat maakt Abel goedkoper dan andere services?
29. Kan de prijs afwijken van de gegeven prijs in de app als er bijvoorbeeld file is?
30. De klant krijgt de mogelijkheid via een creditcard te betalen of iDeal, maar waarom is er geen mogelijkheid om cash te betalen bij de chauffeur?

> Ik las op de website van Abel dat er grootse toekomstplannen zijn, maar dat dit stap voor stap zal gebeuren, dus ik ben wel benieuwd naar de toekomstplannen. Vandaar dat ik nu verder zal gaan met een aantal vragen over de toekomst van Abel.

Toekomst

31. Wat is voor u van belang om te bereiken met Abel in de nabije toekomst?
32. Wilt u in de toekomst ook vervoer gaan aanbieden bij Abel voor groepen personen groter dan vier personen?
    - Door bijvoorbeeld de mogelijkheid voor het boeken van een busje aan te bieden?
33. Wilt u in de toekomst het gebied waarin de dienst beschikbaar is nog verder uitbreiden?
34. Wilt u in de toekomst de doelgroep ook uitbreiden? Zodat bijvoorbeeld ook oudere mensen van jullie service gebruik kunnen maken?
35. Wat zijn verdere toekomstplannen voor Abel?
36. Gekeken naar de toekomstige ontwikkelingen op het gebied van mobiliteit en openbaar vervoer, worden er ontwikkelingen als geautomatiseerde voertuigen en Mobility as a Service veracht. Ziet u de toekomst van Abel ook in deze ontwikkelingen?
    - Is een geïntegreerde, Mobility as a Service, dienst mogelijk? (geïntegreerd met andere OV diensten, zoals NS)

> Als laatste heb ik een tweetal vragen over de concepten die in mijn onderzoek centraal staan, namelijk: toegankelijkheid, betrouwbaarheid en gelijkheid.

Centrale concepten

37. Bent u bekend met deze concepten op het gebied van mobiliteit en openbaar vervoer?
38. Wordt er bij Abel gebruik gemaakt van bepaalde mechanismen om deze concepten bij Abel te faciliteren?

- Of heeft u plannen om dit te faciliteren bij Abel?

> Toegankelijkheid (mogelijkheid tot het meebrengen van bagage, huisdieren, rolstoel etc.)
> Betrouwbaarheid (punctualiteit, service beschikbaar op gewenst moment en in gewenst gebied)
> Gelijkheid (ieder persoon, ook met handicap, kan mee)

> Als allerlaatste heb ik nog twee algemene vragen.

Overige vragen

- Kunt u mij op enige manier verder helpen aan het verkrijgen van respondenten?
- Is er een mogelijkheid om bijvoorbeeld een voucher of kortingscode, onder de deelnemende gebruikers te verloten?

Dit waren de laatste vragen, maar voordat we afsluiten zou ik graag willen vragen of ik uw naam mag gebruiken in mijn scriptie?

Oké, nou meer vragen heb ik niet en ik denk dat ik voldoende informatie heb verkregen om mee verder te werken in mijn scriptie. Zodra mijn onderzoek is afgerond zal ik de resultaten naar u toesturen.

Heeft u op dit moment nog vragen?

Dan wil ik u nogmaals hartelijk bedanken voor uw tijd.

II Interview guide for the interview with Peraphan Jittrapirom

First of all we want to thank you for your time and we want to ask you if it is okay if we record the interview?

Secondly, we want to ask you if it is okay to use your name in our research:

- If yes, can we also mention your function as post-doctoral researcher?
- If no, can we mention you by your function as post-doctoral researcher?

Then we will first explain who we are and what we are researching at the moment. As you know, we are Ahmed Ali and Daphne van der Veer and we are in our third year of our Bachelor Geography, Spatial Planning and Environmental sciences. At the moment we are researching the efficiency of new, innovative and on-demand public transport services from a users perspective.

Ahmed is researching publicly run service BrengFlex and Daphne is doing research on privately run taxi service Abel in Amsterdam. Besides this interview we will conduct a questionnaire among the users of those two services to gain insight in how efficient users of those services find the services.

We have set up a few questions for you on public transport, demand responsive and on-demand transport and our central concept efficiency.

Before we start, we want to let you know that if you do not want to answer a certain question, that is no problem. Just tell us and we will continue with the next question.

Do you have any questions at the moment before we start?

To start with we have some general questions about your interest in public transport and your research.

1. Where does your interest in public transport come from?
    *In specific, where does your interest in smart city public transport and sustainable transport come from?

2. Can you tell us more about what you have researched in the past in the area of public transport?
    *Why did you research this?

3. Can you tell us more about what you are researching at the moment?
    *Why are you researching this?

Now, we will continue with questions about Demand Responsive Transport systems.

4. According to your research, what are Demand Responsive Transport systems?

5. Why is DRT gaining importance?

6. When going back further in the past, did there exist any forms of DRT or is it a recent phenomenon?

7. According to your research, which specific trends have led to the growing interest in Demand Responsive Transport services?

9. What is the progress in DRT in terms of research?

10. What are challenges that DRT is facing?

11. What opportunities is DRT facing?

12. What are the roles of public bodies in DRT?

13. What is the progress in DRT in terms of policy and practices?

14. To what extent does policy include development of DRT? What is the role of policy in DRT?

15. Based on your research do you see any differences in policy making in the area of public transport in the Netherlands and elsewhere?

- And/or similarities in policy making in the area of public transport in the Netherlands and elsewhere?

16. Is the Netherlands progressive in the development of DRT? Or are there any other countries that are more progressive and further in the development of DRT?

17. Looking at the effects of DRT, what are positive effects?

18. What are negative effects of DRT?

19. Which factors contribute to the successfulness of a DRT service?

20. Which factors contribute to the failure of a DRT service?

21. Can you give us a best practice example of a DRT service?

22. Can you give us a worse practice example of a DRT service?

As you probably know, some on-demand services are publicly run and others are privately run. Both public and private services have their own motivations to provide the service.

23. What are, according to your research, the differences between public and private on-demand services?

24. What are, according to your research, similarities between public and private on-demand services?

25. What is the difference in terms of the view on, on the one hand public, and on the other hand, private on-demand services?

26. What are the differences between on-demand public transport services and on-demand taxi services?

*Are there any differences?

Now we will continue with some questions about the concepts that we have used in our research and the effect the difference between public and privately run services has on those concepts. The main concepts in our research are: efficiency, accessibility, equity and justice.

27. In general, what are the effects of the different motivations behind publicly and privately run on-demand services?

- What are the effects of those different motivations on efficiency of the services? Are there any effects on efficiency?
- What are the effects of those different motivations on accessibility of the services?
- What are the effects of those different motivations on equity and justice of the services?

Another important concept that has to do with public transport is transport-poverty.

28. Transport-poverty is often apparent in underdeveloped, rural and periphery areas. Can you tell us more about what transport-poverty actually is?

- Do we have transport-poverty in the Netherlands?
- What effect can DRT services have on transport-poverty?
- Can publicly run on-demand services have different effect on transport-poverty than privately run services?
- Does transport poverty have an effect on the policy concerning DRT?

29. Does the difference in motivation behind publicly and privately run on-demand services have effects on transport-poverty?

---

30. We are researching the efficiency of on-demand public transport services from users' perspectives. According to your research, what makes public transport efficient for a user?

31. As said before, two concepts that are central in our research are equity and justice. To what extent, based on your research, do you think those concepts are important for the efficiency of a service?

32. Other concepts that are important to measure efficiency are accessibility and trustworthiness. To what extent, based on your research, do you think those two concepts are important for the efficiency of a service?

A discourse that is apparent in the current society is sustainability and sustainable development.
33. Is there a link between DRT and sustainability?

Besides the development of DRT and on-demand services on the demand side of transport, on the supply side of transport the development of Mobility is a Service can be found.
34. What is the difference between an on-demand, DRT service and a Mobility as a Service service?

To end with, we have one last question.
35. According to your research, how do you see the future of Demand Responsive and on-demand transport services?

This were all the questions, but before we finish, do you have any questions for us?

Okay, again we would like to thank you for your time and we will use the information you have given us with care.

And if you want to we can send you our final report once we are finished at the end of June?

Thank you.

III Survey for the users of Abel

Introduction

Dear user of Abel,

I am Daphne van der Veer and I am currently in my third year of my study Geography, Spatial Planning and Environmental Sciences at the Radboud University, Nijmegen. For my graduation project I am researching the efficiency of the on-demand taxi service 'Abel', which is located in Amsterdam.

Before starting the survey it is important that you know the following:

- Completing the survey takes up to 10 minute.

- The results will be processed anonymously and confidentially. Your answers will not be linked to your personal information.

- If you have any questions or complaints about the research, you can contact me personally. Daphne van der Veer, via e-mail: d.vanderveer@student.ru.nl

- The research is conducted **independently** from Abel.

Thank you in advance for your cooperation!

Instructions:

1. The questions are divided by subject.
2. Click **one** answer to you when it is a multiple-choice question.
3. Type your answer as clear as possible when it is an open-ended question.

General questions

To begin, I want to ask you to answer some general questions.

1. What is your age?
    - Younger than 18
    - 18 – 24
    - 25 – 34
    - 35 – 44
    - 45 – 54
    - 55 – 64
    - 65 – 74
    - 75 – 84
    - 85 or older
2. Sex:
    - Male
    - Female
    - Otherwise

3. Marital status:
    - Unmarried
    - Married
    - Divorced
    - Widow

4. Highest level of education:
    - Primary education
    - Secondary education (LBO / VMBO)
    - HAVO or VWO
    - Secondary vocational education (MBO)
    - Higher education (College or University)
    - Other, namely:…….
5. Work status:
    - I work full time
    - I work part time
    - Unemployed jobseeker
    - Unemployed and not seeking employment
    - Retired
    - Studying
    - Disabled
6. Composition of your household:
    - Single without children
    - Single with children
    - (Married) couple with children
    - (Married) couple without children
    - Housemates
7. What is your average monthly net income?
    - Up to €1000
    - €1000 to €1500
    - €1500 to €2000
    - €2000 to €2500
    - €2500 to €3000
    - €3000 or more
    - I do not want to answer this question
8. Do you own a car?
    - Yes
    - No
9. Do you have a public transport chip card?
    - Yes (if yes, continue with question 15)
    - No (if no, continue with question 17)
10. Do you have a subscription on your public transport chip card?
    - Yes (if yes, continue with question 16)
    - No (if no, continue with question 17)
11. What kind of subscription do you have on your public transport chip card?

12. Do you have special requirements for your trip? (E.g. wheelchair, pram, assistance dog, pet)?
    - Yes
    - No
13. Do you need help getting in and/or out of the car?
    - Yes
    - No

Questions about your last ride with Abel taxi

While answering the next set of questions, I would like to ask you to do this in view of your last ride with Abel.

14. What kind of ride was your last trip with Abel?
    - Business
    - Leisure
    - Cultural
    - Other, namely.....

15. Who was with you in the car this ride?

16. What day of the week was this ride?

17. At what time of the day was this ride?

Two things that are important for efficiency are trustworthiness and travel time:
- For trustworthiness you should think about punctuality and taxis available at the appropriate time and in the desired area.
- For travel time you should think about the real travel time corresponding to the predetermined time, the waiting time for taxis and if your ride with Abel taxi is faster or slower compared to public transport like tram/metro, train and bus.

18. Can you describe your last ride in terms of *trustworthiness?*

19. Can you describe your last ride in terms of *travel time*?

The use of Abel

The following questions are about your use of Abel.

20**.** When did you start using Abel?

21. Why did you start using Abel?

22. How often do you use this service?
    - Daily
    - Once a week
    - Once a month
    - 2 to 3 times a month
    - A few times a year
23. I want to use this service regularly.
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree

Efficiency of Abel

The following questions are about the efficiency of Abel. The questions are divided into sub-topics that are all of importance for efficiency.

Accessibility and mobility in accordance with necessities

24. Extra 'luggage', such as a suitcase, a pram or wheelchair can be carried on the taxi without any problem.
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree
    - Does not apply
25. A pet or assistance dog can be taken on the taxi without any problem.
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree
    - Does not apply

Accessibility

26. The taxi drivers help me getting on and off the taxi.
    - Yes
    - No
    - Does not apply

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
27.	The service is accessible					
	Accessibility equity/justice					
28.	I can use this service without any problem					
29.	Anyone can use this service without any problem					
	Accessibility, trustworthiness and mobility in accordance with necessities					
30.	The service is available at any desired moment of the day					
31.	The service is available at the desired starting point					
32.	The service is available at the desired destination					
	Trustworthiness					
33.	The service is punctual					
	Vehicle characteristics					
34.	The vehicles are clearly recognizable					
35.	The taxi service is a sustainable mode of transportation					
36.	Traveling with this service is comfortable					
	Vehicle characteristics and mobility in accordance with necessities					

37.	The maximum number of passengers (3 persons) for each trip is sufficient					
38.	The vehicle meets my *preferences* (E.g. a van, traveling alone/together)					
39.	The vehicle meets my *needs* (E.g. bringing extra baggage, wheelchair or pram)					

Travel time

40. On average, how long do you wait before the taxi picks you up?
- 0 to 5 minutes
- 5 to 10 minutes
- 10 to 15 minutes
- 15 to 20 minutes
- 20 minutes or longer

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
41.	The final travel time equals to the predetermined travel time					
42.	Traveling with Abel is faster than with other modes of public transport (E.g. bus, metro/tram, train)					
43.	It is off added value that I can chose how much I am in a rush (or not) in the mobile app (possible options: in a rush, neutral, not in a rush)					
	Adequate information					
44.	The mobile app is user friendly					
45.	The mobile app provides accurate information (E.g. right price and travel time)					
46.	I can adapt my journey to my preferences via the					

	app (E.g. taking a wheelchair of pram)					
47.	The app gives me all needed information					
	Other questions ***Price and payment***					
48.	The available payment methods are sufficient					
49.	The price-quality ratio is good					
50.	Paying via the mobile app is easy					
51.	Abel is cheaper than other taxi services (E.g. Uber or a 'normal' taxi)					

Travel experience

The following questions are about the average experience you have during a trip with Abel.

52. While using Abel, I feel:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Calm					
Stressed out					
Relaxed					
Hurried					
Safe					
Unsafe					
Confident					
Worried					
Comfortable					
Uncomfortable					
Restful					
Restless					
Bored					
Enthusiastic					
Anxious					
Happy					
Conscious of other passengers					
Unaware of other passengers					

Review of Abel

In the next questions, I ask you to judge Abel.

53. What are positive things about Abel?

54. What could be improved about Abel?

55. Give the service a rating from 1 to 10 (1 = very bad, 10 = very good)

1 2 3 4 5 6 7 8 9 10

56. Give the efficiency (based on accessibility, trustworthiness, travel time, equity and justice, vehicle characteristics and adequate information) of this service a rating from 1 to 10 (1 = very bad, 10 = very good):

1 2 3 4 5 6 7 8 9 10

Thank you very much for your cooperation in this research, your answers have been registered!

IV The flyer


Voor vragen en/of opmerkingen: d.vanderveer@student.ru.nl
IK BEN OP ZOEK NAAR JOU!
HELP MIJ AFSTUDEREN!
Abel
Voor mijn afstudeer-onderzoek ben ik op zoek naar gebruikers van taxi Abel. Ben jij of ken jij iemand die deze service (heeft) gebruikt?
Vul dan mijn anonieme enquête in via de link of stuur deze link door!
<- - - - - - - - - -
http://fmru.az1.qualtrics.com/jfe/form/SV_5nDGtAzQ9Tkwu1L
BEDANKT!
PS. Dit onderzoek wordt onafhankelijk van Abel uitgevoerd!
Radboud Universiteit Nijmegen


For questions or comments: d.vanderveer@student.ru.nl
I AM LOOKING FOR YOU!
HELP ME GRADUATE!
Abel
For my graduation project I am looking for users of Abel taxi. Are you an user or do you know someone who uses Abel?
Please fill in my anonymous survey or forward the link!
<- - - - - - - - - -
http://fmru.az1.qualtrics.com/jfe/form/SV_5nDGtAzQ9Tkwu1L
THANK YOU!
PS. Thirs research is conducted independently from Abel!
Radboud Universiteit Nijmegen

V Tables with answers of respondents on open-ended survey questions

1. When did you start using Abel?

Respondent	When	Categories
1	When I heard about the 'sharing' concept	No exact moment
2	Immediately, when they started	Early user
3	December 2016	Early user
4	Immediately, when they started	Early user
5	March 2017	Recent user
6	When I saw one after a night out	No exact moment
7	2 months ago (April)	Recent user
8	January 2016	Early user
9	February 2016	Early user
10	When a friend of mine became driver at Abel	No exact moment
11	I don't know	No exact moment
12	In the trial phase	Early user
13	A year ago (May 2016)	Early user
14	April 2017	Recent user
15	After a night out	No exact moment
16	1 year ago	Early user
17	Last month (April)	Recent user
18	Since 1 year (April 2016)	Early user
19	July 2016	Recent user
20	Since 4 months (January)	Recent user
21	This year	Recent user
22	End of 2016	Early user
23	2016	Early user
24	April 2016	Early user
25	3 months ago	Recent user
26	This year	Recent user

2. Why did you start using Abel?

Respondent	Why	Category
1	Cheap and a nice idea of sharing your ride with people you don't know	Price, sharing
2	Because I work for Connexxion and I went to a meeting about Abel	Work
3	-	-
4	Because it is the cheapest taxi service in Amsterdam	Price
5	I was not satisfied with the 'regular' taxi's: too expensive and unfriendly drivers	Unhappy about other taxi
6	Cheap and the idea it was easy and fast	Price, easy
7	It supports iDeal payments, I have no credit card to pay for Uber	Payment methods
8	I saw cars driving, what made me curious	Curiosity
9	-	-
10	The cheap price	Price
11	It is cheaper than other taxi's and my daughter recommended it	Price, recommendation
12	My sister and stepsister run Pup, the publicity agency that makes Abels advertising	Recommendation
13	Easy and cheap	Price, easy
14	Cheap	Price
15	Because I was curious about this new service	Curiosity
16	Cheaper than regular taxi or Uber and my roommate works for Abel	Price, recommendation
17	I wanted to be at my destination fast, without any surprises from a regular taxi	Fast
18	Because I was not happy about my private driver	Unhappy about other taxi
19	Cheap and easy	Price, easy
20	Someone told me about it	Recommendation
21	Reliable transport mode	Reliable
22	Because I had an internship at Abel	Work
23	For my work	Work
24	One of my friends recommended it	Recommendation
25	I heard good messages about it	Recommendation
26	I saw them driving and Googled it	Curiosity

3. Who was with you during your last ride?

Respondent	Who was with you?	Categories	Shared (yes/no)
1	Two friends	Friends	Yes
2	My manager and two colleagues	Friends	Yes
3	A friend and her boyfriend	Friends	Yes
4	No one	No one	No
5	No one	No one	No
6	No one	No one	No
7	My friend	Friends	Yes
8	No one	No one	No
9	No one	No one	No
10	Friends	Friends	Yes
11	My daughter	Family	Yes
12	A friend	Friends	Yes
13	No one	No one	No
14	Friends	Friends	Yes
15	My boyfriend	Friends	Yes
16	No one	No one	No
17	A friend	Friends	Yes
18	No one	No one	No
19	No one	No one	No
20	My roommate	Friends	Yes
21	A friend	Friends	Yes
22	Only the driver	No one	No
23	Alone	No one	No
24	No one	No one	No
25	My husband	Family	Yes
26	A friend	Friend	Yes

4. What day of the week was your last ride?

Respondent	Day of the week	Week/weekend
1	Friday	Week
2	Monday	Week
3	Friday	Week
4	Wednesday	Week
5	Sunday	Weekend
6	Sunday	Weekend
7	Saturday	Weekend
8	Saturday	Weekend
9	Friday	Week
10	Thursday	Week
11	Saturday	Weekend
12	Monday	Week
13	Thursday	Week
14	Thursday	Week
15	Saturday	Weekend
16	Friday	Week
17	Thursday	Week
18	Thursday	Week
19	Monday	Week
20	Friday	Week
21	Friday	Week
22	Monday	Week
23	Friday	Week
24	Saturday	Weekend
25	Friday	Week
26	Saturday	Weekend

5. At what time of the day was your last ride?

Respondent	Time of the day	Category
1	-	-
2	17.00	Afternoon
3	3.00	Night
4	22.00	Evening
5	Midday	Afternoon
6	16.30	Afternoon
7	16.00	Afternoon
8	21.00	Evening
9	In the evening	Evening
10	01.00	Night
11	18.00	Evening
12	19.30	Evening
13	00.00	Night
14	00.15	Night
15	23.00	Evening
16	In the night	Night
17	21.15	Evening
18	-	-
19	Afternoon	Afternoon
20	23.30	Evening
21	20.00	Evening
22	20.10	Evening
23	20.00	Evening
24	01.30	Night
25	12.00	Afternoon
26	2.00	Night

6. Can you describe your last ride with Abel in terms of travel time?

Respondent	Travel time of last ride with Abel	Key words/categories
1	Good travel-time and no detour	Good, direct
2	The ride was directly and on time, exactly as the app showed	On time, direct, as predicted
3	-	-
4	Went good! Faster than public transport.	Good, faster
5	Good	Good
6	The waiting time is horrible. Never as predicted, always later. Public transport is faster with a waiting time this long	Horrible, longer
7	Very good	Good
8	Picked up 2 friends who also use the app and got there dryer and faster than any available alternative	Faster
9	The travel time is often longer than the app shows	Longer
10	The driver forgot to charge his car, so we stopped at the high way, which pretty much ruined our evening	Longer
11	The first ride was faster than public transport. The second ride we came 5 minutes late due to road construction, but public transport would not have been faster	Faster
12	Good	Good
13	Fast	Fast
14	The driver forgot to charge his car, so the ride took a very long time	Longer
15	The waiting time and travel time took a bit longer than planned, but public transport would not have been faster, so it was worth it	Faster
16	Travel time was very fast, took way shorter than public transportation	Fast
17	Faster than public transport, travel time was the same as shown on the app	Faster, as predicted
18	Good, fast and easy	Good, fast
19	-	-
20	We did not take a detour	Direct
21	Travel time was the same as predicted, waiting for the taxi was longer than expected. But it is faster than public transport	As predicted, faster
22	The travel time was good, no detour and it was fast	Good, direct, fast
23	Good	Good
24	It was nice. I had to take the night bus, so Abel was 25 minutes faster	Good, faster
25	Good	Good
26	We had to wait a bit for the taxi, but were home fast	Fast

7. Can you describe your last ride with Abel in terms of trustworthiness?

Respondent	Trustworthiness of last ride with Abel	Key words/categories
1	The taxi arrived fast	Fast
2	The taxi was on time, exactly at the time the app showed	On time
3	Good and fast	Good, fast
4	Good, taxi was available immediately. But it did take some time to it arrive.	Good, not on time
5	Good	Good
6	Very bad. Had to wait for an hour, while I could see the taxi was driving around. Often no taxi available, bad solutions for this.	Bad, not available
7	A bit messy. The driver had to go out of his way to pick up another person.	Bad
8	Arrived when predicted	On time
9	Sometimes the ride is declined or delayed	Not available, not on time
10	The ride was very reliable	Reliable
11	Nice driver, fast at destination.	Fast
12	Good	Good
13	Reliable	Reliable
14	Bad, driver forgot to charge his car, we had to stop at the highway	Bad
15	Immediately a car available, driver was too late, but no problem.	Reliable
16	The ride was there in the allocated timeslot, which was quite fast, and at the right place	On time, fast
17	Taxi was on-time and fast	On time, fast
18	Good and safe feeling	Good, safe
19	-	-
20	Was on time.	On time
21	Very reliable, good service, punctuality was good.	Reliable, good, on time
22	Very reliable, was on-time.	Reliable, on time
23	Reliable and friendly	Reliable
24	My taxi was on time, but first had to wait 20 minutes before a taxi was available	On time, not available
25	Was on time.	On time
26	First no car was available, but the second time there was.	Not available

8. What are positive things about Abel?

Respondent	Good things	Category
1	Sustainability	Sustainability
2	Fast and cheap	Travel time, price
3	Cheap	Price
4	Fast and cheap	Travel time, price
5	-	-
6	Cheap	Price
7	Cheap and electric cars	Price, sustainability
8	Price, electric cars and nice drivers	Price, sustainability, drivers
9	It is cheap	Price
10	The price and nice drivers	Price, drivers
11	Customer friendly, help with getting in and off the car, asking if it is a problem someone else shares the ride, offering of food/drinks from the driver	Drivers
12	Price, nice and friendly drivers	Price, drivers
13	Everything	Everything
14	Cheap	Price
15	Knowing what the price is in advance, automatically paying via the mobile app	Price, mobile application
16	Fast way of reliable and good transportation against low costs	Travel time, sustainability, price
17	Electrical cars, shared driving, mobile app	Sustainability, sharing, mobile application
18	Being on time	Punctuality
19	-	-
20	Everything went well so far	Everything
21	Good service	Service
22	Price, nice drivers and nice cars	Price, drivers, sustainability
23	Service	Service
24	Price and sustainable driving	Price, sustainability
25	Environmental friendly	Sustainability
26	Sustainability by using electrical cars	Sustainability

9. What are things to improve at Abel?

Respondent	Things to improve	Category
1	Waiting time before the taxi picks you up	Waiting time
2	I don’t know	Nothing
3	Sometimes there is no car available	Availability of cars
4	The app often shows wrong information on where the driver is and when he is coming to pick you up	Mobile application
5	-	-
6	Service, professionality of the drivers, focus on the customers, punctuality	Service, drivers, punctuality
7	More taxi drivers at busy times. I often have to choose another service at busy times (4 am fri-sat) because it shows 'No Driver available'	Availability of cars
8	Using it way less, as often time no car is available and use Uber instead	Availability of cars
9	It takes a lot of time before the taxi to arrive and during busy moments there is often no drive available	Waiting time, availability of cars
10	The expected pick-up time is not always true	Punctuality
11	Nothing, I am very satisfied	Nothing
12	Often there are no drivers available, the easiness of the app also can be improved	Availability of cars, mobile application
13	-	-
14	Waiting time before pick-up	Waiting time
15	Nicer drivers	Drivers
16	The payment methods could be extended. Also, on busy days it is almost impossible to get an available Abel driver	Payment methods, availability of cars
17	More marketing, so more people are going to use this service	Marketing
18	Bigger cars	Size of the cars
19	The size of the cars	Size of the cars
20	Everything can always be improved	Everything
21	Better punctuality	Punctuality
22	Being able to book in advance	Booking in advance
23	Wider area where service is offered	Available area
24	The amount of available cars	Availability of cars
25	I don’t know	Nothing
26	The availability to tell if you are bringing luggage or not and the maximum number of passengers in one car	Mobile application, size of cars, telling if you bring luggage