



How do people perceive new ways of sustainable  
mobility?

The case of Electric scooters: San Francisco vs  
Lisbon

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## **Abstract**

Nowadays, mobility is a crucial factor in our society, we use it almost every day. However, it is important to think about the consequences of our actions, it is important to be sustainable and adopt sustainable means of transport. The purpose of the present dissertation is to understand how people perceive new ways of sustainable mobility, specifically the electric scooters and to compare the results between Lisbon and San Francisco. In order to conduct this study, literature was revised to get a clear vision on strategies, sustainability and consumer behavior related with mobility and the electric scooters. As for retrieving data, mixed methods methodology was used, an online survey with 345 participants and three interviews with two representatives of mobility companies and one representative of the city hall of Lisbon. The results show that there is a difference in usage between people from San Francisco and from Lisbon (more for San Francisco), however no differences in perceptions between both cities. After the data analysis it was possible to conclude that people perceive technology, sustainability and safety as the most important characteristics on a transport. Further analysis indicated that measures must be taken in order to increase the perception of safety regarding the electric scooters, such as safer places to ride and safer designs. To summarize, the advantages of using electric scooters surpass the disadvantages, nevertheless it is necessary to take measures, both companies and the government, to face the disadvantages.

**Keywords:** Sustainability, mobility, strategy, electric scooters, people's perceptions

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## **Resumo**

Hoje em dia, a mobilidade é um fator crucial na nossa sociedade, usamo-la quase todos os dias. No entanto, é importante pensar nas consequências das nossas ações, é importante sermos sustentáveis e adotarmos meios de transporte sustentáveis. O objetivo da presente dissertação é perceber como as pessoas percebem novas formas de mobilidade sustentável, nomeadamente as scooters elétricas, e comparar os resultados entre Lisboa e São Francisco. Para realizar este estudo, a literatura foi revista para obter uma visão clara sobre estratégias, sustentabilidade e comportamento do consumidor relacionados com a mobilidade e as scooters elétricas. Quanto à obtenção de dados, foi utilizada metodologia de métodos mistos, um inquérito online com 345 participantes e três entrevistas com dois representantes de empresas de mobilidade e um representante da câmara municipal de Lisboa. Os resultados mostram que há uma diferença de utilização entre pessoas de São Francisco e de Lisboa (mais para São Francisco), no entanto não há diferenças de percepção entre ambas as cidades. Após a análise de dados, foi possível concluir que as pessoas veem a tecnologia, a sustentabilidade e a segurança como as características mais importantes num transporte. Uma análise mais aprofundada indicou que devem ser tomadas medidas para aumentar a percepção de segurança no que diz respeito às trotinetes elétricas, tais como locais mais seguros para andar e designs mais seguros. Resumindo, as vantagens de utilizar trotinetes elétricas superam as desvantagens, no entanto, é necessário tomar medidas, tanto as empresas como o governo, para fazer face às desvantagens.

**Palavras-chave:** Sustentabilidade, mobilidade, estratégia, trotinetes elétricas, percepções das pessoas

**Título:** How do people perceive new ways of sustainable mobility? The case of electric scooters: San Francisco vs Lisbon.

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## **List of Abbreviations**

**ES- Electric Scooters**

**SF- San Francisco**

**RQ- Research Question(s)**

**H- Hypothesis**

**USA- United States of America**

**CSR- Corporate Social Responsibility**

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## **1.- Introduction**

### **1.1- Relevance**

Nowadays, with increasing cities' dimensions and the total world population rising so does the pollution increases (Cole & Neumayer, 2004). This creates an issue regarding sustainability and the environment itself. Global warming is a real threat and it mainly drives from human activity. It is time for a change. These changes cannot happen overnight, however it is possible to improve one step at a time. Bearing this in mind, an accord was created between many nations worldwide, it is called the Paris Agreement (2015) and has the objective to bring these nations together to fight climate changes and adapt to its effects.

In the interest of this dissertation, both USA and Portugal made part of the Paris Agreement. At the time, President Barack Obama stated that can be difficult to bring so many nations together and with different agendas to fight climate changes, however, in his words, "together we're proving that it is possible". Miguel Vales, from Efacef, stressed in the interview for this dissertation that not only Portugal made part of this agreement but is also being one of the leaders in decarbonizing transports.

Mobility is one of the major issues affecting our environment now, there is a need to adopt new ways of cleaner and sustainable mobility (Global EV Outlook, 2019). Additionally, people are progressively more conscious of the impact fossil fuels have on the environment and are starting to take more eco-friendly substitute transports to travel within the city, as the population starts to have more positive behaviors and attitudes regarding personal mobility vehicles, such as bicycles, e-scooters and kick scooters (Ando & Li, 2012). However, this situation does not come without its issues, the usage and neediness of new ways of transportation raised a few questions regarding its costs, the lack of parking spaces, road safety and the possible environmental impact (Ozbay, Bartin, & Berechman, 2001). Sustainability is the future but this range anxiety (Eberle & Helmolt, 2010) regarding safety, costs, infrastructures and efficiency of these electric vehicles can be a major setback.

With that being said, the aim of this dissertation is to understand how people perceive these new ways of mobility, specifically electric scooters, the factors (social, demographic, economic...) that can influence that perception and how they can be improved overtime, in order to make the changes we need for a more sustainable future. Furthermore, and to enrich the study, a comparison between Lisbon and San Francisco will be conducted to fully



understand if there is a difference between these two cities in terms of consumer perception and also to assess what can be done to improve these new ways of sustainable mobility.

Regarding the methodology, both quantitative and qualitative analysis will be conducted in order to address the hypothesis and research questions. The quantitative analysis will be through a survey in order to address the consumers' point of view, as for the qualitative analysis, this will be done through interviews with representatives of Portuguese companies and the city hall that highly relate with mobility and sustainability.

Hopefully, the results obtained from this study can be a future path for transport companies, with more traditional values, to understand how people perceive new ways of sustainable mobility and what they are looking for as a consumer. This study can also help to build a bridge towards adapting to this new conjuncture of sustainable mobility.

## **1.2- Context**

Electric vehicles are at this time seen by many countries as a path to decarbonize transportation and to face climate change, as more than 10% of total greenhouse gas emissions originate from land transports (OECD, 2010), also, in urban areas, on-road transports have the largest contribution to air pollution (Belis et al., 2013). Furthermore, it is estimated that the peak of oil usage will occur no later than 2030 (Aftabuzzaman & Mazloumi, 2011) and by decreasing urban pollution, it may help to block environmental issues and health problems (Shepherd et al., 2012). The usage of e-scooters, for example, is a solution created to satisfy the peoples' needs for transportation while caring for the environment and acknowledging the negative effects that some ways of transportation have on pollution, specifically in urban environments.

Regarding the electric scooters, they have been around in San Francisco since 2017, when the first platforms for shared electric scooters appeared. With this also came the first issues, despite the benefits, the cities adopting these new ways of mobility had to adapt their infrastructures to face this growing demand (Kostrzewska & Macikowski, 2017). Lisbon had to wait until October 2018 to have their first electric scooters platforms. Despite this fact, the acceptance was such a success that there are around 5 thousand (comparing to the 10000 in SF) shared ES in Lisbon and that more than 10 thousand trips are made every day. Adding to this, there are over 150 thousand users supporting these new ways of transportation.

Moreover, many advantages have been observed concerning the usage of ES such as the easy way to access and use; the convenience regarding its availability and easiness to park and also usefulness when travelling short distances in order to avoid traffic and parking jams (Chiu & Tzeng, 1999).

To address these situations and increase the usage of sustainable mobility within cities, many initiatives are starting to develop such as the promotion and manufacture of electric vehicles, electric scooters and bicycles (e.g. Uber, Lime, etc.) Furthermore, the creation of new lanes designed specifically for Electric Scooters, or even bicycles, can provide safe routes to either the users but also the other pedestrians. This sense of safeness can even extend to people who drive cars and do not feel safe with these other vehicles circulating in the same lanes. This new conception of mobility represents a significant change in the cities' planning strategy as a tactic to adopt new ways of sustainable mobility (Schade, Krail, & Kuhn, 2014).

The reason behind the choice of San Francisco and Lisbon as study subjects is to compare SF, considered state of the art in the matter of new ways of sustainable mobility, with Lisbon that represents a city new to these new ways however in a very promising path.

### **1.3- Research Questions**

Following these premises, a few research Questions arose in order to understand and explain the perception that people have about these new ways of sustainable mobility:

- Which factors make people use Electric scooters?
- What measures people believe can be taken in order to improve these new ways of mobility?
- Do people from SF and Lisbon have different perceptions regarding sustainable mobility? What factors can influence those perceptions?

Hopefully, and after the literature review, all questions can have their hypothesis to be tested throughout the methodology and respective analysis.

## **2- Literature review**

As stated before the purpose of this dissertation is to understand peoples' perception regarding new ways of sustainable mobility while comparing Lisbon to San Francisco. However, due to scarcity of literature regarding e-scooters, scientific papers regarding

sustainability, strategy and consumer behavior were analyzed in order to provide foundation of knowledge on the topic and the hypothesis for the research.

## **2.1- strategy**

Strategy can be defined as the path that someone, or a company, chooses towards their objective or goal, it is in the core of every business. It includes everything from operations to capital investments, passing through marketing, sales and so on. In order to create value for the products a clear strategy must be defined.

The following papers were highlighted between many others in order to provide foundation for the hypothesis, one regarding the companies' point of view and the other addressing a governmental point of view. Furthermore, throughout the text, references from other papers of the literature review were used in order to increase the veracity of the observations and provide a groundwork for a strategic point of view on peoples' perceptions.

### **2.1.1- From value co-creation to value co-destruction? The case of dockless bike sharing in China**

The dockless bike-sharing systems appeared as an innovation of transportation in China, late 2015, with the objective of growing urban mobility and to contribute to sustainability. The increase usage of shared bicycles is considered, by many cities, a sustainable mean of transportation due to the fact that it does not rely on fossil-fuel energy or carbon emissions. Nevertheless, controversies about these types of transportation arose, namely concerns about the environmental impact (Hollingsworth et al., 2019) Many bicycles are left on the side of the road with no regard for safety or the environment which results in a distrust on the companies' strategies that provide this kind of services.

This research paper emphasizes on consumer value by investigating the potential negative impacts of the dockless bike sharing by analyzing how users take part in value co-creation and co-destruction activities. The authors created an analysis in China using a sample of 8813 tweets from social media and investigated numerous resources and practices, including product-service, consumer, relational, emotional and energy sources. Therefore, the authors concluded that the experience of riding a shared bike is the factor that contributes the most to value creation of the dockless shared bikes, meanwhile post-riding practices lead to value destruction. To increase the cyclists' comfort, some regulations need to be taken, such as prioritized signals for bicycles and different locations for bicycle lanes (Nabti & Ridgway, 2002).

### **2.1.2- Trotinetes eléctricas: em 1918, já eram moda entre a elite portuguesa (article retrieved from observador)**

Despite the fact of not being a scientific article, it is of significant importance in order to understand how people, specifically in Lisbon in this case, perceive the electric scooters. Nowadays is normal to see many electric scooters everyday on the street, however, and even though these electric scooters are an economic, ecological and user-friendly way of transportation, there has been some controversial issues in terms of security and regulation.

Although some scientific papers refer to these issues, this article from Observador show us examples of how significant these issues can become and that they are a force to be recon and faced in order to provide the best and safest service possible. The article shows incidents that can create barriers against the adoption of electric scooters, in Barcelona these were banned after the death of a ninety-year-old lady, and even in Portugal in earlies 2019, already 2 people died and 40 suffered injuries. Many complains followed these unfortunate incidents, such as the fact that users of shared electric scooters just leave them unattended, most of the times obstructing passages. Furthermore, cycling on the roads as an alternative to fuel consumption vehicles can be eco-friendly but also dangerous, considered to be one of the most risky ways of travel (Noland, 1995) as almost all cyclists are in favor of facilities and designated roads for them to travel safely (Antonakos, 1994).

**Hypothesis: Even though the advantages of using electric scooters surpass the disadvantages, there is a need to face the disadvantages in order to create value on the electric scooters.**

### **2.2- Consumer behavior and its relationship with sustainability**

Sustainability can be defined as making sure that our actions today will not affect the future in a way that it will be compromised for future generations (Crommentuijn-Marsh, 2010). This means that we, Mankind, must ensure that there will be a future, a sustainable and clean future so that the next generations can enjoy it like we did.

Sustainability is a term that can be related to many other areas: transportation, consumerism, economics, environment, to name a few, and the way of life that we currently take can explain many problems that we face, such as extreme usage of natural resources, poverty, climate changes and pollution (Thogersen, 2005). In this case, the correlation will be made between sustainability and consumer behavior, meaning, what actions do consumers

have or need do have in order to ensure sustainability and if consumers acknowledge that sustainability is imperative for the preservation of the environment.

Many companies bear responsibility for the existing unsustainable lifestyle, these companies are accused on making profits at the cost of sustainable development (Beschoner et al., 2007). As a result, companies are expected to increase Corporate Social Responsibility (CSR) to contribute to a sustainable development (Martínez-Ferrero et al., 2015)

### **2.2.1- The future of electric two-wheelers and electric vehicles in China**

Despite the fact this paper is about China, it is significant for the understanding of the changes that can apply in the cities in order to make way to these new ways of sustainable mobility. The paper's main focus is to illustrate the main forces resisting the future electric two wheelers and the reasons behind these forces. While comparing gasoline-motor vehicles with electric-motor vehicles in terms of costs, speed, consumption and environmental impact, also known as range anxiety.

Furthermore, the paper also emphasizes the advantages of adopting new ways of sustainable mobility in order to promote them and create awareness. Force Field Analysis was used on this paper to create a descriptive and complex model that can correlate several different areas such as social, political and economic. Which can be of great use to understand people's perception regarding new ways of sustainable mobility. After this analysis it was established that improving of the air quality and traffic jams led to political support of the electric two wheelers, also due to the fact that changing from gasoline vehicles to electric vehicles will have many improvements such as air quality and the reduced dependence on imported petroleum (Ayalon et al., 2013). Regarding the efficiency of these vehicles, the improvement of speed and battery technology is a driving force towards the adoption of the electric vehicles (Thompson et al., 2011). However, the superior performance of motorcycles and automobiles can be an obstacle against the adoption of sustainable vehicles.

The main conclusions on this paper can highly relate to the understanding of how people perceive the electric vehicles.

**Hypothesis: If proven to be equally efficient and significantly better for the environment, the majority of people will adopt new ways of sustainable mobility**

### **2.2.2- The sustainability of international higher education: Student mobility and global climate change**

Nowadays global climate change is a very relevant topic and cannot be ignored, but is there really someone changing their way of living in order to face this issue? The main focus of this paper is to understand if students that get a higher education would be more aware of the issues that inflict severe and irreversible damage on the environment and what measure they can take to minimize the greenhouse gas emissions associated with international student mobility. The study concludes that international mobility is important for the personal development, but also that students take in consideration the possible effects of travelling and mobility and that they take actions to reduce the impact on the environment. However, some limitations can reduce the plausibility of the study due to the fact that some countries do not report data regarding these issues and that differences in emissions related to consumption and lifestyle are difficult to measure.

**Hypothesis:** The higher the education, the higher the awareness to environmental issues, impact of different types of mobility and acceptance of new ways of sustainable mobility.

### **2.2.3- Happiness and limits to sustainable tourism mobility: a new conceptual model**

This paper tries to fill in the gap between tourists understanding of the negative impacts of their mobility patterns and their attitudes favoring such behaviors. Happiness is a vital part of the tourist experience, especially in the decision making (Hart et al., 2009) and in the pursuit of happiness tourists are demanding longer, further and faster trips in order to achieve these sensations of happiness. However, these behaviors contribute massively to unsustainable behavior. Through the analysis it can become clear that new policies need to be taken in consideration to reduce the environmental impact, since every new way of mobility needs a redesign in order to become sustainable. In the case of tourists and travels, these policies can pass to tax on carbon emissions (Tol, 2007) which can lead to reducing fuel consumption and have a positive impact on the environment. For cars and petrol taxes the effect of this measure has been considerable (Stern, 2007). Some authors, however, believe that societal change can be more efficient than policy change due to the fact that role models can have a higher range of influence on personal motivations for travelling and efficiently reduce the gap between attitudes and awareness (Miller et al., 2010).

**Hypothesis:** Happiness has a negative impact on peoples' attitudes and awareness towards the environment.

The hypothesis for this paper can be redundant, however happiness is a variable that can affect any human being, despite race, gender, age or culture. To provide a correlation between the described variables can help understand peoples' motivations and perceptions better.

Further literature review suggested that more variables can influence how people perceive new ways of sustainable mobility. Gender can have an impact on this matter for example. There are stereotypes around gender but can some of them relate to sustainability and can they be proved? The stereotypes divide women as more socially aware and oriented as for men, these are more individually oriented (Eckel et al., 2008).

Age can also have an impact on people's perception. Older people are not so keen on new technologies and innovations, opposite to younger people that are more likely to adopt new technologies (Czaja et al., 1998). Since electric scooters are considered a new technology, literature review suggests that younger people will be more open to this new way of mobility.

As for a political point of view, it is believed that the right wing of the political spectrum is for more conservative people and therefore less concerned with the environment, although acknowledging that environmental quality is important. The left wing, considered more for the liberals, will have a more pro-environmental approach on their decisions, either personal or professional (Dunlap et al., 2001)

To summarize, these variables can influence the consumers' behavior and will be tested in the methodology section in order to understand how they can affect the consumers' perception.

### **3.- Methodology and methods**

After retrieving the hypothesis from the literature review it is time to test them. To do so, a mixed methods methodology was used. This combines both quantitative and qualitative methods, therefore compensating for each disadvantage that each method may have and, while doing so, increasing the veracity and legitimacy of the results (White & Rayner, 2014). Another reason behind this approach is the necessity of not only understanding people's perceptions but also how companies and the city hall of Lisbon perceive these new ways of mobility. Therefore, a survey was created to analyze people's perception, while interviews were conducted to address the companies and city hall's point of view. In regard of the

interviews, Miguel Vales, digital marketing director from Efacec, Djalmo Gomes, CEO of Electric-rent and Pedro Machado, assessor of the councilman of mobility at the city hall of Lisbon, were the chosen interviewees. As Valentine (2005) said “Often researchers draw on many different perspectives or sources in the course of their work. This is known as triangulation. The term comes from surveying, where it describes using different bearings to give the correct position. In the same way researchers can use multiple methods or different sources to try and maximize their understanding of a research question.”

### **3.1.- Quantitative analysis**

In order to understand people’s perception about new ways of mobility, specifically electric scooters, a survey was created and, after being tested, it was shared on social media, such as Facebook and WhatsApp, and the Amazon’s platform M-Turk. This method was chosen because it allows to gather a large number of respondents in a short period of time and also because it allows a more visual interaction (Wright, 2005). The questions on the survey were created based on the research questions and on the hypothesis retrieved from the literature review. Its main objective is to understand people’s perceptions about this topic and, if possible, to answer all the hypothesis and research questions.

#### **3.1.1.- Survey**

The survey (Appendix 9) was composed by 23 mandatory closed and open-ended questions, however, there were questions that were not presented to all the respondents since there were specific questions for respondents that already had used electric scooters and specific questions for respondents that had never used them. The survey was divided in three different blocks, the first addressing perceptions, the second addressing usage and behaviors, the third addressing socio-demographic data and two questions regarding the current pandemic of covid-19 that will be analyzed in a different chapter of the dissertation. Since the objective of this dissertation is also to compare perceptions of people from Lisbon with San Francisco, the respondents were alerted that they could only answer if they lived or had lived in one of these cities. Through M-Turk, this was ensured by restricting the answers to only Lisbon and San Francisco area. The respondents were also assured that the responses were confidential and used strictly for academic purposes.

Regarding the sample, there were a total of 443 respondents however 97 responses were eliminated because either did not complete the entire survey or lacked consistency on the answers and, therefore, will not be considered to the analysis. This gives a total of 346



respondents, 78,1% of total respondents, which can transmit the idea that the survey was somewhat too long and can be reformulated to get a higher rate of respondents. Of the total 346 respondents, 254(73,4%) responded affirmatively when asked if they ever used electric scooters and 92(26,6%) responded that they never used electric scooters.

### **3.1.1.1- Procedure**

In order to create a more reliable survey, several scales were researched in order to create questions and answers in a manner that they can be analyzed posteriorly. For questions 1 to 3, 5, 7, 15,16 and 19 it was used a nominal scale varying from single and multiple choice. Questions 6 and 20 to 23 used an interval scale. Questions 8 through 13 were created based on a 1-7 Likert scale, usually an ordinal scale with a middle point decreasing and increasing in opposite sides of that point (Joshi et al., 2015). With this approach of the Likert scale, the participants are encouraged to rate the statements according to their preferences, while having a middle point for the unsure respondents (Grover & Vriens, 2006). Questions 9 and 10 were assessed using the Usability Perception Scale (Karlin & Ford, 2013) with the same 1-7 Likert scale, in order to assess the factors that could influence the usability of electric scooters. Questions 4, 14, 17 and 18, used a 10-point Likert scale in order to assess usage of the electric scooters, willingness to recommend, political position and happiness.

After collecting all the responses, the data retrieved was analyzed through IBM SPSS (Statistical Package for the Social Sciences).

### **3.1.2- Data analysis**

Regarding the socio-demographics analysis, out of the 346 respondents, 95(27,5%) responded Lisbon, 115(33,2%) responded San Francisco and the remaining respondents 136 (39,3%) responded other cities. Despite being contacted in order to know which of the cities they were responding, it was not possible to contact them all. Therefore, only the respondents that answered Lisbon or San Francisco will be used on the analysis for the third research question that compares both cities' perceptions, maintaining the reliability of the results. As for the other research questions and hypothesis all of the sample will be used.

Regarding gender the answers were almost even, 184(53,2%) were male respondents and 162 (46,8%) were female respondents. The respondents' ages were aggregated in 4 groups instead of the original 6 on the survey, all the respondents until 29 years old were aggregated and also the ones with more than 48. The reason behind this is to eliminate variables that had very few respondents giving a more compact analysis. With that being said,

166(48%) were 28 or less years old; 101(29,2%) were between 29 and 38 years old; 41(11,8%) were between 39 and 48 years old and 38(11%) were more than 49 years old. In terms of education, 39(11,3%) respondents indicated High school as their higher grade of education; 29(8,4%) indicated technical degree; 191(55,2%) indicated Bachelor's degree; 85(24,6%) indicated Master's degree and 2(0,6%) indicated Doctorate degree. In terms of occupation, 52(15%) respondents were students; 29 (8,4%) were students working; 226(65,3%) were employed; 33(9,5%) were unemployed and 6 (1,7%) were retired.

### *3.1.2.1- Factors influencing the use of electric scooters*

In order to understand which attributes most influence the use of electric scooters, a multiple linear regression was performed. The attributes such as price, technology, comfort, easiness to use and park, efficiency, sustainability and safety (question 8 of the survey) were treated as independent variables and the frequency of use (question 4 of the survey) as a dependent variable. The results are shown in table 1.

It can be observed that the model is globally significant ( $F=9.469$ ;  $p<0.05$ ). However, it is observed by the analysis of adjusted  $R^2$  that only 19% of the variability of scooter use is explained by three predictor variables under analysis. Thus, the technology ( $B=0.723$ ;  $t=5.095$ ;  $p<0.05$ ) and sustainability ( $B=0.584$ ;  $t=3.715$ ;  $p<0.05$ ), have a statistically significant, direct and positive influence. Meaning, the more these attributes are valued, the greater the use of electric scooters. The safety variable ( $B=-0.453$ ;  $t=-2.883$ ;  $p<0.05$ ), has a statistically significant, direct and negative influence. Therefore, the more valued safety is by people, the lower their tendency to use electric scooters. It was concluded that the variables that weigh the most in the use of electric scooters are technology and sustainability, and technology is the one with the highest weight ( $B=0.723$ ).

In relation to the assumptions of the model, these have been validated. In fact, the average of the residues is zero (table 1), there is homoscedasticity of the residues (Appendix 3) and there is no multi-commonness between the independent variables (see Tolerance statistics in table 1). Regarding the normal distribution of waste, this was rejected by the Kolmogorov-Smirnov test (Appendix 1). However, calling for the Central Limit Theorem (above 30 units, the sample tends to be normal) and because the ratio between skewness and its standard error is between minus two and two (it is equal to 0.405) (Appendix 2), we can consider that the residues follow an asymptotically normal distribution (Laureano, 2011).

**Table 1 - Multiple Linear Regression - factors influencing the use of electric scooters**

	Unstandardized Beta	Standardized Beta	t	p-value	Tolerance
(Constant)			5,851	0,000	
Comfort	-0,351	-0,138	-1,943	0,053	0,631
Technology	0,723	0,344	5,095	0,000	0,701
Price	-0,303	-0,127	-1,926	0,055	0,736
Easy to use and parking	-0,282	-0,114	-1,643	0,102	0,662
Efficiency	-0,128	-0,055	-0,707	0,480	0,530
Sustainability	0,584	0,255	3,715	0,000	0,682
Safety	-0,453	-0,197	-2,883	0,004	0,686
<b>R<sup>2</sup> adjusted=0,190; F (9,469); p=0,000</b>		Standardized Waste Average=0,000			

### 3.1.2.2- Measures to improve new ways of mobility

In order to evaluate the measures that people consider can increase the use of new forms of mobility, a univariate analysis of question 9 was carried out. It can be observed in table 2 that the measurements had an evaluation above the midpoint of the scale (from 1 to 7 on the Likert scale), so the respondents consider that they are important. The creation of safer places presents the highest average (M=5.44; SE=0.073), followed by lowers costs (M=5.35, SE=0.74), safer design (M=5.03; SE=0.085). In the second line we can present more availability (M=4.96; SE=0.84) and more efficiency /speed (M=4.91; SE=0.081). Less valued we have the more regulations measures (M=4.63; SE=0.087) and, finally, to exercise (M=4.33; SD=0.097).

Table 2 - Univariate statistics on perceptions for improvement of new forms of mobility

Variable	M	SE	Max.	Min.	Confidence Interval (95%)	
					Maximum	Minimum
Lower costs	5,35	0,74	7	1	5,21	5,50
More Availability	4,96	0,84	7	1	4,79	5,12
More Efficiency/Speed	4,91	0,081	7	1	4,75	5,07
Safer places	5,44	0,073	7	1	5,30	5,59
More Regulations	4,63	0,087	7	1	4,46	4,80
Safer design	5,03	0,085	7	1	4,86	4,20
To exercise	4,33	0,097	7	1	4,14	4,52
None of the above	3,08	0,106	7	1	2,88	3,29

M=Mean; SE= Standard Error

### 3.1.2.3- Comparison of averages of the use of electric scooters between the inhabitants of Lisbon and San Francisco.

In order to evaluate whether there are differences in the use of electric scooters (question 4) between the populations of Lisbon and San Francisco, it was intended to perform the *t-test* for two independent samples. The assumption of normality was violated (Appendix 4). It was also found that the distributions are strongly asymmetric because the skewness ratio with its standard error is greater than minus two and two in the two samples (Appendix 6) (Laureano, 2011). Therefore, it was decided to proceed to the alternative nonparametric Mann-Whitney test for comparison of means. The data is presented in table 3.

It can be observed that there are statistically significant differences ( $U=1665.00$ ;  $p<0.05$ ) between the averages of the orderings of use of electric scooters from Lisbon and San Francisco. In fact, the averages of the ordinations of San Francisco (100.51) is higher than that of Lisbon (58.99). It is concluded that the population of San Francisco uses this type of transport more than the population of Lisbon.

**Table 3** - Mann-Whitney test for comparison of averages of the use of electric scooters between Lisbon and São Francisco

	Lisbon (n=68)	San Francisco (n=98)	U	p-value
	Average of ordinations	Average of ordinations		
Frequency of use of electric scooters	58,99	100,51	1665,0	0,000

### 3.1.2.4- Comparison of average perceptions about the use of electric scooters among the inhabitants of Lisbon and São Francisco

In order to evaluate whether there are differences in perceptions (question 12) regarding the use of electric scooters between the populations of Lisbon and São Francisco, it was intended to apply the *t-test* to two independent samples. The assumption of normality was

violated (Appendix 5). It was also found that the distributions are strongly asymmetric (Appendix 7) because the *skewness* ratio with its standard error is greater than minus two and two in all samples. Thus, it was decided to perform the alternative nonparametric Mann-Whitney test for comparison of means (Laureano, 2011). The data is presented in Table 4.

It can be observed that there are no statistically significant differences between the perceptions of respondents from Lisbon and San Francisco regarding the use of electric scooters, for any level of significance ( $p > 0.05$ ). It is concluded that there is no association between the fact of living in one of the two cities and the perceptions regarding the use of electric *scooters*.

**Table 4** - Mann-Whitney Test for the comparison of averages of perceptions of use of electric scooters between Lisbon and São Francisco

	Lisbon (n=97)	San Francisco (n=115)	U	p-value
	Average of ordinations	Average of ordinations		
Provide fun rides	105,93	106,98	5522,500	0,898
Emission free	108,48	104,83	5385,500	0,657
Fast way to commute	103,67	108,89	5303,000	0,524
Reduces car traffic	108,69	104,66	5365,500	0,622
Awareness for bike lanes	110,27	103,32	5212,000	0,399
To exercise	101,63	110,61	5105,000	0,281

### 3.1.2.5- Comparison of averages of the use of electric scooters between age groups

In order to understand whether the use of *scooters* (question 4) varies according to age, the ANOVA test was applied to one factor. In order to obtain larger samples, some age groups were added. Thus, the age groups of children under 18 years and between 18 and 28 were aggregated into a group, and the ranges of 49 to 58, from 59 to 68 and more than 68, in

another group. The age groups were maintained from 29 to 38 years and from 39 to 48 years. From six age groups it went to four.

The assumption of normality was validated by *the Shapiro-Wilk* tests for the age group 39-48 years. In relation to the other age groups, the null hypothesis of normality was rejected by the *Kolmogorov-Smirnov* and *Shapiro-Wilk* tests (Appendix 4). However, the data follow an approximately normal distribution, since its asymmetry coefficient is in the interval between minus two and two (Appendix 6). Regarding the assumption of variance homogeneity, it was validated by the Levene test (Appendix 8) (Laureano, 2011).

It is observed in table 5 below that there are statistically significant differences in the mean of at least one age group ( $F=6,500$ ;  $p<0.05$ ). Thus, it is concluded that there is an association between age and the use of electric *scooters*.

**Table 5** - ANOVA to a factor for the difference in averages of use of electric *scooters* between age groups.

	Less or equal 28 (n=130)		29-38 (n=76)		39-48 (n=27)		Greater or equal to 49 (n=21)		F	p-value
	M	SE	M	SE	M	SE	M	SE		
Frequency of use of electric scooters	3,92	2,94	5,71	2,72	4,26	2,46	4,86	3,12	6,500	0,000

M=Mean; SE=Standard Error

To understand which groups where this difference is statistically significant, *Scheffe's post-hoc* test was performed for multiple comparisons. The data is presented in table 6.

It can be observed by analyzing the data that there is a statistically significant difference ( $p<0.000$ ) between the means of the age groups less than or equal to 28 years ( $M=3.92$ ;  $SE=2.94$ ) and from 29 to 38 ( $M=5.71$ ;  $SE=2.72$ ). In fact, the average of this age group is higher at 1,787 points. It was concluded that respondents aged between 29 and 38 years use electric scooters more frequently compared to younger respondents.

Table 6 - *Post Hoc* test of multiple comparisons to the average use of electric scooters between different age groups.

		Difference in means	p-value
Less than or equal to 28	29-38	<b>-1,787</b>	<b>0,000</b>
	39-48	-0,336	0,958
	Greater or equal to 49	-0,934	0,583
29-38	Less or equal to 28	<b>1,787</b>	<b>0,000</b>
	39-48	1,451	0,161
	Greater or equal to 49	0,853	0,687
39-48	Less or equal to 28	0,336	0,958
	29-38	-1,451	0,161
	Greater or equal to 49	-0,598	0,914
Greater than or equal to 49	Less or equal to 28	0,934	0,583
	29-38	-0,853	0,687
	39-48	0,598	0,914

### 3.1.2.6- Comparison of averages of the use of electric scooters and education

In order to evaluate whether the use of scooters varies according to education, the ANOVA test was applied to one factor. Since the PhD segment has only two respondents this class has been eliminated from the test.

The assumption of normality was validated by the *Shapiro-Wilk* test for the technical degree class. In relation to the other classes of education, the null hypothesis of normality was rejected by the *Kolmogorov-Smirnov* and *Shapiro-Wilk* tests (Appendix 4). However, the data follow an asymptotically normal distribution for the bachelor's and master's degree classes, since the ratio between the asymmetry coefficient and its standard error is in the interval between minus two and two (Appendix 6) (Laureano, 2011). Only the high school class has an asymmetric distribution. It was still decided to proceed with the test. Regarding the assumption of variance homogeneity, it was validated by the Levene Test (Appendix 8).

In table 7, it is observed that there are statistically significant differences in the mean of at least one of the education classes ( $F=4.181$ ;  $p<0.05$ ). Thus, it is concluded that there is an association between education and the use of electric scooters.

**Table 7** – ANOVA test to the difference in averages of use of electric scooters between different levels of education.

	High School (n=27)		Technical degree (n=20)		Bachelor's degree (n=143)		Master's degree (n=63)		F	p-value
	M	SE	M	SE	M	SE	M	SE		
Frequency of use of electric scooters	3,15	2,80	4,05	2,64	5,08	2,84	4,22	3,08	4,181	0,007

M= Mean; SE=Standard Error

To understand which classes where this difference is statistically significant, Scheffe's Post-Hoc test (table 8) was performed for multiple comparisons.

It is observed by the analysis of the data that there is a statistically significant difference ( $p < 0.05$ ) between the means of the bachelor's degree ( $M=5.08$ ;  $SE=2.84$ ) and high school ( $M=3.15$ ;  $SE=2.80$ ). In fact, the average of the former is higher at 1,929 points. It is concluded that respondents with bachelor's degree use electric scooters more frequently compared to high school respondents.

Table 8 - *Post Hoc* test of multiple comparisons to average use of electric scooters between different education segments.

		Difference in means	Valor p
High School	Technical degree	-0,902	0,772
	Bachelor's degree	<b>-1,929</b>	<b>0,019</b>
	Master's degree	-1,074	0,455
Technical degree	High school	0,902	0,772
	Bachelor's degree	-1,027	0,528
	Master's degree	-0,172	0,997
Bachelor's degree	High school	<b>1,929</b>	<b>0,019</b>
	Technical degree	1,027	0,528
	Master's degree	0,855	0,282
Master's degree	High school	1,074	0,663
	Technical degree	0,172	0,740
	Bachelor's degree	-0,855	0,436



### 3.1.2.7- Comparison of averages of electric scooters use between the two genders

In order to evaluate whether the use of electric scooters varies according to gender, the t-test was applied to two independent samples. The normality test of the distributions of the two samples was rejected by the Kolmogorov-Smirnov test (Appendix 4). However, by calling on the Central Limit Theorem because the sample size is greater than 30 (n=144 for male and n=110 for female) and because the ratio between asymmetry indices and their standard errors is less than minus two and two (Appendix 6), we can assume that distributions asymptotically follow a normal distribution (Laureano, 2011).

The results presented in table 9, show that there are statistically significant differences between the averages of use of electric scooters in men and women ( $t=3,107$ ;  $p<0.05$ ). It is observed that the average of men ( $M=5.06$ ;  $SE=2.96$ ) is higher than the average of women ( $M=3.93$ ;  $SE=2.79$ ). It is concluded that there is an association between gender and the use of electric *scooters*, and men use more than women.

Table 9 - *T-test* for the difference in averages of use of electric scooters between male and female samples

	Male (144)		Female (n=110)		<i>t</i>	p-value
	M	SE	M	SE		
Frequency of use of electric scooters	5,06	2,96	3,93	2,79	3,107	0,002

M= Mean; SE=Standard Error

### 3.1.2.8- Correlation between political attitude and the use of electric scooters

In order to evaluate the relationship between political attitude and frequency of use of electric scooters, Pearson's linear correlation was used.

In table 10 it is observed that there is a weak and positive correlation ( $r=0.436$ ;  $p<0.05$ ) between the use of electric scooters and political attitude. Thus, the more the

respondent is in the right-wing political spectrum, the greater their tendency to use that type of transport.

Table 10 - Pearson correlation between frequency of use and political attitude

	Political attitude (left vs right)	p-value
Frequency of use of electric scooters	0,436	0,000

### 3.1.2.9 Correlations between the level of happiness and perceptions regarding electric scooters.

In order to evaluate the relationship between happiness and perceptions of the use of electric scooters, Pearson's linear correlation was used.

It can be observed by the analysis of table 11, that there is a statistically significant, positive but very weak correlation between happiness and the perception that electric scooters should be banned ( $r=190$ ;  $p<0.05$ ). Thus, the higher the happiness index, the greater the perception that the use of electric *scooters* should be ended. As for the other perceptions, there were no statistically significant correlations with happiness.

Table 11 - Pearson's correlations between perceptions regarding electric *scooters* and happiness

	Irresponsible users	Unsafe for pedestrians	Unsafe for riders	There should be more measures	They endanger other drivers	Should be banned
Unsafe for pedestrians	0,581**					
Unsafe for riders	0,411**	0,611**				
There should be more measures	0,476**	0,516**	0,546**			
They endanger other drivers	0,541**	0,612**	0,602**	0,573**		
Should be banned	0,271**	0,356**	0,393**	0,247**	0,487**	
Happiness	-0,085	-0,062	0,027	0,037	0,034	0,190**

\* $P<0,05$ ; \*\*  $P<0,05$

### **3.2- Qualitative analysis**

The collection of primary data also passed through a qualitative method, as explained before, this method was used due to its advantages comparing to the quantitative method, however it was much more time consuming compared to the survey. As for the procedure, individual interviews were conducted with semi-structured questions, this method allows the interviewees to respond in their own words instead of just “yes” or “no” (Longhurst, 2003). These interviews were conducted through phone calls, lasted between 30 minutes and 1 hour and the questions were mainly related to the topic and the research questions. The interviewees were also encouraged to step out of their companies’ point of view and to share their opinion on the matter. Furthermore, the interviewees were asked if the interviews could be recorded, which they gave their consent, in order to allow for a more fluent conversation and keep track of every response with accuracy while doing the analysis.

The selection criteria of the interviewees was based on the fact that the survey would cover most of people’s perceptions as a whole, however different points of view would enrich the study. With this in mind, two representatives of two mobility companies in Lisbon were contacted and also a representative of the city hall of Lisbon, to share insights on the topic. As it was stated before, the chosen interviewees were Miguel Vales, digital marketing director from Efacec; Djalmo Gomes, CEO of Electric-rent and Pedro Machado, assessor of the councilman of mobility at the city hall of Lisbon.

#### **3.2.1- Data analysis**

When asked about sustainable mobility and electric scooters, the interviewees gave similar responses. The main idea retrieved is that there is a struggle between profit and sustainability, since sustainable mobility does not give as much profit. However, all interviewees stressed that sustainability must be a part of the companies’, and the city hall’s, purpose. There is a need to make a tendency for the future to opt for sustainable and electric vehicles. Specifically for the city hall there is a clear purpose to replace two thirds of all traditional transports for sustainable transports, more precisely electric transports, by the year of 2030. This replacement will also include companies of shared mobility, such as shared electric scooters. Efacec goes even further by also reducing emissions by the year of 2030 and wanting to achieve total decarbonization by the year of 2050.

**H1: Even though the advantages of using electric scooters surpass the disadvantages, there is a need to face the disadvantages in order to create value on the electric scooters.**

As for electric scooters, it was mentioned by all that there are clear advantages and disadvantages, with some discordance on the actual importance of this mean of transportation. Djalmo and Pedro emphasized that the electric scooters are a very viable mean of transport within the cities, it can be very helpful when complementing other means of transport or to travel short distances. As for Miguel, the electric scooters can be a complement of other means of transport but also for leisure, referring that it is mostly used by tourists. Regarding the advantages, electric scooters are a fast and fun way to travel, particularly in short distances, they are eco-friendly and do not represent excessive costs due to the apps for shared electric scooters. As for the disadvantages, the safety and the post usage actions are the most problematic. Users tend to leave the ES unattended in the middle of the roads instead of parking them in the designated locations, this can create negative perceptions on the pedestrians that do not see care for the public spaces. Despite some disadvantages, the conclusion was unanimous, the advantages of electric scooters surpass the disadvantages.

In order to face the disadvantages and create value on electric scooters, the interviewees agree that regulations must be enforced. The city needs to adapt to new circumstances and to do so, there is a need to create more specific lanes for these types of transportation. If specific lanes and specific parking spots were created, it would solve the problem of the complaining pedestrians and the post misuse attitudes of the users. As for the safety of the users, many ideas arose but it always depends on the companies that provide the services. For instance, a change in the design of the electric scooters would be very beneficial in terms of users' safety. If a seat and a helmet were added to the original design it would provide safer rides for the users and, more importantly, the perception of safety would rise. Not only the government but also the companies have to work together to create even more lanes and parking spots in order to increase value on electric scooters. However, this is not enough to make sure that every single user respects the regulations and that random pedestrians do not misuse the electric scooters. So, in order to face this, regulations must be enforced by either the police or parking companies. This will result in more compliance by users and pedestrians, and reduce the post misuse attitudes which, according to the literature review, is the factor that creates more value destruction on these types of transportation.

**H2: If proven to be equally efficient and significantly better for the environment, the majority of people will adopt new ways of sustainable mobility**

While addressing this hypothesis, different responses were recorded. For one perspective, the city hall has a purpose of creating awareness to the public in order to promote sustainable ways of mobility. To do so, several campaigns will be created in order to illustrate the advantages of accepting new and sustainable ways of mobility. In the year 2020, Lisbon is the European “green” capital, this movement can create sustainable attitudes not only for companies but also for consumers. This can be a step towards progression in transports. However, incentives must be created in order to create larger acceptance within the city, not only acknowledging the issue but also changing attitudes and actually replacing the traditional ways of mobility for sustainable ones.

On the other hand, it could be difficult to change those perceptions. Most of the times people do not change their ways of living just because it involves change. It is important not only to create incentives for electric scooters but to create alternatives that can face the disadvantages of the electric scooters. One of the examples mentioned was the climate conditions, electric scooters are not suitable for bad weather. Electric cars could be a viable alternative to continuing travelling and be sustainable.

**RQ3: Do people from SF and Lisbon have different perceptions regarding sustainable mobility? What factors can influence those perceptions?**

Being one of the research questions, it was asked to the interviewees if they believed people from San Francisco and Lisbon have different perceptions towards sustainable mobility. The answer was unanimous, San Francisco is more aware of the need to use sustainable mobility. However, it was stressed that there is not a lot of information on the matter to sustain this idea that people from San Francisco are in fact more aware. In fact, there is not a lot of information about Lisbon either. The interviewees reinforced that such studies, like this dissertation, are needed in order to improve for the future.

Regarding the available information, there are clear signs that the state of California (USA) have in fact a culture of technology and mobility and can be seen as a world reference on this matter. Lisbon comes behind on this matter, however, it has a lot of potential of becoming a reference for sustainable mobility in the future. As for awareness, the interviewees

acknowledge that people from Lisbon are in fact becoming more aware of climate changes and the need to adopt new ways of sustainable mobility.

#### 4-Covid-19

It is important to address the current pandemic situation of 2020. At the time this dissertation is being developed, it is very difficult to predict what will happen to the world. What will be the repercussions of the covid-19 virus? And, for the interest of this dissertation, what will change in transportation around the world?

In order to try understanding what people feel about the possible repercussions, there were specific questions about this topic in both methods. In the survey it was asked 2 questions, one just to understand if people felt that there would be repercussions and, for the ones that responded “yes” another question with several options of possible consequences of this situation. Of the total 346 respondents, 197(56,9%) said yes, while 96(27,7%) said no and 53(15,4%) did not have an opinion. Since the majority believe that there will be consequences, a follow up question was displayed.

Since the question allowed more than one response, the results are displayed with a percentage of the frequency that each answer was chosen. Therefore, of the total 346 chosen responses to this question 137 (39,6%) “people will be more afraid of public and shared transportations”. 89 (25,7%) “daily trips will decrease.” 60 (17,3%) “people will stop using electric scooters.” 76 (22%) “the government should implement measures in order to assure the continuity of public transports without endangering public health.” 35 (10,1%) “I will spend less time using public transports”. 51(14,7%) “I will stop using public transports, including electric scooters”. The last option had an entry text choice for other possible suggestions or consequences, the one that stood out the most was suggesting that not only the government should implement measures but also the companies too, in coordination with the government in order to achieve the best results. This suggestion was also mentioned in the interviews, therefore it was accepted and considered relevant.

As for the interviews, the same questions were asked and also what could be the solutions to face the possible consequences. For now, there is uncertainty on how things will develop, it is believed that it is possible that not all companies will survive this economic recession and low demand. In a short-term vision, the perspectives are not the best.

On the other hand, it is also believed that these types of mobility can have an even higher rate of demand in a medium term. However, measures should be taken in order to incentive the clients to use shared mobility. Some examples were given such as usage of masks and disinfectant, but also the need to disinfect the vehicles on regular basis. Furthermore, all interviewees suggested that the government and companies should join forces in order to make sure all the required measures are being taken and to assure the clients that it is safe to use any kind of shared/public transport.

## **5. Discussion**

Sustainable mobility must be a trend for the future, not only provides individual health as well as a cleaner and healthier environment (Banister, 2008), but could also be a solution to face the climate changes. As it was shown in the analysis, technology and sustainability are the factors that people most value on a transport. This means that people are aware of the need to be sustainable and to invest in both progress and technology for the future. In the same analysis, peoples' perception about safety is also very important and could be a setback towards the use of electric scooters. With that being said, it was needed to understand what could motivate people to adopt electric scooters and still feel safe while using them. The main measures chosen were the creation of safer places to ride these transports, followed by lower costs and a safer design. It is possible to observe that safety is important as well as price. It was suggested by the literature and the interviews that there is in fact room to grow. As for safer places to ride, the city hall's commitment to turn two thirds of all mobility sustainable will also mean an investment in safer places to ride, therefore increasing the satisfaction of the users. A safer design, as it was suggested in the analysis, could be the implementation of a seat and a helmet. It is important that companies providing these services be aware of what the customer needs and values.

The literature review suggested that people from San Francisco are very apologist of technology and sustainability and, despite being on a promising track, Lisbon is not at the same level. One of the objectives of this dissertation was to compare both cities and analyze if in fact there is a difference in use and perceptions. In terms of usage, people from San Francisco are in fact ahead, using electric scooters more often than people in Lisbon. However, regarding perceptions, there were no statistically significant results that confirmed that people from San Francisco have in fact different perceptions. Therefore, with the

variables that were used, it is not possible to accept this idea. Although it still remains a lingering question, if there are no differences in perceptions why do people from San Francisco use more? As for electric scooters, it is possible that people from San Francisco are more used to them simply because ES have been around for more time than they have been in Lisbon. The idea that people from SF have different perceptions was not proven through the quantitative method, however, with the qualitative method, all the interviewees stated that in fact people from San Francisco are more aware of the need to use sustainable mobility, although admitting that there is not much data to prove these assumptions.

Further literature review suggested that there could be other factors that might influence peoples' perceptions about electric scooters and sustainable mobility itself. One of these factors is age, as literature suggested that younger people would be more prone to use electric scooters than older people. After the Scheffe's post-hoc test, two age groups had a statistically significant relation and had different results than expected. It was concluded that people with ages between 29-38 use electric scooters more frequently than younger people, therefore, for this two age groups, the hypothesis is rejected. It is possible that people from the age group 29-38 have a more financially independent life and therefore use more. As for older groups it would be interesting to test other variables in order to further analyze this hypothesis.

Education is a major influencer in almost every aspect, literature suggested that the more an individual is educated the more it will adopt sustainable ways of mobility due to the awareness of environmental problems. As it was confirmed throughout the analysis, it is in fact true that, at least for high school degrees and bachelor's degrees the ones statistically significant, people with a higher education are more prone to adopt new ways of sustainable mobility. The hypothesis is accepted. It is important to raise awareness, to use media and advertising in order to inform and to invest in education in order to achieve sustainable mobility (OECD, 2002). Not only that but, in combined efforts, companies and the city hall must join forces and create incentives. As it was shown in the analysis between both cities, is not enough to create awareness, it is also important to take action and adopt measures that actually make people change from their traditional ways of transport to more sustainable ones.

Addressing gender, the analysis disproved the hypothesis that women would be more predisposed to use electric scooters. Since the sample is relatively equal (144(59%) males and



110(41%) females) the hypothesis is rejected for this sample. Gender could be a non-influencing factor towards the adoption of sustainable mobility.

Political attitude is actually an important factor because, as it was suggested in both methods responses, the government should take part on the decision making and incentives towards sustainable mobility. However, it was interesting to observe that, contrary to the hypothesis, people that place themselves on the right side of the political spectrum are more inclined to use electric scooters. Although the correlation provided in the data collection is weak, the hypothesis is rejected.

Lastly, happiness was also tested. Literature suggested that, in terms of transportation, the more a person was happy the less the same person would care for sustainable mobility. It was interesting to observe in the analysis that the one that had more significance was the variable “electric scooters should be banned”. However, the correlation is very weak and even weaker for the other variables, therefore it was not possible to prove or reject the hypothesis.

As for the Covid-19 pandemic, it is very difficult to predict what will be the repercussions. For now, it is possible to observe that some of the survey’ respondents are preoccupied with using public and shared transports, even with some of the respondents choosing not to use these kinds of transports again. Nevertheless, the interviewees are optimistic and believe that this recession and low demand is just short-term and that, after this this pandemic, sustainable mobility can get an even higher rate of demand than before, with the right incentives.

In conclusion, it is important to emphasize that electric scooters have more advantages than disadvantages and, in order to face those disadvantages, it is imperative that both companies and government, or city hall, work together towards a common goal, which is a sustainable future.

### **5.1-Limitations**

The scarcity of literature involving this topic was higher than expected, one of the purposes of this dissertation is also to fill this gap and contribute to future research and therefore, it relies mostly on primary data collected through the methods.

As for methodological limitations, although the sample was interesting, is always important to have a larger sample in order to confirm the veracity of the results. One of the research questions was partially affected by an error on the survey, allowing the respondent to

answer “other” city besides San Francisco and Lisbon, drastically reduced the sample to analyze that research question. As for the interviews, it was very difficult to get in touch with the possible interviewees, unfortunately none of the representatives of companies of electric scooters accepted the invitation to be interviewed. Moreover, it was even more difficult to contact representatives of companies in San Francisco, no responses were received.

Regarding the analysis, the survey should be straighter to the point and shorter in order to get a higher rate of responses. One other possible limitation is the fact that the survey was shared through social media, therefore reducing the sample only to people that use social media or the platform M-Turk. As for the interviews, it would be valuable for the study to have more interviewees and, as stated before, representatives of companies of electric scooters in both cities.

### **5.2- Future Research**

-As for future research it is important to test other variables, especially on the hypothesis that were neither confirmed nor denied.

-It is important to include in the analysis people that do not use social media, sharing the survey in different ways.

-Remaking this study in 5 or 10 years from now and compare the results to observe if peoples’ perceptions may have changed.

-Lastly, it would be interesting for the topic to develop the same study but comparing with other cities. For example, San Francisco, Lisbon and Mumbai (India).

## 6. References

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## Appendixes

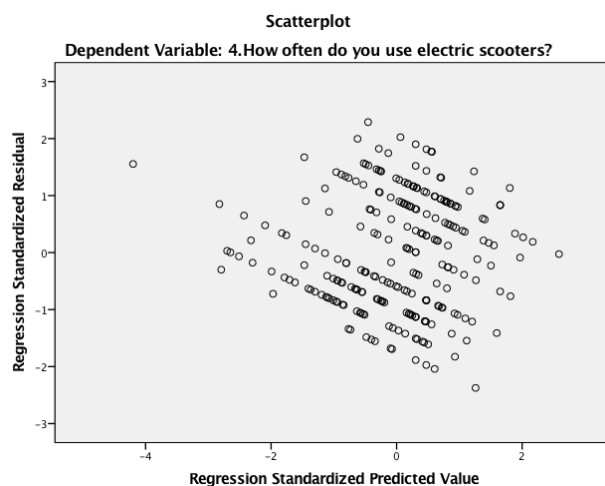
### Appendix 1 - Kolmogorov-Smirnov Normality Test to residual standardized

	Test Statistics	P-value
Standardized residual	0,080	0,000

### Appendix 2 –Asymmetry in the distribution of standardized residual

	n	Skewness	Std. Error Skewness
Standardized residual	254	0,062	0,153

### Appendix 3 - Homocedasticity of Waste



#### Appendix 4 - Test of normality to the use of electric scooters (question 4)

		Test	Test Statistics	Valor-p
City	Lisbon	<i>Kolmogorov-Smirnov</i>	0,243	0,000
	San Francisco	<i>Kolmogorov-Smirnov</i>	0,199	0,000
Age groups	Less or equal to 28	<i>Kolmogorov-Smirnov</i>	0,208	0,000
	29-38	<i>Kolmogorov-Smirnov</i>	0,222	0,000
	39-48	<i>Shapiro-Wilk</i>	0,177	0,093
	Greater or equal to 49	<i>Shapiro-Wilk</i>	0,177	0,032
Education	High school	<i>Shapiro-Wilk</i>	0,806	0,000
	Technical degree	<i>Shapiro-Wilk</i>	0,913	0,073
	Bachelor's degree	<i>Kolmogorov-Smirnov</i>	0,177	0,000
	Master's degree	<i>Kolmogorov-Smirnov</i>	0,194	0,000
Gender	Male	<i>Kolmogorov-Smirnov</i>	0,174	0,000
	Female	<i>Kolmogorov-Smirnov</i>	0,213	0,000

#### Appendix 5 - Test of normality to perceptions of use of electric scooters (question 12)

		Test	Test Statistics	Valor-p
Provide fun rides	Lisbon	<i>Kolmogorov-Smirnov</i>	0,224	0,000
	San Francisco	<i>Kolmogorov-Smirnov</i>	0,214	0,000
Emission-free	Lisbon	<i>Kolmogorov-Smirnov</i>	0,229	0,000
	San Francisco	<i>Kolmogorov-Smirnov</i>	0,186	0,000
Fast way	Lisbon	<i>Kolmogorov-Smirnov</i>	0,188	0,000
	San Francisco	<i>Kolmogorov-Smirnov</i>	0,215	0,000
Reduces Traffic	Lisbon	<i>Kolmogorov-Smirnov</i>	0,218	0,000
	San Francisco	<i>Kolmogorov-Smirnov</i>	0,219	0,000
Awareness	Lisbon	<i>Kolmogorov-Smirnov</i>	0,188	0,000
	San Francisco	<i>Kolmogorov-Smirnov</i>	0,176	0,000
Exercise	Lisbon	<i>Kolmogorov-Smirnov</i>	0,168	0,000
	San Francisco	<i>Kolmogorov-Smirnov</i>	0,165	0,000



#### Appendix 6 - Asymmetry of distributions for the use of electric *scooters* (question 4)

		n	Skewness	Std. Error Skewness
Age	Less or equal to 28	130	0,402	0,212
	29-38	76	-0,308	0,276
	39-48	27	0,113	0,448
	Greater ore qual to 49	21	0,081	0,501
Education	High school	27	1,408	0,448
	Technical degree	20	0,730	0,512
	Bachelor's degree	143	-0,222	0,203
	Master's degree	63	0,412	0,302
Gender	Male	144	-0,134	0,202
	Female	110	0,448	0,230
City	Lisbon	68	0,787	0,291
	San Francisco	98	-0,772	0,244

#### Appendix 7 - Asymmetry to perceptions of electric scooter use (question 12)

		N	Skewness	Std. Error Skewness
<b>Provide fun rides</b>	Lisbon	97	-1,043	0,245
	San Francisco	115	-0,876	0,226
<b>Emission-free</b>	Lisbon	97	-0,721	0,245
	San Francisco	115	-0,744	0,226
<b>Fast way</b>	Lisbon	97	-0,626	0,245
	San Francisco	115	-0,615	0,226
<b>Reduces Traffic</b>	Lisbon	97	-0,789	0,245
	San Francisco	115	-0,646	0,226
<b>Awareness bike lanes</b>	Lisbon	97	-0,630	0,245
	San Francisco	115	-0,683	0,226
<b>Exercise</b>	Lisbon	97	-0,278	0,245
	San Francisco	115	-0,518	0,226

#### Appendix 8 -Test for the homogeneity of variances

	Levene statistics	Valo- p
Use of ES between age groups	1,657	0,177
Use of ES and Education	2,711	0,046

## Appendix 9- Survey layout

1- Where do Live?

- A) San Francisco
- B) Lisbon
- C) Other

2- Have you ever used electric scooters?

a) yes

b) no

3-(add display logic for the ones who answer yes on 2) When you first tried electric scooters it was...  
(can choose more than one)

- a) To save money on transportation
- b) Because it looked fun/ curious to try
- c) To get around more easily/ faster
- d) Because it is better for the environment
- e) To move faster in shorter distances
- f) To complement my usual means of transportation
- g) Because it is easy to use and to park
- h) Because it is a new technology

4- how often do you use electric scooters? (scale 1-almost never (ou rarely) 10- everyday) (add display logic for only to who answered yes on 2)

5- Why did you never used electric scooters? (can choose more than one) (add display logic only to who answered no to 2)

- a) I believe the city's infrastructures are not adequate
- b) I always use other type of transportation
- c) The service is expensive
- d) The service is dangerous
- e) I don't need it/find it useful
- f) I don't know how to ride an electric scooter
- g) I never had the opportunity

6- how long do you take each day to reach your destinations?

- a) less than 15 min
- b) between 15 min and 30 min
- c) between 30 min and 45 min
- d) between 45 min and 1h
- e) more than 1 hour

7- to reach your destinations which means of transportation do you use? (can choose more than one)

- a) car
- b) bike
- c) motorcycle
- d) electric scooters
- e) walking
- f) public transports (train, bus, subway, boat)
- g) taxi, uber, etc.
- h) other, which one?

8- (scale 1-Completely disagree to 7- completely agree) what do you value most on a type of transport?

- a) Comfort
- b) Technology
- c) Price
- d) Ease of use and park
- e) Efficiency (e.g. speed)
- f) Sustainability
- g) Safety

9- Please classify the following statements bearing in mind what would make you use electric scooters more often (scale 1-completely disagree to 7- completely agree)

- a) Lower costs/ more discounts
- b) More electric scooters available
- c) More efficiency/speed
- d) Safer places to ride (e.g. specific lanes)
- e) More government control and regulations
- f) Different and safer design (including a seat and an helmet for example)
- g) To exercise
- h) None of the above would

10- classify the following statements bearing in mind what would NOT make you use electric scooters more often (same scale as 14)

- A) I don't feel safe using them
- B) Lack of government control and regulations
- C) I cannot use the mobile app for shared electric scooters
- D) I don't know how to drive one
- E) The roads' conditions are not suitable for electric scooters
- F) I don't need it/ find it useful
- G) To save money

11- After riding electric scooters for the first time, your opinion about them and their benefits improved. (answer on a scale of 1- completely disagree to 7 – completely agree) (add display logic to only yes to 2)

12- Bearing in mind the possible benefits of electric scooters, classify the following statements (scale 1-completely disagree to 7- completely agree)

- a) Provide fun rides
- b) Promote an emission-free transportation alternative
- c) Fast way to commute
- d) Reduces number of cars, therefore decreasing traffic jams
- e) Create awareness to develop bicycle lanes and incentives on Electric Scooters
- f) To exercise

13- Please classify the next statements regarding your opinion on electric scooters (scale 1-completely disagree to 7-completely agree)

- a) Users are irresponsible and leave them everywhere
- b) They are unsafe for pedestrians
- c) They are unsafe for riders
- d) There should be more safety measures
- e) They endanger other drivers on the road
- f) They should be banned

14-(add display logic for yes on 2) how likely are you to recommend electric scooters to others? Scale 1 not at all likely to 10 extremely likely Net promoter score

15- At the beginning it was asked for you to ignore the current pandemic situation, however do you believe that covid-19 will have a negative impact on our future in terms of transportation?

- a) yes
- b) no
- c) don't know

16- (add display logic to people answering yes to 20) please choose the following statements that you believe will be a consequence of the covid-19 virus

- a) People will be more afraid of public/shared transportations
- b) People will drastically decrease daily trips
- c) People will stop using shared electric scooters
- d) The government should provide safety and health measures in order to assure the continuity of these transportations without endangering public health
- e) Personally, I will decrease the amount of money I spend on transports
- f) Personally, I will not use any kind of public transports, including electric scooters
- g) None of the above
- h) Other, which one?

17- considering the political spectrum where do you place yourself? Scale from left to right 0-10 Net promoter score

18- how happy do you consider yourself to be upon taking this survey? Scale-0 extremely unhappy to 10-extremely happy

19- Please indicate your gender

a ) male

b) female

20- Please indicate your age

less than 18

18-28

29-38

39-48

49-58

59-68

More than 68

21- Please indicate your level of Education

- a) High school
- b) Technical degree
- c) Bachelor's degree
- d) Master's degree
- e) Doctorate

22- What is your current occupation?

- a) Student
- b) Student/worker
- c) Employed
- d) Unemployed
- e) Retired

23- What is your household income per month?

- a) Less than 1000
- b) Between 1000 and 2000
- c) Between 2000 and 3000
- d) Between 3000 and 4000
- e) Between 4000 and 5000
- f) More than 5000