Shared Electric Scooters:
How this new mobility offer is being addressed in Lisbon

Pedro Canhestro

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Abstract

Title of the dissertation: Shared Electric Scooters: How this new mobility offer is being addressed in Lisbon

Author: Pedro Miguel Sobral Canhestro

The mobility market has constantly been exposed to innovation, and shared mobility solutions are becoming increasingly viable. The new offer of shared electric scooters has joined current offers such as bike-sharing or car-sharing, and quickly spread throughout the city of Lisbon, with a growing number of companies entering the market. This study aims to understand how this new mobility offer is being addressed in Lisbon, providing an overview of the service through the identification of the main characteristics of the users, the main drivers for using the service and the main barriers that may exist.

Two methodologies were used - semi-structured interviews (12 participants) and an online survey (127 participants). The results show that the service seems to be more attractive to young adults, digital economy participants, people who value innovation and sustainability when choosing a mode of transport, and people who seek to save time on travel. The service is also considered enjoyable and as a way to spend pleasant moments. It is seen mostly as a way of complementing other means of transport and for short distances and not as a primary mode of transport. Being the main barriers: the price, since people consider that the service becomes expensive if it is used on a regular basis, the city's infrastructures, which people consider are not completely prepared for the effective use of the service, and the lack control of inappropriate parking of the scooters, causing dissatisfaction to users and non-users.

Keywords: shared electric scooters, shared mobility, smart mobility, mobility, collaborative consumption, service

Resumo

Título da dissertação: Trotinetes Elétricas Partilhadas: De que forma esta nova oferta de mobilidade está a ser abordada em Lisboa

Autor: Pedro Miguel Sobral Canhestro

O mercado da mobilidade tem sido constantemente exposto a inovação e as soluções de mobilidade partilhada estão a tornar-se cada vez mais viáveis. A nova oferta de trotinetes elétricas partilhadas juntou-se a ofertas já existentes como *bike-sharing* ou *car-sharing*, e rapidamente espalhou-se por Lisboa, com um número crescente de empresas a entrar no mercado. O objetivo deste estudo é perceber de que forma esta nova oferta de mobilidade está a ser abordada em Lisboa, fornecendo uma visão geral do serviço através da identificação das principais caraterísticas dos utilizadores, dos fatores que impulsionam a utilização e das principais barreiras que podem existir.
Para tal, foram utilizadas duas metodologias – entrevistas semiestruturadas (12 participantes) e um questionário *online* (127 participantes). Os resultados revelam que o serviço parece ser especialmente atrativo para jovens adultos, participantes da economia digital, pessoas que valorizam inovação e sustentabilidade num meio de transporte e pessoas com procuram poupar tempo. O serviço é também considerado divertido e como uma forma de passar momentos agradáveis. É visto essencialmente como uma forma de complementar outros meios de transporte e para curtas distâncias e não como um meio de transporte principal. Sendo as principais barreiras: o preço, uma vez que as pessoas consideram que o serviço se torna caro se for usado de forma recorrente, as infraestruturas da cidade, que as pessoas consideram que não estão completamente preparadas para o uso efetivo do serviço, e a falta de controlo no estacionamento inapropriado das trotinetes, que provoca descontentamento a utilizadores e não utilizadores.

Palavras-chave: trotinetes elétricas partilhadas, mobilidade partilhada, mobilidade inteligente, mobilidade, consumo colaborativo, serviço

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List of abbreviations

App: Application

E-Scooters: Electric Scooters

H: Hypothesis

ICT: Information and Communications Technology

Km: Kilometre(s)

MaaS: Mobility-as-a-Service

QR: Quick Response

SPSS: Statistical Package for the Social Sciences

RQ: Research Question

USA: United States of Americ

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1- Introduction

1.1- Contextualization

Innovation is everywhere, and the market for mobility is not an exception, mobile applications, social networks and sharing economy practices are also impacting on this market, creating new offers that provide more information and flexibility for users. The existence of developed mobility services is crucial for citizens to participate with quality in social and professional life, the socio-economic dynamics of cities and people's everyday lives are strongly dependent on the mobility offers' quality and consequently, the quality and convenience of the services will affect individuals' mobility choices and preferences (Cresswell, 2010; Sheller & Urry, 2006, 2016).

New mobility offers, characterized by the possibility to be shared on a peer-to-peer basis, have appeared in the mobility market: carsharing, motorcycle, scooter sharing, and bike-sharing. This phenomenon is due largely to the need to fulfil the new demands that modernity is bringing and address new concerns that may have social or environment nature, following the concept of collaborative consumption and through the use of information-sharing devices that have the capacity to provide previously unavailable information or make it more easily understandable while improve the efficiency and sustainability of urban development (Jin et al., 2018).

1.2- Problem Statement and Research Questions

The main focus of this study is to analyse the electric scooters sharing offer in the Portuguese market, focusing on the city of Lisbon, with the aim to understand which type of users are using this service, the reasons why they are using and/or preferring it, as well as the barriers of the service. Starting by revising the literature on the main concepts related with the service as, collaborative consumption, Mobility-as-a-Service, smart mobility, and shared use mobility, as a way of structuring the reasoning and then begin to discuss the shared scooters' thematic in particular. In order to answer the following research questions:

- RQ1: Who are the users of shared electric scooters?
- RQ2: Which are the drivers for using shared electric scooters' service?
- RQ3: Which are the main barriers to the effective use of the shared electric scooters' service?

1.3- Managerial and Academic Relevance

In terms of managerial relevance, this study can be important for companies that want to invest in the mobility sector in Portugal, particularly in shared mobility, a sector that is constantly exposed to innovation. Since the study is based on actual perceptions of current users and potential users, providing a broad overview of the particular case of shared electric scooters to know the main characteristics of the users as well as the main drivers and barriers of the service.

From the academic point of view, considering the novelty of the topic being studied there is not much academic information about shared mobility, and especially about shared electric scooters, this study will contribute to developing it. Additionally, since it is based on real perceptions about mobility, this study can also be significant to draw insights into the mobility market in general.

1.4- Dissertation Structure

This dissertation is divided into five chapters. The first one includes a contextualization on the topic, the problem statement and research question, and the managerial and academic relevance of the study. Chapter 2 comprises the literature review about different aspects related to the topic. Chapter 3 describes the methodology used in this dissertation, both qualitative and quantitative. In Chapter 4 the results from the data collected are analysed and finally in Chapter 5 the main findings and conclusions of the study are presented as well as the main limitations and points to be developed in future researches.

2- Literature Review

2.1- Collaborative Consumption

The way people are consuming products and using services is changing, mainly due to, the increasing societal, ecological, and developmental concerns (Hamari et al., 2016). New concepts, as collaborative consumption, are arising. A concept that can also be known as sharing economy, basically because individuals are sharing access to resources; or peer-to-peer exchange, because both the service provider and recipient are individuals instead of businesses (Perren & Grauerholz, 2015). It is an economic-technological phenomenon that is fuelled by developments in information and communications technology (ICT), it is the peer-to-peer-based activity of obtaining, giving, or sharing goods and services coordinated by community-based online services (Hamari et al., 2016).

Collaborative consumption participants can be motivated by different factors since the will to use more sustainable solutions until the economic gains that may arise from the participation (Hamari et al., 2016). The rationality of the model resides in the benefits of using goods rather than owning them, and on the possible economic and convenience gains (Binninger & Ourahmoune, 2015).

2.2- Mobility-as-a-Service (MaaS) - The concept and advantages

The developments in ICT and Collaborative Consumption brings new opportunities, new types of service, and new notions such as Mobility-as-a-Service, making mobility more easily accessible for users (Jittrapirom et al., 2017). Hietanen (2014) describes MaaS as a mobility distribution model that combines different transport modes offering a tailored mobility package. Holmberg et al. (2016) highlight the subscription's role that provides to the user the possibility to plan the journey, booking several transport modes and making the payment in just one service in a secure way. The service is personalized, taking into consideration traveller's preferences, which is a great advantage compared with conventional public transport services (Atasoy et al., 2015).

MaaS provides transport from point A to B, facilitating users life by combining available mobility options, and presenting them in an integrated way (Flood & Mulligan, 2015). Rather than having to locate, book, and pay for each mode of transportation separately, MaaS platforms let users plan and book door-to-door trips using a single app. Taking into account different options and personal preferences, and facilitating mobile payments, creating a more user-centred mobility paradigm. It provides alternatives to move people and goods in a faster,

cleaner and less expensive way and it could transform a relatively inflexible transportation system in a more flexible one (Goodall et al., 2017).

2.3- The concept of smart mobility

Associated with this whole new way of seeing transport services, the concept of smart mobility naturally arises. It aims in achieving sustainable development through the transport services' optimisation, considering technological, societal, economic, and environmental challenges. This concept has a significant potential to mitigate some environmental problems and at the same time, increase the convenience to the traveller (Zawieska & Pieriegud, 2018). Smart mobility allows connectivity into cities, that is affordable, effective, attractive, and sustainable, using technology to generate share data, information, and knowledge that is extremely useful to make decisions, and at the same time enhance vehicles, infrastructures and services (Lyons, 2018). Connectivity between people and means of transportation is the key for smart mobility offers, in the cases of smart mobility initiatives involving electromobility, shared use mobility, and MaaS, is ICT that makes the transport mean available and possible to use (Nikitas et al., 2017).

2.4- Shared use mobility

2.4.1- The concept

Related to smart mobility, the concept of shared use mobility can also be defined. This is transforming the way people move around cities and is becoming a challenge for consolidated transport offers as private cars, public transport, and taxi (Santi & Ratti, 2017). Shared mobility systems are transitioning from a promising and tempting idea, that almost everyone would like to experiment, to a severe option for rationalizing urban mobility (Le Vine et al., 2014), vehicle sharing has experimented a rapid growth in the last decade following the development of ICT-enabled business models (Cohen & Kietzmann, 2014).

Shared mobility, basically the shared use of a vehicle (motorized or not), enables travellers to have short-term access to means of transport basing the utilization on their needs. It has been seen not only as an innovative transportation mode but also as a way to mitigate the problems associated with the first- and last-mile (components that involve walking to get our transportation) connectivity with public transit, bridging gaps in the existing transportation network, that are mainly based on fixed routes, providing more flexibility to the travellers.

Moreover, shared mobility offers an alternative to transportation modes which are dependent on the land-intensive parking infrastructure (Shaheen & Chan, 2016).

H1: The users perceive shared electric scooters as an alternative to traditional transportation modes.
H2: The users perceive shared electric scooters as a complement to traditional transportation modes.

2.4.2- Economic motivations behind shared mobility

Urban mobility is suffering a transition to a new mobility concept, transport's users living in cities with a broader agglomeration area would not feel the need to own a car any longer. The usage cost of have an own car (for example: initial cost of the car, continually growing fuel prices, maintenance costs, insurance costs, parking costs and time spending with traffic) are redefining the transportation patterns in big cities, increasing the demand for alternative vehicle-sharing alternatives. Car ownership is becoming a luxury, and the use of public transports implies restrictions on freedom and quality of travel, being vehicle-sharing options seen as the middle solution. Instead of investing in a car, citizens may appeal to a mobility provider that will fulfil their mobility need (Efthymiou et al., 2013).

H3: The users perceive shared electric scooters as an economical solution.

2.4.3- Types of shared mobility services

There are already different types of shared mobility services available, bike-sharing that is the offer of public bikes usually at fixed stations and requires the purchase of annual subscription including many times the first 30 minutes of each travel for free. Car-sharing, where the operator is responsible for the maintenance of the vehicle, and the registered members in the majority of the cases just need to pick-up and park the car within a designated area. Ride-sharing, where today the drivers can offer trips on an online platform and registered users can reserve one of these trips. And small electric vehicles sharing, something that solves some limitations of cars and bikes usage, for instance, the fact that cars require a significant road space and parking spaces and the fact that bikes are not motorised. All of these solutions are powered by ICT, allowing consumers to have access to vehicle information in real time and reserve vehicles (Schade et al., 2014).

2.5- Rational reasons behind the use of new shared mobility offers

2.5.1- Structural and environmental challenges

The current challenges of energy scarcity and climate protection are closely related, both require a reduction in the use of fossil fuels and an increase in the use of more energy-efficient vehicles, energy for transport will no longer be abundant and inexpensive but scarce and expensive. This phenomenon will have consequences for mobility and location behaviours in cities, having significant impacts on the philosophy and method of urban modelling (Wegener, 2013).

The emergence of the sharing economy's concept is becoming particularly patent in big cities that have to deal with population growth and increasing density. Sharing vehicles can be seen as essential to mitigate traffic and congestion problems as well as pollution. Shared mobility solutions providers seek to develop business models addressing deficiencies in public infrastructures and transit systems (Cohen & Kietzmann, 2014). A new sustainable mobility paradigm (Banister, 2008) is being increasingly promoted, a mobility more based in optimal congestion instead of minimal congestion (Urry & Lyons, 2005), that rests in: fewer trips, basically a reduction in the number of needed daily trips, performing some activities online in order to achieve this, as for example, online purchases for goods and services instead of going to a physical space; modal shift meaning basically changing the transportation hierarchy from single occupancy vehicles to for instance shared transit alternatives; distance reduction being a more structural objective, creating solutions closer and more accessible for all citizens; and lastly, increased transport efficiency that is associated with the reduction of the environmental impact of transportation, using more efficient solutions (Banister, 2008).

As mentioned above, with the population growth in cities the transport demand also growths and leads to traffic congestion, higher energy consumption and carbon dioxide emissions that are prejudicial for the environment, being transport systems, the largest source of these emissions. Due to their mobility-related activities, urban areas are extremely vulnerable to greenhouse gas emissions that are continuously increasing. Taking into account that by 2050 more than 60% of the global population is expected to live in cities (UN, 2014), it is crucial to start developing smart mobility solutions in urban areas taking into consideration the convenience of the transport, as well as, climate and energy policies. All these pressures to reduce the emission of greenhouse gases by transport and to follow the environmental protocols are encouraging the investment in more sustainable alternative solutions, as conventional or electrified vehicle-sharing (Millard-Ball et al., 2005; Shaheen & Cohen, 2007; Barth & Shaheen, 2002; Shaheen et al., 2010a, 2010b, 2010c). Mobility of the future

will experience transformations due to developments in new forms of propulsion, new forms of vehicle control, changing business models of vehicle ownership and use, mobile technologies that provide new opportunities to individuals and new ways to perform activities without the need to travel (Lyons, 2018). The emerging concept of smart cities and technological development can be a critical factor to mitigate these problematics and create new transport systems (Zawieska & Pieriegud, 2018).

2.6- Convenience and Sustainability

2.6.1- Importance of convenience for consumers

Empirical findings show that convenience plays a decisive role in the relationship between customers and service providers (Moeller et al., 2009). Convenience has even demonstrated to be the primary reason for customers to intensify the relationship with service providers, influencing customer satisfaction (Colwell et al., 2008; Seiders et al., 2007).

Demand for convenience is increasing, and customers are becoming more convenience-oriented, also increasing the interest of marketers in the definition of this concept. Convenience can be analyzed in a goods or services perspective, focusing on service convenience, it can be conceptualized as "consumers' time and effort perceptions related to buying or using a service" time and effort costs are the variables that impact on the perception of convenience for consumers. The less time and effort invested in using the service the higher the level of convenience for the consumer (Berry et al., 2002; Goebel et al., 2012; Seiders et al., 2007). In short, in this context, convenience can be seen as the ability to reduce consumer's non-monetary costs when using a service (Berry et al., 2002; Farquhar & Rowley, 2009; Seiders et al., 2007).

Studies have shown that convenience interacts with customers' satisfaction having the capacity to influencing consumers' future intentions, impacting on customer loyalty (Hsu et al., 2010; Seiders et al., 2007; Srivastava & Kaul, 2013).

2.6.2- Importance of sustainability for consumers

McCann-Erickson (2007) defines sustainability as a collective term for everything to do with responsibility for the world in which we live, being an economic, social, and environmental issue about consuming differently and efficiently. There is a growing interest in "sustainable marketing" (Jones et al., 2008), that is, the creation of sustainable solutions that continuously satisfy customers and stakeholders (Charter et al., 2006). Customers value sustainable

attitudes, sustainability information about a company has a significantly positive impact on the evaluation of a company and purchase intent by customers, the fact that a company is described as poorly committed with sustainability leads to significantly negative evaluation and purchase intent (Choi & Ng, 2011).

2.7- Shared Electric Scooters (E-Scooters)

2.7.1- The offer

An increasing number of companies are investing in micro-mobility, defined by Heineke et al. (2019) as all passenger trips of less than 8 kilometres, over the last few years. This trend was consolidated with the emergence of shared and "dockless" electric scooters that had as pioneers the companies Bird and Lime in the United States of America (USA). Companies that rapidly proved their value, becoming the fastest ever USA companies reaching billion-dollar valuations. Following this trend, other companies have entered this market, in Europe, several e-scooter companies have emerged and raised over $150 million of capital since 2018 (Ajao, 2019). In order to use the service, the riders need to download the associated smartphone application and create a login, after they need to agree with a contract that makes clear that the user is responsible for any injury or damage, the use of helmets is required, drivers must be over the age of 18, it is not allowed to riding with more than one person at a time and that scooters should not ride on the pedestrian walk. Subsequently, they can find on the application a map with all the scooters available in their surrounding area, and they only need to pick one. When near enough to the scooter, the user has to click on a button in the app to unlock the scooter, scan a QR code inserted on the scooter. The entire process is relatively intuitive and user-friendly (Smith, 2018).

The e-scooters are "dockless", when riders finish their travel, they can park the scooters anywhere local regulations permit (Smith, 2018), a characteristic that can be a definite advantage in comparison with docked systems where customers need to find a docking station to take the vehicle, something which can be difficult at peak times. In parallel, this type of system is easier and cheaper to implement and can grow much faster once no docking stations need to be installed, being easier to adjust the offer based on customer demand (Wilke & Lieswyn, 2018).

It becomes an affordable way of transportation, costing $1 plus $0.15 per minute, an average trip will cost few dollars, something impossible with other solutions, as a personal car, if the cost of gas, insurance, maintenance and parking is taken into account (Frazer, 2018).

Additionally, it seems to be an enjoyable experience that appears to make people happy, not only because it is many times a faster solution than car-based trips but also because it provides a sense of freedom to users that have fresh air-based travel while avoiding traffic jams (Heineke et al., 2019).

2.7.2- The impact

Big cities all over the world are facing considerable challenges in terms of congestion and pollution caused by rapid urbanization, something that is pressuring personal and public transportation systems. In the USA, 46% of car traffic is due to trips that last less than 5 kilometres, and micro-mobility solutions could be a suitable solution to alleviate traffic congestion, mainly in rush hours (Ajao, 2019). This increasing pressure on urban passenger transport systems and the need for more efficient solutions has increased the demand for innovative solutions, as the shared mobility services. The developments in ICT allow these new offers to be a convenient door-to-door transport decreasing the need to own a private vehicle. These mobility services are made based on consumer needs, being faster, cleaner, less expensive, and more convenient (Kamargianni et al., 2016).

In the electric scooters particular case, it seems to actually are impacting on reducing congestion in cities, according to data provided by Lime, 30% of the riders report using e-scooters to replace car rides on their most recent trip and 27% of riders in major urban markets used an e-scooter to connect to or from public transport during their most recent ride (Warren, 2018).

The sustainability level of the solution is also something indispensable to take into account, in order to be considered sustainable, a mobility service offer should be environmentally friendly (or at least friendlier than private car use), economically viable, and socially acceptable. It should also support urban planning and design, especially concerning land use (Giesecke et al., 2016). Taking all of this into account, it is expected that shared electric scooters will have a significant impact on the mobility services and will transform the dynamic of the cities, being a “door-to-door” mobility solution with the potential to mitigate the “first mile” and “last mile” problems and to make possible to avoid wastes of time with traffic. It can be a very convenient solution for customers that need to run distances that are just a bit too far to walk as well as a bit too short to drive and take traffic jams. In parallel, it is an environmentally friendly solution, not contributing to air pollution. Moreover, it can also mitigate the problem associated with parking spaces allowing users to save also some money here (Frazer, 2018).

H4: Shared electric scooters are more appropriate to be used to run short distances.

H5: The fact of being considered as an enjoyable experience, can be one of the main drivers for the use of shared electric scooters.

H6: Convenience gains from the saving of time avoiding traffic congestions and problems with parking spaces can be one of the main drivers for the use of shared electric scooters.

2.7.3- Barriers that may affect the consumption

Shared mobility, in general, brings a lot of advantages and opportunities, however, some challenges have arisen, particularly in the area of public policy. Cities have had difficulty legislating and revising the policy to follow the development of shared mobility innovations and issues of public safety, insurance and, liability, and fair labor practices are being addressed (Shaheen & Chan, 2016).

The main concerns around these offers are the safety of users and other citizens and whether cities have infrastructures able to support the influx of these vehicles (Ajao, 2019), shared electric scooters are being also associated with various injuries: a scooter driver can be hit by other larger vehicles, a pedestrian can be hit by an e-scooter, abandoned scooters can difficult the normal pedestrian's paths or a malfunctioning scooter can cause a crash. When some accident involves an e-scooter driver the liability will fall on the negligent party, however, the riders are not required to carry liability insurance, and the company that rents the scooter will not cover that liability when a driver causes an injury. Companies only report the risks that users are exposed to when using the service and the rules that they must respect, nevertheless, some entities are beginning to pressure companies to increase their level of responsibility (Smith, 2018).

Another possible barrier is the structural particularities of cities like Lisbon, that are bumpy with many climbs and descents. And in Lisbon's particular case, the fact that some roads are made with the typical Portuguese sidewalk where it can be challenging to ride with these means of transport. Taking into consideration these limitations, companies are entering the market with more robust equipment as the Flash case, which is offering more prepared scooters, with larger wheels, reinforced suspensions and, twin brakes. At the same time in order to try to mitigate the problem associated to improper parked scooters, this company is offering discounts to the users that are correctly parking the scooters in the virtual parking areas identified in the app and also making available helmets in order to increase the service safety (Espassandim, 2019; Naves, 2019).

H7: The security of the service is something that users would like to see improved in the shared electric scooters service.
H8: Robustness of the shared electric scooters is something that users would like to see improved in the shared electric scooters service.
H9: Poor city infrastructures is something that is affecting the use of the shared electric scooters service.
H10: Shared electric scooter users would like to see improved the improper parking control

2.7.4- Who will be willing to buy or share electric vehicles

A study of expert opinions indicated that electric vehicles in general are seen as being especially appropriate to be used in urban areas within a limited range, this type of vehicle is seen as being attractive to urban individualists interested in new and innovative technology and/or with environmental concerns. Technology and innovation enthusiasts and well-off people, according to the expert declarations, might be more likely acquire or lease this type of vehicle, for consumers with environmentally concerns or other urban individuals owning or share an electric vehicle could also be attractive, depending on their needs and living situation. Consumers living in cities who already are accustomed to combine various modes of transport and to share with other users, will find these sharing offers attractive and useful, the most important thing for them in this field is to be able to fulfill their mobility need comfortably, without having significant restrictions, costs and effort (Dütschke et al., 2013).
Additionally, Millennials, people that have born between 1981 and 1996 (Pew Research Center, 2019), are changing their attitudes in terms of car ownership that is translated in 35-50% drop in driving in the USA (McDonald, 2015) and a decline in driver-licence holding, Millennial generation appears to have a different cultural view of car ownership (Mulley, 2017), also undertaking fewer trips and travelling fewer miles and minutes on a daily basis (McDonald, 2015). For these and other reasons, Millennials have been recognized as an important consumer group for collaborative consumption and sharing economy offers. The idea to access to products, services and, resources without the necessity of purchasing or owning them seems to be very attractive to that generation which is composed by active users of the internet and social media where they engage in entertainment and gather information (Moore, 2012). In addition to being digital natives who grew up in a world of widespread online information sharing, Millennials tend to be attentive to social causes and pragmatic about the environmental impact of their choices, which also leads them to many times prefer

collaborative rather than individual consumption (Garikapati et al., 2015; Godelnik, 2017; Hwang & Griffiths, 2017).

H11: The shared electric scooters service users are innovation enthusiasts.

H12: The shared electric scooters service users are mainly young adults.

H13: The shared electric scooters service users are persons that do not mind sharing modes of transport with other users.

H14: The shared electric scooters service users are persons who have more environmental concerns.

2.7.5- The offer in Lisbon

The map of shared scooters' usage, for every company, covers practically the entire city of Lisbon except the areas of Alfama and Bairro Alto that, as a requirement of the Municipality of Lisbon, were defined as "red zones" being illegal to park scooters there (Machado, 2019). Nine companies currently compose the shared scooter market in Lisbon: Lime, Voi, Hive, Tier, Bungo, Wind, Flash, Bird, and Frog (Nunes, 2019). According to Brad Bao, Lime's Co-Founder and Executive Chairman, the company Lime achieved 53 thousand users in only two months of activity in Lisbon, and three out of five users are using the service to perform the trajectory between home and their workplace or university. Furthermore, 20% of the users argue that they are replacing their car usage by the use of these scooters (Bourbon, 2019).

All companies are practicing the same prices: 1€ to unlock the scooter plus 0.15€ per minute (Nunes, 2019), only existing a differentiation in the discounts and promotions that companies are offering. It could also be interesting to add to this analysis the electric bikes offer existent in Lisbon, once they are offering a similar service. In the bicycles' segment, exists a public offer, known by GIRA where bikes have to be picked and parked in physical stations (information from GIRA's official website), and an offer of "dockless" shared electric bikes by the JUMP project powered by Uber, that recently entered in the market and have a similar price to electric scooters, 0.15€ per minute, but without the need to pay 1€ to unlock the bicycle, becoming a more affordable option (information from Uber Portugal and JUMP's official websites). The tables in Appendix I and II emphasize the characteristics of each player.

3- Methodology and Data Collection

3.1- Research Method

Based on the conducted literature review and due to the novelty of the service being studied, in order to collect primary data, this study will follow a triangulation research approach, a mixed methods methodology that combines qualitative and quantitative research. The possibility to triangulate the research allows the subject to be evaluated from different perspectives increasing the reliability and validity of the findings, compensating the weaknesses and disadvantages of the separated approaches and contributing to making it more robust and valid (White & Rayner, 2014).

3.2- Research Instruments

3.2.1- Qualitative Data

Concerning the qualitative data collection method, semi-structured interviews were chosen, the qualitative research technique of conducting individual interviews guided by a list of questions but offering participants the chance to explore their perspectives about the thematic, that is, a method that combines structured questions with unstructured exploration. Being a useful tool when the research objectives centre on understanding experiences and attitudes (Rowley, 2012; Wilson, 2014). This technique allows capturing detailed descriptive data about interviewees' behaviours and perceptions, and a vivid picture of the participant's perspective about the research topic. During the process, participants are encouraged to express their personal feelings, opinions and experiences freely, and once it is an individual interview they are more confident and relaxed and it can be easier to extract from them their deepest thoughts about the topic, since they do not feel the peer pressure that methods like focus group could generate (Milena et al., 2008). One of the main weaknesses of the interview method is the fact that is a more time-consuming method especially when the sample is large (Kothari, 2004), in order to mitigate this question and because we will have the opportunity to triangulate this data with the data from the quantitative research, a sample of twelve individuals was defined. The sampling method used was purposive sampling, which allows the researcher to choose the participants taking into consideration the most relevant characteristics in the study context, choosing participants who will be more knowledgeable and will bring richer insights (Bernard, 2006). The participants selection criteria were based place of residence, being selected only persons living in the Lisbon metropolitan area; on familiarity with the use of the service, being selected six shared electric scooters users and six

non-users; and on age groups because from literature it is expected that the Millennials, current young adults, that have a different cultural view about the ownership, are increasingly basing their consumption in more ecological products and are more familiarized with new technologies usage, would be the main consumer group of this service. Based on that, eight Millennials (between 20 and 29 years old) and four Generation X people (between 39 and 54 years old) were interviewed (Appendix IV). The gender balance of the sample was also taken into consideration, being interviewed, five women and seven men.

3.2.2- Qualitative Research General Insights

Although, as mentioned above, part of the interviewees are non-users, all participants have a general notion of the service characteristics being able to discuss it.

Starting with the users, only two persons are using shared electric scooters frequently or more than once per week. different reasons motivate them. One is using this service, alternating with bike sharing service and his bike, almost every day because he prefers ecologic modes of transport. And the other is using the service only in the path between her home and her gym, a path that is "a little bit too far to go by foot but too close to use the car". After two persons are using the service on average once per week. Both of them have as main mode of transport the car but they are using shared electric scooters in situations where they need faster affordable mobility for short routes, to have fun moments with friends and in places where is difficult to go by car and where there is a lack of public transportation but appropriate infrastructures to the use of scooters. Nevertheless, they do not consider the service able to replace the use of their car but consider that is very interesting to use the service in order to have fun moments because it is an enjoyable experience, in short routes, to fill the lack of public transportations and in touristic parts of the city in order to facilize the tourists transportation. The remaining two users are using the service sporadically or just used it once, but they enjoyed the experience and are considering repeating it, they are from different generations, but both tried the service for curiosity and to have a fun moment. However, they are not considering to use the service in a day-to-day basis, one of them because is a 54 years old man considering this is not the most appropriate service for people from is age group, having some physical risks associated and, additionally, the car usage is essential for his daily commitments. The other person considers the service too expensive taking into consideration her needs, also highlighting the physical risks associated to the service and considering it not appropriate to use in some parts of the city, as zones without bicycle paths, with climbs and Portuguese sidewalk. Moreover, she prefers to use the subway and e-Commerce platforms for individual

passenger transport services in de-characterized vehicles in order to fulfill her mobility needs. The two interviewees agree that it is appropriate to use shared electric scooters in parts of the city with proper infrastructures and where it is difficult to park the car, to fill the lack of public transportation and/or to complement them and in order to have fun moments.

In general, the users interviewed are not able to identify significant differences between the players acting in this market, only arguing that some scooters are more robust, faster and more comfortable to use taking in consideration the particular characteristics of Lisbon.

About the possible service improvements, the variety of suggestions was wide, being the improvement in the scooters parking control in order to decrease the quantity of badly parked scooters one of the most expressed ideas, as well as the improvement in terms of scooters robustness and urban infrastructures in order to improve the experience quality. A price reduction or creation of price benefits for regular users, in order to increase the utilization rate, were also mentioned. The service security was also addressed, some users suggested the provision of helmets by the companies.

Focusing on the non-users, only the oldest interviewees (46 and 51 years old) are considering unlikely to try the service in the future, and they would never use shared electric scooters in a daily basis. The reasons why are very similar, they "do not feel the need to use the service", the car usage bring them more flexibility and additionally, they do not consider the service "appropriate for people with their characteristics" mainly from people from their age group, stressing the physical risks associated to the service. The other interviewees consider likely to try the service in the future but mainly due to curiosity, in order to have fun moments or as a complement to their current modes of transport. One of them admitted that the service could be "perfectly complementary to his current mode of transport" once he is using public transportations to do the path between home and his university and he needs to walk more or less 3 km every day, being possible to use shared electric scooters during this route. Regarding the remaining persons, with ages between 22 and 39 years old, two of them are public transports users, and the other one car user. All agree that the service is "too expensive taking into consideration their needs" and then, some indicate the payment of a monthly fix amount with unlimited rides just like happens in other services or at least a decrease in the unlock price, as a way to increase the usage rate of the service in a daily basis. Moreover, they highlighted the necessity to create more bicycle paths in order to make the service completely viable.

When the interviewees were asked to express the first three things about the service that comes to their minds, rarely some disadvantage or a defect was expressed, only being

expressed the word “risk” once and, the word “expensive” twice. Words like “flexibility”, “convenience”, “ecology”, “fun” and “availability/accessibility” were the most expressed, even by non-users,

something that could mean that even the persons that are not using the service can see some advantages on it. Counterbalancing with the word “expensive” the word “affordable” was also expressed twice, this is not completely strange because it could depend on different factors, firstly the value the money can be different for each person and secondly, the persons that referred “expensive” and “affordable” are thinking in the service from different perspectives, the first is thinking on the possibility to use the service as his principal mode of transport and so consider it expensive taking into consideration his needs. While the second one, is thinking in the service as a complement for his current modes of transport for short routes, and in that perspective considers the service affordable.

Summing up, following the insights from the interviews, it is possible to argue that people from older generations are less willing to use the service in comparison with people from younger generations basically because they do not identify themselves with the service characteristics. The non-users from younger generations interviewed shown interest in at least try the service in the future, and in general positive adjectives were associated with the service. Currently, the service is seen as a complement to other transport offers or as a way to have fun moments. And in order to the usage in a daily basis become completely viable, it would be necessary to reduce the prices or provide some financial incentives, increase the safety of the service and improve the urban infrastructures, once nowadays is challenging to use shared electric scooters in some parts of the city. Additionally, people are not able to see significant differences between the players present in the Lisbon market, and the significant number of badly parked scooters along the city is something unappreciated by the interviewees that suggest an additional effort in controlling it.

3.2.2- Quantitative Data

Regarding the quantitative data collection method, online survey research method was chosen, since it allows to collect data from a large number of participants in a short period, it has no significant costs associated, and data are directly loaded in a data analysis software, saving time and resources. At the same time, this method allows for more flexibility and can be more interactive and visual (Duffy et al., 2005; Ilieva et al., 2002; Wright, 2005).

The survey was designed based on the insights from the literature review and on the results from the interviews previously performed, and it aims to extract data on shared electric

scooters users and non-users' behaviours, preferences, ideas and, perceptions about mobility in general and the service in particular. Before extract the participants' sociodemographic data through questions that come at the end of the survey in order to avoid possible negative feelings caused by the provision of personal data in the beginning of the survey that can impact on participants' performance, three types of questions were designed. Multiple-choice questions that can be distinguish in two different types, the ones where the respondents can choose only one option, being the objective to encourage the participants to prioritize decisions or the other ones where they can select more than one option, something that is more applicable in questions that are more generic or where different option may have the same importance. Moreover, dichotomous yes / no type questions were also used, both multiple-choice and yes / no type questions were designed in order to extract information from direct easy questions and perceive participants' behaviours and ideas. Finally, questions based on a 1-5 Likert scale (Murphy & Likert, 1938) were also performed, with the idea to provide sentences and encourage the respondents to rate it and also to provide specific attributes and encourage participants to rank it as well, in order to perceive participants' preferences. The five-options balance rating scale contains the equal number of favourable and unfavourable categories and a neutral point for the undecided respondents (Grover & Vriens, 2006), providing independence to the participant to choose any response in a balanced and symmetric way, in either direction (Joshi et al., 2015). Characteristics that are very important in a study like this one where some participants are non-users and may not have as much information and experience to rate some sentences.

Additionally, the use of rating scales provides a relatively easy way in which the customer can evaluate the service on several of different items allowing comparisons between different important items. The data obtained through this method is appropriate for the creation of mean scores, and for carrying out correlation or regression analyses using other data, for instance, satisfaction or behavioural data (Brace, 2004).

Although the survey is divided with some questions directed only to users and others directed only to non-users the survey has a significant number of similar questions in both groups, because just like Shaheen et al. (2011) have considered in their study, it was considered that once the service is widely distributed in Lisbon, with a significant number of companies providing it, even non-users have access to a lot of information and may be able to demonstrate their perceptions about the service and show their level of agreement with a series of statements about the service.

3.2.3- Quantitative Data Collection

The online survey was prepared using the online software Qualtrics, and it was revised conducting a pilot with 5 persons in order to make sure that there were no errors and the questions were understandable, the suggestions from the pilot were crucial to adjust some questions. The survey was written in Portuguese and English targeting the individuals currently living in the Lisbon metropolitan area being possible to include foreigners, for instance international students that can be usual users of the service. It was distributed between 23rd of April and 7th of May, and the participants were recruited on social media, through private messages on WhatsApp and Facebook posts, additionally some were also recruited using private emails.

3.2.4- Quantitative Analysis – Online Survey

The data collected throughout the online survey were analysed using the statistical software – IBM SPSS (Statistical Package for the Social Sciences) 25.

Descriptive and inferential statistics were used in the statistical analysis. The level of significance to reject the null hypothesis was set at $(\alpha) \leq 0.05$. The homogeneity of variances was analysed with the Levene test and the normality of the variables with the Kolmogorov-Smirnov test. The Chi-Square Test and the Mann-Whitney Test were used, taking in consideration that the Chi-Square Test should not have more than 20% of the cells with expected frequencies less than 5. The use of parametric tests requires an interval dependent variable with a normal distribution and homogeneous variances (Marôco, 2011; Martins, 2011) since these assumptions were rarely satisfied, non-parametric tests were mostly used.

4- Results' Analysis

4.1- General sample characteristics

4.1.1- Socio-demographic characteristics and travel habits

A total of 149 surveys were started and 131 were fully completed which can be translated into an 87,9% completion rate that is acceptable for the study's purpose and make it possible to conclude that the survey length was adequate. After cleaning the data set and removing the outliers, the final sample was composed of 127 people. The general socio-demographic characteristics of the final sample are presented in Appendix VI.

In terms of age group, 48.8% of the respondents belong to the 18-28 range, followed by the respondents aged between 29-38 (20.5%) and those aged between 39-48 (20.5%), which leads to 89.8% of the sample being aged bellow 48-year-old. The oldest respondents belong to the 59-68 range only representing 2.4% of the sample, something that is expected not to be problematic in terms of responses' quality since it is expected from the literature that younger people are more predisposed to use the service. Moreover, the sample is composed of 57.5% men and 42.5% women, the majority (86.6%) had a higher level of education, and the remaining 13.4% had High School Degree. In terms of occupation, 59.8% of the respondents were employed, 33.9% were students, and 6.3% were working-students. The household composition ranges were more uniformly distributed. The majority (67.7%) of the participants has a monthly household income smaller or equal to 3500€, and 68.5% lived in the city of Lisbon while 31.5% lived in another location in the Lisbon Metropolitan Area.

Furthermore, 52% of the participants have past or current experience using the shared electric scooters service (Appendix VII).

In terms of modes of transport frequently used (Appendix VIII), where the participants were able to choose more than one option because participants can reconcile different means of transportation. Approximately half of the respondents (49.6%) assumed that frequently use public transports, 45.7% use their own car or motorcycle, 27.6% frequently move by foot, 20.5% are frequently using different types of shared mobility, 13.4% use Uber or similar, 7.9% their own bicycle and 1.6% use Taxi.

Finally, regarding the time spent per day travelling (Appendix IX), the majority (61.4%) spend until 1 hour per day travelling, 26% spend between 1 hour and 1 hour and 30 minutes, 7.9% between 1 hour and 30 minutes and 2 hours and only 4.7% more than 2 hours.

4.2- Behaviours, Preferences, and Opinions

4.2.1- Valued attributes when choosing a mode of transport

The most valued attribute when participants (Appendix XX) choose a mode of transport is the speed, valued in a mean of 4.59 out of 5 in terms of importance, being closely followed by the price (mean of 4.50), something that seems to indicate that time and money are highly valued by the respondents with regard to means of transport. Ease of use and to park, safety, comfort, and sustainability are attributes also considered as "very import". Being innovation, the unique attribute considered as "relatively important" classified in 2.89.

4.2.2- General behaviors when using a service or consuming a product

In order to understand some general habits and pretensions of the participants were asked to them to classify on a scale of 1-5 (1 – Strongly disagree; 5 – Strongly agree) some statements. On average the respondents partially agree with every statement (Appendix XI), they are willing to reconcile different modes of transport if it allows them to save money and/or time (mean of 4.23) as well as they are willing to share means of transport with other users (mean of 4.19). At the same time, they enjoy trying innovative products and services (mean of 4.09), they participate in the digital economy (mean of 4.03) and seek to consume sustainable products and services (mean of 3.91).

4.2.3- Shared electric scooters service perceptions

The same logic described above was used to understand how participants perceive the shared electric scooters service (Appendix XII). On average the participants partially agree that the service is a sustainable solution (mean of 4.35), that the service is accessible to different type of persons (mean of 3.72), that it can be used as a complement to other modes of transport (mean of 3.63) and that it is a solution that allows saving time (mean of 3.51). By the other hand, they seem to be not sure if the service can be one of the most important solutions in the future (mean of 3.16), if the service is an economical solution (mean of 3.09), if the shared electric scooters service is a safe solution (mean of 2.76), and if the service is more appropriate to use only on special occasions instead of in a day-to-day basis (mean of 2.70). Additionally, apparently, they partially disagree that the service should be used only to have fun moments (mean of 2.48), that it is only appropriate for young people (mean of 2.30) and that the service can fully substitute their current modes of transport (mean of 1.90).

4.3- Users

Concerning the frequency of use (Appendix XIII), no user is using the service every day of week or even every business day, 36% of the users that participated in this survey are using shared electric scooters, on average, less than once a week and 35% of them just have used once. Followed by 15% that are using once a week and the remaining 14% two or three times a week.

The most mentioned reason (Appendix XIV) for using the service was "to have fun moments or for curiosity" stated by 74% of the users and the answer "for short routes" pointed by 45% of the users. Moreover, precisely 50% are using or have used the service to complement their current modes of transport while 20% to substitute their current modes of transport. The use in order to save time is also cited by 27% of the users. Some characteristics associated to the service seems to be also an incentive for people to use it, like the fact that it is ecological and sustainable and because it is easy to use and to park, mentioned by 23% of the users. Innovation is also considered as a driver to use the service by 18% of the users. To save money (3%) and for medium distances and long distances (both with 2%) were the less stated reasons.

Apparently, the players offering the shared electric scooters' service in Lisbon appear to have similar characteristics, only 35% (Appendix XV) of the people that have used the service identified differences between the companies (Appendix XVI), 87% of the participants that have identified differences referred to the discounts offered, 74% the scooters robustness, 57% the control of improper parking, 39% the scooters speed, 30% the scooters design and 13% the price and the scooters safety.

Regarding satisfaction (Appendix XVII), the users seem to be totally satisfied with the number of scooters available (mean of 4.55 out of 5). Partially satisfied with the scooters' design (4.42), with the scooters' speed (4.39), with the functionality of the mobile applications (4.36), with the scooters' robustness (3.61) and with the scooters' safety (3.52). While neither satisfied nor dissatisfied with the scooters parking control (2.64) and partially dissatisfied with the price (2.23). In order to evaluate the total service satisfaction, a new variable was created using the eight variables just mentioned, where it is possible to verify that, on average, the users are partially satisfied with a mean of 3.71 with the service.

About the things to improve in the service (Appendix XVIII), no respondent said that is totally satisfied and does not would like to see improvements in the service. A decrease in the price was the most mentioned improvement, stated by 88% of the users, being coherent with previous results. The most suggested improvements were related to price, 45% of the users

would like to see created a package with unlimited trips paid monthly and 41% would like to have access to more discounts. Another question proposed by the majority of the users (59%) was improvements in the improper parking control, followed by improvements in the scooters' robustness (24%) and in the scooters' safety (21%). An increase in the number of scooters available and the speed of the scooters were less mentioned, 8% and 5%, respectively.

4.4- Non-users

The majority of the non-users (69%) argue that they are not using the service because do not feel the need to replace the current means of transport used, 59% do not consider the city infrastructures appropriated, 34% consider the service expensive taking into consideration their needs, 25% do not consider the service appropriate taking into consideration their personal characteristics, 18% consider the service dangerous, 14% consider the service not attractive and 2% do not use smartphone and do not trust in payments through mobile apps (Appendix XIX).

Despite this, on average the non-users appear not to have an opinion totally formed about the possibility to try the service in the future (Appendix XX) considering, on average, this possibility "neither likely nor unlikely" (3.23), with 51% considering likely ("extremely likely" plus "partially likely") to try the service and 33% considering unlikely ("extremely unlikely" plus "partially unlikely").

Lastly, 56% of the non-users mentioned a decrease in the price as a reason to start using (Appendix XXI) and, 54% have mentioned improvements in terms of the city's infrastructures. Additionally, 23% have mentioned safety enhancements and 16% improvements in scooter's robustness. Only 10% have declared that nothing would make them try the service.

4.5- Statistical Analysis

RQ1: Who are the users of shared electric scooters?

H11: The shared electric scooters service users are innovation enthusiasts.

In order to address this hypothesis, the Mann-Whitney Test between the results from the question "Do you use, or have you used the shared electric scooters service in the city of Lisbon?" and "Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I like to try innovative products and

services." was performed, in order to check if there is a difference in terms of innovation appreciation between users and non-users, assuming that respondents with a higher degree of agreement with the sentence are more enthusiastic about innovation. Evaluating the results provided by the table in Appendix XXII it was possible to verify that people that already used the service value more innovation.

This difference was proved statistically relevant through the Mann-Whitney Test, the value of the *U* was 1327.5 with a level of significance of p = 0.000, concluding that there are significant differences between the two groups compared (users and non-users).

Test Statistics[a]

	I like to try innovative products and services (1-5)
Mann-Whitney U	1327.500
Wilcoxon W	3218.500
Z	-3.580
Asymp. Sig. (2-tailed)	0.000

a. Grouping Variable: Do you use, or have you used the shared electric scooters service in the city of Lisbon?

Table 1 - Mann-Whitney Test (User-Innovation)

H12: The shared electric scooters service users are mainly young adults.

In order to address this hypothesis, first the crosstabulation between the results from the question "Do you use, or have you used the shared electric scooters service in the city of Lisbon?" and "Please indicate your age" was performed, in order to check if there is a difference in terms of age group between user and non-users. It was verified that 75.8% of the users are young adults (age group 18-28 and 29-38) and only 3% of them are over 49 years old while regarding the non-user 62.3% are young adults and 18.1% are over 49 years old. Showing that there is apparently a difference between age groups between people who have used the service and those who have never used it. Apparently with older people tending to be less prone to use the service (Appendix XXIII)

In order to understand if there is a statistically relevant association between the service usage and being young adult, the variable *YoungAdult* was created, separating respondents below the age of 38 from the other, and the Chi-Square Test was performed. It was obtained a value with 1 degree of freedom of 2.700, with an associated probability of p = 0.100, so it seems to not existence of a statistically significant association for a 95% confidence level.

Chi-Square Test

	Value	df	Asymptopic Significance (2-sided)
Pearson Chi-Square	2.700[a]	1	0.100
Likelihood Ratio	2.708	1	0.100
Linear-by-Linear Association	2.679	1	0.102
N of Valid Cases	127		

a. 0 cells (0,0%) expected count less than 5. The minimum expected count is 18.73.

Table 2 - Chi-Square Test (User-YoungAdult)

H13: The shared electric scooters service users are persons that do not mind sharing modes of transport with other users.

Performing the Mann-Whitney Test with the results from the question "Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I do not mind sharing means of transport with other users.". It was possible to verify that the shared electric scooters users have a higher level of agreement with the statement (Appendix XXIV).

Analyzing the Mann-Whitney Test, in order to verify if the difference between the two groups is statistically significant, the value of the *U* obtained was 1532.5 with a level of significance of p = 0.012, existing a statistically significant difference between users and non-users.

Test Statistics[a]

	I don't mind sharing means of transport with other users (1-5)
Mann-Whitney U	1532.500
Wilcoxon W	3423.500
Z	-2.516
Asymp. Sig. (2-tailed)	0.012

a. Grouping Variable: Do you use, or have you used the shared electric scooters service in the city of Lisbon?

Table 3 - Mann-Whitney Test (User-Willingness to Share)

H14: The shared electric scooters service users are persons who have more environmental concerns.

Performing the crosstabulation now between service usage or not and the results from the level of importance assigned for sustainability when choosing a mode of transport, assuming that a person who values sustainability has more environmental concerns. It is possible to verify that apparently there is a difference between the importance level that users attribute to sustainability when choosing a mode of transport and the non-users importance level. Users presented an average of 3.79 out of 5 of importance, while non-users presented an average of 3,29 (Appendix XXV).

Running the Chi-Square Test in order to understand if there is a statistically significant association between have used or not the shared electric scooters service and consider sustainability an important factor to have in consideration when choosing a mean of transport, it was obtained a value with 4 degrees of freedom of 13.679, with an associated probability of p = 0.008. Proving the existence of a statistically significant association.

Chi-Square Test

	Value	df	Asymptopic Significance (2-sided)
Pearson Chi-Square	13.679[a]	4	0.008
Likelihood Ratio	14.064	4	0.007
Linear-by-Linear Association	7.163	1	0.007
N of Valid Cases	127		

a. 2 cells (20.0%) expected count less than 5. The minimum expected count is 2.40.

Table 4 - Chi-Square Test (User-Sustainability Appreciation)

RQ2: Which are the drivers for using shared electric scooters' service?

H1: The users perceive shared electric scooters as an alternative to traditional transportation modes.

Performing the crosstabulation, using the results from the question "Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I believe that the shared electric scooters service could completely replace my current means of transport.", there seem to exist differences between users and non-users'

opinions, however, both disagree with the sentence, users with a mean of 2.15 and non-users 1.63 (Appendix XXVI).

Running the Mann-Whitney Test it is possible to verify that the differences are statistically significant (U=1434.500 and p = 0.003).

Test Statistics[a]

	Shared Electric Scooters could replace my current mode of transport (1-5)
Mann-Whitney U	1434.500
Wilcoxon W	3325.500
Z	-3.008
Asymp. Sig. (2-tailed)	0.003

a. Grouping Variable: Do you use, or have you used the shared electric scooters service in the city of Lisbon?

Table 5 - Mann-Whitney Test (User-Scooters as a substitute)

Additionally, it is possible to verify that only 20% of users assume that they are using the service to replace their current mode of transportation (appendix XIV)

H2: The users perceive shared electric scooters as an alternative to traditional transportation modes as complement to traditional transportation modes.

In order to address this hypothesis, a similar analysis was performed but now with the results from the level of agreement about the possibility of the service complement the current means of transport used by participants. From the crosstabulation, it is possible to verify once again that apparently there is a difference between the two groups, users with an average of agreement of 4.15 and non-users 3.07 (Appendix XXVII).

Running the Chi-Square Test it was obtained a value with 4 degrees of freedom of 35.234, with an associated probability of p = 0.008. Proving the existence of a statistically significant association between service usage or not and consider the service as a complement.

Chi-Square Test

	Value	df	Asymptopic Significance (2-sided)
Pearson Chi-Square	35.234[a]	4	0.000
Likelihood Ratio	40.454	4	0.000
Linear-by-Linear Association	26.521	1	0.000
N of Valid Cases	127		

a. 1 cells (10.0%) expected count less than 5. The minimum expected count is 4.80.

Table 6 - Chi-Square Test (User-Scooters as a complement)

Additionally, it is possible to verify that 50% of users assume that they are using the service to complement their current mode of transportation (Appendix XIV)

H3: The users perceive the shared electric scooters as an economical solution.

In this specific case, after performing the crosstabulation, it is possible to verify that apparently there are small differences between the two groups, although the average of both falls in the neutral zone, non-users have a higher degree of agreement (3.12 out of 5) in comparison with users (3,08) (Appendix XXVIII).

Performing the Chi-Square Test it is possible to verify that exists a statistically significant association (p = 0,005), between use or not the service and consider that the service economical.

Chi-Square Test

	Value	df	Asymptopic Significance (2-sided)
Pearson Chi-Square	14.710[a]	4	0.005
Likelihood Ratio	15.576	4	0.004
Linear-by-Linear Association	0.035	1	0.852
N of Valid Cases	127		

a. 0 cells (0.0%) expected count less than 5. The minimum expected count is 6,24.

Table 7 - Chi-Square Test (User-Scooters as an economical solution)

In addition, 88% of the users would like to see a decrease in the price (Appendix XVIII), only 3% are using the service because they consider that it allows them to save money (Appendix XIV) and 56% of the non-users pointed a decrease in price as a motivation to start using (Appendix XXI).

H4: Shared electric scooters are more appropriate to be used to run short distances.

When asked the reasons why participants used or are using the service, 58% of them admitted that this is to run short distances (0-3km) while only 2% are mentioned "to run medium distances (3-6km)" or "to run long distances (more than 6km)" (Appendix XIV).

H5: The fact of being considered as an enjoyable experience, can be one of the main drivers for the use of shared electric scooters.

The most mentioned reasons that led people to use or try the service was "for fun or curiosity", with 74% of the users mentioning it (Appendix XIV).

H6: Convenience gains from the saving of time avoiding traffic congestions and problems with parking spaces can be one of the main drivers for the use of shared electric scooters

Regarding this hypothesis, in fact from the crosstabulation, it is possible to verify that apparently there are differences between the level of agreement of users and non-user concerning the possibility to save time with the use of the service. Users with a level of agreement of 3.75 and non-users 3.25 (Appendix XXIX).

Performing the Chi-Square Test it was obtained a value with 4 degrees of freedom of 14.334, with an associated probability of p = 0.006. Proving the existence of a statistically significant association between use or not the service and consider that the service allows saving time.

Chi-Square Test

	Value	df	Asymptopic Significance (2-sided)
Pearson Chi-Square	14.334[a]	4	0.006
Likelihood Ratio	15.129	4	0.004
Linear-by-Linear Association	6.665	1	0.010
N of Valid Cases	127		

a. 2 cells (20.0%) expected count less than 5. The minimum expected count is 2.88.

Table 8 - Chi-Square Test (User-Convenience gains)

Furthermore, it is possible to verify that 38% of users assume that they are using the service because it allows them to save time (Appendix XIV).

RQ3: Which are the main barriers to the effective use of the shared electric scooters' service?

H7: The security of the service is something that users would like to see improved in the shared electric scooters service.

Although the sample mean is 3.55 indicating that users can be satisfied with the security of the service (agree), after performing the confidence interval we can affirm with 95% of certainty that the real average of the population is between 3.28 and 3.75 (Appendix XXX). As the lower bound falls on the neutral region (3.28) we cannot claim that, on average, users agree to the statement.

Moreover, 21% of the users would like to see the scooters' safety improved (Appendix XVIII) and 23% of the non-users claimed safety enhancements could be a reason for them to start using the service (Appendix XXI).

H8: Robustness of the shared electric scooters is something that users would like to see improved in the shared electric scooters service.

Apparently, on average participants agree that they are satisfied with scooters robustness with an average of 3.61. Performing the confidence interval it is possible to affirm with 95% of certainty that the real average of the population is between 3.37 and 3.84 (Appendix XXXI), falling the lower bound on the neutral region (3.37) and so, it is not possible to claim that, on average, users agree to the statement.

Furthermore, 24% (Appendix XVIII) of the users would like to see the scooters' robustness improved and 16% (Appendix XXI) of the non-users claimed safety enhancements could be a reason for them to start using the service.

H9: Poor city infrastructures is something that is affecting the use of the shared electric scooters service.

Considering the city infrastructures not prepared for the use of the service was something mentioned by 59% of the non-users as a reason for not using the service (Appendix XIX), being one of the most referred reasons. Moreover, 54% of them mentioned improvements in terms of city infrastructures as a reason to start using (Appendix XXI)

H10: Shared electric scooter users would like to see improved the improper parking control

Regarding the hypothesis, the level of satisfaction of participants about the improper parking control, is on average 2.64 out of 5 falling in the neutral region. Throughout the confidence interval, it is possible to verify with 95% of certainty that the real average of the population is between 2.39 and 2.89 (Appendix XXXII), falling the lower bound in the partially dissatisfied region.

Additionally, 59% of the users would like to see an improvement in the improper parking control (Appendix XVIII) and 57% consider that there are different approaches to this problem between the players in the market (Appendix XVI).

4.6- Binary Logistic Regression

In order to try to understand which factors can lead to a higher likelihood to use the shared electric scooters' service, a Binary Logistic Regression was performed using as the dependent variable, the variable *User* (codified with 0 if user and 1 if non-user). Several binary variables were created, always using the same reasoning, for instance, in order to create the binary variable *ScooterCompl* it was assumed that persons that do not consider shared electric scooters as a possible complement for their usual mode of transport scored the sentence with 1, 2 or 3 and the persons that consider it, with 4 and 5. Five of these variables have revelated significant to explain the model: *ScooterCompl* – people seeing on the service a good complement for their usual mode of transport; *EcoDigConsumer* – people participating on the digital economy; *Sust*Appreciation – people who value sustainability when choosing a mode of transport; *YoungAdult* – people under 38 years old and *Innovat*Appreciation – people who value innovation when choosing a mode of transport:

	Variables in the Equation						
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1a	ScooterCompl(1)	1.651	0.499	10.945	1	0.001	5.212
	EcoDigConsumer(1)	1.290	0.587	4.833	1	0.028	3.633
	SustAppreciation(1)	1.063	0.491	4.687	1	0.030	2.895
	YoungAdult(1)	1.592	0.570	7.801	1	0.005	4.912
	InnovatAppreciation (1)	1.479	0.610	5.872	1	0.015	4.388
	Constant	-4.229	0.955	19.592	1	0	0.015

a. Variable(s) entered on step 1: ScooterCompl, EcoDigConsumer, SustAppreciation, YoungAdult, InnovatAppreciation.

Table 9 - Binary Logistic Regression

This model explains 43,0% (Nagelkerke R Square) of the likelihood to use the shared e-scooters' service, which means that other variables can be important to explain this phenomenon. It is possible to interpret the output provided by the regression saying that, *ceteris paribus*, the odds for a person that see shared electric scooters as a complement for their usual mode of transport to use the service are 5.212 (exp(1.651)) higher as they are for a person that does not see it. The same for a person participating in the digital economy that will have odds 3.633 times higher compared to a person that is not. A person that values sustainability when choosing a transport will have odds, *ceteris paribus*, 2.895 times higher than a person that does not value. The odds for young adults to use the service are, *ceteris paribus*, 4.912 higher comparing to a person from another age group and finally a person that values innovation will have odds, *ceteris paribus*, 4.388 times higher in comparison to a person that does not value it.

5- Conclusion, Limitations and Future Research

5.1- Conclusion

Technology developments and new demands and concerns have been changing the way people move, increasing shared mobility offers with a significant focus on micro-mobility. This dissertation sought to study who the very recent micro-mobility market is being addressed in the area of Lisbon, focusing on the shared electric scooters offer.

After triangulating the results from the qualitative and quantitative researches, it was possible to withdraw similar insights. Firstly, regarding shared electric scooters users' characteristics, although a large part of the participants in this study was young, which may limit the quality of the conclusions, it was possible to verify that youngers apparently are more prone to use the service. All young non-users interviewed showed interest in trying the service while older respondents tend to not identify themselves as much with the characteristics of the service. Additionally, analyzing the data from survey it was possible to verify that 75.8% of the users are young adults (between 18 and 38 years old) and only 3% of them are over 49 years old, while concerning the non-users 62.3% are young adults and 18.1% are over 49 years old. The association between the service use and age group was not proved statistically significant for a 95% confidence level, which makes the results less conclusive. However, the variable *YoungAdult* was proved to be significant to explain the Binary Logistic Model. The shared electric scooters' users tend to be more enthusiastic about innovation in comparison with non-users, something also confirmed through the Binary Logistic Model, a person who values innovation is more likely to be a user. The same was verified about sustainability. Users seem to be more available to share modes of transport with other people, in comparison to non-users, and the fact of a person usually participates in the digital economy also increases the odds of using the service.

About the drivers for using the service, shared electric scooters seem not to be used as a way of replacing the usual means of transport of the users, but rather to complement them. Although there is a statistically significant difference between users and non-users, none of the groups, on average, considers that the service can replace other means of transport and only 20% the users are using it as a substitute. By the other hand, 50% of the users admitted that they are using the service to complement their usual mode of transport and they seem to consider the service appropriate for that purpose, while non-users seem to have no structured opinion on this point. People that see shared electric scooters as a complement are more likely to become users, as suggests the Binary Logistic Model. The possibility to save money using

the service was one of the points that have created more doubts, the participants in the qualitative research argued that it is necessary to decrease the price of the service to make it a viable solution in a daily basis. In the quantitative research, both users and non-users are not sure if they can classify the service as economical, at the same time, 88% of the users would like to see a decrease in the price, only 3% are using the service because they consider that it allows them to save money and 56% of the non-user pointed out a decrease in price as a motivation to start using. And, 34% the fact that consider the service expensive taking into consideration the needs as reason for not using, something also quite mentioned in the qualitative research. Furthermore, 41% of the users would like to have access to more discounts and 45% would like to see created a package with unlimited trips paid monthly, just like happens with public transports or with public bike-sharing offers. The price, that is one of the most valued attributes for people when choosing a mode of transport (4.5 out of 5) appears to be one of the most problematic points for respondents. The users appear to be more clarified about the impact of the service in terms of time-saving and 38% of them are even using the service with this purpose. By the other hand, for non-users this question is not so clear, indicating that this benefit is more noticeable by those who use the service and that only experience can demonstrate it.

The fact that it is considered a fun experience and arouses curiosity appear to be characteristics attracting users, once 74% of the users confessed that used the service for fun or curiosity. At the same time, it is considered more appropriate to be used in short distances (by 58% of users) instead of medium or long distances.

Regarding to possible improvements in the service, the users' satisfaction in relation to the safety of the service and the robustness of the scooters, despite falling, on average, on the area "satisfied" and the median of both was 4 ("partially satisfied"), seem to not be totally clear since the means are more or less on the border between "neither satisfied nor dissatisfied" and "satisfied" and the lower bound of the confidence interval falls on the neutral region. Moreover, 21% of the users would like to see the scooters' safety improved and 23% of the non-users claimed safety enhancements could be a reason for them to start using the service while 24% of the users would like to see the scooters' robustness improved and 16% of the non-users claimed safety enhancements could be a reason for them to start using the service. It is not possible to conclude if these questions are impacting on the use of the service, things that can be further explored in future studies. The improper parking control appears to be a more problematic issue, even though, the level of satisfaction falls, on average, in the neutral region (neither satisfied nor dissatisfied) it is more or less on the border between "partially

dissatisfied" and "neither satisfied nor satisfied", falling the lower bound of the confidence interval on the dissatisfied region and being the median 2, indicating that at least 50% of the users are dissatisfied. It was also a very mentioned problem during interviews, and additionally, 59% of the users would like to see an improvement in improper parking control. Finally, the infrastructures of the city can also be a barrier to the use of the service once 59% of the non-users mentioned the lack of preparation in the city infrastructures as a reason for not using the service, being one of the most referred reasons. And, 54% of them mentioned improvements in terms of city infrastructures as a reason to start using.

It is also possible to conclude that it is a market with little differentiation, since few respondents demonstrated to identify differences between the different players (only 35% in the survey). Nevertheless, the most identified differences were the discounts provided, the scooters' robustness and the control of improper parking, which may indicate that these issues are the most sensitive to users.

In summary, this service seems to be attractive and to be able to affirm itself even more in the city of Lisbon, being apparently especially attractive for younger people, digital economy participants, people who do not mind sharing modes of transport with others, people who value innovation and sustainability, and who seek to save time. It is also considered an enjoyable solution and being used as a way to have fun times. The service is mainly seen as a complement to the traditional means of transport mainly because people consider that the price does not allow them to use it more frequently and because they consider the infrastructures of the city not fully prepared. Besides the price, improvements in the improper parking control must be taken in to account by the companies.

5.2- Limitations and Future Research

One of the limitations of this study was the lack of academic literature related to the shared electric scooters market in particular, once it is a very recent thematic. Something that made the literature review in part based on more general concepts like Collaborative Consumption, Mobility-as-a-Service, Smart Mobility, and Shared Mobility.

The samples for both the quantitative and qualitative research were relatively small, and the fact that the study is aimed only at inhabitants of the metropolitan area of Lisbon has increased the difficulty in the data collection process. Moreover, it was not possible to obtain data from all age groups in a uniform way, with the majority of participants (69.3%) less than 38 years old, something that may create biased results and compromise some analysis, also because age was an important variable for the study.

The fact that the survey was distributed online through social media platforms is also in itself a limitation, since it restricts the sample only to the researcher's network, which may not be very diversified and increases the tendency for people to rush to finalize the questionnaire quickly and to pay less attention, something that can contribute to inconsistent results.

Moreover, the use of non-parametric tests can also be considered a limitation since the non-parametric tests are considered less powerful compared to the parametric ones (Marôco, 2011; Martins, 2011)

This study is focused only on the user's perception of the service, however, in future studies, it might be interesting to try to evaluate also the side of the companies that are providing this service, and which are increasingly entering in the market. In order to better understand their sector’s vision, as well as their mission. And thus, increase the number of insights and data sources.

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Appendices

Appendix I: Electric Shared Scooters offer in Lisbon

SCOOTERS OFFER	Price	Discounts	Differentiated Characteristics
Lime	1€ to unlock the scooter plus 0.15€ per minute	Discount coupons for new users and when invited friends become users	Different means of payment: pre-payment and credit card; Possibility to pause the ride
Voi	1€ to unlock the scooter plus 0.15€ per minute	Discount coupons for new users and when invited friends become users	-
Hive	1€ to unlock the scooter plus 0.15€ per minute	Discount coupons for new users and when invited friends become users	Possibility to pause the ride
Tier	1€ to unlock the scooter plus 0.15€ per minute	Discount coupons for new users and when invited friends become users	-
Bungo	1€ to unlock the scooter plus 0.15€ per minute	Discount coupons for new users and when invited friends become users	Different means of payment: pre-payment and credit card
Wind	1€ to unlock the scooter plus 0.15€ per minute	Discount coupons for new users and when invited friends become users	Parking lots; Different means of payment: pre-payment and credit card
Flash	1€ to unlock the scooter plus 0.15€ per minute	50% discount if the user properly parked the scooter in a parking lot	Parking lots; Possibility to pause the ride; Possibility to estimate the ride's price; Availability of helmets; more robust material and wheels
Bird	1€ to unlock the scooter plus 0.15€ per minute	Discount coupons for new users and when invited friends become users	-
Frog	1€ to unlock the scooter plus 0.15€ per minute	Discount coupons for new users and when invited friends become users	1% of the revenue will be donated to environmental organizations

Appendix II: Electric Shared Bikes offer in Lisbon

BIKES OFFER	Price	Discounts	Differentiated Characteristics
GIRA	Annual subscription: 25€ for unlimited utilizations with maximum of 45 minutes in a row plus 1€ per minute for rides between 45 and 90 minutes or plus 2€ per minute for rides with more than 90 minutes. Monthly subscription: 10€ for unlimited utilizations plus conditions mentioned above. Daily subscription: 2€ for unlimited utilizations plus conditions mentioned above.	-	Public offer with physical stations.
JUMP	0.15€ per minute	Discount coupons when invited friends become users	"Dockless" offer without physical stations; There is no need to pay for unlock the bikes.

Appendix III: Interview script

Qualitative Research – Interview Script

This interview comes within the scope of an academic dissertation about the shared electric scooters market. It will be conducted to users and non-users of this service in the same proportion in order to try to avoid biased conclusions. The data provided in the interviews will have an exclusively academic purpose and the anonymity of each interviewee is guaranteed.

Questions:

1. Do you use the shared electric scooters' service? (Everyone)

2. Why are you using this service? (Users)

   OR

3. Why are you not using this service? (Non-users)
4. How often are you using this service? (Users)
5. If you are a non-user, are you interested in try the service? (Non-users)
6. When you think about this service what are the first three things that comes to your mind? (Everyone)
7. Which means of transportation do you usually use in your day-to-day? (Everyone)
8. Do you think that shared electric scooters' service can replace these means of transportation? (Everyone)
9. In which context do you think that the use of shared electric scooters' service is more appropriate? (Everyone)
10. If you are a shared electric scooters user, do you identify differences between the various players? In which aspect? (User)
11. If you are a shared electric scooters user, what would you like to see improved in the service? (User)
12. How old are you? (Everyone)
13. Are you: student; student worker; worker or unemployed? (Everyone)
14. Where do you live: Lisbon or another place inside the Lisbon metropolitan area? (Everyone)

Appendix IV: Interviewees Distribution

Age Group	Nº of persons	Nº Users	Nº Non-users
18-28	6	3	3
29-38	2	2	0
39-48	2	0	2
49-58	2	1	1
Total	**12**	**6**	**6**

Appendix V: Online Survey

Online Survey

Dear participant,

I am a master student at Católica Lisbon School of Business and Economics and I am currently writing my dissertation, which is related to the service of shared electric scooters

available in the city of Lisbon, service provided by the companies: Lime, Voi, Hive, Tier, Bungo, Wind, Flash, Bird and Frog, in which it is possible to rent electric scooters through a mobile application. This questionnaire is precisely on this topic and it is intended for users and non-users of the service with the aim of capturing the sincerest opinions about it.

The questionnaire will take about 6 minutes to respond and the answers are strictly confidential and will be used exclusively for this study.

In case of any question or curiosity do not hesitate to contact: pedro_canhestro@hotmail.com.

Your contribution will be extremely important to my work, so I thank you in advance for your participation.

Thank you very much,

Pedro Canhestro

Q1) Do you live in Lisbon or Metropolitan Area of Lisbon and are you over 18 years old?

- Yes
- No

The participants who answered "Yes" will proceed to the next questions and the questionnaire will end for the participants who answered "No".

Section 1 – Behavioral data and personal views and characteristics

Q2) How much time do you spend each day traveling?

- Less than 30 minutes
- Between 30 minutes and 1 hour
- Between 1 hour and 1 hour and 30 minutes
- Between 1 hour and 30 minutes and 2 hours
- More than 2 hours

Q3) Which means of transportation do you normally use? (you can choose more than one option)

- My own car or motorcycle
- My own bike
- Public transport (bus; train; subway; tram)
- I usually walk
- My own electric scooter
- Bike-sharing

- Car-sharing
- Motorcycle-sharing
- Shared electric scooters
- Taxi
- Uber and similar
- Other. Which one?

Q4) Please indicate the importance level, on a scale of 1-5, that you assign to each of the following elements when you choose the means of transport in which you are traveling (1 - Without any importance, 5 - Extremely important):

	1- Without any importance	2- Slightly important	3- Relatively important	4- Very important	5- Extremely important
Comfort	○	○	○	○	○
Ease of use and park	○	○	○	○	○
Innovation	○	○	○	○	○
Price	○	○	○	○	○
Speed	○	○	○	○	○
Safety	○	○	○	○	○
Sustainability	○	○	○	○	○

Q5) Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree):

	1- I strongly disagree	2- Partially disagree	3- Neither agree nor disagree	4- Partially agree	5- I strongly agree
I seek to consume sustainable products and services.	○	○	○	○	○
I like to try innovative products and services.	○	○	○	○	○
I often participate					

in the digital economy (buying and selling via the internet and / or mobile applications).	○	○	○	○	○
I do not mind reconciling different means of transport if it allows me to save money and / or time.	○	○	○	○	○
I do not mind sharing means of transport with other users.	○	○	○	○	○

Q6) Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree):

	1- I strongly disagree	2- Partially disagree	3- Neither agree nor disagree	4- Partially agree	5- I strongly agree
I believe that the shared electric scooters service could completely replace my current means of transport.	○	○	○	○	○
I believe that the shared electric scooters service could complement my current mode of transport.	○	○	○	○	○
I think the shared electric scooters service serves only as a form of entertainment and not as a means of transportation.	○	○	○	○	○
I believe that the shared electric scooters service is only for use on special occasions, for example when I am late, and I have no other service available nearby.	○	○	○	○	○

Q7) Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree):

	1- I strongly disagree	2- Partially disagree	3- Neither agree nor disagree	4- Partially agree	5- I strongly agree
I think the shared electric scooters service is only appropriate for young people.	○	○	○	○	○
I believe that the shared electric scooters service is accessible to different types of people.	○	○	○	○	○
I believe that the shared electric scooters service is a sustainable mode of mobility.	○	○	○	○	○
I believe that the shared electric scooters service is an economical mode of mobility.	○	○	○	○	○
I believe that sharing electric scooters is a safe mode of mobility.	○	○	○	○	○
I think by using the shared scooter service I can save time.	○	○	○	○	○
I believe that shared electric scooters can be one of the most important means of transport in the future.	○	○	○	○	○

Q8) Do you use, or have you used the shared electric scooters service in the city of Lisbon?

- Yes
- No

The participants who answered "Yes" will have different questions from participants who answered "No" from here.

Section 2.1 – Questions for users (participants who answered "Yes" in Q8)

Q9) Why do you use or used the service? (you can choose more than one option)

- For fun and / or curiosity
- To move in short distance (up to 3 km)
- To move in medium distance (between 3 and 6 km)
- To move in long paths (more than 6 km)
- To replace my usual means of transport
- To complement my usual means of transport

- Because it allows me to save money
- Because it is innovative
- Because it is ecological and sustainable
- Because it allows me to save time
- Because it is easy to use and park
- Because it is safe
- Other. Which one?

Q10) How often do you use the service?

- I only used it once
- Less than once a week
- Once a week
- Two to three times a week
- Every business day
- Every day of the week

Q11) Are you able to identify differences between the companies that are offering the shared electric scooters service in the city of Lisbon?

- Yes
- No

Q12) If you are able to identify differences, in which aspects? (you can choose more than one option)

- Control of improper parking
- Design of the scooters
- Price
- Special Offers (discounts)
- Robustness of the scooters
- Safety of the scooters
- Speed of the scooters
- Other. Which one?

Q13) In which aspects would you like to see the service improved? (you can choose more than one option)

- None, I am satisfied
- Decrease in price
- More Special Offers (discounts)

- Creation of a package with trips paid monthly
- Increase in the scooters' speed
- Decreased in the scooters' speed
- Improvement in the scooters' robustness
- Improvement in the scooters' safety
- Improvement in improper parking control
- Increase in the number of scooters available
- Other. Which one?

Q14) Please indicate the satisfaction level, on a scale of 1-5, that you assign to each of the following service factors (1 - Extremely satisfied, 5 - Extremely satisfied; you can repeat the scores):

	1- Totally dissatisfied	2- Partially dissatisfied	3- Neither satisfied nor dissatisfied	4- Partially satisfied	5- Totally satisfied
Parking control of the scooters	○	○	○	○	○
Design of the scooters	○	○	○	○	○
Mobile applications functionality	○	○	○	○	○
Price	○	○	○	○	○
Robustness of the scooters	○	○	○	○	○
Safety of the service	○	○	○	○	○
Speed of the scooters	○	○	○	○	○
Quantity of scooters available	○	○	○	○	○

Section 2.2 – Questions for non-users (participants who answered "No" in Q8)

Q9) Why did you never use the service? (you can choose more than one option)

- I do not feel the need to replace my current means of transport
- I do not consider the service appropriate given my personal characteristics
- I consider the city infrastructures not prepared

- I consider the service expensive considering my needs
- I do not consider the service attractive
- I consider the service dangerous
- I do not use smartphone
- I do not trust payments through mobile apps
- Other. Which one?

Q10) How likely, on a scale of 1-5, will you experience service in the future?

- 1 - Extremely unlikely
- 2 - Partially unlikely
- 3 - Neither likely nor unlikely
- 4 - Partially unlikely
- 5 - Extremely likely

Q11) What would make you start using the service? (you can choose more than one option)

- No change would make me use the service
- Safety enhancements
- Improvements in terms of city infrastructures
- Decrease in price
- Improvement in the scooters' design
- Improvement in the scooters' robustness
- Other. Which one?

Section 3 – Sociodemographic Data

Q12/Q15) Please indicate your age:

- 18-28
- 29-38
- 39-48
- 49-58
- 59-68
- More than 68

Q13/Q16) Please indicate you gender

- Female
- Male

Q14/Q17) Please indicate the highest level of studies you have completed:

- Basic Education
- High School
- Bachelor's Degree
- Master's Degree
- PhD or higher
- Other. Which one?

Q15/Q18) Please indicate your current professional situation:

- Student
- Student worker
- Employee
- Unemployed
- Retired

Q16/Q19) Please indicate the size of your household:

- 1 person
- 2 people
- 3 people
- 4 people
- 5 or more people

Q17/Q20) Please indicate the monthly income level of your household:

- Up to 700 €
- Between 701 - 1400 €
- Between 1401 - 2100 €
- Between 2101 - 2800 €
- Between 2801 - 3500 €
- Between 3501 - 4200 €
- Between 4201 - 4900 €
- Higher than € 4901

Q18/Q21) Please indicate where you live:

- City of Lisbon
- Another location in the Lisbon Metropolitan Area

End of the questionnaire

Appendix VI: Sample general sociodemographic characteristics

Sociodemographic Variables	Values	Frequency	Percentage	Cumulative Percent
Age	18-28	62	48.8	48.8
	29-38	26	20.5	69.3
	30-48	26	20.5	89.8
	49-58	10	7.9	97.6
	59-68	3	2.4	100
	Total	127	100	
Gender	Female	54	42.5	
	Male	73	57.5	
	Total	127	100	
Education	High School	17	13.4	
	Bachelor	64	50.4	
	Master	42	33.1	
	PhD or above	4	3.1	
	Total	127	100	
Occupation	Student	43	33.9	
	Working-student	8	6.3	
	Employed	76	59.8	
	Total	127	100	
Household	1 person	18	14.2	
	2 people	19	15	
	3 people	32	25.2	
	4 people	38	29.9	
	5 or more people	20	15.7	
	Total	127	100	Cumulative Percent
Monthly income of the household	1 - Until 700€	4	3.1	3.1
	2 - Between 701 - 1400€	17	13.4	16.5
	3 - Between 1401 – 2100€	21	16.5	33.1
	4 - Between 2101 - 2800€	23	18.1	51.2
	5 - Between 2801 - 3500€	21	16.5	67.7
	6 - Between 3501 – 4200€	20	15.7	83.5
	7 - Between 4201 – 4900€	5	3.9	87.4
	8 - Higher than 4901€	16	12.6	100
	Total	127	100	
Place of residence	City of Lisbon	87	68,5	
	Another location in the Lisbon Metropolitan Area	40	31,5	
	Total	127	100	

Appendix VII: Experience with shared electric scooters

Shared E-Scooter Users	Frequency	Percent
Users	66	52
Non-users	61	48
Total	127	100

Appendix VIII: Modes of transport frequently used

Modes of transport frequently used	Frequency	Percent
Own car or motorcycle	58	45.7
Other modes of transport	69	54.3
Total	127	100
Own bike	10	7.9
Other modes of transport	117	92.1
Total	127	100
Public transport	63	49.6
Other modes of transport	64	48
Total	127	100
By foot	35	27.6
Other modes of transport	92	72.4
Total	127	100
Own electric scooter	3	2.4
Other modes of transport	124	97.6
Total	127	100
Bike-sharing	16	12.6
Other modes of transport	111	87.4
Total	127	100
Car-sharing	2	1.6
Other modes of transport	125	98.4
Total	127	100
Motorcycle-sharing	1	0.8
Other modes of transport	126	99.2
Total	127	100
Shared electric scooters	7	5.5
Other modes of transport	120	94.5
Total	127	100
Taxi	2	1.6
Other modes of transport	125	98.4
Total	127	100
Uber and similar	17	13.4
Other modes of transport	110	86.6
Total	127	100

Appendix IX: Time spent per day travelling

Time spent per day travelling	Frequency	Percent	Cumulative Percent
Less than 30 minutes	23	18.1	18.1
Between 30 minutes and 1 hour	55	43.3	61.4
Between 1 hour and 1 hour and 30 minutes	33	26	87.4
Between 1 hour and 30 minutes and 2 hours	10	7.9	95.3
More than 2 hours	6	4.7	100
Total	127	100	

Appendix X: Valued attributes when choosing a mode of transport

Attributes	Confort		Ease of use and to park		Innovation		Price		Speed		Safety		Sustainability	
Scale	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1	1	0.8	2	1.6	16	13	0	0.8	0	0.8	1	0.8	5	3,9
2	8	6.3	4	3.1	26	21	0	0	0	0	4	3.1	15	11.8
3	35	28	13	10	47	37	14	11	8	5.5	21	17	34	26.8
4	49	39	54	43	32	25	36	28	36	28.3	47	37	51	40.2
5	34	27	54	43	6	4.7	77	61	83	65.4	54	43	22	17.3
Total	127	100	127	100	127	100	127	100	127	100	127	100	127	100
Average	3.85		4.21		2.89		4.5		4.59		4.17		3.55	
Std. Dev.	0.921		0.87		1.071		0.689		0.609		0.874		1.037	

Note: 1 – Without any importance; 5 – Extremely important

Appendix XI: General behaviours when using a service or consuming a product

Behaviours	Habit to consume of sustainable products and services		Habit to try innovative products and services		Participation in the digital economy		Willingness to reconcile modes of transport		Willingness to share modes of transport	
Scale	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1	2	1.6	1	0.8	3	2.4	1	0.8	2	1.6
2	3	2.4	3	2.4	11	8.7	12	9.4	9	7.1
3	33	26	21	17	10	7.9	12	9.4	15	11.8
4	56	44	60	47	59	47	34	27	38	29.9
5	33	26	42	33	44	35	68	54	63	49.6
Total	127	100	127	100	127	100	127	100	127	100
Average	3.91		4.09		4.03		4.23		4.19	
Std. Dev.	0.868		0.811		0.966		1.017		1.006	

Note: 1 – Strongly disagree; 5 – Strongly agree

Appendix XII: Shared electric scooters service perceptions

Opinions	Shared E-Scooters as a Substitute		Shared E-Scooters as a Complement		Shared E-Scooters Exclusively for Fun		Shared E-Scooters Exclusively for Special Occasions		Shared E-Scooters Exclusively for Young People	
Scale	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1	60	47	10	7.9	32	25	28	22	41	32.3
2	40	32	15	12	40	32	33	26	42	33.1
3	10	7.9	16	13	25	20	20	15.7	14	11
4	14	11	57	45	22	17	41	32.3	25	19.7
5	3	2.4	29	23	8	6.3	5	3.9	5	3.9
Total	127	100	127	100	127	100	127	100	127	100
Average	1.90		3.63		2.48		2.70		2.30	
Std. Dev.	1.097		1.187		1.221		1.243		1.224	

Note: 1 – Strongly disagree; 5 – Strongly agree

Opinions	Shared E-Scooters Accessible to Different Types of People		Shared E-Scooters as a Sustainable Solution		Shared E-Scooters as an Economical Solution		Shared E-Scooters as a Safe Solution		Shared E-Scooters as a Time-Saver Solution		Shared E-Scooters as one of the Most Important Solutions in the Future	
Scale	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1	7	5.5	1	0.8	13	10	16	12.6	6	4.7	11	8.7
2	14	11	3	2.4	30	24	39	30.7	18	14.2	20	15.7
3	13	10	8	6.3	29	23	35	27.6	31	24.4	42	33.1
4	67	53	53	42	42	33	33	26	49	38.6	46	36.2
5	26	21	62	49	13	10	4	3.1	23	18.1	8	6.3
Total	127	100	127	100	127	100	127	100	127	100	127	100
Average	3.72		4.35		3.09		2.76		3.51		3.16	
Std. Dev.	1.083		0.772		1.178		1.072		1.083		1.050	

Note: 1 – Strongly disagree; 5 – Strongly agree

Appendix XIII: Frequency of use

Frequency of use	Frequency	Percentage
Just once	23	35%
Less than once a week	24	36%
Once a week	10	15%
Two to three times a week	9	14%
Every business day	0	0%
Every day of the week	0	0%
Total	66	100%

Appendix XIV: Reasons for using the service

Reasons for Using	Frequency	Percent
For Fun or Curiosity	49	74%
Short Distances (3 km)	38	58%
Medium Distances (3-6 km)	1	2%
Long Distances (more than 6 km)	1	2%
To Substitute	13	20%
To Complement	33	50%
To save money	2	3%
Because it's Innovative	12	18%
Because it's ecological and sustainable	15	23%
To save time	25	38%
Because it's easy to use and park	15	23%

Appendix XV: Users identifying differences between the players

Users identifying differences between the players	Frequency	Percentage
	23	35%

Appendix XVI: Differences identified

Differences identified	Frequency	Percentage
Control of improper parking	13	57%
Scooters Design	7	30%
Price	3	13%
Special offers (discounts)	20	87%
Scooters Robustness	17	74%
Scooters Safety	3	13%
Scooters Speed	9	39%

Appendix XVII: Users' satisfaction

Satisfaction	Scooters Parking Control		Scooters Design		Apps Functionality		Price	
Scale	Freq	%	Freq	%	Freq	%	Freq	%
1	7	11%	0	0%	0	0%	10	15%
2	28	42%	3	5%	4	6%	37	56%
3	14	21%	5	8%	7	11%	13	20%
4	16	24%	19	29%	16	24%	6	9%
5	1	2%	39	59%	39	59%	0	0%
Total	66	100%	66	100%	66	100	66	100%
Average	2.64		4.42		4.36		2.23	
Std. Dev.	1.017		0.824		0.905		0.819	

Note: 1 – Totally dissatisfied; 5 – Totally satisfied

Satisfaction	Scooters Robustness		Service Safety		Scooters' Speed		Quatity of Scooters Available	
Scale	Freq	%	Freq	%	Freq	%	Freq	%
1	0	0%	2	3%	0	0%	1	2%
2	11	17%	7	11%	0	0%	0	0%
3	15	23%	20	30%	7	11%	3	5%
4	29	44%	29	44%	26	39%	20	30%
5	11	17%	8	12%	33	50%	42	64%
Total	66	100%	66	100%	66	100%	66	100%
Average	3.61		3.52		4.39		4.55	
Std. Dev.	0.959		0.949		0.677		0.727	

Note: 1 – Totally dissatisfied; 5 – Totally satisfied

Appendix XVIII: Things to improve

Things to improve	Frequency	Percent
None, I am satisfied	0	0%
Decrease in price	58	88%
More special offers (discounts)	27	41%
Creation of a package with trips paid monthly	30	45%
Increase in scooters' speed	3	5%
Decrease in scooters' speed	0	0%
Improvements in scooters' robustness	16	24%
Improvements in scooters' safety	14	21%
Improvements in improper parking control	39	59%
Increase in the number of scooters available	5	8%

Appendix XIX: Reasons for not using

Reasons for Not Using	Frequency	Percent
No need to replace current modes of transport	42	69%
Service not appropriate taking into consideration personal characteristics	15	25%
Service expensive taking into consideration the needs	21	34%
Don't consider the service attractive	10	16%
Consider the service dangerous	11	18%
Don't use smartphone	1	2%
Don't trust in digital means of payment	1	2%
Consider the city infrastructures not prepared	36	59%

Appendix XX: Likelihood to try the service in the future

	Likelihood to try the service	Frequency	Percent
	1 - Extremelly unlikely	3	5%
	2 - Partially unlikely	16	26%
	3 - Neither likely nor unlikely	11	18%
	4 - Partially likely	26	43%
	5 - Extremely likely	5	8%
Average	3.23		
Std. Dev.	1.086		

Appendix XXI: Motivations for start using

Motivations for Start Using	Frequency	Percent
No change would make me use the service	6	10%
Safety enhancements	14	23%
Improvements in terms of city infrastructures	33	54%
Decrease in price	34	56%
Improvements in scooters' design	0	0%
Improvements in scooters' robustness	10	16%

Appendix XXII: Mann-Whitney Test Ranks – "Do you use, or have you used the shared electric scooters service in the city of Lisbon?" and "Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I like to try innovative products and services."

Mann-Whitney Test Ranks

	Do you use, or have you used the shared electric scooters service in the city of Lisbon?	N	Mean Ranks	Sum of Ranks
Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I like to try innovative products and services	Yes	66	74.39	4909.50
	No	61	52.76	3218.50
	Total	127		

Appendix XXIII: Crosstabulation: Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate your age

		Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate your age. Crosstabulation					
		Please indicate your age					
		18-28	29-38	39-48	49-58	59-68	Total
Yes	Count	30	20	14	1	1	66
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	45.5%	30.3%	21.2%	1.5%	1.5%	100%
No	Count	32	6	12	9	2	61
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	52.5%	9.8%	19.7%	14.8%	3.3%	100%

Appendix XXIV: Mann-Whitney Test Ranks – "Do you use, or have you used the shared electric scooters service in the city of Lisbon?" and "Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I do not mind sharing means of transport with other users"

Mann-Whitney Test Ranks

	Do you use, or have you used the shared electric scooters service in the city of Lisbon?	N	Mean Ranks	Sum of Ranks
Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I do not mind sharing means of transport with other users.	Yes	66	71.28	4704.50
	No	61	56.12	3423.50
	Total	127		

Appendix XXV: Crosstabulation: Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate the importance level, on a scale of 1-5, that you assign to each of the following elements when you choose the means of transport in which you are traveling (1 - Without any importance, 5 - Extremely important): - Sustainability

		Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate the importance level, on a scale of 1-5, that you assign to each of the following elements when you choose the means of transport in which you are traveling (1 - Without any importance, 5 - Extremely important): - Sustainability. Crosstabulation					
		Please indicate the importance level, on a scale of 1-5, that you assign to each of the following elements when you choose the means of transport in which you are traveling (1 - Without any importance, 5 - Extremely important): - Sustainability.					
		1 - Strongly disagree	2 - Partially disagree	3 - Neither agree nor disagree	4 - Partially agree	5 - Strongly agree	Total
Yes	Count	1	8	10	32	15	66
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	1.5%	12.1%	15.2%	48.5%	22.7%	100%
	Mean	3.79					
No	Count	4	7	24	19	7	61
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	6.6%	11.5%	39.3%	31.1%	11.5%	100%
	Mean	3.29					

Appendix XXVI: Crosstabulation: Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): believe that the shared electric scooters service could completely replace my current means of transport.

		Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): believe that the shared electric scooters service could completely replace my current means of transport. Crosstabulation					
		Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): believe that the shared electric scooters service could completely replace my current means of transport.					
		1 - Strongly disagree	2 - Partially disagree	3 - Neither agree nor disagree	4 - Partially agree	5 - Strongly agree	Total
Yes	Count	23	24	6	12	1	66
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	34.8%	36.4%	9.1%	18.2%	1.5%	100%
	Mean	2.15					
No	Count	37	16	4	2	2	61
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	60.7%	26.2%	6.6%	3.3%	3.3%	100%
	Mean	1.63					

Appendix XXVII: Crosstabulation: Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I believe that the shared electric scooters service could complement my current means of transport

		Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I believe that the shared electric scooters service could complement my current means of transport. Crosstabulation					
		Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): believe that the shared electric scooters service could complement my current means of transport.					
		1 - Strongly disagree	2 - Partially disagree	3 - Neither agree nor disagree	4 - Partially agree	5 - Strongly agree	Total
Yes	Count	3	2	4	30	27	66
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	4.5%	3.0%	6.1%	45.5%	40.9%	100 %
	Mean	4.15					
No	Count	7	13	12	27	2	61
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	11.5%	21.3%	19.7%	44.3%	3.3%	100 %
	Mean	3.07					

Appendix XXVIII: Crosstabulation: Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I believe that the shared electric scooters service is an economical mode of mobility

		Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I believe that the shared electric scooters service is an economical mode of mobility. Crosstabulation					
		Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I believe that the shared electric scooters service is an economical mode of mobility.					
		1 - Strongly disagree	2 - Partially disagree	3 - Neither agree nor disagree	4 - Partially agree	5 - Strongly agree	Total
Yes	Count	7	15	12	30	2	66
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	10.6%	22.7%	18.2%	45.5%	3.0%	100%
	Mean	3.08					
No	Count	6	15	17	12	11	61
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	9.8%	24.6%	27.9%	19.7%	18.0%	100%
	Mean	3.12					

Appendix XXIX: Crosstabulation: Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I think by using the shared scooter service I can save time

		Do you use, or have you used the shared electric scooters service in the city of Lisbon? * Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I think by using the shared scooter service I can save time. Crosstabulation					
		Please indicate, on a scale of 1-5, your level of agreement with the following statements (1 - Strongly Disagree, 5 - Strongly Agree): - I think by using the shared scooter service I can save time.					
		1 - Strongly disagree	2 - Partially disagree	3 - Neither agree nor disagree	4 - Partially agree	5 - Strongly agree	Total
Yes	Count	4	6	11	27	18	66
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	6.1%	9.1%	16.7%	40.9%	27.3%	100%
	Mean	3.75					
No	Count	2	12	20	23	4	61
	% within Do you use, or have you used the shared electric scooters service in the city of Lisbon?	3.3%	19.7%	32.8%	37.7%	6.6%	100 %
	Mean	3.25					

Appendix XXX: Confidence interval "Please indicate the satisfaction level, on a scale of 1-5, that you assign to each of the following service factors - Safety of the service"

Descriptives

			Statistic	Std. Error
Please indicate the satisfaction level, on a scale of 1-5, that you assign to each of the following service factors - Safety of the service	Mean		3.52	0.117
	95% Confidence Interval for Mean	Lower Bound	3.28	
		Upper Bound	3.75	
	5% Trimmed Mean		3.55	
	Median		4.00	
	Variance		0.900	
	Std. Deviation		0.949	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		1	
	Skewness		-0.547	0.295
	Kurtosis		0.167	0.582

Appendix XXXI: Confidence interval "Please indicate the satisfaction level, on a scale of 1-5, that you assign to each of the following service factors – Scooters Robustness"

Descriptives

			Statistic	Std. Error
Please indicate the satisfaction level, on a scale of 1-5, that you assign to each of the following service factors – Scooters Robustness	Mean		3.61	0.118
	95% Confidence Interval for Mean	Lower Bound	3.37	
		Upper Bound	3.84	
	5% Trimmed Mean		3.62	
	Median		4.00	
	Variance		0.919	
	Std. Deviation		0.959	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		1	
	Skewness		-0.312	0.295
	Kurtosis		0.799	0.582

Appendix XXXII: Confidence interval "Please indicate the satisfaction level, on a scale of 1-5, that you assign to each of the following service factors – Scooters parking control"

Descriptives

			Statistic	Std. Error
Please indicate the satisfaction level, on a scale of 1-5, that you assign to each of the following service factors – Scooters parking control	Mean		2.64	0.125
	95% Confidence Interval for Mean	Lower Bound	2.39	
		Upper Bound	2.89	
	5% Trimmed Mean		2.63	
	Median		2.00	
	Variance		1.035	
	Std. Deviation		1.017	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		2	
	Skewness		0.250	0.295
	Kurtosis		-0.914	0.582