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School of Science
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Anant Shiv

**Analysis of last mile transport pilot:
Implementation of the model and its adaptation
among local citizens**

Master's Thesis

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Supervisor: Matti Vartiainen, Professor

Thesis advisor(s): Teemu Surakka, M.Sc. (Tech.)
Vasily Bykov, MBA (Exec.)

Author: Anant Shiv	
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<p>When we contemplate an ideal city's constituents such as social environment, medical facilities, law enforcement and education, the one that is religiously used by its inhabitants is public transport. An ideal public transport, if not impossible, is hard to achieve as each individual possesses unique needs. Mobility as a service focuses on achieving the desired by combining multiple transport systems (bus, metro, tram, taxi, car sharing, bicycle sharing) into one single platform. One of the biggest challenges faced by MaaS is to solve the first/last mile problem.</p> <p>This research focuses on understanding stakeholders' collaboration, required business model, user behaviour and experiences for a new first/last mile transport service by analysing a three-month kick-scooter sharing pilot concluded in the city of Espoo, Finland by Samocat Sharing Oy. Collected data for the exploratory research was in the form of 54 user survey responses, 2 in depth user interviews, interviews with Samocat co-founders, overall trip data, user helpline data, emails and documents. The qualitative and quantitative data was analysed with the help of generated hierarchical MaaS framework. The findings highlight essential elements needed for a successful stakeholders' collaboration and what is the required business model to make the kick scooter service sustainable by benchmarking existing MaaS business model and analysed data. Findings also highlight the modifications required in the service for a better user experience by analysing user behaviour during the pilot.</p> <p>Overall, findings prove the hypotheses "Samocat kick-scooter sharing solves the last mile problem" right. Samocat sharing service shows great potential to be an ideal MaaS candidate providing true door to door and a natural mode of transport for shorter distances. The service shows potential to generate synergistic effects with other mode of transport, opening doors for new research fields at the same time.</p>	
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1. Introduction

1.1 Background

Most of us, in our daily lives, follow a set pattern; Waking up, brushing our teeth, get fresh, have breakfast, get ready, travel and go to work. Out of all these activities, the one that acquires most of our time is commuting.

Considering an urban European environment, from a varied range of available transport methods, majority of us use public transport. In most of these cases, from our doorsteps to the metro/bus station we are forced to walk. Same is the case when we get down on a metro/bus station and walk to our destination. The lack of speedy transport options for the first and last mile is termed as a “last mile problem” illustrated in *Figure 1*.

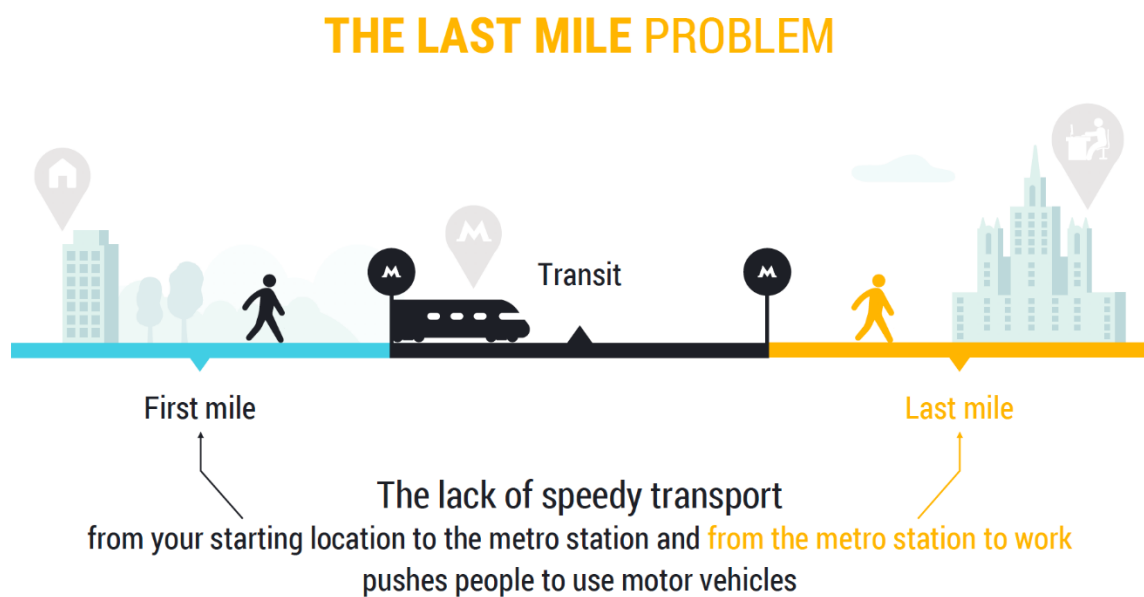


Figure 1. The last mile problem

Focusing on current transport trend, Mobility as a service (MaaS), a term introduced recently for combined mobility services is one of the main disruptions occurring in the transport sector (Atkins 2014).

So far, we have a limited number of last mile transport solutions, such as bike sharing, car sharing and taxi sharing. Due to the fact that these solutions are fairly popular, an adequate amount of research has been done in MaaS sphere considering their feasibility, user experience and overall infrastructural challenges they bring, but considering the last mile problem context, the research is fairly limited.

Samocat sharing Oy (Samocat, 2017), an international start-up with Russian roots has developed a kick-scooter sharing system ([Appendix 1](#)) aimed to solve the first/last mile problem for urban areas. In collaboration with City of Espoo (espoo.fi, 2017), TEKES (Tekes, 2017), ACRE (Aalto University Campus and Real Estate, (Aalto-yliopistokiinteistöt Oy, 2017)), and AYY (Aalto-yliopiston ylioppilaskunta, Ayy.fi, 2017), a three-month pilot project around Aalto University in the Otaniemi area of city of Espoo, Finland was conducted to test the developed system in real conditions ([Appendix 2](#)). The inspiration behind the service is to solve the long realised first/last mile problem in Otaniemi area.

The system consists of the hardware part that is Kick-scooters and station assembly, as well as a mobile app platform for payment, system interaction and fleet management ([Appendix 3](#)).

Considering the potential of this service in the context of MaaS, which offers consumers access to a range of vehicle types and journey experiences (Transport System Catapult, 2016), it makes the kick-scooter sharing system an ideal candidate for MaaS ecosystem as the last mile transport solution. Considering transportation in Helsinki capital region, the area is well connected through trams, metro line, regional trains, bus rapid transit as well as bicycle and pedestrian lanes. The main pain point being the destination point, that is in most cases, far-off from the closest metro, tram or bus station, forcing users towards personal vehicles (car or bicycle).

Recent introduction of city-bikes (HSL, 2017) is a rather positive step but these bicycles are not highly mobile when it comes to going through subways, metro stations, shopping malls or university campuses, and require dedicated parking spaces. The introduction of kick-scooters as daily transport could help this problem greatly with its docking station, free parking and station's ability to be even hanged on the wall in tight spaces. The preparation for the service execution being minimal as the infrastructure requirement for such service are fulfilled by normal bicycle and pedestrian lanes itself.

The Kick-scooter sharing service, being the first of its kind, having slightly different operational mechanism has not been either researched or tested in real life conditions before. The pilot was aimed to provide short distance transport solution to locals, university students, visitors and university staff (B2C) where city administration City of Espoo (B2G) and university real estate and campus administration (ACRE) served as partners, allowing multiple stakeholder involvement in the pilot project.

Due to the newness of Samocat sharing service, it provided a great opportunity to research multiple stakeholders' collaboration required business model, user behaviour and experiences where these research findings helped validate the hypotheses "Samocat kick-scooter sharing solves the last mile problem."

The focus group for the research were Aalto University students, staff and corporate employees around Otaniemi area who were prime end users for Samocat kick-scooter sharing service.

The pilot project kicked off in the beginning of September 2017 and ended in November 2017 serving from six locations around Aalto University campus.

The research could create a roadmap for upcoming last mile transport solutions which would help them take the idea towards a sustainable business.

1.2 Purpose and research question

MaaS involves a profound institutional transition from mobility as a self-service towards mobility as a service (Finnish Transport Agency, 2015) attracting numerous researchers to dive deep into the phenomenon and future possibilities it encloses. Considering the urban European environment, the first/last mile problem solution being faced by the users regularly rely greatly on MaaS. Having fairly low solutions of such kind where none being close to an ideal last mile transport solution makes this field yet to be discovered and analysed. Samocat sharing kick-scooter service opens numerous opportunities for research in this area in the form of early user experience, behaviour and later user adaptation.

How a new last mile mobility player would establish itself into an urban society with the help of right stakeholders and how to utilise that collaboration, how to make the whole service more user centric and overall how to establish a sustainable business out of it is the

theme of the thesis. MaaS heavily relies on digitalization and an end-user-oriented approach (VTT, 2017). How in a certain geography (Southern Finland) the MaaS would need to function and what modifications would make the mobile application, payment system and cloud services user-centric must be researched.

This thesis focuses on the analysis of the pilot considering the utilisation of stakeholders' collaboration, requirements for the design and implementation of the last mile service business model, user behaviour and experiences.

1.3 Structure of the thesis

Thesis starts by highlighting main purpose behind the research, more specifically the problem description by highlighting Samocat sharing pilot case and introduction of the last mile problem following by the general research questions. To understand the case, MaaS understanding is vital which is covered thoroughly in the theoretical background. Current trends in transportation, how they affect human activities, general MaaS introduction and its platforms following by MaaS integration index, MaaS business models and first/last mile services around us are the core of this chapter which concludes by introducing MaaS hierarchical framework that has been used in the research to analyse the last mile MaaS solution. Data gained from methods such as survey, interviews and documents with the help of applied research methodology have been analysed in order to answer the research questions in the following chapter, Research design, material and methods. The research findings highlight importance of stakeholder collaboration and what are the factors to consider for a successful relationship following by the requirement for the first/last mile business models and how to make it sustainable has been explained with the help of data analysis. Findings highlight user behaviour and user experience throughout Samocat pilot and how was the adaptation of the service among users following by the MaaS integration of Samocat in the pilot's context. Thesis concludes by explaining theoretical and practical implications, evaluating the overall research followed by future research challenges the topic unveils.

2. Theoretical background

2.1 Current transportation trends and user needs

After stone age, we went through thousands of years of incremental development. During the 18th century, the industrial revolution completely changed our lifestyles. Innovations like steam engine and development of tools replaced the manual work. Railways and locomotives made extraordinary impacts on society by changing the way individuals and goods move. The second innovation and technology wave introduced combustion engines, chemicals and iron technology. Cars and lorries equipped with combustion engine and extended road network connected each household with transportation systems. Air transport additionally made thousands of miles travelling possible in limited time. The third technological turning point in 1970s did not bring any significant change in transport apart from being more digitalised and equipped with Information and communication technology (Himanen, Lee-Gosselin, & Perrels, 2007). From this particular time the total miles driven around the globe have steadily increased. Only after this time period, from the start of 21st century, developed nations, predominantly Americans drove lesser miles, considering absolute as well as in per-capita terms. The younger generation is leading this decline of vehicle-miles travelled by preferring to walk, bike or taking public transportation or stay connected to mobile technologies instead of travelling. (OSPIRG Foundation, 2012)

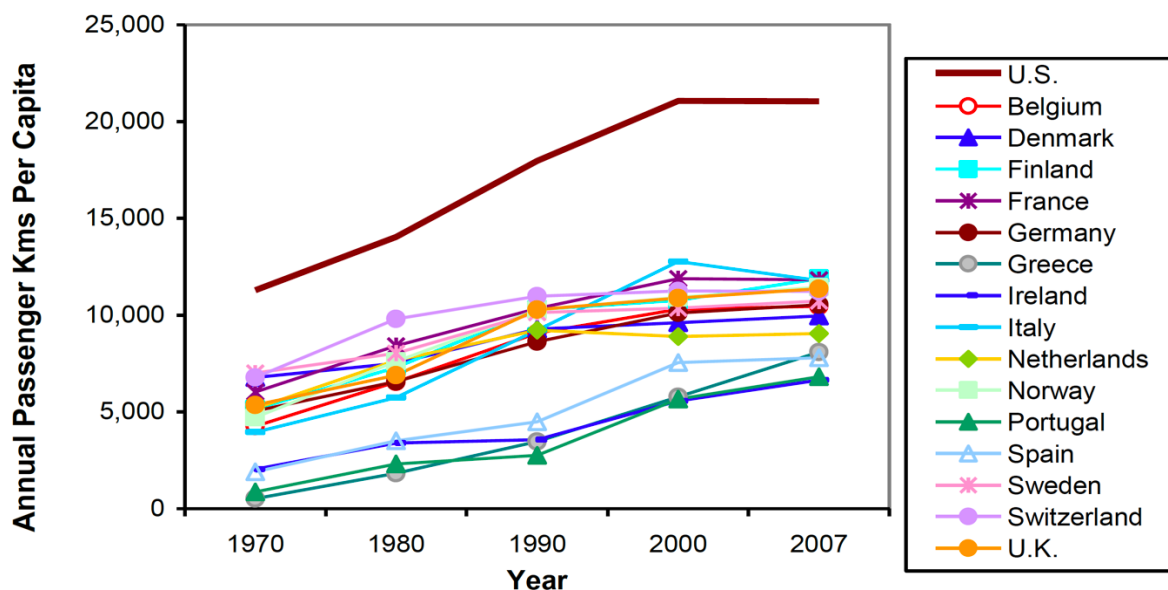


Figure 2. International Vehicle Travel Trends (Litman, 2016, p. 9)

In a 2011 research by University of Michigan Transportation Research Institute, researchers found that of the 14 countries studied other than the United States, seven developed countries— Sweden, Norway, Great Britain, Canada, Japan, South Korea and Germany— showed a recent decrease in the percentage of young people with driver's licenses. In addition to licensing rates, driving rates have also fallen in many developed countries. Vehicle-miles travelled have either levelled off or fallen in Western European countries including Belgium, Denmark, France, Germany, Italy, The Netherlands and Spain (Litman, 2016).

Multiple factors such as higher gas prices, new licensing laws, improvements in technology that support alternative transportation, and changes in Generation Y's values and preferences are responsible for such change and would likely to have an impact for years to come. (OSPIRG Foundation, 2012)

Smartphone revolution has been a decisive factor in technologies that are supporting alternative transportations. It provides ability to be permanently connected to an ever-growing range of services and huge quantities of up-to-date information.

We can now check live bus times or buy train tickets on our phones as well as plan our journeys and keep an eye out for any issues on the transport network, such as congestion, as it arises. Comparing the past and current mobility trends from the discussion above, car ownership and long-term season tickets use to be the standard, whereas now a trend towards the emergence of the sharing economy and the provision of access to mobility is bringing a new mind-set to customer expectations.

Flexibility in societal transportation demands, part-time working, working from home and more flexible journey choice are essential user requirements (Atkins, 2014). These requirements of an ideal transportation system lay the foundation of an ideal city.

Transportation touches all the aspects of our daily life. It is an investment tool that cities use to help achieve their larger goals (Tumlin, 2011). The impact of transportation can be explained as follows:

- **Economic development.** A well-connected area would be more attractive for jobs and residencies. Access drives real estate values.
- **Quality of life.** Advantages and disadvantages goes hand in hand with transport. Stronger economies complaint about congestion which dates back to the ancient Rome time when Julius Caesar banned daytime use of carriages to reduce congestion and noise. Same is the case at present time, where most of the metro cities are facing the congestion and noise pollution issue, but the advantages it brings also cannot be neglected. Transport can be central to the quality of life of cities, and the source of both public comfort, enjoyment and tourism. Metro cities are mostly equipped with many modes of transports to distribute the congestion such as metro, tram, buses, taxis etc.
- **Social equity.** Transportation policy is certainly a social policy. Certain group will benefit whereas some will significantly get harmed. Higher-income motorists being benefitted whereas lower-income pedestrians will face the policy harshness. But during all this, other investments could significantly expand mobility and job opportunities for those too young, old, or disabled to drive. According to Tumlin (2011, p.4): “Advocates for the winners in conventional transportation funding allocations sometimes argue that any adjustment in the current formula is “social engineering”—a criticism with some merit—but then, any public investment in transport, even and perhaps even especially those reinforcing the status quo, results in social impacts.
- **Public health.** Due to easy availability of transport mediums, children and elderly do not get sufficient walking time that is 20 minutes per day to be healthy. An ideal transport system makes daily walking a pleasure for the citizens. If required physical activity level is ignored, a significant public health costs can occur.
- **Ecological sustainability.** For most of the greenhouse gas emissions and petroleum consumption the most responsible factor is transportation. Innovations are required to make them greener and sustainable. We are going to the right direction but not in a mass. Certain regulations are required for developing countries and vehicle manufacturer. International relations are certainly being affected by this factor mostly.

The above-mentioned factors explain the extremes of transportation system such that what could happen if the implementation is done right and what would be at stake if done wrong. With the help of current technical advancements, focusing on the user needs, mobility should be seen as a visionary and feasible offering that influences our present and our future – regardless of our budgets, capabilities, competences, and needs, regardless of where the demand is being generated and where it is being fulfilled making it a smart mobility or intelligent mobility (Flügge, 2017).

2.2 MaaS as a concept & platform:

2.2.1 Nature of MaaS

We are edging towards the end of third industrial revolution where we have seen the digitalisation of most of our traditional industries (Freeman and Louçã, 2003). The fourth industrial revolution is a digital revolution focusing on integration of computation, networking and physical processes. (Hatzakis, 2016). Most of the sectors have seen significant disruption in the third industrial revolution such as media and telecommunications, but somehow the most significant sector that left behind is transport sector. The major factors being high cost, longer time to develop necessary infrastructure and most vital, the complex regulatory framework. (Atkins, 2014) The recent technology developments such as Artificial intelligence (AI) and Internet of Things (IoT) are helping in combining all transportation options into a single platform according to end user needs creating an intelligent mobility platform capable of providing Mobility as a service (MaaS).

Mobility as a Service is a quite novel term and a commonly agreed definition is difficult to find (Holmberg, Collado, Sarasini and Williander, 2016). MaaS is often described as an alternative to private vehicle ownership that combines different types of mobility services as part of a single, seamless offering made available to users via subscription-based smartphone applications (Beutel et al., 2014; Goldman and Gorham, 2006; Sochor et al., 2015). According to Kamargianni et al. (2016), the term “MaaS” stands for buying mobility services as packages based on consumers’ needs instead of buying the means of transport (Kamargianni, Li, Matyas & Schäfer, 2016). Transport system catapult describes it as “MaaS encapsulates the ability for the service to offer any type of travel experience using any form of transport service, public or private” (Mobility as a Service, 2016). Atkins (2014) explicates that MaaS focuses on providing a single platform for combining all transportation options and presenting them to the customer in a simple and completely integrated manner – the emphasis being on how to get from A to B rather than the individual transport modes and services. By analysing these explanations, for the scope of this research, following definition of MaaS can be deduced:

MaaS is a combined mobility service (CMS), with a mechanism of intelligent mobility.

Here, Combined mobility services (CMS) denotes a stricter description of a service offering containing several transport modes offered in one subscription/service offering to the customer (Holmberg, et al., 2016). The term intelligent mobility (*Figure 3*) denotes a new way of thinking about how to connect people, places and goods across all transport modes. It is about how we utilise a combination of systems thinking, technology and data across the transport network to inform decision making and enable behavioural change (Atkins, 2014).

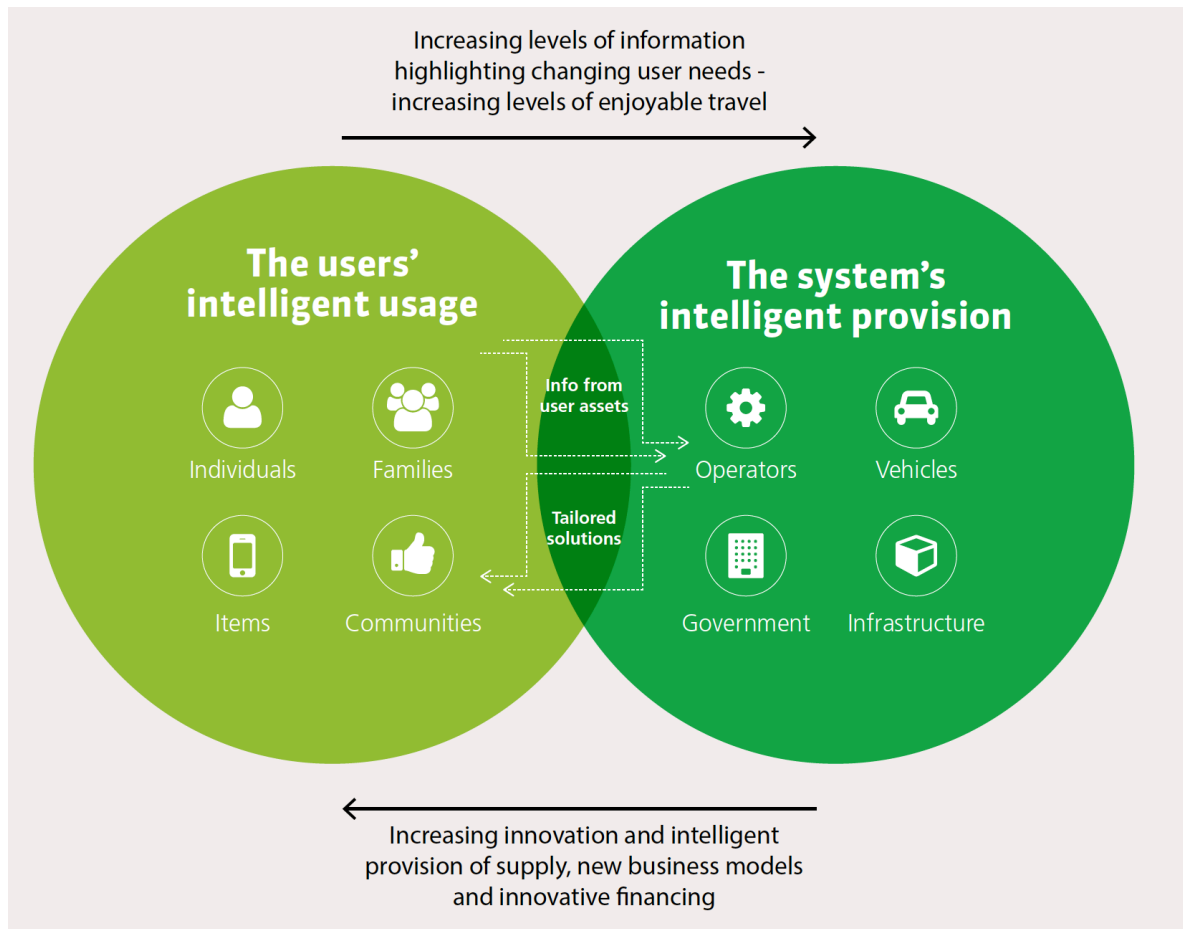


Figure 3. Intelligent mobility elements (ATKINS, 2014, p.4)

Using MaaS intelligent platforms, service providers would be able to offer end users an ideal transport solution, keeping cost, comfort and reliability as a priority. Services that will be in the same platform are public transport, car-sharing, car leasing and road use and efficient options for shipping & delivery etc. MaaS holds tremendous opportunities for transportation sector and due to this, MaaS is widely regarded as the next paradigm change in transportation (Giesecke, Surakka, and Hakonen, 2016).

To understand MaaS, we have to understand the nature of MaaS based travel. According to research paper “Conceptualising Mobility as a Service, a user centric view on key issues of mobility services” the key factors are as follows (Giesecke, Surakka, and Hakonen, 2016, pp. 2-4):

- A. The type of payload: Can the transport medium fit the luggage the passenger carrying.
- B. Travel goal: Experience vs bridging a distance. A user may travel just not to travel from point A to B but for the sake of experience as well. On the other hand, user might want to travel to reach destination quickly and comfortably.
- C. Trip purpose: Private or professional purpose, or in most cases, a combination.
- D. Trip distance: Short range, mid-range or longer-range travel depending on the demography.
- E. Accessibility and directness: How user friendly is the transport medium for disabled people and would multiple interchanges be needed to travel from point A to B.
- F. Travel mode and means: Mode could be where the transport performs, air, land or water. Another explanation could be, is it a private or public transport. The term means would define the exact transportation used such as cruise, bus, car or airplane.

- G. Borders and boundaries: Depending on the demography, borders and boundaries may produce multiple barriers according to the regulation of given land which influences the transport choice user makes.
- H. Trip phases: From planning to journey, the pre-planning phase a user makes is vital in choosing the right transport medium. These phases are:
 - 1: Planning
 - 2: Booking
 - 3: Paying
 - 4: Ticketing
 - 5: Journey
 (Giesecke, Surakka, and Hakonen, 2016)

To understand MaaS aspect of Samocat sharing case, service flexibility towards CMS and the intelligent mobility aspect were researched on the basis of above discussion. The nature of MaaS based travel helped in formulating user surveys, interviews and related data sets for case analysis.

2.2.2 MaaS ecosystem and platforms

Combined mobility services (CMS) is a subset of MaaS ecosystem. CMS acts as a business ecosystem where multiple actors add services from their existing core businesses into a whole that constitutes the CMS offerings. (Holmberg, Collado, Sarasini and Williander, 2016)

Figure 4 illustrates the MaaS ecosystem actors and their relationships with each other. The actors are as follows:

CMS Operators: CMS operators work as business ecosystem leaders who scale and grow combined mobility services. For this, operators need to work locally and create a uniform network of CMS which provide geographical scaling.

Mobility Service Providers: Local CMS providers further collaborate with taxi companies, car sharing companies, bicycle sharing companies and other mobility service providers (MSP) who provide the desired solution for customers mobility needs.

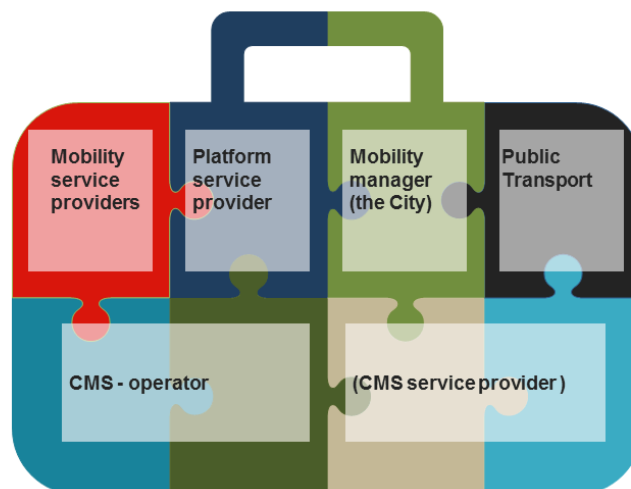


Figure 4. MaaS EcoSystem Actors, (Holmberg, et. al, 2016, p.26)

Public transport (PT): Public transport is a basic need of society that helps it function. For citizens, public transport is the most economic mode of transport and in most of the cases due to high operational costs but to keep the price low, public transport needs to be subsidised and owned by governments.

Platform service provider (PSP): A link between customer mobility need finding to mobility service provider and overall payment, trip and contract management is provided by platform services. In the MaaSterplan project (Vinnova, 2015), it was being found that it is technically and commercially feasible to develop and provide a generic CMS service platform supporting various types of MaaS-services offered by a PSP.

MaaS platforms can be defined as online systems that enable transport services to be served. The increased penetration of smartphones and access to Internet is considered as the main enabler of this transformation of the transport sector towards what is known as Intelligent mobility (Felländer et al., 2015). Referring to a presentation by Tuomo K Kinnunen at the 1st International Conference on Mobility as a Service in Tampere, Finland on the topic “Open mobility data integration platform: Lowering the threshold for introducing smart mobility services”, a smart mobility service can be built on three elements (Kinnunen, 2017, p.7):

1. Mobility (real-time) data sources, such as an on-board computer or a vehicle mobile client
2. Integration platform (provides API solutions for data storage and retrieval)
3. End-user services (providing application/service specific implementations).

Figure 5 illustrates the platform concept with the basic elements requiring for its functionality. The platform concept lays the basic foundation of MaaS platform and according to the user needs at a certain geography, features could be added on these elements separately.

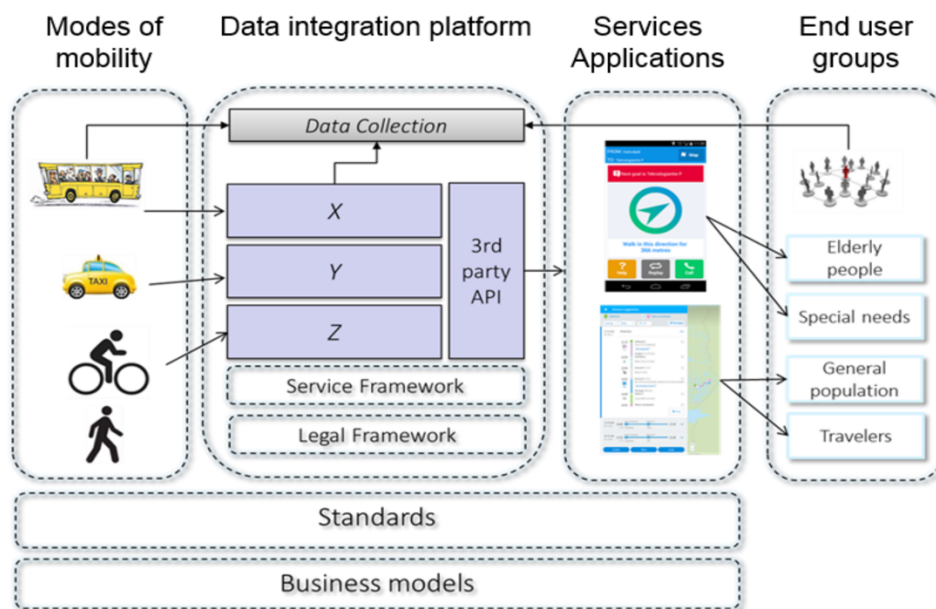


Figure 5. General open mobility data integration platform concept (Kinnunen, 2017, p.7)

For Samocat case, this discussion helped in understanding the required mobile application platform mechanism and what further modifications it would be needing in order to be a user centric MaaS member.

2.2.3 Factors influencing MaaS

Overall, factors influencing MaaS are directly related to individual mobility behaviour of a user, and these factors can be categorised as, internal and external factors shown in *Figure 6*.

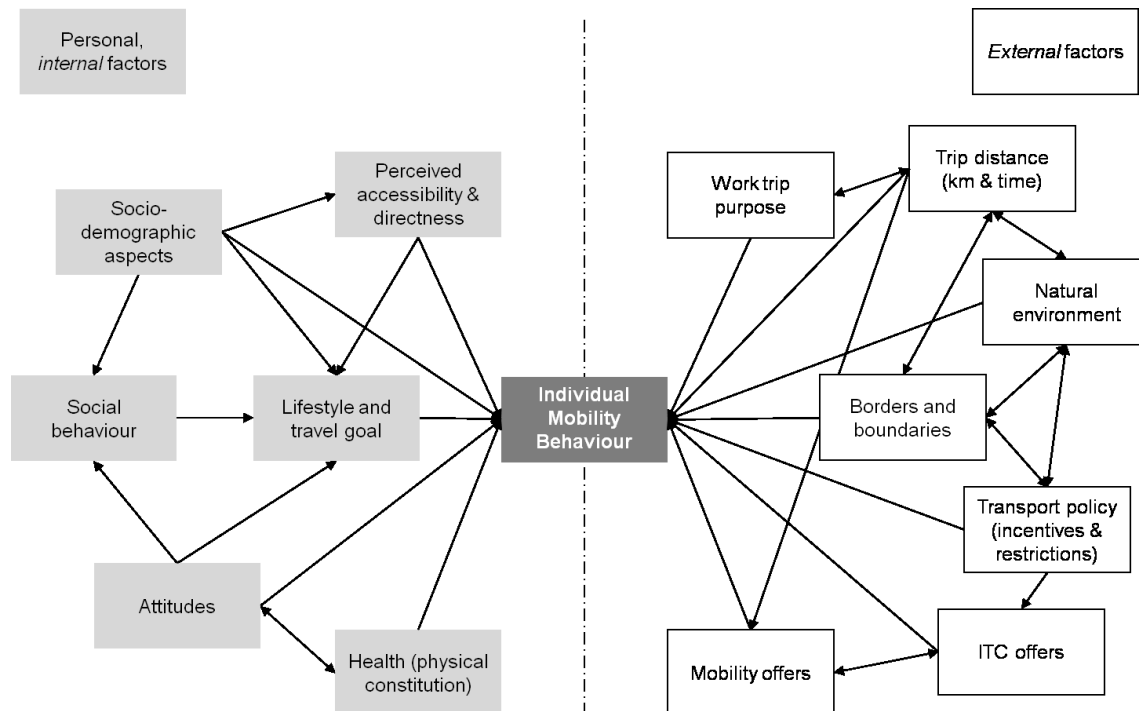


Figure 6. Complex mixture of internal and external factors (Giesecke et al., 2016, p.5, adopted & supplemented from Kemming, Brinkmann and Greger, 2007)

User behaviour and adaptation being the focus of Samocat case, analysing user journey on the basis of individual mobility behaviour was constructive. The number of users, number of rides according to time of the day have been understood by the personal and external factors on a deeper level.

2.2.4 MaaS Data generation

Exact data that needs to be collected is vital, especially considering the short Samocat sharing pilot duration. Since the research questions predominantly circle around the overall assessment of the Samocat pilot project, to understand the success of MaaS an assessment framework proposed in “Impact assessment” report by Karlsson et al. (2017) and illustrated on *Table 1*, would be helpful in finding what data needs to be collected out of a huge data pool. The tentative assessment framework focuses on environmental, economic and social impact areas on individual, business and societal levels.

Table 1. Overview of anticipated impacts (Karlsson et al., 2017, p.4)

Level	KPIs	Impact areas		
		Environmental	Economic	Social
Individual /user level	Total number of trips made	✓		✓
	Modal shift (from car to PT, to sharing, to ...)	✓		
	Number of multimodal trips (combining different modes of transport)	✓		
	Attitudes towards PT, sharing, etc.	✓		
	Perceived accessibility to transport			✓
	Total travel cost per individual/household		✓	✓
Business/ organisational level	Number of customers		✓	
	Customer segments (men/women, young/old, ...)		✓	✓
	Level of collaboration/partnerships in value chain		✓	
	Revenues/turnover		✓	
	Level of data sharing		✓	
	Organisational changes		✓	
Societal level	Emissions	✓		
	Resource efficiency (roads, vehicles, land use, ...)	✓	✓	
	Citizens accessibility to transport services		✓	✓
	Modification of vehicle fleet (electrification, automation)	✓		
	Legal and policy modifications	✓	✓	✓
Overall positive increase/decrease				
Both positive and negative increase/decrease				
Overall negative increase/decrease				
Not possible to assess				

For the scope of the thesis, it is unimportant to group the KPIs into different levels but the recognition of the KPIs that drive a MaaS project is essential for this research to understand what the required data would be.

Out of many MaaS services currently operating, it is difficult to find which is better than other. With the help of “**MaaS integration index**” proposed by Kamargianni and colleagues (Kamargianni, Li, Matyas and Schäfer, 2016) where the total score can be calculated which help deciding which service has the best integration. The total score or MaaS integration index is calculated by adding five separate factors as shown here:

- TI score: for ticket integration, “1” score for each mode included;
- PI score: for payment integration, “1” score if payment integration exists;
- JP score: for ICT integration, “1” score if journey planning function exists;
- B score: for ICT integration, “1” score if booking function exists;
- MI score: for mobility package integration, “1” score if mobility package integration exists.

Ticket integration, measured by the number of modes that can be accessed via a single ticket and six most commonly observed modes, i.e. bike-sharing, car-sharing, car rental, rail, urban public transport and taxi etc. ICT integration includes functions of journey planning, booking, real-time information and personalized trip advice. Further on journey planning and booking are two separate determinants of integration level. A higher total score implies higher a level of mobility integration. Score 10 and 9 are described as extremely high integration rate.

The Helsinki model, now known as the Whim model (Whim - Travel Smarter, 2017) has the highest rating due to variety of modes it includes with a single ticket i.e. bike-sharing,

car-sharing, car rental, rail, urban public transport and taxi and have a complete integration with payment, ICT and mobility packages, scoring one in each remaining category scoring 10. Following Whim is UbiGo with an integration level of 9 including bike-sharing, car-sharing, car rental, urban public transport and taxi in the ticket integration category, and it scores one in each remaining category.

Kamargianni et al. (2016, p.9) quoted, “The methodology used to develop such grading system is very basic. It is a fresh attempt in transport research community trying to find out a way that can better study the existing MaaS schemes. More sophisticated methods are expected by future works when more data of these schemes become available.” The MaaS integration index has been fairly useful in generating the theoretical framework and analysis of Samocat sharing service integration.

2.3 MaaS Business Model

MaaS heavily depends on its digitalised platform which mostly is the differentiating factor from the traditional transportation sector. Due to its newness, MaaS is still gaining end-user acceptance, which is fairly evident in looking at the maturity of available business models. However, MaaS requires interoperable solutions which not only require a more inclusive understanding of available solutions and customers’ needs, but also an exploitation of new value capturing models (VTT, 2017). A MaaS operator can be private, public or a mixture which is a crucial factor in deciding its business model.

In the 1st international conference on Mobility as a Service, research paper presented by Aapaoja, Eckhard and Nykänen (2017) titled “Business models for MaaS”, two operator models – reseller and integrator which would be managed by commercial MaaS operator are identified. Whereas a public transport operator may focus on enriching its services by integrating other transport-related services into its regular service portfolio. (VTT, 2017).

An example of a current private innovative MaaS provider from Finland is Kyyti (*Figure 7*). Kyyti provides MaaS in form of an application (piloted as Tuup) that makes different mobility services easy to find, compare, book and pay. Also, Kyyti rideshare is based on pooling demand with an automated routing and fleet management. Kyyti is currently operational in 3 major Finnish cities and launches in Switzerland, Vietnam and US cities are being prepared (Taskinen, Karvonen & Salonen, 2017).

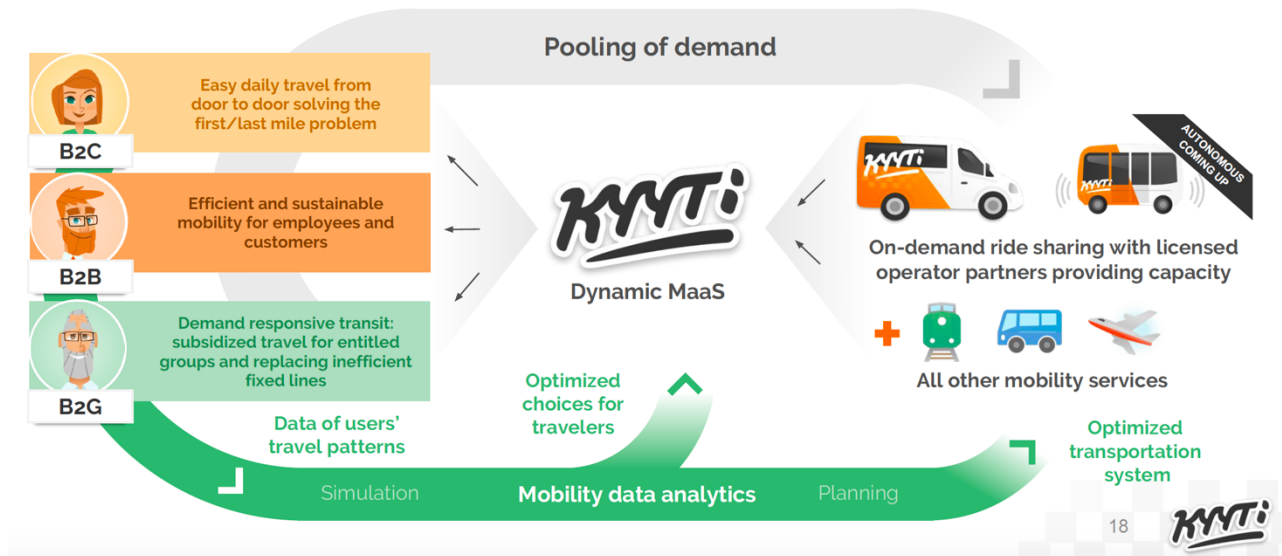


Figure 7. Kyyti pool demand across segments (Kyyti, 2017, p.18)

Figure 7 provides Kyyti pool demand across different segments. Kyyti target users are widespread from B2B, B2C and B2G whereas the partnerships with licenced operators helps in overall service operation and significant service charge margin help bringing revenue.

The Go: Smart project involved the development and field operational test (FOT) of an innovative transport broker service, named UbiGo (Figure 8) for sustainable transport of people in urban environments for limited period of six months (Sochor, Strömberg & Karlsson, 2015). The project shares a lot of similarities with Samocat sharing pilot considering limited time pilot, understanding user travel behaviour, mode choices etc. A generalised MaaS provider's business model by Swedish project UbiGo according to Osterwalder business model canvas (Osterwalder & Pigneur, 2010) has been provided by Holmberg (Holmberg et al., 2016) shown on Table 2.

UBiGo service offer an easy, flexible, reliable and priceworthy everyday travel without having to own a car (or a 2nd car). UbiGo positioned itself against car ownership, not against car use per se. The development and test of the UBiGo services differentiated from other projects in this area by building on a viable business model that is tested by real customers, paying real money for real services (UbiGo innovation AB, 2015). Through a web interface adapted to smartphones, the UbiGo service offers a one-stop access to the range of travel services. Customers, an individual or a family pay a monthly subscription adapted to their transport needs, which includes a personalized combination and amounts of credit for different travel services. During the FOT, the minimum limit for prepaid credit was 1200 SEK/month, or approximately 135 EUR at the time. Credit could be topped up or rolled over, and the subscription could be modified on a monthly basis. In order to encourage participation in the FOT, any unused credit was refunded to the participants at the end of the test. The project could compensate participants for not using a private vehicle during the FOT, i.e. to offset insurance, parking, etc. up to a fixed limit (Sochor et al., 2015).

Table 2. UbiGo business model canvas. (Holmberg et al., 2016, p.31)

Key Partners <ul style="list-style-type: none"> IT Platform and transection handling Public transport (Local franchisee) 	Key Activities <ul style="list-style-type: none"> Procurement services and market development Analytics IT development 	Value Proposition <ul style="list-style-type: none"> Easy, flexible, priceworthy everyday travel without having to own a car No admin travel management /Increased accessibility 	Customer Relationships <ul style="list-style-type: none"> Subscription bonus Feedback/control Travel warranty 	Customer Segments <ul style="list-style-type: none"> Urban households Businesses (Employers, stores etc.)
	Key Resources <ul style="list-style-type: none"> Negotiations and market competence Customer base knowledge Brand and franchise concept 		Channels <ul style="list-style-type: none"> App (Book, pay, check, info) 24/7 support Partners PR, W-bM 	
Cost Structure <ul style="list-style-type: none"> Warranty Key personnel Support Marketing IT platform license/ Operation 			Revenue Streams <ul style="list-style-type: none"> Travel service margins Add-On for businesses Interest Franchising-fees 	

To keep the theoretical review under the scope of the thesis topic, it is important to look at the most popular last mile transport solutions. There have been many pilot projects regarding Flexible micro transport services (FMTS), also known as DRT (Demand responsive transport) which lies in between taxi and bus service (Sihvola, Jokinen and Sulonen, 2012). Success stories of FMTS such as Uber, Ola cabs and Lyft are somewhat effective in solving the last mile problem but out of these last mile solutions, one of the most prevalent is bicycle sharing.

To understand bicycle sharing business model, DeMaio (2009) described the Models of provision of bicycle sharing in figure 8. Bike-sharing providers range from governments, quasi-governmental transport agencies, universities, non-profits, advertising companies, and for-profits. In the **government model**, the locality operates the bike-sharing service as it would any other transit service. The government maintains the liability for the program, which can be less desirable from a government’s perspective (DeMaio, 2009). HSL city bikes falls under this category.

The **transport agency model** has a quasi-governmental (semi-govt.) organization providing the service. Jurisdiction, region, or nation are the primary customers. The authority benefits from the experience and innovation of the bike-sharing service provider, without needing to develop the capabilities internally. Additionally, both the jurisdiction and transport agency’s top priority are to provide a useful transit service, rather than generating revenues. Disadvantage of this model is that, without the locality releasing a tender for the service, a more qualified operator may exist than the transport agency operator.

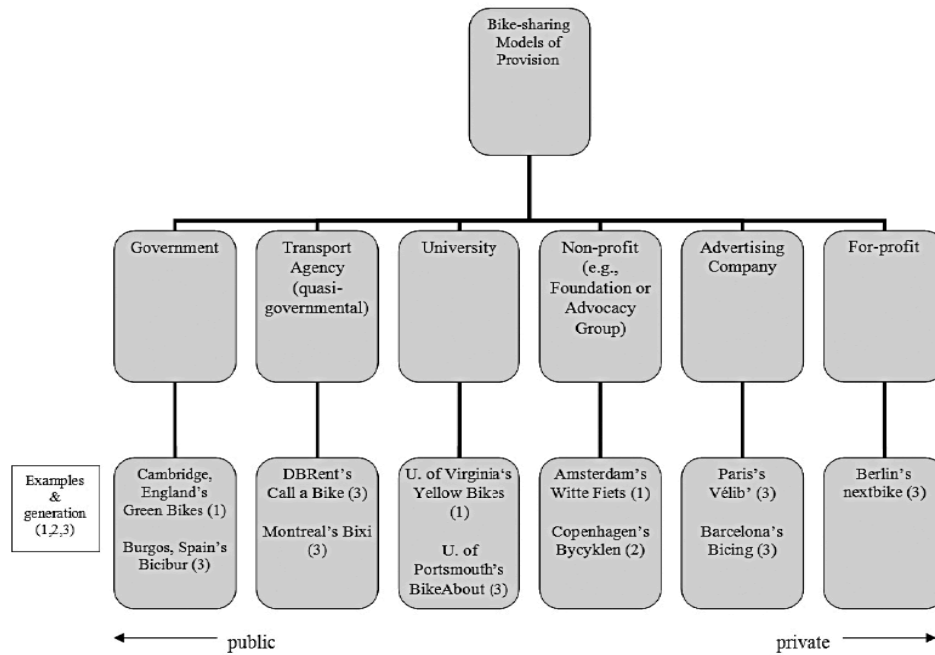


Figure 8. Bicycle sharing model of provision (DeMaio, 2009, p.46)

In the **University model**, the educational institute are the primary operators. A university can benefit by expanding its intra-campus transit service without relying on the authorities and other stakeholders to provide sufficient bike-sharing service on campus. Disadvantage is the surrounding locality would not benefit from the service unless it was opened to use for others. If there is an introduction of new service around, there might be compatibility issues as well.

The **non-profit model** works with some organisation that was solely created for the operation of the service or one that folds the bike-sharing service into its existing interests. Though a non-profit operates the program, mostly it receives funding from the authorities for the service it provides to the local mass in addition to collecting the revenues generated by membership and usage fees and sponsorships (Nice Ride Minnesota, 2009). The non-profit model benefits the locality as it removes liability from it and places the liability on the non-profit which has limited funding and is less likely to be sued. Disadvantage of this model is that a non-profit can be dependent on the public sector for a majority of its funding (Nice Ride Minnesota, 2009).

In the **advertising company model**, companies control and offer the bike sharing service to the authorities for an exchange of the right to use public space to display revenue-generating advertisements on billboards, bus shelters, metro stations, shops and outside malls. The benefit of this model is it can be convenient and cost-effective for local governments that are low on budget to provide the bike-sharing service otherwise. This model has been the most popular out of all. Disadvantage with the model is that the advertising company often does not benefit from revenues generated by the system, as the revenues usually go to the authority which later could discourage the advertising company to stop the service when the budget goes low or they met their target.

The **for-profit model** is where the service is provided by a private company having limited or no government involvement. The company is the sole owner and keeps all the revenues generated. The advantage is that the private company can start the whole operation seeing the user need in certain area without the involvement of any external parties which makes the whole implementation process faster. The disadvantage lies on the approval of

using public or private places from related parties and generating funding as they require no involvement of external parties, making the whole model less attractive for investors. Each model of provision exhibits its own characteristics on how the vehicles are supplied to the user. Presently there are two types of bicycle sharing systems available: station based, or Dock based and station-less or Dock less. In station-based systems, vehicles are only accessible at specific locations throughout the city, whereas in station-less systems, a service area is designated. These both sub models of provision come with their own benefits and drawbacks directly affecting the planning, implementation, and operation of shared mobility system (SMS). In the case of station-based systems, decisions on the number, location, and size of stations are required. The spatial flexibility is compromised in this case, but overall relocation operation is much easier. For the station-less system, free floating trips provide maximum flexibility as the vehicle can be returned at any location within the service area (Vogel, 2015).

Samocat sharing is a station-based kick-scooter service which as compare to bicycle sharing requires less installation area and due to its compactness, it could be installed in tight spaces. The compactness of kick-scooters helps greatly in relocation operation as well.

2.4 First / Last mile services

Currently the most popular last mile solution is undoubtedly the bicycle sharing system (BSS). BSS recently gain popularity due to easy, automated access, and one-way trips enabled by information systems support. (Vogel, 2015) According to Roland Berger, global strategy consulting firm, bike sharing market is growing at an annual growth rate of 20%, market size estimates of 3.6 to 5.3 billion euros by 2020. More than 2000 cities in the world are equipped with bicycle sharing.

2.4.1 Current Bike sharing giants

Ofo and Mobike, two start-ups that, taken together, have raised \$2.2bn of capital and are valued at more than \$4bn, having 7m and 10m bikes in China (The Economist, 2017). Most city bike-sharing systems, such as HSL city bikes in Helsinki are dock-based. Ofo and Mobike instead uses dock-less bike which is secured with a smart lock that unlocks via a smartphone app. Their costs are fairly less than public transport programmes.

In London, city bikes costs £2 (€2.25), with equally unpleasant user experience such as unresponsive touch screen for unlocking. HSL city bikes work on daily, weekly and season pass costing €5, €10 and €25 respectively, giving 30 min of free ride time after it needs to be locked to the dock again (HSL, 2017). With Ofo in China rides cost between 0.50 and 1 yuan (\$0.08-0.15) for 30 minutes.

The main reason for this drastic price change is that these bicycle companies saves on physical dock infrastructure. There have been numerous companies who tried the same business model but gone bust due to theft of bicycles. For one operator, 90% of its 1200 bikes got stolen within six months after launch. (The Economist, 2017). The main reason for Ofo and Mobike even after considering theft issues, able to afford such low fees is because they have plentiful funding. According to The Economist, “In June Mobike raised \$600m, much of it from Tencent, a messaging, gaming and payments giant. (Qualcomm, an American chipmaker, made a smaller investment this month.) In July Ofo raised \$700m in a funding round led by Alibaba, an e-commerce and payments company” (The Economist, 2017).

Improving the operation of BSS involves additional financing, introducing new technologies, and combining BSS with other modes of transportation. Since most BSS are not financially self-supported, additional financing possibilities provide revenue. Schemes such as involving sponsors as a long-term funding source or offering special fees to local companies and their employees could attract more users. Developing and introducing new technologies, such as RFID or GPS, are encouraged to improve rental processes and trip tracking. Combining BSS with other modes of transportation by means of an integrated smart card supports intermodality and multimodality and may increase usage. (Vogel, 2015).

2.4.2 Other popular last-mile services

Electric scooters, motorized skateboards, foldable e-bikes and hoverboards are not only popular among kids but due to their strong electric motor, they are being used as a last mile transport by many.

According to CNET, a famous American media website's review of above mentioned last mile solutions, they stated "There's a whole wave of new vehicles strong enough to support the weight of an adult yet fold up small enough to carry onto public transportation or in the back of a Miata (Mazda Car)". Further in their comprehensive review, they found Hoverboards are great, but bumps and potholes will easily misbalance the rider. The electric skateboards are much faster, and the speed is controlled by the remote in user's hands, but it is hard to stop them during emergency. Foldable E-bikes provide all the features of a standard electric bike with portability but even after folding, overall weight is fairly high to carry it in busy metros and buses. The one solution that stood up was electric kick-scooter. It was fast, easy to ride with foldable handles and body making it much compact than other. The handle keeps the balance in any of the road conditions and brakes can be used during emergency without the fear of misbalancing (CNET, 2018).

2.5 User needs in developing last mile service

2.5.1 User desire and needs

With the continuous population growth and at the same time a relatively low growth of public and private mode of transportation have made a wide gap between the mobility demand and supply. Due to continuous technological developments, users desire to have a flexible, easy and at the same time affordable mobility solution. (Vogel, 2015)

MaaS can contain most of these desired features by including public and private mobility players in the same platform. Success story of bicycle sharing system (BSS) is a proof where it has become a norm for short term trips. According to Vogel (2015, p.9), "Positive effects such as better exploitation of given transportation infrastructure, reduction of pollution, and increase in health pave the way for the rapidly growing spread of BSS."

It is difficult to address each user's needs but to combine them in two primary categories could be as follows:

- **Collective transport.** Integrating public and private mobility players to provide a seamless service is a common desire. The desired changes cannot be brought about by the development of a single transport mode or by focusing solely on a shift from fossil-fuelled, private cars to public transport, but by the integration of different transport services including both public and private solutions, i.e. "collective transport" (Sochor, Strömberg and Karlsson, 2015).

• **Joint ownership.** As explained by Sochor et al., A shift in individuals' outlooks in a more environmentally conscious direction, creating a trend towards joint/shared ownership or no ownership at all – including car and bike-sharing open up new possibilities for new types of travel offer or services, such as Uber, Lyft, Moovel, Qixxit etc.

2.5.2 User Motivation

One of the most important factor for a service to be popular is users' motivation to use it. For MaaS, the question is “What motivate users' to adopt MaaS services?” That could be answered as follows (Sochor & Sarasini, 2017):

- The combination of modes within MaaS offerings;
- The convenience and usability of the service;
- The design and function of smartphone applications;
- Environmental motivations

According to Public bike share user survey from BikePlus UK, 50% of people using the service are either new cyclists or were non-frequent cyclists before using the service. 20% of the users use bike share in conjunction with the bus service and 40 % with train, proving the first point, combination of modes within MaaS. 22% people switched their main bike share journey from a car to a bike seeing the convenience and 59% clearly stated the motivation was the convenience to use bike sharing. 85% people rated most of the service aspects as great including mobile application. Most interestingly, 65% of the people chose to go with bike sharing due to health and environmental benefits. (Public Bike Share Users Survey Results 2016, 2017) Samocat kick-scooter sharing followed the same learning while designing and implementing the service.

One of the most important factor in analysing mobility services is the geographical location. Different city and community have different needs and in Samocat's case, first step was to understand users in Otaniemi area and its surrounding localities' needs and problems they are facing with current transport system.

2.5.3 User experience testing

To dive deep into the user experience as a phenomenon, it is important to understand the behaviour of users and factors that affects it. One of the most famous theory in User behaviour change is Fogg's (2009) theory.

User Behavioural Change

The kick-scooter sharing system being fairly new transport medium “forces” users to come out of their daily travelling routine. This indicates that a behavioural change is needed in an individual to use the kick-scooter service. From being forced to being encouraged, the most important factor in this behavioural change is motivation (Nevid, 2012). There are typically two main categories of motivation, intrinsic and extrinsic (Desi and Ryan, 1985). Internal interests and enjoyments are the source for intrinsic motivation. Self-behavioural change due to well-being and feel good factors are the source of intrinsic motivation. External influences and rewards generate extrinsic motivation. Further, extrinsic motivation can be categorised into the external regulation, introjection, identification and integration. These external rewards and punishments generate external regulation. Introjection is fairly close to internalisation of motivation driven by guilt or a gained feeling of self-esteem; but is external

in nature. The identification and integrated regulation are autonomous, self-determined and internalised in nature. There is a process of internalising originally external motivation when the values are identified as consistent with one's perception of self and the motivation is identified as less controlling (Desi and Ryan, 1985). The Cognitive Evaluation Theory of Deci (1975) finds out factors that enable intrinsic motivation through contexts that support the personal feeling of competence.

These different types of motivation and the influencing factors helped in understanding user behaviour towards new Samocat sharing kick-scooter service and how could the offering as well as marketing be directed to influence the user choices more towards a better overall throughput of the service.

Fogg's behavioural model

The behavioural model was understood in depth by Fogg's behaviour change model, generally termed as FBM. According to Fogg (2009, p.1), "Behaviour is a product of three factors: motivation, ability and triggers. These factors have their own subcomponents as well. For any desired behaviour to be achieved, a person must be sufficiently motivated with an ability to perform the behaviour and be triggered to perform the behaviour" (Fogg, 2009). An illustration of these factors and their relationship is shown in Figure 9.

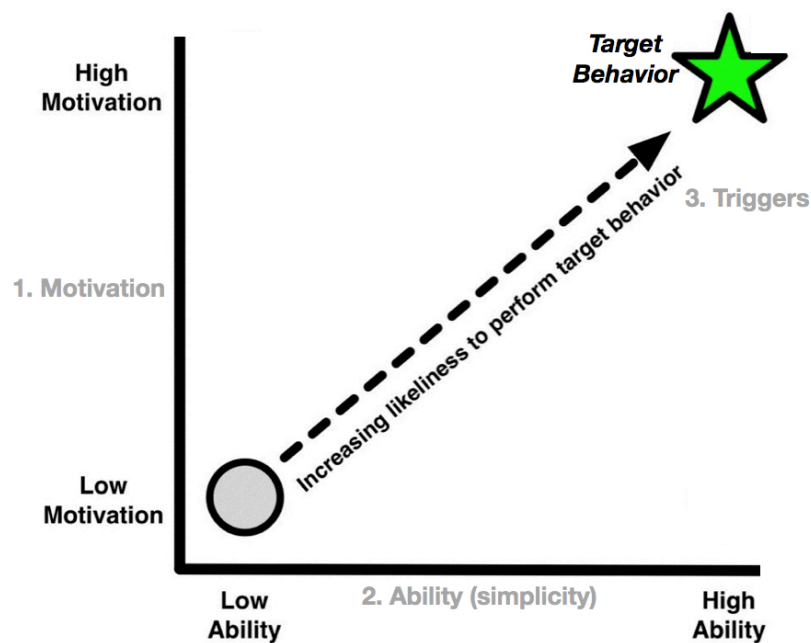


Figure 9. Fogg's behavioural model components (Fogg, 2009, p.2)

As shown in the diagram, vertical axis represents motivation. A person low on motivation will be lower in the axes and the one high will be upwards. The horizontal axis represents ability or simplicity. A person having low ability to perform a target behaviour would be marked toward the left side of the axis whereas the right side is for high ability. The star on the top right section represents the target behaviour. Point to be noted here is that the target behaviour can be anywhere according to the defined units and scored values of motivation and ability needed to achieve that, but typically high motivation and high ability are required to achieve a target behaviour. The arrow extending from bottom left to top right represents the likeliness of achieving the target behaviour with increase in motivation and ability accordingly.

The third factor is trigger. It is placed close to the target behaviour. According to Fogg it is to imply that “the trigger must be present for the target behaviour to occur.” Figure 9 is the most natural way to represent the relationship of these three factors, but it can be illustrated in many ways. Trigger goes by many names such as prompt, cues, calls to action etc.

According to Fogg (2009, pp. 5-6), “A trigger is something that tells people to perform a behaviour now.” Further explained by Fogg, “For behaviours where people are already above the activation threshold – meaning they have sufficient motivation and ability – a trigger is all that’s required.” Triggers have three types. (1) Spark as Trigger (2) Facilitator as Trigger and (3) Signal as Trigger.

Motivation Factor

Though motivation and its types have been defined earlier, Fogg describes it in three forms:

1. Pleasure / Pain: Certain activity that gives us pleasure to do something or forces us to do something because we do not want to feel pain.
2. Hope / Fear: Anticipation of an outcomes results in hope and fear. In times, more powerful than pleasure/pain. Hope and fear are fairly powerful motivators in persuasive technology.
3. Social acceptance / Rejection: When a certain mass of society follows a trend, in individual can feel the pressure of accepting it due to the fear of rejection, which is a motivational factor for most of the things in current social media scenarios such as Facebook, twitter and Instagram.

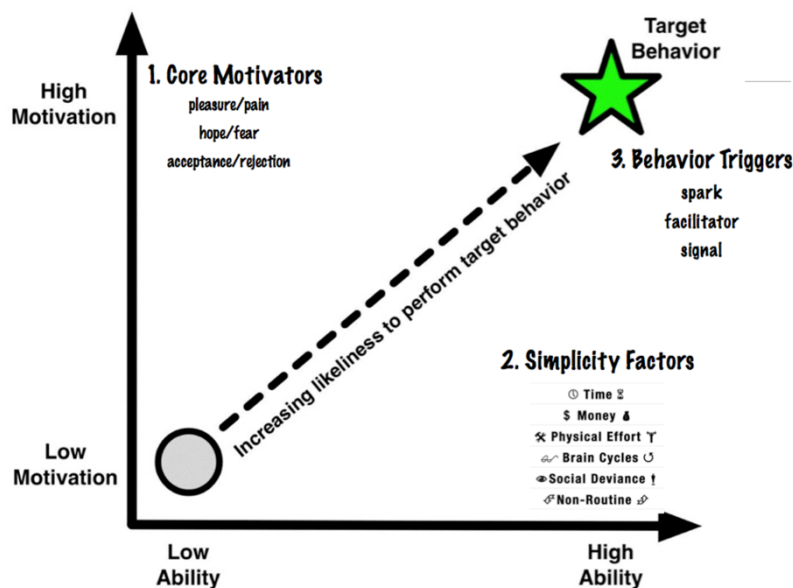


Figure 10. Fogg's behavioural model sub components (Fogg, 2009, p.5)

Ability Factor

Ability is the characteristic or set of characteristics of any person to perform a certain task by certain skill set. According to Fogg, “We are fundamentally lazy.” This means that people generally avoid certain tasks that require special training or instructions. Due to this reason, simplicity of the service use is a must. Fogg has deduced the following six components that influence Ability factor:

1. Time: A target behaviour requiring more time is not simple behaviour.
2. Money: An economical target behaviour is simple in nature whereas costly behaviour can make it complex to achieve for most of the people.
3. Physical Effort: Behaviours requiring physical effort are not simple.

4. Brain Cycle: Problems that require extra mental effort can be hard in nature.
5. Social Deviance: “Going against the norm” is a difficult ask and makes the issue uneasy.
6. Non-Routine: Fogg explains “In seeking simplicity, people will often stick to their routine.” Which implies that changing a habit is not in human nature and requires going a step further. This makes the behaviour uneasy.

Theory of reasoned action and planned behaviour, Integrated behavioural model (IBM)

The Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB) focus on theoretical constructs concerned with individual motivational factors as determinants of the likelihood of performing specific behaviours. The best predictor of a behaviour is intention, which is determined by attitudes toward and social normative perceptions regarding the behaviour (Glanz, Rimer & Viswanath, 2015). In simple terms, a person having strong beliefs that positively valued outcomes will result by performing the behaviour in question will have a positive attitude toward the behaviour, whereas a person who holds strong beliefs that negatively valued outcomes will result from the behaviour will have a negative attitude. The theory of planned behaviour adds perceived behavioural control to the TRA to account for factors outside individual control that may affect intentions and behaviour (Ajzen, 1991). By combining the features of TRA and TPB a generalised diagram shown in *Figure 11* can be deduced known as Integrated behavioural model (IBM).

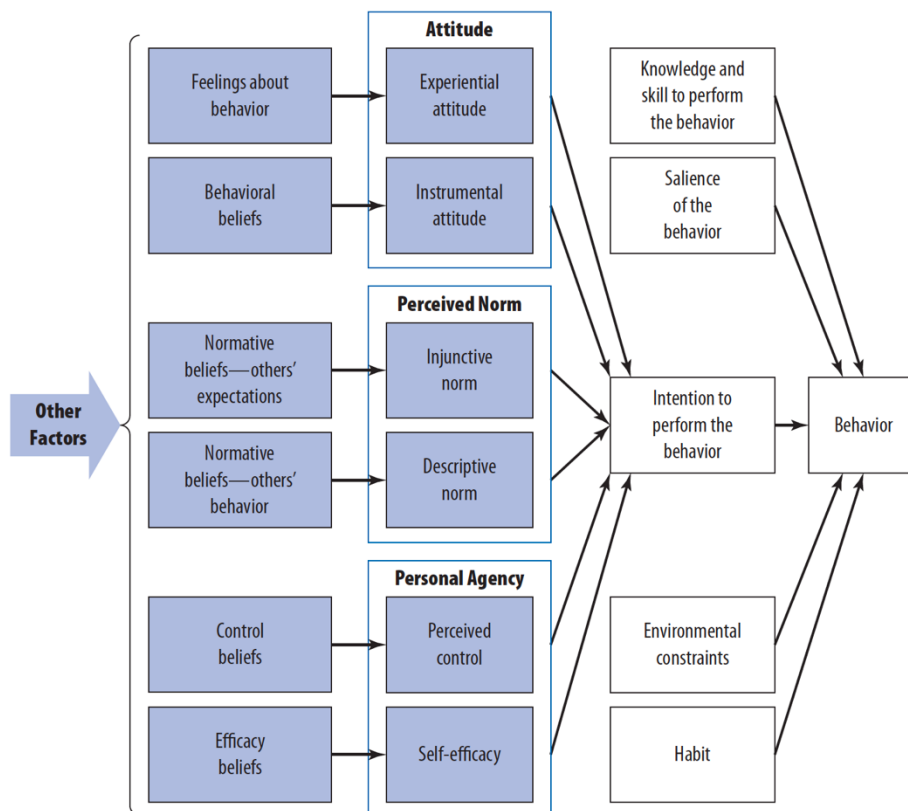


Figure 11. Integrated behavioural model (Glanz et al., 2015, p.104)

It can be concluded that when using a completely new service, if the user has positive notion that is he or she heard from colleagues or friends, would motivate the user as his or her attitude is already positive. The same could go negative and lead to no motivation if the preconception that got formed by listening or watching someone was not good.

2.6 Framework of study

2.6.1 Synthesising theory and practice

The theoretical review chapter has covered the evolution of transportation from its early history to current transportation trends and user needs. This part elaborated about MaaS as a concept and what does it mean in theory by explaining its nature, factors that influence it, MaaS platforms and how can data be generated through MaaS services that could prove how well the service integrates with other services. The MaaS business model highlights MaaS ecosystem players, a typical MaaS business model, MaaS services and their stakeholders as well as how their business model works. Going deeper into MaaS, we highlighted some notable first/ last mile services, specifically bike sharing. How do they operate and what are their challenges? At the end, we discussed theoretically what user desire in context of last mile services, how is it to be a user of last mile services and what are the main factors that would motivate a user towards last mile services. The theoretical concepts have been used to analyse Samocat kick-scooter sharing case. The kick-scooter service claims to be the first of its kind and due to its nature, would be the latest member of MaaS family under first/last mile service. Synthesising theoretical and practical implications of Samocat kick-scooter sharing service on MaaS, a framework shown in *Figure 12* has been deduced which helped analysing the service with respect to MaaS on a deeper level and helped in overall purpose of the research.

2.6.2 The hierarchical MaaS framework

The framework highlights specific characteristics of the service being analysed on different levels. The hierarchical model is used due to the nature of the service that solves a specific purpose and by going deeper, focuses on certain elements. The levels are as follows:

1. Activity level: The specific activity in question, i.e. transportation, get characterised here. In case of Samocat sharing kick-scooter service, what activities the service perform, and does it solve the main transportation purpose, i.e. providing commute for goods & services or living entities from point A to B. The level is helpful in understanding specifically how the service in question will affect user transportation activities, directly or indirectly.
2. Category level: Any service that falls under transportation or are involved with transportation activities, possess specific characteristics. For the research, we are interested in mobility as a service (MaaS). The category level is helpful in categorising the various services and highlight the distinctive feature of the service that puts it into MaaS category.
3. Service level: What are the constituents that put a normal transportation service into MaaS category. Service level is the most important part of this framework highlighting the nature of the service, the business model and user centricity during the development and execution of the service.

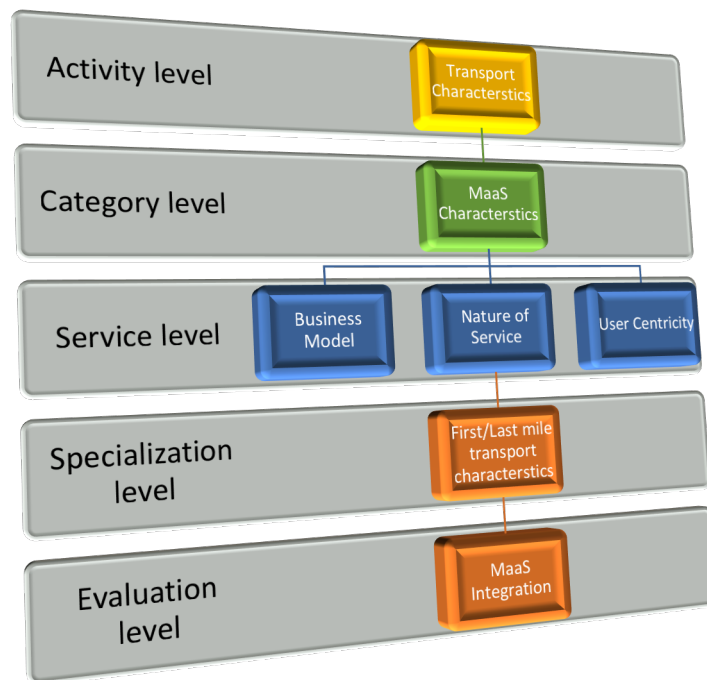


Figure 12. Hierarchical MaaS framework

Business model further investigates the ecosystem, services it encompasses, stakeholders, closeness to other MaaS business models and specific category of a service's business model with the outcomes helping in creating the service expansion strategy. User centricity helps in gathering and analysing data related to user behaviours, their needs and how the service is fulfilling them. What is the user satisfaction level, what could be done to improve it and what are the system level modifications needed to attract more users? The nature of service is the first factor to consider but explained at last due to its relevance to the business model and user centricity. The nature of MaaS has specific categories which should be considered while analysing mobility related services. Further, understanding MaaS platform and its integration with the service offering should be analysed.

4. Specialization level: After analysing the nature of the service and the business model, it would be easier to determine service offerings and evaluate whether the service fulfils first/last mile problem? If the requirement is met, the service could be labelled as a last mile transport solution.
5. Evaluation level: MaaS is all about integration of multiple services within a service and how well the integration could be the sole factor that determines how good the service is. With the help of various constituents that make MaaS and their integration, an overall score can be given by adding the individual integration score and determine the service standard.

3. Research design, material and methods

3.1 Research questions

The exact research questions that would be answered through this research are as follows:

- How to utilise the collaboration of stakeholders in designing and implementing the kick-scooter sharing service?
- What are the requirements for designing and implementing a last mile transport business model for the kick-scooters service?
- How is the user behaviour and experience throughout the user journey?

3.2 Methodological approach

A combination of methodologies is used to analyse a completely new last mile transport service under MaaS ecosystem. The research exhibits exploratory nature where the hypotheses “Samocat kick-scooter sharing solves the last mile problem” is being tested. The pilot project can be identified as “service as a case” where a certain sociotechnical system is serving the locals’ last mile transport needs. The service exhibits sociotechnical behaviour as the first layer of interaction being mobile application interface and the second layer being automated kick-scooter station itself, following by the third layer where kick-scooters provide commuting medium. The kick-scooter sharing pilot was a social experiment that requires user feedback, behaviour observation, interviews and trip analysis in order to answer research questions which were approached by both qualitative and quantitative methods due to their nature. The required data could be categorised according to the research method as below:

Quantitative: Pilot data calculation

- Ride time, ride frequency, most common ride, most popular station, most popular time range.
- Cost projections in the context of overall business model

Qualitative

- User interviews
- Service provider interviews
- Analysing documents such as agreements, emails, minutes of meeting and proposals
- Helpline data analysis (user adaptation and user experience)

Overall, the research was inductive in nature as the concept was new and findings during the research could lead to re-defining the problem making the process iterative. Method of constant comparison (Glaser and Strauss, 1967) has been used due to the possibility that the new data could give useful information when compared with previously- collected data.

3.3 Material and methods

3.3.1 Data

Samocat sharing case being the primary research reference has been the main source of data. Samocat sharing IT cloud generated data from two sources, kick-scooter stations and mobile application. Kick-scooter stations were responsible for generating data regarding kick-scooter availability, ride start, ride end and stations online/offline status. On the other hand, mobile application collected data regarding the user registration and payments. The data was available on Samocat back-end server in raw form being quantitative in nature. Users had an option to contact Samocat helpline via a mobile application in the forms of Facebook chat and email. Complementing that, a dedicated helpline number was available that worked 24 X 7. The Number of calls, the duration and chat/email content data were collected in their dedicated service pages. Service agreements, contracts and emails with partners, proposal papers, marketing material and research plans formed a great data pool being qualitative in nature. Another source of qualitative data came from end users as their behaviour and experiences are most crucial in answering the research questions. As a researcher, being present throughout the pilot and observing stakeholder collaboration process, user behaviours and service feedback as well as daily operations observations notes have generated another significant data source.

3.3.2 Data collection

Taking the pilot project from commencement to conclusion, data collection is explained in the same sequential order. Documents available from Samocat sharing were ordered in sets such as Samocat proposal presentation and paper in one set, following by service agreement and contract in another set. Partners' minutes of meeting and emails followed by research plan for TEKES and marketing material had their own separate sets. ([Appendix 4](#))

To get insights regarding user behaviour and experience, interaction and user feedback were quintessential elements. A survey consisting of 12 questions was formulated covering seven categories namely User Information, Marketing, User experience, Service feedback, CMS ecosystem, Business model and Expansion. The survey link was sent to registered Samocat users via text message. 54 responses were received out of 217 users, registering 25% reach ([Appendix 5](#)).

Though the user survey covered most of the areas under the scope of this research, to understand user desires on a deeper level, two interviews were conducted, one with a frequent user and another with a first-time user.

To understand Samocat sharing's vision, their personal experience and future possibilities that emerged from the pilot, deep interviews with CEO Vasilii Bykov and co-founder Sergej Pisarenko were conducted. All the interviews were conducted in a traveller approach (Kvale, 1996) by going along with the questions and exploring the research topic jointly, but at times miner approach (Kvale, 1996) was applied when the interesting points arose during the interview and could lead to important data ([Appendix 6](#)). Due to the lack of centralized data hub, helpline data that consisted of texts and email received had to be collected from direct sources such as Facebook pages, company helpline emails and direct calls. Direct calls as well as face to face interaction with users during operation were transcribed and altogether kept in a data pool. According to the themes such as User experience, technical issues and future possibilities ([Appendix7](#)) helpline data was collected and categorised ([Appendix 8](#)).

Samocat sharing backend collected all trip statistics and user information data in fairly fragmented way which needed to be combined in one pool in order to be analysed ([Appendix 6](#), [Appendix 9](#)). Each research question associates with certain (One or many) data sets. Data sets are as per Venn diagram in *Figure 13*.

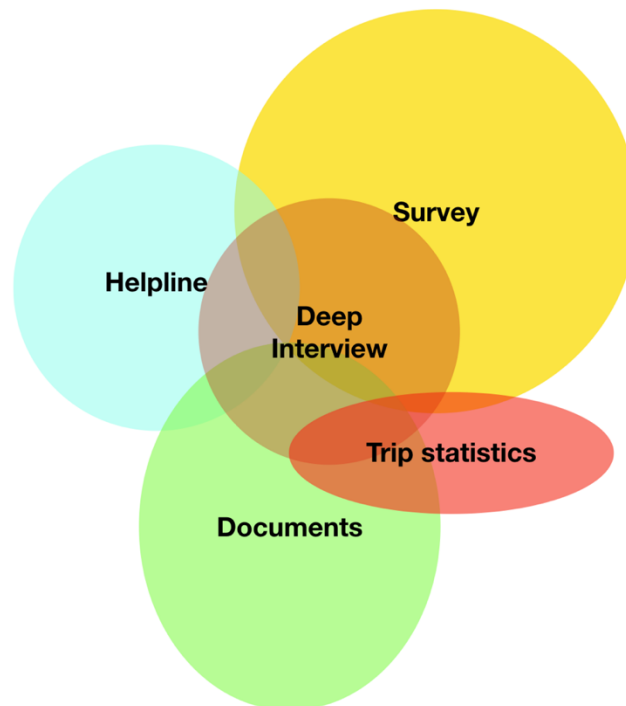


Figure 13. Data sets and their relationship with each other

3.3.3 Data analysis

Data from documents was straightforward such as dates of commencement of a certain operation, Samocat and partners combined goals, financials from agreement etc. The number of stations, kick-scooters allocated, and the exact location of the kick-scooter station was revealed through the planning documents. These documents helped in further analysing current and future financial projections. From the survey responses, open comments by the users were recorded in Microsoft excel spreadsheet under the themes they fit into. Interview insights were captured in the same manner following by helpline data. This data then got combined according to their relevant themes as was done earlier and duplicate comments were numbered according to their repetition so higher number could be prioritized. This data analysis gave useful insights related to operations and especially mobile application improvements that are required. Most of the issues were rectified during the pilot itself with few major issues being fixed now. ([Appendix 10](#))

Samocat backend server is capable of collecting a lot of information but being in early stage and lacking some crucial features, most of the data analysis needed to be done manually. Overall raw station trip data was imported into an excel spreadsheet and unnecessary columns were omitted. Further, individual spreadsheets were assigned for each station due to the traffic in certain stations being relatively higher than others which helped analyse the reason for certain user flow. After placing defined filters, the main spreadsheet

generated the following data ([Appendix 6](#)): Total number of registered users, total number of rides, average ride time and the number of rides according to time of the day ([Appendix 13](#)). Separate station spreadsheets generated the following data: rides completed from origin to destination ([Appendix 9](#)) and most popular station (Maximum number of rides) ([Appendix 11](#)). Pie charts and column charts were used to visualise the quantitative data more clearly.

3.4 Research procedure

The research was exploratory in nature. The research plan was focused on the kick-scooter pilot and the overall pilot duration including the planning phase has been used for data collection more specifically, trip data and helpline calls and chats. During this period, in addition to data collection, theoretical aspects of MaaS specifically first/last mile transport was studied followed by user behaviour and experience. Particularly, data collection had a constant pace as each week's ride and user data was collected at the end of that week. During the last phase of the pilot, the user survey was distributed among registered users following by two user interviews. After the conclusion of the pilot, interviews with Samocat sharing's two founders were conducted to get their opinion on the pilot results and overall pilot journey. Data collected from above mentioned methods was analysed in the context of research questions which then lead to findings.

4. Findings

After collecting the data, the different data sources and analysing them, findings have been categorised according to research questions.

RQ1: How to utilise the collaboration of stakeholders in designing and implementing the kick-scooter sharing service?

RQ2: What are the requirements for designing and implementing a last mile transport business model for kick-scooters service?

RQ3: How is the user behaviour and experience throughout the user journey?

4.1 Stakeholder collaboration in designing the service concept to implementation

WWF strategies unit define stakeholder as any person, group, or institution that— positively or negatively— affects or is affected by a particular issue or outcome (WWF, Ecoregional Conservation Strategies Unit, 2000). Further explanation, according to Freeman et al. (2010, p. 24) is given as: “Business can be understood as a set of relationships among groups which have a stake [hence, stakeholder] in the activities that make up the business. Business is about how customers, suppliers, employees, financiers (stockholders, bondholders, banks, etc.), communities, and managers interact and create value. To understand a business is to know how these relationships work. Samocat sharing, being an early stage start-up getting its foot in a completely new environment needed to establish trust and transparency with all the stakeholders since the beginning. Samocat’s kick-scooter sharing directly deals with government, University and end users covering all the major business areas B2G, B2B & B2C. Samocat has identified three key steps before the start of the pilot for a successful stakeholder collaboration (*Figure 14*).

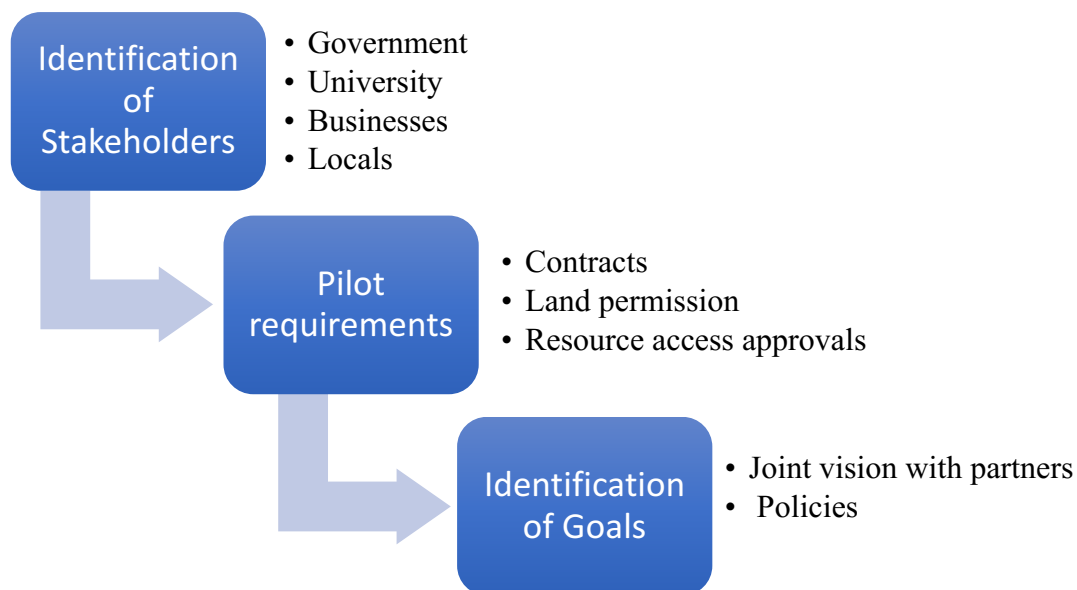


Figure 14. Steps for a successful stakeholders’ collaboration

4.1.1 Identification of stakeholders

The nature of contract and provided service were organised in such a way that Samocat had multiple partners and user groups. To have a fruitful relationship, it was important to know the stakeholders' expectations and needs closely. Keeping the pilot scope in mind, most important stakeholders are categorised as follows:

- B2G: City of Espoo, TEKES
- B2B: Aalto campus and real state (ACRE), Aalto university student union (AYY), Urban Mill, Helsinki business Hub, Nearby corporates
- B2C: Aalto university students, staff, visitors, High school students, corporate employees.

Suppliers: Manufacturing facility in Kaliningrad, Russia and electronic part supplier from China and a kick-scooter supplier from Sweden.

4.1.2 Pilot requirements

Samocat sharing kick-scooter stations needed to be installed on public or private places according to the location selected which required a certain amount of permissions and approvals from authorities and land owners. The foremost step was to sign a contract with related authorities which covers following points:

- Length of the pilot
- Number of stations
- Number of kick-scooters
- Amount of funding assigned
- Expectation from company
- Final report requirement

After the contract signing, the next step was to find the suitable locations to place the stations. For this, meetings with ACRE and City of Espoo were arranged following by field visits. After careful investigation of the user traffic in selected routes and building around Aalto campus, six locations were selected.

4.1.3 Identification of goals

After discussion with all the partners, the goal for the pilot project were agreed as follow:

- Identify potential user groups and their needs. (Ideal value proposition)
- Monitoring trip statistics and routes to further validate plans for the expansion of the project in other areas
- Developing a suitable business model for the system
- Identifying policy and regulatory framework from the EU perspective to help transforming the pilot into a sustainable and systematic service.

Looking at the timeline of the pilot, between 22.06.2017 to 22.07.2017, the above-mentioned steps were completed. A point to be mentioned here is that the agreement was signed between ACRE, City of Espoo (who paid the initial amount for the manufacturing of kick-scooter stations) and Samocat sharing, whereas TEKES came into picture later when applied research funding got approved.

The biggest challenge of Samocat sharing was giving the exact time to partners about when the kick-scooter stations will be installed. ("Interview with CEO, Samocat Sharing", 2017) Other issues were as follows:

- Few parts coming from abroad had to go through custom clearance that can take quite a long time.
- Without the prepayment received from the partners, it would be hard to start the manufacturing as a prior order requires to start the manufacturing.
- Urban mill, Espoo office being the assembly hub was expecting stations from Kaliningrad and kick-scooters from Sweden which was making it hard to plan the installation ("Interview with CEO, Samocat Sharing", 2017).

4.2 Requirements for designing and implementing Samocat sharing business model

4.2.1 Samocat model of provision

As shown in Figure 4 about MaaS ecosystem actors, Samocat sharing's role is as a Mobility service provider. The diagram shows the overall functioning actors who would complete the combined mobility services (CMS) ecosystem. By looking at the Samocat sharing service ecosystem, we can see many elements already present within the service such as a platform service provider (Amazon cloud services) supporting the mobile application and cloud architecture as well as mobility manager, which in this case are City of Espoo and ACRE.

The current model of provision for Samocat falls under many categories. As the bicycle sharing model has been a constant source of comparison in this research, taking example from the theoretical review part, from Demario's multiple model of provision, **Transport agency model** would describe Samocat best. Being partners with City of Espoo (City government) who provided the space for station installation and financial aid to cover the operational cost whereas Samocat was responsible for the whole operations and services which gives it a **Quasi-governmental** organisation structure.

Aalto campus and real estate (ACRE) and Aalto university student union (AYY) were the partners as well providing similar means as City of Espoo, whereas the primary users were Aalto University students covering 70% of overall users according to the survey data and second in the list is Aalto university staff being 18% of the overall users. Since the University did not operate the service, it cannot be a complete **University model** but partially it sticks to most of the characteristics.

The overall aim of the pilot was to test the feasibility of the kick-scooter service and get maximum user engagement in contrast to a typical bike sharing service. The profit aim was completely neglected by keeping the ride costs to almost negligible which puts Samocat into the category of **Non-profit model** as well. As seen above, Samocat sharing model of provision is a **Hybrid model** taking certain characteristics from many models.

4.2.2 Current Samocat Business model; Similarities & differences with UbiGo service

As highlighted in the theoretical review part, it is tricky to give a straightforward business model for a MaaS service due to multiple variables. Though the basic elements of any business never change, i.e. customer value proposition, market segment, revenue model, growth model and at the core of these, capabilities (Afuah, 2014). Being detailed and comprehensive, Osterwalder business model canvas (Osterwalder & Pigneur, 2010) was

used. Though by practice a kick-scooter sharing service is fairly similar to bike sharing system as highlighted in the theoretical review part, the biggest bike sharing giants Ofo and Mobike do not possess a sustainable business model. The whole operation is extremely influenced by investment funds and having maximum users is the priority, keeping the ride price as low as \$0.07 per half-hour (Skift, 2018). Due to this reason, a fair comparison in business models could be drawn between Samocat current business model and UbiGo business model explained in the theoretical review part. UbiGo service, being at the same geographical location, i.e Scandinavia (Sweden) as Samocat sharing (Finland) as well as both of the projects being limited time period MaaS offerings made the comparison more practical.

Table 3. Samocat sharing business model

Key Partners <ul style="list-style-type: none"> • ACRE • AYY • City of Espoo • Helsinki Business hub • TEKES • Urban mill 	Key Activities <ul style="list-style-type: none"> • 24 X 7 kick-scooter renting • Customer query response • IT Development • On field technical troubleshooting 	Value Proposition <ul style="list-style-type: none"> • Economic, flexible and most compact last mile transport solution • Widespread station locations to move around quickly in the campus • Flexibility to use with Metro, bus, and tram • Up to six time more economic than bike sharing (kick-scooter stations vs bike sharing stations) 	Customer Relationships <ul style="list-style-type: none"> • Social media (Facebook/Instagram) • Feedback through Email/App 	Customer Segments <ul style="list-style-type: none"> • ACRE • AYY • City of Espoo • University Students • University Staff • Visitors • High school students • Otaniemi local residents
Cost Structure <ul style="list-style-type: none"> • Station manufacturing • Parts • Office space • Logistics • Key personnel • Support • IT platform license/ Operation 	Key Resources <ul style="list-style-type: none"> • On field technical support • Station and Ride status/statistics • Helpline • ACRE/AYY/ City of Espoo 		Channels <ul style="list-style-type: none"> • Mobile App (Register, pay, check, info) • Helpline support • Website 	
		Revenue Streams <ul style="list-style-type: none"> • Renting fee 		

The UbiGo service is in many ways is different from the Samocat Kick-scooter service but if we look at the place of both services in MaaS ecosystem, they would fit into mobility service provider group. Due to this reason, keeping a generalised MaaS business model as parameter, comparisons were drawn. Key activities and key resources are the essentials for value proposition which is relatively different, as Samocat specifically deal with only kick-scooter sharing. Finding differences here would be detrimental for the scope of this thesis as nature of contract was the main driving force for Samocat. Looking at the customer segment, keeping in mind both services provide mobility solutions, Samocat had only focused on University students, staff and nearby high school students. On the other hand, UbiGo’s customer segment clearly engaged urban households as well as businesses where both presented customer loyalty as well as high profit margins. Looking at the Channels, Samocat as well as

UbiGo had great reach through different sources of communication. Cost structure once again heavily depend on key activities which were different for both services.

Though, the most interesting part of the comparison came through Customer relationships and Revenue streams. Samocat clearly had less customer relationships than UbiGo, specially subscription bonuses and travel warranty which are known to be highly demanded as seen from Uber, Kyyti and Whim. For the revenue stream, UbiGo could rely on revenues from service margin, business add-ons, interests and franchise fees whereas Samocat was solely focused on only renting fees. It is necessary for Samocat to look for a for-profit model of provision in future as completely relying on partners and investors for the operations cost is highly risky and demotivating for all involved parties. ("Interview with CEO, Samocat Sharing", 2017)

4.2.3 Required modifications in the business model

Taking our learnings from the theoretical review, a business can only be called successful if the business is sustainable. The most important factor in being sustainable is making profit. A profit can have multiple definitions for different organisations but in case of Samocat, as mentioned by the company in their proposal presentation and reports, profit is, covering all incurred costs and having substantial amount for near future expansion.

1. Key partners

MaaS ecosystem has multiple players making the system complex but at the same time it presents multiple opportunities of partnerships as well. Mobility service providers have been growing in numbers around the globe, specifically in Scandinavia. In Helsinki, two big players, Whim and Kyyti are fairly popular, with their services growing to other cities and even outside Finland in near future. In Samocat pilot, there was no marketing during the beginning of the pilot and during later stage social media marketing and pamphlets, posters and table triangles were used to spread the word. The point is important to mention here because when asked in the interview about how the users got aware by Samocat services, 83% answered, by seeing the station following by through a friend, 18.9%.

It strongly gives an idea that probably a more effective way for marketing could be an association with MaaS providers who could help bring their customer base to Samocat and in return, they get to add another service layer (last mile transport) in their already existing services. Also, it is crucial for Samocat sharing to partner with city administrations wherever they plan to expand as it makes the whole approval process easier. ("Interview with Sergej, Business manager Samocat Sharing", 2017)

2. Customer segment

As seen from the UbiGo business model, to be a widespread MaaS provider, it is crucial to target urban households and businesses. If Samocat kick-scooter station could be installed near a corporate park where multiple businesses are functioning, Samocat can start negotiations with the corporate to give packages to their employees so they can reach to nearest bus/metro station quickly. It can provide stable funds for Samocat and at the same time bigger user base. Same principles can be applied to households where Samocat can find suitable places to install kick scooter stations in an urban locality where kids can use the kick-scooter to go to school/nearest bus station as Samocat kick-scooter can be used by kids in and over the age of 10 yrs. Parents can use them for the same purpose and a family package can be provided.

3. Revenue stream

As calculated in the data analysis part, for fulfilling the calculated user needs, Samocat sharing requires 310,000€. As per the findings, it can be estimated which sources can help bring this amount. The first and foremost source of revenue is riding fees. When asked about the eagerness to go with a subscription, 48.1% of the survey answers were positive and when asked about the best subscription option for a user, 34.2% chose 10€/month and 36.8% chose paying for each ride. This clearly showed users were open for a subscription package as well as most of them want to pay per ride. Samocat can introduce a pricing model with multiple options where daily commuters can choose an option of season pass, which many users asked to be lowered in the survey being 39€/season, which was inspired by HSL city bikes could be 25€/season with first 15 min free on every ride or they can choose to pay each month 10€ or pay for each ride as 4c/min. The idea is to include flexibility, the most important feature of intelligent mobility, for users in the pricing where users choose according to their needs. Another source of revenue could be from sponsorships. As can be seen in many city bikes around the globe as well as with HSL city bikes, Alepa, a well know Finnish grocery store sponsors city bikes. The advantages for sponsors are to get visibility through advertisements as the city bikes station are in public places and when bike moves around it catches greater visibility. Samocat kick-scooter stations are in well accessed public places and kick-scooters also can be used for advertisements. Sponsors can cover a great amount of operations cost as advertisements in general are fairly expensive and with more stations, a substantial amount can be quoted.

4.3 User behaviour and experience

4.3.1 User needs

The starting point of experience-centered design should be user needs that are linked with emotions. An experience itself can be categorized by primary and universal needs they fulfil with user experience being always situational (Hassenzahl et al., 2010). It is vital for a mobility service to fulfil user needs. Specially in case of Samocat, where the service is one of its own kind and 33.3% users have no experience in using similar service elsewhere as per the survey.

Aalto university campus being fairly big consists of many blind transport spots, meaning areas where public transport does not reach. For a local resident, it takes quite a while to reach to the nearest bus stop/metro station. The only way to commute between different buildings is walking. During the user interview both of the user agreed with this issue and told the main motive for them was lack of any mode of transport to move around. During a casual conversation with many users, especially with new students, they said that bicycles are fairly expensive and kick-scooters being available helped them commute around the campus. 31.5% of the users chose to use kick-scooters to save time whereas 35.2% were those who wanted to have fun as well as save time. This clearly showed the need of having a last mile transport service in Otaniemi. Taking learnings from the theoretical review part, to achieve a target behaviour, motivation and users' ability are the key (Fogg, 2009).

4.3.2 Motivation

20.4% of users said that the main reason to use the Samocat service for them was pure fun, whereas 31.5% chose “to save time”. Those who chose both above options are 35.2%. Whereas remaining 12.9% in open comments hinted as they were curious how it works. All of these factors suggest that users were intrinsically motivated.

Another question from the survey that enquired how the users came to know about Samocat sharing service the total of 20.8% users chose “through a friend or colleague”, making their motivation as introjection, extrinsic in nature. This is defined by Fogg (2009) as social acceptance/rejection. 83% of the users responded with “By seeing the station”, which showed their curiosity towards the service, making it an intrinsic motivation. By seeing the data, it could be estimated that Samocat sharing services have scored fairly high in motivation axis.

Though, there are certain fields which would help Samocat more. As mentioned in the findings for the business model section, user subscription and offers could generate extrinsic motivation, specifically external regulation. Also, having schemes such as a limited time period offer for free rides could generate hope/fear motivation as the users would not want to miss the offer, they would register and use the service.

4.3.3 Ability

When asked if the users have used a similar service elsewhere, 66.7% answered yes. This showed that users were familiar with mobile application-based renting services as well as locking and unlocking of doc-based system as most of the bike sharing services are doc based and 88% of the users have used bike sharing out of the above-mentioned number.

(Important point to mention here is that there is a high probability that certain users were highly motivated to use the service but due to mobile app-based interface, which could have been difficult for them, they might have decided to not use the service. This data is hard to collect as the survey is taken from the registered users who have used the service. But considering active use of smartphone and many service dependencies on the mobile app ecosystem at present time, it could be assumed that the numbers would be fairly low.)

Another question was asked about instructions of the service to a user in the mobile app and info board regarding their clarity where 80% responded answered with a yes and 12.7% as maybe. Above mentioned data goes in favour of higher ability, but there is another important data set, data set 4, collected from Helpline calls and emails.

Looking at the physical layout issues, most of the users had issues folding the kick-scooters. Few users experienced issues during locking. Technical issues such as weak internet connectivity delayed the locking and users would not hear the unlocking beep. Also, a battery drains due to excess use of a certain station created problems while returning the scooter. Mobile application was not available for all the countries app/play store which restricted the app download, ultimately users are not able to use the service. Few users faced issues in receiving SMS code for registration. These issues restricted certain users to use the service and ultimately even demotivating them. It can be stated that Samocat service scores somewhere between low and high ability forcing the target behaviour of kick-scooter users to fall short (*Figure 9*).

In order to maintain user ability close to the ideal, following step could be taken:

- Mobile application and station info board can include clearer instruction for folding kick-scooters.
- Mobile application should be accessible from all regions’ app/play stores.

- Station connectivity can be optimised by utilising higher speed internet plans.
- Spare battery option could help in case primary battery drains out.

4.3.4 User behaviour

Theory of reasoned action explained that first time user experience can act as a chain reaction, as the users will take that feeling and explain to their colleagues/co-workers who will generate a positive attitude towards the service and will be in a positive mind-set while performing the behaviour. Integrated behavioural model explains the combined factors of TRA and TBP. The personal agency (*Figure 11*) factor, can generate the intention to perform the behaviour by self- efficacy. This theory could be applied when we look at the data for the frequency of top 20 Samocat users. Rides being in 30s and 20s shows that users have used the service on a regular basis considering the pilot length, weather conditions that according to data have been fairly irregular due to rain and snow for continuous weeks. Most number of rides, 379, have been from Otakaari 18 station, following by Alvar Aalto park (236) and Aalto university east entrance (153). Otakaari 18 building is at the start of student residency Teekkarikylä, home to thousands of Aalto university students where the frequency of buses was limited and due to single bus route, they were not ideal for going around the campus. Onto further analysis of the rides from Otakaari 18 station, it could be seen that 30.2% rides were from Otakaari 18 to Alvar Aalto park, also the front side of Aalto university library, is the main bus station for taking regional buses. 24.5% rides were from Otakaari 18 to Otakaari 18 itself. There could be two main reasons for that. One, students were curious and tried the kick-scooter service. They just rolled them around and then put them at the same place. Second, Teekkarikylä is fairly big in area and the only way to go around is walking, so it could be assumed that users used kick-scooters to commute around such as meeting friends, picking up some small stuff etc. The third most used ride is from Otakaari 18 to Aalto university east entrance which is the east side of main Aalto building. Most of the classrooms are around this building as well as its easier to go to other buildings from the main building. The same can be seen from other stations as well. Highest share of rides has been finished at Otakaari 18, home of many students. Looking at the graph of no. of rides according to time of the day, rides have been completed throughout the day with the time period 10:00 to 13:00 recording most number of rides, following by 16:00 to 19:00. These time ranges are common for going and coming back from university. This clearly showed that kick-scooters more or less have been adapted as a natural mode of transport by the users.

Another interesting data was from helpline phone calls and emails. In total there were 30 phone calls and around 20- 25 emails. Facebook chat has been also used as helpline. Looking at the trend of the number of calls and email/chats, the numbers decreased significantly from the beginning till the end of pilot. It clearly shows that users understood the unlocking, folding and returning mechanism as well as mobile app interface once they got the habit of using it. Most of the users requested for kick-scooter stations in specific places, not only in Otaniemi but in Espoo and Helsinki as well, showing the usefulness of the service from users' point of view.

4.3.5 User experience

Users have rated their overall user experience as good with different service within the kick-scooter service. Kick-scooter riding experience have been very good, station usability has been very good too. Helpline experience has been good whereas mobile application experience has gained a mix of good and satisfactory vote. Talking about helpline data, users had issues with folding the scooter and with understanding the instructions through mobile

app and station info panel but as mentioned, the complaints were reduced after users understood the mechanism. With a service that is one of its own, it would always face such challenge, still, information panel could add more detailed instruction as well as mobile application can be more interactive and informative. The overall user experience has been rated positive by 50.9% users followed by 19% users rated ride experience as positive. On the other hand, 35.9% users have rated mobile app experience as negative followed by 28.2% user rated user experience negative for the lack of station.

The latter was a rather positive sign that users want more stations and showed the need of the service. Mobile application being the predominant factor for user experience in most of the MaaS offerings, exhibits the same effects for Samocat sharing as well. Rectifying the issues mentioned in data analysis regarding the mobile application could help greatly in the overall user experience.

4.4 MaaS integration

Though Samocat kick-scooter sharing service is in the development phase and the aim of the pilot was to test the system in real life conditions, it is important to see how complete the service is so far and what would be needed in order to be an ideal MaaS provider.

MaaS integration index” proposed by Kamargianni et al. (2016) focuses on the CMS provider’s success rate elements:

- TI score: for ticket integration; Kick-scooter sharing being a standalone service operated by Samocat sharing would get a score 1 here.
- PI score: for payment integration, Samocat does include the credit card integration to pay for all expenses, giving it a score of 1.
- JP score: Journey planning is not the feature in the mobile app.
- B score: Booking feature is not in the Samocat service portfolio.
- MI score: Users do get options to choose time period according to their mobility needs, giving it a score of 1.

The overall MaaS integration index is 3 for Samocat sharing.

5. Discussion and conclusions

5.1 Theoretical and practical implications

Samocat sharing kick-scooter service has provided the opportunity to analyse a last mile transport service in the form of its pilot project in Espoo, Finland. From its commencement to conclusion, finding out critical factors a last mile transport service needs and testing the hypotheses “Samocat kick-scooter sharing solves the last mile problem” has been the core of this research. Looking at the outcomes from the pilot, it could be concluded that with a user reach of 217 and 969 rides completed in fairly short period of time, the service has been accepted by the users. With stations Otakaari 18, Alvar Aalto park and Aalto university east entrance being most popular in the sequential order, shows the natural flow of traffic where user used the service to reach to nearest bus station and vice versa to their apartments/ university building. Proving the hypothesis “Samocat kick-scooter sharing solves the last mile problem” right. The generated theoretical framework named as “Hierarchical MaaS framework” has helped in the analysis of Samocat sharing kick-scooter service by scrutinizing the service into five different levels. The findings revealed additional features and modification the service needs for better user experience and MaaS integration in order to be a true last mile MaaS provider.

The hierarchical MaaS framework generated in the study could help other new last mile MaaS players to move towards more sustainable businesses and most importantly, towards the ideal state of a true last mile transport. Successful stakeholder collaboration is vital in developing MaaS and the findings in *Figure 14* could work as a foundation of detailed theories regarding stakeholders’ role and collaboration in developing last mile services. Additionally, qualitative and quantitative data collected from the pilot could help in the research of behavioural change theories related to last mile transport.

On the practical side, user interviews, surveys and observation findings altogether can help Samocat sharing in creating a user centric, fluid and flawless kick-scooter sharing service. By utilising hierarchical MaaS framework, more specifically the evaluation level where Samocat sharing got MaaS integration index as 3 should in no mean exhibits the success rate of the service, but the availability of essential elements that make a service, MaaS. It has been asked by the users as well as being observed in other mobility services, booking is an important aspect of journey planning and introducing that feature could help Samocat in the overall integration.

Another point to mention is that having a partnership with existing mobility service providers, who are mentioned earlier as well, could help both the involving parties, as for the MaaS provider, kick-scooters could bring an extra TI score with a unique last mile transport solution and for Samocat, it would be an opportunity to be part of the bigger picture, getting many benefits such as user base and ICT integration as an addition.

5.2 Evaluation of the study

The study’s focus has been mostly on last mile transport service by taking Samocat sharing pilot as an example. Looking at the empirical section of the research, ten-week time period for the pilot is rather short to understand user behaviour and experience on a deeper level. Timing of the pilot considering weather conditions has disturbed the users’ natural commuting routine and up to certain level has influenced the data collection too. Focusing on the data collection, more user interviews following by partners’ interviews would have helped understand their perspective in a better way which was a challenge

considering the schedule and unavailability of the related parties. Focusing on the theoretical part, due to the newness of first/last mile problem, it was hard to find related theoretical material. Mobility as a service has research articles but the content has high discrepancy due to each having their own definitions and characteristics making it a challenge to come to a conclusion.

On the positive side, user surveys have been answered by 25% users, providing great insight and data pool. Transparency from Samocat sharing has helped in evaluating the emails and documents containing contracts and approvals which helped in filling the gap created by inability of taking partners interviews. The long realised last mile problem specifically considering huge Aalto university campus has helped in quick service popularity and high initial usage. Due to most of the users being students, user adaptation has been fairly quick in mitigating the challenge exerted by short duration of pilot.

5.3 Conclusion and future research challenges

Mobility as a service exhibits all the characteristics of a transportation game changer and with MaaS reaching every part of the globe, it is crucial they solve one of the most basic and long-realised problem related to commuting, i.e. the first/last mile problem. Not only for individuals, last mile problem costs metro cities millions of euros due to the fact most of the workforce is busy commuting, more private vehicles cause traffic jams, logistics and emergency services being affected causing an overall productivity loss. Having limited last mile transport solutions have restricted researches into this area. Bike sharing being one of the few solutions, has been on an exponential rise in recent years. They are fairly close when it comes to solve last mile problem but due to station size, the cost of the setup and for station less systems, low return on investment are few of the multiple challenges. Samocat sharing kick-scooter service claims to be the lost piece in the last mile MaaS puzzle. Three-month pilot in Otaniemi, Espoo around Aalto university campus has generated a lot of attention throughout Aalto media communication, among mobility researchers and specially among local residents. The pilot has been able to attract 217 users with 969 rides completed, considering the weather conditions at this time of the year. Six stations at major locations had served 40 kick-scooters 24 X 7. Overall adaptation of the service has been fairly natural among local residents consisting of students, University staff, visitors and nearby High-school students. Most famous stations being the one near two main bus stations around Aalto university showing the synergistic effect which such service can bring with other mode of transports. The research findings confirm that Samocat sharing contains all the elements that are needed in order to be an ideal mobility service provider and becoming an integral part of MaaS ecosystem, though there are certain hurdles that needs to be overcome.

First and foremost, is the user experience. Overall, users have been positive about the UX including physical layout and riding experience. Mobile application is a field where Samocat needs to work hard as the service is one of its own kind and due to the difference in operating mechanism, it can present certain ability barriers for motivated users. Issues has been collected through this research and have been presented to Samocat.

Second factor is business model for Samocat. Current business model is solely designed keeping pilot in mind but for a sustainable business, pricing model needs to be redesigned. Most important point here is having collaborations with sponsors and MaaS providers to bring financial means as well as users who would fulfil it partially. Having a flexible pricing model that suits most of the user needs is vital keeping offers and exclusive deals as sales catalysts.

Third factor is marketing. At the start of pilot, Samocat went with the strategy “install and forget” where users come to know about the service when they see. For a fitting launch of the service, it is vital that Samocat create an attractive marketing plan to involve as many users as possible and highlight the pricing model and subscription benefits transparently. The aim of the research has been to highlight MaaS features and what are the factors a mobility service provider should consider by meeting user needs specially if they are into first/last mile transport category by analysing Samocat sharing pilot project. User behaviour will always be a deciding factor for the success of such services and understanding the factors that influence it could help a new player.

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Appendices

Appendix 1: Samocat sharing station picture

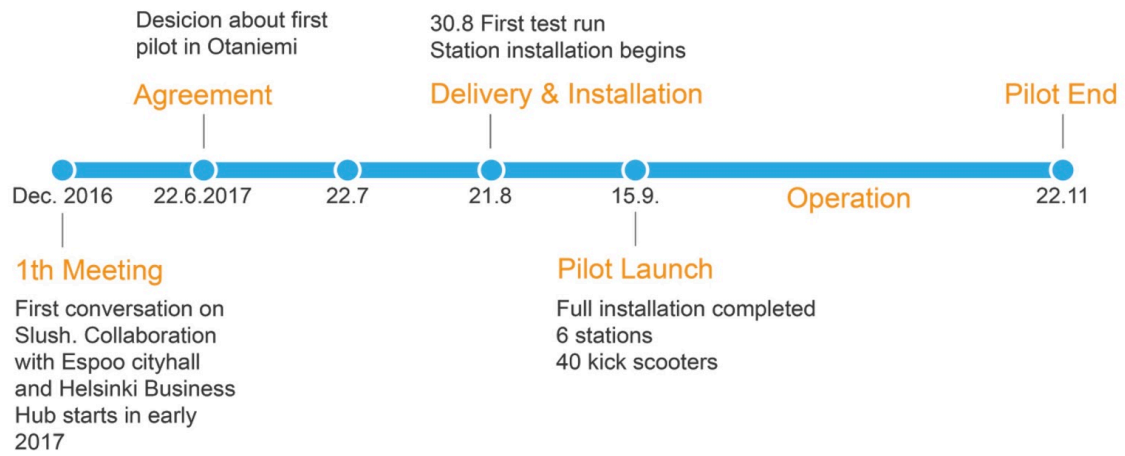


Two sided Samocat sharing kick-scooter station Aalto University East entrance station

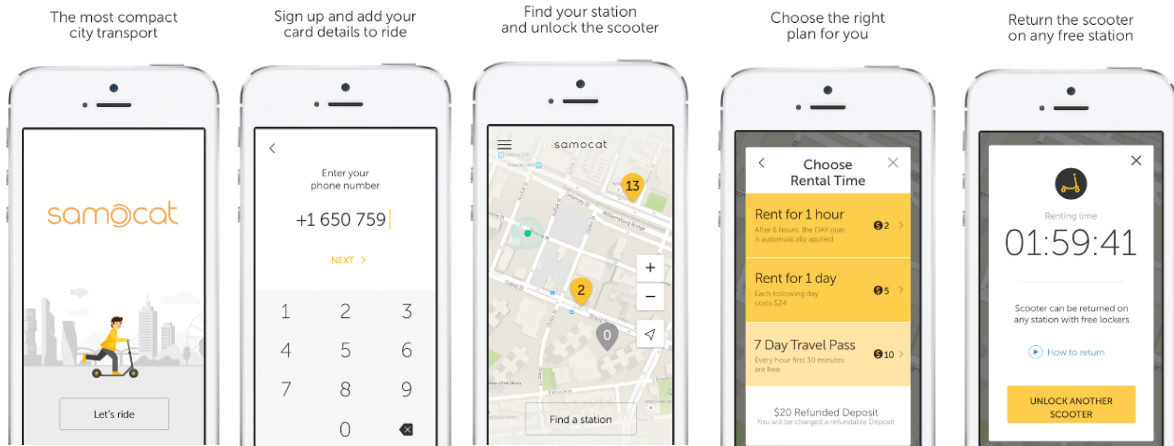


One sided station, Alvar Aalto park

Appendix 2: Samocat sharing pilot timeline



Appendix 3: Samocat mobile app interface



A typical samocat sharing mobile app layout for IOS

Appendix 4: Documents data

List of analysed documents:

Set 1

- Proposal paper and presentation

Set 2

- Contract with ACRE and City of Espoo
- Station location approval from ACRE
- Station location approval from City of Espoo

Set 3

- Emails with partners
- Minutes of meetings

Set 4

- TEKES research plan
- Marketing material

Data from proposal paper and marketing material regarding pricing:

Pre-pilot pricing model: Having roots from Russian market, company stick with the pricing model that was a hybrid between Russian mobility services and EU bicycle sharing services. The idea was that a new user will pay 20€ deposit fee which would be refundable when the user returns the kick-scooter. Each ride will cost 2€/hour with first 15 minutes being free of charge. Every hour after that would be +2€.

User will have option to rent for the whole day (8€) or even for the whole week (20€).

As highlighted in the theoretical review part, bike sharing companies adheres to similar model with ride cost and time being different in different countries and areas.

The model was about to be implemented but during the partners meeting, it was agreed that the pricing of 2€/hr might be too high for students who were estimated to be the majority of the users. Comparing with regular student one region single bus ticket which costs 1,10 € the price was double. These factors influenced Samocat to modify the pricing.

First implemented pricing model: The pilot started with the following pricing model:

Refundable security deposit: 20€

Free ride time: 30 min

Ride price: 1€/hr

Each extra hour: +1€

Whole day: 8€

Whole Week: 20€

The first iteration was about the riding price being reduced to half, at 1€/hr, making it cheaper than any available commute. In the partners meeting, it was also discussed that it is important to have the maximum user engagement, and for that to make the pricing attractive and more affordable, free ride time on each ride was increased to double, 30 min/ ride.

For the first day of pilot, this pricing model was used.

Looking at the backend data it is found that there was only one completely functioning station for the first day which significantly held number of users using the service to a handful.

The pricing model being complete in its own still was not the final pricing model due to one major issue.

The payment system used in the mobile app platform was not able to sync well with Finnish banks, due to which, when few users took the kick-scooter and 20€ refundable security deposit got debited from their credit card, when the deposit got refunded after the ride, it took fairly long time to reflect back in their bank account.

According to the helpline data, one user received the money after two weeks.

Appendix 5: User survey

Category	Question	Data
User Information	Age group of respondents	18-22: 42.6% 23-27: 35.2% 28-35: 9.3% 35+: 13%
	Occupation of respondents	Aalto students: 70.4% Aalto Staff: 18.5% Student elsewhere: 9.3% Others: 1.9% (Entrepreneurs, Business advisors/High school students/ Employees)
	Have you used any similar service as Samocat elsewhere?	Yes: 66.7% No: 33.3%
	What was the similar service?	Bike sharing, EU and US: 33.3% HSL city bikes: 55.6% Drive now: 11.1%
Marketing	Awareness about Samocat sharing service	By seeing the station: 83% Through a friend: 18.9% Through social media: 1.9% Colleague: 1.9% Business contact: 1.9%
User experience	Did the user find instructions clear in Samocat sharing Mobile application / station information board?	Yes: 80% Maybe: 12.7% No: 7.3%
	If not, what could be changed?	<ul style="list-style-type: none"> • Returning instructions • Renting time (Free Vs Payable) • Refund details • Returning notification • Payment card registration should be more smooth • Scooter unlocking process should be more easy • Pricing information on the info panel vs mobile application (What to trust)

		<ul style="list-style-type: none"> Confusion between electric and manual, should be mentioned. 																														
	Main reason to use Samocat sharing service?	<p>To save time: 31.5%</p> <p>It's fun: 20.4%</p> <p>Both above options: 35.2%</p> <p>Miscellaneous: 12.9% (Wanted to try how it works/ Familiarise with the service)</p>																														
	Overall user experience with different services: (1: Extremely Good 2: Very Good 3: Good 4: Satisfactory 5: Bad)	<table border="1"> <caption>User Experience Ratings by Service</caption> <thead> <tr> <th>Service</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <td>Kick scooter riding</td> <td>8</td> <td>19</td> <td>12</td> <td>7</td> <td>8</td> </tr> <tr> <td>Station usability</td> <td>9</td> <td>18</td> <td>12</td> <td>9</td> <td>6</td> </tr> <tr> <td>Mobile application</td> <td>5</td> <td>12</td> <td>19</td> <td>15</td> <td>3</td> </tr> <tr> <td>Helpline</td> <td>5</td> <td>6</td> <td>31</td> <td>8</td> <td>4</td> </tr> </tbody> </table>	Service	1	2	3	4	5	Kick scooter riding	8	19	12	7	8	Station usability	9	18	12	9	6	Mobile application	5	12	19	15	3	Helpline	5	6	31	8	4
Service	1	2	3	4	5																											
Kick scooter riding	8	19	12	7	8																											
Station usability	9	18	12	9	6																											
Mobile application	5	12	19	15	3																											
Helpline	5	6	31	8	4																											
Service feedback	Positives from the service	<p>Overall User experience: 50.9%</p> <p>Ride experience: 19.3%</p> <p>Faster transport: 15.8%</p> <p>Economic: 14%</p>																														
	Negatives from the service	<p>Mobile app experience: 35.9%</p> <p>Lack of stations: 28.2%</p> <p>Ride experience: 20.5%</p> <p>Station usability: 15.4%</p>																														
CMS ecosystem	Willingness to use the service with Metro/Buses	<p>Positive: 75.9%</p> <p>Negative: 24.1%</p>																														
Business model	Willingness to pay a subscription fee for the service	<p>Yes: 48.1%</p> <p>No: 51.9%</p>																														
	Best subscription option for the user	<ul style="list-style-type: none"> 10€ per month (each ride less than 15 min free): 34.2% 15€ per month (each ride less than 30 min are free): 7.9% 39€ per season (each ride less than 20 min are free) : 21.1% I would prefer to pay for each ride 1€ without subscription: 36.8% 																														

Expansion	Places where users would like to see next stations	TUAS/CS building: 22.6% Metro entrance: 20.8% Servin Meijän: 18.9% Tapiola: 7.5% Kampii:7.5% Alepa Otaniemi: 5.7% Leppävaara: 5.7% Unisports Otaniemi: 3.8% Chem Engg Building: 3.8% Matinkylä: 1.9% Ruolahti: 1.9%
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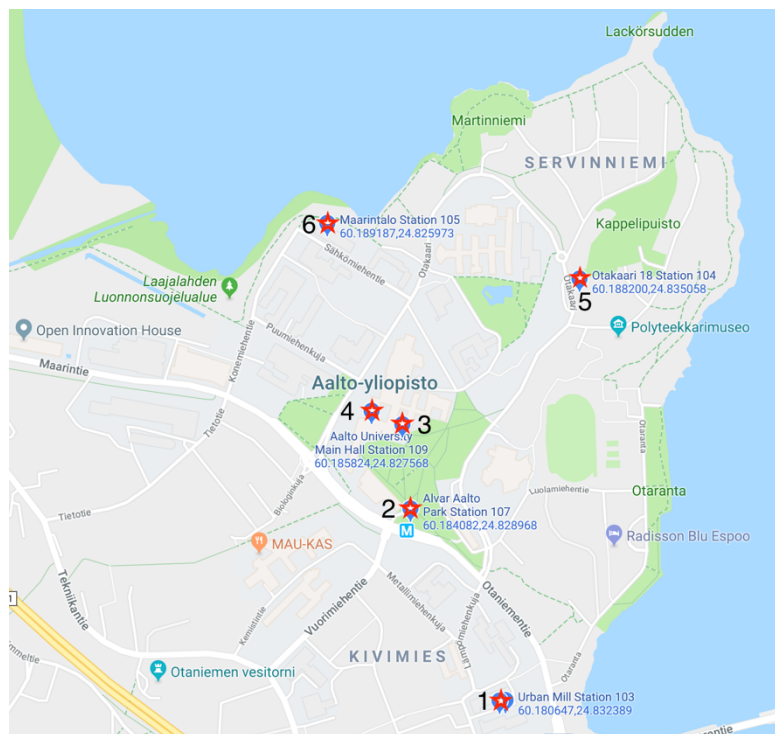
Open comments by the users:

- Cents/Minute would be ideal.
- Subscriptions are too expensive as compare to HSL city bikes.
- It should be integrated to HSL travel card.
- Season pass is the best option but should be cheaper.
- Unclear subscription scheme.
- Should have subscription fee as well as per ride charge.
- Should have free riding period.
- Electric kick-scooter would be great.
- Amazing idea. Keep it up.
- Hope it continues, was upset when scooters were no longer available.
- Availability is the key.

Appendix 6: Trip statistics

Total number of Kick-scooter stations	6
Total kick-scooter capacity	50
Total number of kick-scooters allocated	40
Total no of rides	969
Total no of registered users	217
Average ride time	11.8 Minutes
Average distance between stations	500 meters

Name and location map of kick-scooter stations in Otaniemi, Espoo:



- 1: Urban Mill (Station no. 103)**
Total no of rides: 62
- 2: Alvar Aalto park (Station no. 107)**
Total no of rides: 236
- 3: Aalto University east entrance (Station no. 108)**
Total no of rides: 153
- 4: Aalto University main hall (Station no. 109)**
Total no of rides: 48
- 5: Otakaari 18 (Station no. 104)**
Total no of rides: 379
- 6: Maarintalo (Station no. 105)**
Total no of rides: 93

Total no of Samocat mobile application downloads:

Android: 477 (Source: play store)
iOS: 210 (Source: iTunes/ app store)
687

Appendix 7: Interviews

Contains three deep interviews of Samocat sharing service users.
Interview questions were similar to the survey except more focused towards the user experience.

User A

(Aalto student, first time user, recently moved to Otaniemi, Looking forward for next year operation)

Moved to Otaniemi recently and don't have enough mode of transport to move around
Planned to purchase bicycle but since here for short time, does not bother.

Lack of returning places around Otaniemi.

Concerns me that I don't have enough time to return the scooter in nearby station.

Lives in Servin Meijan 12, saw a station Otakaari 18, which is on the way and another station is near the main building so makes it an ideal candidate to commute.

UX points

Tried to find the app and couldn't find. (Spelling mistake)

Took some time to load once installed, needed to restart the phone

Payment:

Problem in placing the card information as the page is not in a classic payment layout where everything from month and year as well as CVV are in different lines.

Stations showed offline, due to the fact that we stopped the operation and was troublesome for the user as they did not realise that is the system problem or connection problem.

First time experience with the app is really vital.

The lading problem should be fixed.

Payment service: Phone no etc. should be normal

The app logo should be more symbolic rather than giving a feeling of luxurious item, for example clearly mentioning the kick-scooter.

Decided to buy one of her own.

A monthly fee would be much better option.

Station design is great, scooter also looks great. Overall a well-made product.

Instructions were pretty clear.

Picture of the station would be great when you click on the station in mobile app.

QR code on the instruction panel would be great.

QR code scan for unlocking.

User B

(Aalto Student, Frequent user, lives in Otaniemi

2nd year in Aalto, moved to Otaniemi in Summer, July.

1: Lives in Otaniemi: Servin Meijan.

2: Uses kick-scooter almost every day/ alternative day/ multiple times a day:

3: Personal experience from mobile application to interaction with station (taking/ returning)

Don't have a bike. So, kick-scooter is interesting.

Otakaari 18 station the first one she saw.

First time used from Urban mill.

Did not face any difficulty in the app.

Scooter was not unlocking in Otakaari 18 in first few tries.

Did not used Kick-scooter recently only when she was kid.

First ride from Urban mill to Otakaari 18.

Difficulties with unfolding the kick scooter.

Folding was not difficult.

Used it as kind of a weekly commute.

Kick-scooter can surely save time.

From Otakaari 18 to Chemical Eng. building: walking 15 but kick-scooter 6 minutes.

Used it even in rain to not get wet.

Some station near TUAS would be interesting.

Amazing user experience, Mobile app is amazing.

Instructions on the station could be better.

Sergej Pisarenko Co-Founder, Business relations Samocat Sharing

Q: Why we decided to go with Helsinki/Espoo or Finland in general?

Finland is country where system is open for new things and piloting.

Q: Why ACRE/ City of Espoo as partners?

We started to work with Helsinki business hub and they connected us with City of Espoo and transport department (TRAFI).

After two meetings, we had all agreements that helped us to start this pilot in Espoo. In my opinion Espoo and ACRE are interested in conducting pilots on their territory

Q: Why we agreed to sign such kind of deal?

To start the pilot, you need two conditions. Availability of permits for station and budget. We negotiated with several cities in Russia. But the issue of permission to station stations was not solved. The city of Espoo quickly resolved the issue of permits for places and took over part of the expenses of this pilot.

Q: How easy was it as compare to previous experience if any?

The main issue in piloting is the placement permit. For example, in Moscow negotiations on documentation for piloting took more than a year and we did not have time to accommodate in the season of 2017.

Q: What was the time period to get the deal signed? (From proposal to sign)

If we speak about Espoo and this deal it took 3 meetings and started in March 2017 and we signed contract between 3 parties in 1 June

Q:How is the overall experience so far with partners here?

Overall experience was only positive. minimal presence of bureaucracy or its absence.

Q: Which was the most challenging part?

We have a very limited budget. We needed to make and put stations in Finland in a very short time and start work.

Q: Which went way beyond your expectation?

Only positive. Experience with organizations Espoo and Acre. The experience of piloting and the amount of use of the service adjusts only to a positive mood.

Vasilii Bykov, CEO, Samocat sharing

Q: How would you define Samocat sharing in one line?

The most compact public transport solving first and last mile problem.

Q: How do you see the future of Samocat sharing into the vast changing Mobility as a service field?

1B € company able to operate 200 cities with 200, 000 kick-scooters. Manual and electrical. 10% up to 50 %

Q: What were the biggest challenges before and during the pilot?

Before the pilot:

To produce station within 1 month and deliver through 3 borders China Russia EU

During pilot:

1. Banking system in Finland has a specific structure and it was hard to integrate the payment system.

2. Not enough time to attract users to switch to subscription model.

Q: Biggest learning from the pilot?

No of stations required to be sustainable and how to create a network of kick-scooters.

Q: How you see the pilot now since it is over?

The pilot was an amazing opportunity to test the system in real conditions and it exceeded our expectations specially from technical point of view.

Q: How important is the user experience for Samocat sharing?

We have met a lot of user expectations. It's difficult to meet everyone's expectation especially considering the fact that we were working with a minimum viable product during pilot.

For future we have to change a lot of things from the data we generated from users, starting with mobile application.

Q: Expansion plans?

Reaching 200 metro cities in EU and Asia, by the distribution of 50% manual and 50% electric kick-scooters.

Appendix 8: Helpline data

Contains 30 helpline calls, problem description and comments user gave during the problem explanation phase.

User experience based

Physical layout:

- Is it possible to have a mobile holder on the handle of kick-scooter to easily use navigation?
- What about not having the stands at all, and maybe with the help of some GPS tracker, we collect the scooter from anywhere the user leaves it. (Live example: In Shanghai, the bicycle renting companies are doing it on an extensive level)
- Trouble folding the scooter
- Two users already had issues finding empty space to return the scooter at Urban Mill station as the station was full. (Free parking space is now placed there.)
- Users were trying to return the scooters in an incomplete station as the station was missing the information that it is not functioning. Can be solved by modifying the station name as (not working) in the app.
- Maybe there could be some retractable lock in the scooter itself that makes it lock anywhere we want instead carrying a lock yourself.
- A user was not able to lock the scooter, so he used the free locker. Reason was that a bit more push is required to lock it due to shrink wrap alignment.
- Scooters were first locked and then user tried to fold it.

Mobile application:

- Why the app is not available for all other countries' app stores as there are a number of international students in Aalto.
- Trouble returning the scooter
- Two users had issues with returning scooters. They did not receive return notification as well as the money refund.
- Not able to receive the code through SMS for application Registration.
- Registration error in Russian
- Refund not happening
- User did not receive the refund

Technical issues

- Weak connectivity lead to late response time to users.

- Station restart needed due to non-detection of scooters.
- Quick battery discharge due to modem battery consumption.
- Scooter returning issue due to station offline.

Miscellaneous

- A user explained that he was planning to buy a bicycle but since the introduction of Samocat services, he changed his mind.

Future possibilities

- What about an electric kick-scooter?
- Would it be around Espoo/ Helsinki soon?
- What if one of the station could be in lehtisaari as most of the university students/staff walk there from Aalto university to save two region ticket which could be useful for us as these users will find it more useful to use the service than someone who want to try something new.
- A user suggested it would be great to have kick-scooter station at the end of Teekkarikylä, Near Servin Meijan 6, for better connectivity inside Otaniemi.

Samocat realised the problem quickly and considering the first-time user experience, decided to alter the refundable deposit amount.

Final pilot pricing model:

Final pricing model that continued till the pilot end is as follows:

Refundable security deposit: 1€

Free ride time: 30 min

Ride price: 1€/hr

Whole day: 8€

Whole week: 20€

Significant change in the final pricing model came through the refundable deposit which was reduced to 1€. Since the payment system and bank syncing issue was out of the hand of Samocat sharing or payment system provider's reach, the only solution was to reduce the refundable deposit, so the user will not feel uncomfortable in case the money does not come back immediately.

The screenshot shows the 'Fees' screen in the Samocat app. It features a list of three pricing options, each with a right-pointing arrow:

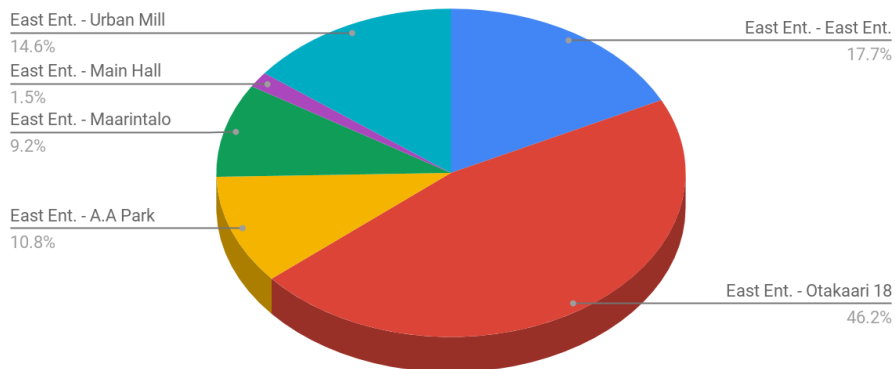
- Hour (Promo 30 min free):** 1 €
- Day (Promo 30 min free):** 8 €
- Week (Promo 30 min free):** 20 €

Below each option is a smaller line of text indicating the cost for additional time: 'Each extra hour 1 euro', 'Each extra day 8 euro', and 'Each extra week 20 euro'.

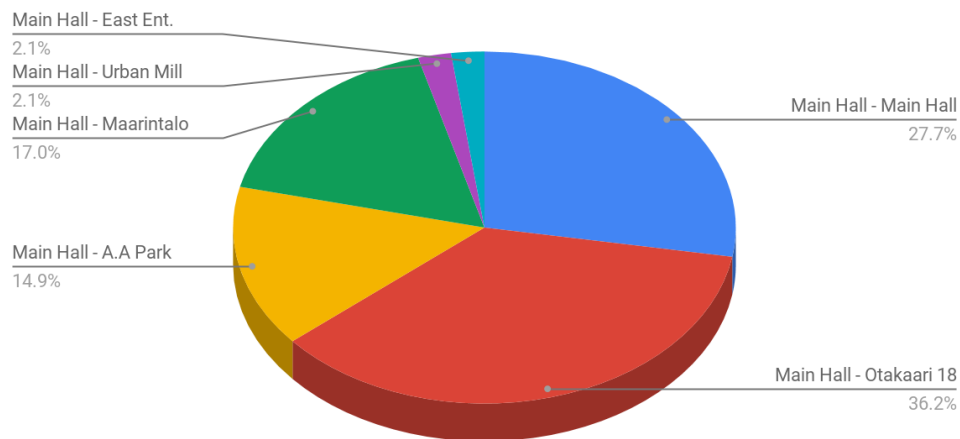
At the bottom of the screen, there is a section titled **1 € Refundable Deposit**. Below this title, a smaller font explains: 'This is taken to cover any repair costs but is instantly refunded upon successful return.'

Appendix 9: Individual station trip statistics

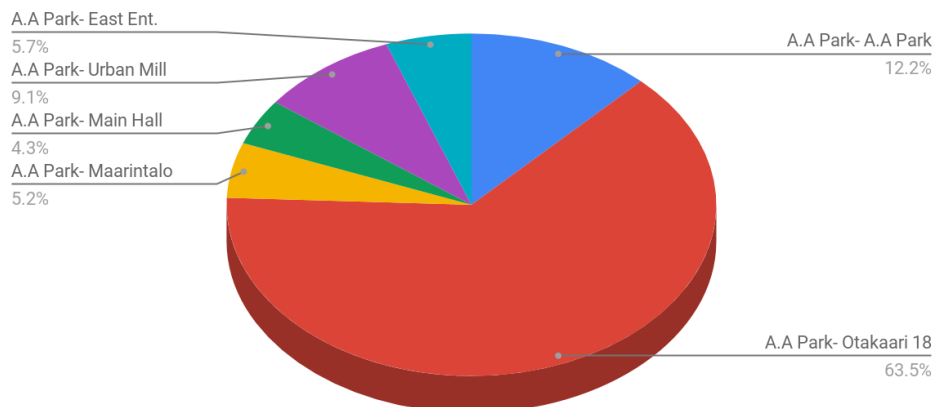
Aalto University East Entrance, Otakaari 1



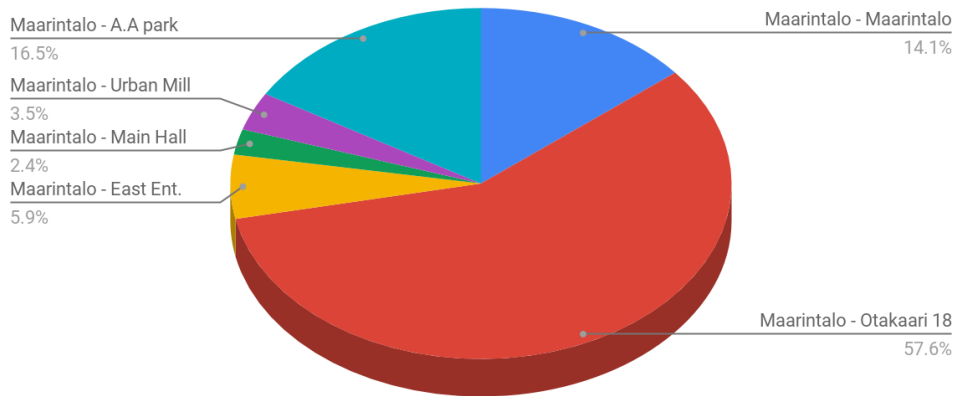
Aalto University Main Hall, Otakaari 1



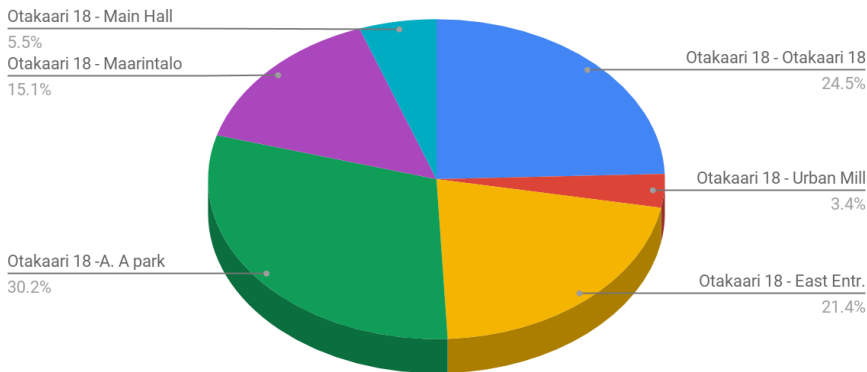
Alvar Aalto Park



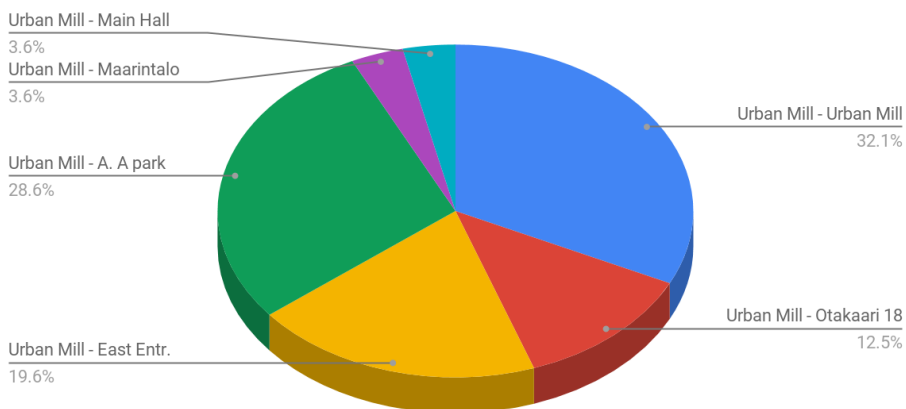
Maarintalo



Otakaari 18



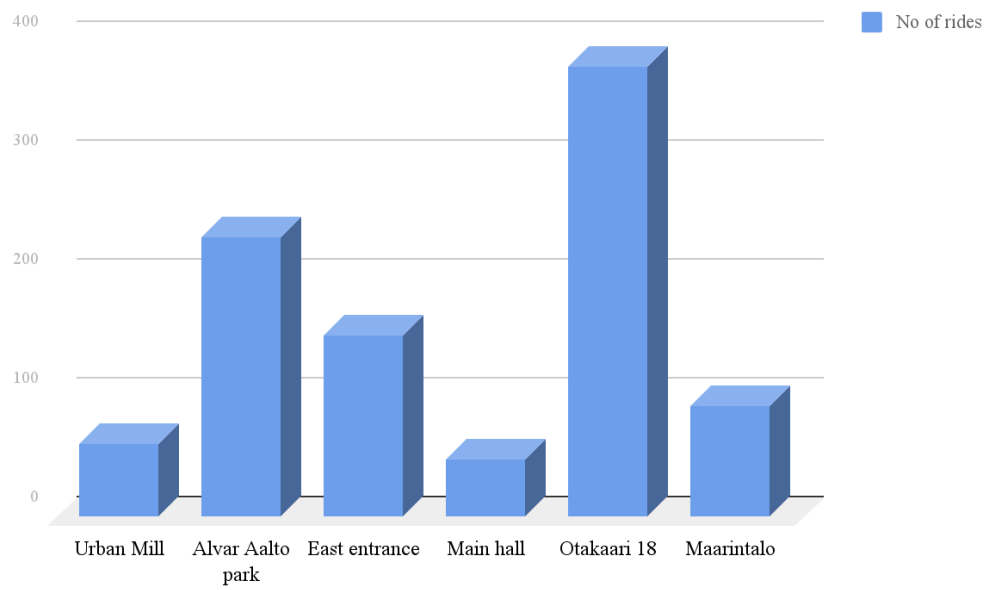
Urban Mill Station



Appendix 10: Samocat mobile application issues

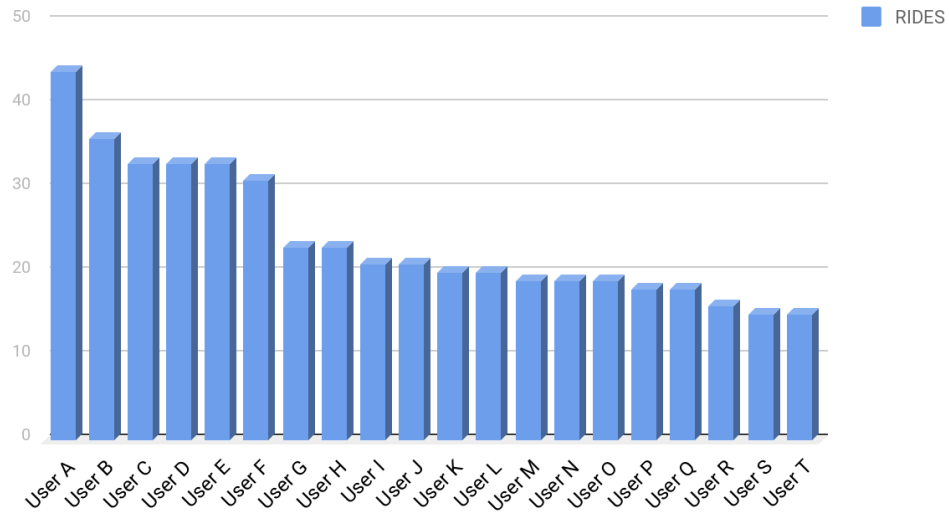
- 1: Android application crashes sometimes, especially during terms and conditions page scrolling.
- 2: Mobile app does not auto refresh and needs to be killed all the time in order to see correct number of kick-scooters.
- 3: Mobile applications show zero kick-scooters if station is full.
- 4: Payment card details page should have the same order as the data is on the card.
(For a better UX)
- 5: It would be a good idea to keep a picture of the station when someone clicks on a certain station in order to not be confused which station he or she is as the location is not always accurately measured.
- 6: The mobile app should restrict the station click/rack unlocking option when station is offline, automatically or should have station offline status so users do not get confused why scooter is not unlocking.
- 7: QR code scanning and unlocking would solve most of the user problems as there will be only one step needed to unlock the scooter.
- 8: Mobile application icon should be distinctive as other bike sharing apps. User can easily understand out of many app icons in his/her phone that it belongs to kick-scooter, now it looks more like a jewellery/luxury item shopping type. Some aggressive colour with clear showcasing of kick-scooter would help users mostly as not everyone remembers the company name.
- 9: While searching the mobile application in app stores, the search should be optimised rather than user writing down complete app name “Samocat Sharing” and then misspelling something and not finding it. It could be like we search kick-scooter or even in local language and our result is in top five.

Appendix 11: Most popular station by no of rides



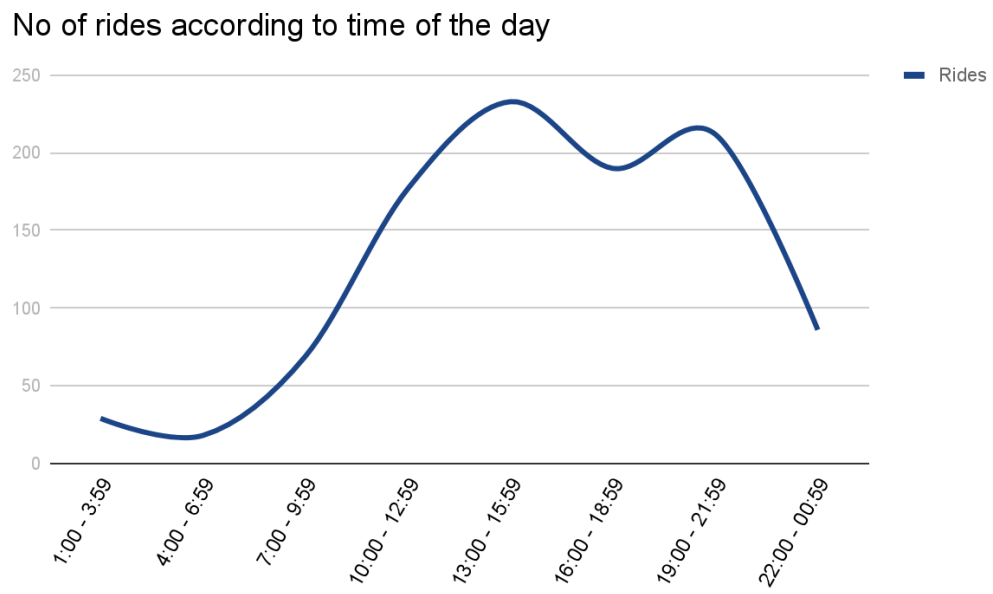
Appendix 12: User ride frequency

Top 20 Users



Users (Top 10)	No of Rides	Users (11 -20)	No of rides
User A	44	User K	20
User B	36	User L	20
User C	33	User M	19
User D	33	User N	19
User E	33	User O	19
User F	31	User P	18
User G	23	User Q	18
User H	23	User R	16
User I	21	User S	15
User J	21	User T	15

Appendix 13: Number of rides vs time of day



Appendix 14: Samocat cost projections

Statistics from Pilot:

No of stations: 6

No of users = 200

No of allocated kick-scooters = 40

5 users per kick-scooter (200/ 40)

Future pricing model

Going with Subscription model, the price for a season pass would be 25€.

As per our calculations and user desires, ideal no of stations in Otaniemi = 25

More stations would open more routes and the user count would be incremental.

Keeping that to 10 users/ kick-scooter from previous 5 users/Kick-scooter.