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The role of innovation on Bicycle Commuting in Portugal

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I want to dedicate my dissertation to all bike commuters in Portugal.

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Abbreviations

BRT	Behavioral reasoning theory
GPS	Global Positioning System
IT	Information Technology
R&D	Research and development
WHO	World Health Organization

Abstract

New models of innovation and strategies of soft mobility, with the objective of lowering CO2 emissions and noise pollution, eliminate traffic congestion and increase public health, support the development of sustainable cities. In Portugal, car is the most used mode of transport for daily commuting and the rate of cycling for everyday travel is 1%, while the average in Europe is 8%. This research aimed to investigate the role of innovation and its contribution to the raise of bicycle commuting in Portugal. Methods comprise research mixed methods, both quantitative and qualitative, based on secondary data research and the elaboration of an online survey. The analysis of Portuguese public policies, bicycle industry innovations and bike commuting related initiatives over the past 10 years illustrates how much has been done. However, that is not enough to enhance bike commuting to the European average levels. It was, therefore, crucial to understand the commuters' motives and barriers that undermine the use of bicycles as a means of transport, as well as innovations that contributed to bike commuting. Innovative knowledge and innovative technologies applied to the level of bicycle commuting could lead to disruptive innovation at different levels, such as legislation, promotion of safety and surveillance, bicycle and accessories, mobile applications and websites, infrastructures, intermodal transport or initiatives to promote bike as a mode of transport. The coordination of these innovations and measures, between public and private sectors, are crucial to make the shift to soft mobility aligned with European policy orientations.

Keywords

Bicycle commuting, bicycle infrastructure, commuting, cycling, disruptive innovation, public policies, soft mobility

1 Introduction

The importance of Sustainable Cities development, based on the conceptualization and implementation of new models of innovation, on strategies of mobility and the use of less polluting resources, is a current issue and usually includes cycling. Countries are increasingly seeking more innovative ways to lower CO₂ emissions and noise pollution, eliminate traffic congestion and increase public health, undertaking a variety of activities to encourage cycling as a daily transport mode.

In Portugal, car is the most used means of transport for daily commuting. In 2001 the percentage of the population that used car, either as a conductor or as a passenger, was about 46%. In 2011 the percentage increased 16 percentage points to 62% and more than 50% of the population spent in average less than 15 minutes traveling from home to work/place of study (Instituto Nacional de Estatística, 2012).

For short distance journeys, up to 5 km, and even more with traffic congestion, the bicycle is time-competitive with the car (Dekoster & Schollaert, 1999; Dill & Gliebe, 2008), however, societies are car dependent and urban cycling is marginalized. In Portugal the rates of cycling for everyday travel increased, from 1% to 1,6%, between 2007 and 2010, but decrease to 1% in 2014, while the average in Europe is 8% (see Table 6 in Appendix) (European Commission, 2007, 2014; The Gallup Organization, 2011)¹. To reach European average, decisions makers have to deal with cycling commuting issues in an integrated and global strategy, namely by establishing effective cycling policies, defining the best approach considering the urban context's specificities for each city, providing and managing adequate infrastructures, promoting cycling usage and embracing a cycling culture.

The UK is a good example regarding the implementation of specific a range of measures, across private and public sectors - such as (1) expansion of the National Cycle Network, (2) expansion of cycling lanes in urban and city areas, (3) establishing environmental and health concerns as a priority issue and (4) increasing the number of large scale organized cycling events - in order to promote the bicycle as a viable alternative travel option and, thus, motivate new and existing cyclists. The efforts made over the past 15 years are paying off and

¹ Founded by George Gallup, Gallup, Inc. is primarily a research-based, performance-management consulting company.

there is considerable evidence of increasing participation in cycling, (1) 3,7 million bikes sold across the UK in 2010, (2) 208 million cycle journeys were made in 2010 (3), net addition of 1.3m new cyclists in 2010 of whom 500 000 are Frequent or Regular Cyclists, (4) 200 000 people took part in Sky Ride events across the UK in 2010, (5) 22 000 people daily, sharing 5 000 hire bikes through the Barclays Cycle Hire in London and (6) a growth of 50% in cycling commuting from 2010 to 2014. Therefore these changes led to enhanced results in health, traffic congestion, economy and environment (European Commission 2014; Grous, 2011; The Gallup Organization, 2011).

Overall, Europe shows high variation in bicycle commuting activity and Portugal, in particular, bicycles are still disregarded as a mobility solution, so there is an urgent need to disruptive innovation in what regards bicycle commuting, in order to find innovative solutions to improve sustainable urban mobility, thus making it accessible to a whole new population. The disruptive innovation process, coined by Christensen (1997), transforms products and services making them much more affordable and accessible to a larger population.² This is critical to encourage new and infrequent cyclists to daily commuting.

Still, several studies (Bartle, Avineri, & Chatterjee, 2013; Claudy & Peterson, 2014; Jones, 2012; McKenzie-Mohr, 2010) highlight the need to implement coordinated measures, involving independent groups, communities, public and private sectors, in order to raise bike commuting rates. These measures should include investments in infrastructures to increase safety, public policies favorable to bike commuting, local authorities promoting cycling participation, private sector contribution, supporting mass-participation events, like “bike to work day” or “Massa Crítica”³, a monthly activist ride spread in more than 300 cities throughout the world to create awareness about bike commuting (Furness, 2007), bike-sharing systems and encouraging employees to cycle.

To obtain financial support for initiatives such as the above-mentioned ones, countries can apply for funding from EU-financed programs or from programs managed by the European

² By pursuing great profit in sophisticated markets, companies show the way for disruptive innovations at the bottom of the market, although it might seem unattractive in the beginning, because of eventual lower gross margins, smaller target markets, and simpler products and services.

³ Mass bicycle ride that takes place on the last Friday of each month, celebrating soft mobility. It began in San Francisco, California, in 1992, and in Lisbon in 2003 (masscriticapt.net).

Commission and EU executive agencies. Overall, cycling projects are eligible for funding in the policy areas of transport, energy, environment, health, regional development and tourism.⁴

Hence, the main research objective of the present study is to review the public policies and innovations regarding cycling in Portugal over the last 10 years, and to understand the main motives and barriers for commuters in Portugal. This will allow us to foresee how innovation and related public policies could favor bike commuting and would contribute to the growth of urban cycling in Portugal. The results of this study are expected to provide important outputs for the development of public policies that promote the bicycle as a mode of transport and thereby contribute to the sustainability of cities. Furthermore, the author expects to be able to provide guidelines for creating alternatives, new solutions and innovative models for social changes regarding bike commuting.

A comprehensive literature research was conducted to identify relevant studies. These were drawn primarily from the main components of the research study including bike commuting assessment; infrastructures; active travel outcomes and innovation. The literature review was then followed by a set of qualitative and quantitative research methods conducted to target urban commuters with the main purpose of understanding people's motivations regarding daily commuting. Hence, the research strategy reflects the interpretivist perspective (Creswell, 2014), and it is based on research mixed methods.

⁴ The European Regional Development Fund (ERDF) The ERDF includes funding for clean and sustainable urban transport, multimodal transport and tourism-related infrastructure. In accordance with the subsidiarity principle, it is usually the Member States and their regions who manage the regional development programmes; The European Agricultural Fund for Rural Development (EAFRD) The EAFRD funds rural development. This can include the creation of cycling infrastructure and promotion of sustainable tourism; Intelligent Energy Europe (IEE) The IEE programme aims at improving energy efficiency and encourages the wider uptake of new and renewable energies. Cycling projects can be funded under its STEER strand which promotes more sustainable energy use in transport. STEER does not fund infrastructure, but only measures to European Commission 14 15 increase demand for sustainable transport such as campaigns, promoting best practices, education and training, and capacity building; The "Seventh Framework Programme" (FP7) (to be followed by FP8 for 2013- 2020) is the main financial tool through which the EU supports research and technological development and demonstration activities, covering almost all scientific disciplines. Its "cooperation" sub-programme is divided in ten themes (including Transport). One key initiative for cycling projects within the FP7 is CIVITAS. With the CIVITAS Initiative, the EC aims to generate a decisive breakthrough by testing ambitious integrated sustainable urban transport strategies. Through the CIVITAS Initiative the EU also funds the development and evaluation of new approaches to safe cycling in cities; Programme of Community Action in the Field of Health The Health Programme is the key means of implementing health objectives at European level. Projects under this programme fall into three categories, known as "strands": health security/health threats; health information; and health determinants/health promotion. Cycling could be funded under the "health promotion" strand which includes the promotion of physical activity.

2 Research Methodology

This study was conducted to understand to what extent innovation contributes to the growth of urban cycling in Portugal. The specific research questions are as follows.

Research Question 1: In what regards promoting bike commuting, what were the most relevant public policies, technology innovations and initiatives in Portugal over the last 10 years?

Method: Document search on government websites and on specialized sites.

Research Question 2: What are the main reasons that motivate people to not commute by bicycle on their daily journeys?

Method: Self-report online questionnaires

Research Question 3: What are the main reasons for urban cyclists commute by bike on their daily journeys?

Method: Self-report online questionnaires

Research Question 4: What are the main barriers that urban cyclists have to face on their daily bicycle journeys?

Method: Self-report online questionnaires

Research Question 5: What were the main innovations that motivate people to start commuting by bike on their daily journeys?

Method: Self-report online questionnaires

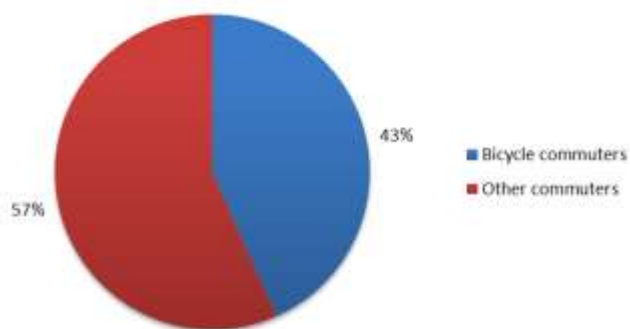
2.1 Participants

An online questionnaire was conducted, from March 2016 to May 2016, targeting urban commuters living in Portugal, with more than 16 years old.

A convenience sampling was conducted by using the internet. It doesn't require a specific sampling frame, instead it involves asking a self selection of individuals willing to participate in the survey. Although convenience samples are not scientific samples, limitations are identified and it has value to the study as well as its results (Battaglia, 2011). Moreover, «limited evidence so far does not suggest that there are substantial differences in either replication or size of effects across probability and nonprobability-based samples. The evidence is not adequate, however, to assess the more general question of whether the two types of samples are always likely to replicate experimental effects» (Callegaro, Villar, Yeager, & Krosnick, 2014).

The sample is composed of 701 participants: 704 responses were obtained, nonetheless, 3 respondents were excluded, since the respondents didn't comply with one of the inclusion criteria: live in Portugal. Of the 701 participants, 43% (N=302) reported bike commuting (see Graphic 1).

Graphic 1
Urban Commuters

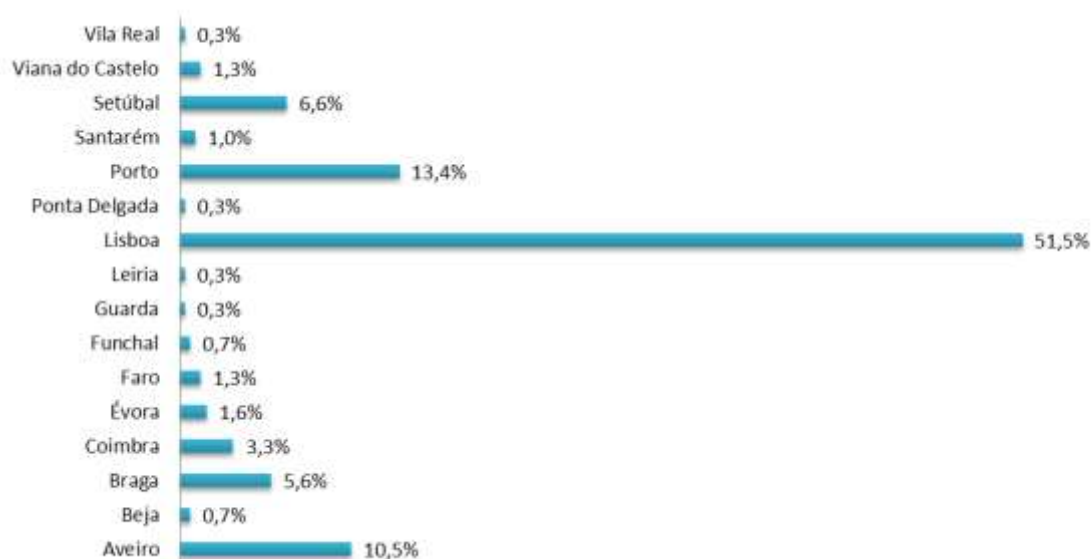


The table below illustrate the urban cyclist's profile and graphic 2 represents the urban cyclist's geographical distribution in Portugal.

Table 1
Urban Cyclist Profile

<p>Gender N= 305</p> <p>n</p> <p>Male 245 80%</p> <p>Female 60 20%</p>	<p>Age N= 304</p> <p>n</p> <p>[16,25] 28 9%</p> <p>[26,35] 92 30%</p> <p>[36,45] 111 37%</p> <p>[46,55] 55 18%</p> <p>≥56 18 6%</p>	<p>Smoker N= 305</p> <p>n</p> <p>Yes 54 18%</p> <p>No 251 82%</p>
<p>Household N= 304</p> <p>n</p> <p>1 69 23%</p> <p>2 83 27%</p> <p>3 66 22%</p> <p>4 66 22%</p> <p>5 15 5%</p> <p>≥6 5 1%</p>	<p>Number of Children N= 305</p> <p>n</p> <p>0 164 54%</p> <p>1 60 20%</p> <p>2 60 20%</p> <p>3 18 6%</p> <p>≥4 3 1%</p>	<p>Other mean of transport N= 305</p> <p>n</p> <p>No 70 23%</p> <p>Car 202 66%</p> <p>Motorcycle 6 2%</p> <p>Car & Motorcycle 27 9%</p>
<p>Academic Qualification N= 305</p> <p>n</p> <p>< 12º ano 25 8%</p> <p>12º ano 58 19%</p> <p>Licenciatura 117 38%</p> <p>Pós-graduação 31 10%</p> <p>Mestrado 58 19%</p> <p>Doutoramento 16 5%</p>	<p>Occupational Status N= 305</p> <p>n</p> <p>Unemployed 22 7%</p> <p>Housekeeper 8 3%</p> <p>Employed Full-Time 226 74%</p> <p>Employed Part-time 21 7%</p> <p>Student 28 9%</p>	<p>Income N= 305</p> <p>n</p> <p>< 1.000€ 160 52%</p> <p>1.000€ - 2.000€ 110 36%</p> <p>2.000€ - 3.000€ 20 7%</p> <p>> 3.000€ 15 5%</p>

Graphic 2
Urban Cyclists Geographical Distribution (Districts)



2.2 Procedures

A representative benchmark analysis and secondary data research was conducted over bicycle commuting using Google, Google Scholar and EBSCO. A comprehensive literature research was conducted to identify relevant studies regarding bicycle commuting and innovation. The researched keywords included bicycle commute, bicycle infrastructure, innovation, disruptive innovation, public policies, sustainability, urban mobility, active travel, health and transport. From the literature review resulted 141 titles, which were screened, analysed and interpreted for inclusion. Following the application of the inclusion criteria, supported by an interpretivist perspective as part of social research approach to identify the factors that influence the outcomes of research questions, 28 papers were considered relevant to the present study and were included in the final review and subjected to content extraction.

Qualitative data search was supported by government websites and specialized sites, specified in Other References, as well as non-structured interviews to municipalities' representatives and researchers. Public policies, technology innovations and initiatives were selected and organized based on the following criteria: (1) Level of impact in terms of increasing bicycle commuters rate, (2) types of innovation implemented in terms of products, services, processes and business models for the bicycle industry in Portugal and (3) length of initiatives involving bike commuters.

An online questionnaire was developed with Google Forms and disseminated through the Internet. Announcements on the questionnaire were made in Facebook, in the most relevant urban bicycle communities and groups and cycling shops pages, on a total of 136 pages (see Table 5 – Facebook pages). As well as, 173 direct messages sending a link to the online survey, by email, LinkedIn or Facebook Messenger, comprising personal contacts, friends, urban cycling ambassadors, bike shops, organizations and companies, and also word-of-mouth.

Both statistical analysis (SPSS method) and qualitative-connotation analysis will be implemented to support the main findings.

2.3 Instruments

A questionnaire, designed with Google Forms, was addressed to 2 different groups – cyclists and non-cyclists - begins with a filter question to segregate one group from the other and therefore have two main sections with different questions, the first addressed to non-cyclists and the second to urban cyclists (see Appendix 3).

For non-cyclist commuters the questionnaire has a Likert scale question, ranging 0 (not relevant) to 5 (most relevant), to identify their motives to not commute by bike in the daily journeys, followed by an open question for respondents refer any other motive not included in the previous question. It also includes an open question to understand what would be necessary to turn them into urban cyclists.

The second section is more exhaustive to deepen the knowledge about Portuguese bike commuters and is constituted by 25 questions, including multiple choice questions, checkboxes, closed questions and open questions, used to identify the reasons why people choose to commute by bicycle; where are they traveling to; preferences for route choice; barriers to bike commuting; contribution of innovation products for becoming an urban cyclist and set their profile.

3 Results

Despite the fact that the sample is non-randomly selected, the chi-square distribution test (see Table 3 and Table 4) was considered to be applied in order to study potential associations among key categorical variables of the study, under the assumption that we could not apply the results to the entire population. Hence, statistic inference will have to be restricted to the sample alone (subset). For this analysis a chi-square test was conducted to determine if there was a significant association between two categorical variables, with 2 or more levels (e.g. Gender has two levels: Male and Female; Age has three levels: 16-35; 36-55, 55+), from a single population (Leeper, J.D.)⁵

⁵ Chi-square test assumes that each cell has an expected frequency of five or more, but the Fisher's exact test has no such assumption and can be used regardless of how small the expected frequency is. But Fisher's exact test can only be performed in SPSS with SPSS Exact Test Module on a 2x2 table, and these results are presented by default.

Research Question 1: In what regards promoting bike commuting, what were the most relevant public policies, technology innovations and initiatives in Portugal over the last 10 years?

The purpose of this research question was to (1) track changes in policy making, macro and micro measurement environment in term of context evolution, (2) acknowledge the contribution of the State measures in favor bicycle commuting and (3) analyze some of the best practices – examples and impacts.

One of the favorable public policies was (1) **the change of the legal framework ensuring greater protection for cyclists. The Portuguese Highway Code** suffered changes in 2014 in order to benefit urban cyclists, such as end of obligation to ride the rightmost possible at the lane, passing distance by motor vehicles should be made leaving a lateral distance of 1.5 meters accompanied of slowing down speed, the cycles when presenting at the right, take priority as any other vehicle, end of the obligation to move the bike path where these exist, becoming only the preferred site circulation, possibility of two-wheeled vehicles in dedicated lanes (bus lanes), by resolution of the City Council, children up to 10 years allowed to ride on the sidewalk, consideration of bicycles as vulnerable users of the road and duty of the motor vehicle drivers to not endanger the vulnerable users, obligation to give way to bicycles when crossing the marked passages, transport of passengers in trailer allowed. (Federação Portuguesa de Cicloturismo e Utilizadores de Bicicleta)

(2) More **favorable public policies were created, such as the traffic calming areas named Zona 30**. That was implemented in residential areas, in areas with high commercial activity and in the vicinity of schools, with the objective of reducing the circulation speed the vehicles are not allowed to drive faster than 30 km per hour. It reduces the accidents occurrence and severity, reduces noise and environmental pollution and ensures road safety. Inside the Zone 30 vertical signs must be reduced to a minimum and traffic calming is ensured by physical changes in the urban space, leading to their rehabilitation, such as reducing the roadway width and increasing pedestrian space, introduction of bushes, trees or street furniture. (Câmara Municipal de Lisboa, n.d.)

(3) Besides these public policies, some **public transport rules** improved, in order to serve some mobility needs, and Carris created **Bike Bus** in 2007, in Lisbon. The bike can be carried

on public transports depending on each transport company specific rules.⁶ Folding bikes are allowed in public transports in general (Deco - Associação Portuguesa para a Defesa do Consumidor, n.d.).

(4) The **Congresso Ibérico** has been a great contribution for promoting bike as a sustainable mode of transport over the last 20 years, by creating awareness, involving local authorities, present the most important developments and experiences around the bicycles as a means of transport, moments of exchange and debate, training and information on issues concerning urban cyclist movement (Federação Portuguesa de Cicloturismo e Utilizadores de Bicicleta, n.d.).⁷

(5) There are other **strategies to encourage bike commuting, such as Murtosa Ciclável**, a project created by Câmara Municipal da Murtosa (Murtosa is situated in Aveiro district) in 2007, in partnership with Agência Portuguesa do Ambiente and Universidade de Aveiro. This project aims to promote the use of bicycle as a means of smooth transport in a day-to-day basis. In addition to the issues associated with the planning and implementation of cycle paths in urban and rural areas, the project includes the promotion of Workshops, Lectures, bike rides and other associated activities organized by the Municipality, schools and local authorities. Murtosa's strategy of making public space more pleasant for citizens had positive results. Câmara Municipal da Murtosa website refers that 16,9% of the active population uses the bicycle as the main form of transport. Investments were made to increase bike lanes, from

⁶ Bike Bus was initially available only in two lines on Saturday, Sunday and holidays. Currently there are 5 Bike Bus lines, 7 days a week, each line with a specific time, namely 708 - Martim Moniz – Parque das Nações; 723 - Campo Mártires da Pátria – Algés; 724 - Alcântara – Pontinha; 725 - Estação do Oriente – Prior Velho and 731 - Av. José Malhoa - Moscavide Centro. This service has no additional cost and allows bike commuters to carry their bike on the bus prepared for its transportation. At Fertagus trains is allowed to carry bicycles, every day of the week. But if there is a large concentration of passengers, cyclists should wait and respect the indications of its employees. Transportation of the bicycle in urban and regional trains is also free. Unlike urban lines, regional have specific rules. The revision operator must issue the ticket and authorize the transport of the bicycle, which depends on the space available and velocipede dimensions. In addition, some routes weekdays and times have temporary restrictions. Aboard Transtejo boats, that connects the south bank to Lisbon, is allowed and free to transport the bicycle. But the number of cycles that can go in each vessel depends on the connection and time. The company recently improved conditions for cyclists. In the past, the capacity for bicycles was more limited and there were tighter restrictions during peak hours. Like Transtejo, the Lisbon Metro also extended the conditions for the transport of bicycles, which is free. In 2013 ceased the existing restrictions that bikes were only allowed on weekdays from 8 P.M., on weekends and holidays. At Porto Metro is possible to carry the bike, as long as access is made by the vehicle's rear door.

⁷ The first Iberian Congress took place in Lisbon, at the initiative of Federação Portuguesa de Cicloturismo e Utilizadores de Bicicleta (FPCUB) and its spanish congener ConBici (Coordinadora en Defensa de La Bici). It was then agreed that this event would take place every two years and is presently performing every year, alternately in Spanish and Portuguese cities. The Second Congress took place in 1998 in La Coruña, the III in 2000 in Aveiro, the IV in 2002 in Gijón, the V in 2004 in Oeiras, the VI in 2006 in Zaragoza, VII in 2008 in Vilamoura, VIII in 2010 Sevilla, IX in 2012 in Murtosa, the X in Vitoria in 2013 the XI in Lisbon in 2014, the XII in Malaga in 2015 and the XIII in Vila Nova de Gaia.

2 km in 2007 to 40 km in 2015 and the urban design planning provided more favorable conditions for bicycle users. In addition Murtosa also provided bikes for tourists, which can use them in a bike sharing system logic. With 10 575 inhabitants, Murtosa is the municipality with higher bicycle usage rate in Portugal (Câmara Municipal da Murtosa, n.d.).

(6) Investments were made in public amenities, green spaces and bicycle infrastructures creating a better environment for cyclists and pedestrians. For instance, in Lisbon, there have been made improvements of existing bike lanes and construction of new ones, launch of a campaign for bike commuting awareness with real testimonials (see Figure 1), implementation of parking places in guarded places and strategic locations in the city, like markets, cultural venues, shopping areas, public transport hubs and urban parks (Câmara Municipal de Lisboa, n.d.). In a broader perspective, bike lanes networks are growing over the years in Portugal, currently counting more than 300 bike paths with more than 2 000 km (Ciclovia, n.d.).⁸

⁸ Ciclovias de Portugal: NORTE - Viana do Castelo: Ciclovias de Caminha, Ciclovias de Monção, Ciclovias de Ponte da Barca, Ecovia do Rio Lima, Ecopista do Rio Minho, Ciclovias de Viana do Castelo, Ciclovias de Vila Nova de Cerveira; Braga: Ciclovias de Braga, Ciclovias de Esposende, Ecopista de Guimarães – Fafe, Ecopista da Linha do Tâmega, Ciclovias de Vizela; Porto: Ecopista do Ramal de Famalicão, Ciclovias de Gondomar, Ciclovias da Maia, Ciclovias de Matosinhos, Ciclovias do Porto, Ciclovias da Póvoa de Varzim, Ciclovias de Santo Tirso, Ciclovias de Vila do Conde, Ciclovias de Vila Nova de Gaia; Vila Real: Ciclovias de Chaves, Ecopista da Linha do Corgo, Ciclovias de Vila Pouca de Aguiar; Bragança: Ciclovias de Bragança, Ecopista da Linha do Sabor, Ciclovias de Macedo de Cavaleiros; CENTRO – Aveiro: Ciclovias de Águeda, Ciclovias de Anadia, Ciclovias da Mealhada, Ciclovias da Murtosa, Ciclovias de Ovar, Ciclovias de S. João da Madeira, Ecopista do Vale do Vouga, Ciclovias de Vale de Cambra; Viseu: Ecopista do Dão, Ciclovias de Sernancelhe, Ciclovias de Viseu; Guarda: Ciclovias de Almeida, Ciclovias de Seia; Coimbra: Percursos de BTT das Aldeias do Xisto, Ciclovias de Cantanhede, Ciclovias de Coimbra, Ciclovias da Figueira da Foz, Ciclovias da Lousã, Ciclovias de Mira, Ciclovias de Pampilhosa da Serra; Castelo Branco: Ciclovias de Castelo Branco, Ciclovias de Vila de Rei; Leiria - Ciclovias de Alcobça, Ciclovias de Alvaiázere, Ciclovias das Caldas da Rainha, Ciclovia da Estrada Atlântica, Ciclovias de Leiria, Ciclovias da Marinha Grande, Ciclovias de Óbidos, Percursos de Pedrógão Grande, Ciclovias de Pombal, Ecopista do Ramal do Lena; Santarém: Ciclovias de Abrantes, Ciclovias de Almeirim, Ciclovias do Cartaxo, Ciclovias do Entroncamento, Ciclovias de Rio Maior, Ecovia da Vala de Alpiarça; LISBOA – Lisboa: Ciclovias de Cascais, Ciclovias de Lisboa, Ciclovias de Loures, Ciclovias da Lourinhã, Ciclovias de Mafra, Ciclovias de Odivelas, Ciclovias de Oeiras, Ciclovias de Sintra, Ciclovias de Torres Vedras, Ciclovias de Vila Franca de Xira; Setúbal: Ciclovias do Barreiro, Ciclovias de Grândola, Ciclovias da Moita, Ciclovias do Montijo, Ciclovias de Palmela, Ecopista do Ramal do Montijo, Ciclovias de Santiago do Cacém, Ciclovias do Seixal, Ciclovias de Sesimbra, Ciclovias de Setúbal; ALENTEJO – Évora: Ciclovias de Arraiolos, Ciclovias de Évora, Ciclovias de Montemor-o-Novo, Ecopista do Ramal de Mora; Beja: Ciclovias de Serpa; ALGARVE – Algarve: Ecovia do Litoral; Faro: Ciclovias de Albufeira, Ciclovias de Alcoutim, Ciclovias de Faro, Ciclovias de Lagoa, Ciclovias de Olhão, Ciclovias de Portimão, Ciclovias de S. Brás de Alportel, Ciclovias de Silves, Ciclovias de Vila Real de Santo António; R. A. AÇORES - São Miguel: Ciclovias de Ponta Delgada; R. A. MADEIRA – Madeira: Ciclovias do Funchal, Porto Santo, Ciclovias de Porto Santo

Figure 1
 Campaign "A Cidade na ponta dos dedos"



Source: A Cidade na ponta dos dedos

(7) **Ciclando - Promoção da Bicicleta e Outros Modos Suaves 2013-2020** was created in 2012 to promote the bicycle and other soft mobility modes (see Figure 2). The main objectives are to promote the dialogue and reflection between public institutions and civil society entities in order to surpass soft modes of transport barriers; Identification of necessary resources and enhancing education, safely in school context, related with bicycle usage and other modes of soft transport and introduce the learning of traffic rules; Create strategic awareness campaigns and education actions for the safely use of soft modes; Support for research projects and the implementation of pilot projects in national urban space to improve the integration of soft modes of transport and their interaction with the public transport systems; Establish achievable goals, namely to increase percentage of urban cyclists by 2012.

Figure 2
Ciclando strategic objectives and scope

Strategic Objective	Scope
A. Place the bike and "walking" in the center of everyday life of citizens	I. Mobility Paradigm / Change II. Public Space / The Infrastructures / The Equipment III. Innovation / Economic Activity / Value Creation
B. Educating for sustainable mobility and for soft modes	IV. The School / Public Health V. Training and Skills / A Sensitization

Source: Ciclando - Promoção da Bicicleta e Outros Modos Suaves 2013-2020, free translation

Accordingly to the second criteria, mentioned before, promotion of urban mobility was also enhanced by the bike industry as a result of technology innovations. Electric bikes and bike sharing systems are two examples of the technology innovations in this sector.

(8) The **CTT bicycle fleet** (see Figure 3) includes 28 regular bikes and 180 electric bikes, produced by Órbita Bikes. This green fleet increases efficiency in the delivery of mail, such as the reduction of distribution time in situations where the electric bike replaces the delivery walk. When it replaces motorcycle there are environmental advantages, namely reducing emitted gases and noise pollution.

Figure 3
CTT electric bikes fleet



Source: CTT

(9) Órbita Miralago developed **JustB, a 3rd generation Bike sharing system**⁹, targeting urban residents and tourists. Available since 2007 under the name Velib' in Paris, JustB allows the user to rent and return the bike at any Dock Station, avoiding deliveries to a central management system. «This massive undertaking and its better-than-expected success changed the course of bike-sharing history» (DeMaio & Metrobike LLC, 2009). The system encompasses four elements, (1) Bicycle Park, including a patented levelling system and a communication system using various technologies, 3G or 4G local internet access, (2) Standard or Customized Bikes with an RFID system allowing its identification, (3) Internet Management system in “Real Time” and a (4) Card, for Users¹⁰. JustB system was also implemented in Portugal, in Águeda – BeÁgueda (2009), Vilamoura - Public Bikes (2012) and Vila do Conde – biConede (2014) (Miralago, n.d.; Órbita, n.d.). There are other bike sharing systems, such as Buga in Aveiro, BiCas in Cascais, Agostinhas in Torres Vedras.

(10) Continuous innovation led to a disruptive and innovative project, different from the systems currently commercialized, the 4th generation bike system. **BikeEmotion**, a Portuguese consortium created in 2011, developed this bike sharing product and management system with GPS location based locking device, attached to a bicycle. BikeEmotion is the result of the joint R&D efforts of three companies and one University: Micro I/O, an electronic products & solutions R&D company; Ponto C, an IT platform developer; Ubiwhere, a R&D software company; and the University of Aveiro. Its mission is to provide an open bike-sharing solution with easy locking/unlocking and tracking methods, allowing users to benefit from increased flexibility. The bicycle can be unlocked by a card, a mobile application or a text message, upon registration; and only allows locking or unlocking a

⁹ The Bike sharing system went through several stages, since it started in the 1960s in Amsterdam with conventional bikes painted in white, provided for public use. The user picked a bike, ride it to the chosen destination and leave it there for the next user. The system failed as the bikes disappeared, thrown in canals and taken for own use. With many improvements, the 2nd generation of bike sharing was born in 1991 in Denmark, but despite continuous developments thefts continued due to the anonymity of the user. This led to new developments and the emergence of the 3rd generation, in 1996 at Portsmouth University in England. Continuous progresses were made and bike-sharing systems were smartened through technological innovation and grew slowly in the following years to a large scale system, launched in 2005 in Lyon (DeMaio & Metrobike LLC, 2009).

¹⁰ The management system uses Ethernet network components conferring versatility, performance and security. It aggregates all document flow between the Management System, Sales Point, Parks, Bikes, Users and Cards, enabling problem diagnosis and remotely solutions development. It has the following features: (1) Monitors in “Real Time” status of each Bike Park, giving warnings of vehicle transfer need to other Parks; (2) The Operating Platform has many Warning Systems as well bicycle theft attempts; (3) Identifies and Processes in Real Time, Bicycle movement data, generating outputs per interval of Use, per Journeys, per User, number of Rent Bicycles, Bicycles parked by Park, Free and busy Park Docks, Card trekking; (4) Statistic Data providing, such as Customer Frequency use, Users per Park, Cards by Age assigning, highest useless period, frequent travelled tracks, among others. Cards can be charged at the Sales Network or through ATM machines.

bicycle in defined areas. The advanced technology enables, through GPS, to locate each bicycle at any time. It's possible to adapt the device to any bicycle, and the system to any city. The flexible stations make the system cost effective, while providing advanced technology. Each bicycle is GPS locatable, and the system manager can restrict the renting areas to only allow the user to leave the bicycle at authorized areas. Each bicycle will alert the system and sound alarm in case of damage, theft or inappropriate use. The system is interactive, providing useful and targeted information. It can suggest interesting nearby places and routes through a context-aware user interface (BikeEmotion).

(11) Still in what concerns innovation in the bicycle industry, **Polisport Group** is a remarkable example (see Figure 4), with a well-structured R&D department. This international corporation, founded in Portugal, is the world leader in baby and child seats production. In what regards urban commuting, according to the survey results, carriage accessories, including baby and child seats, are the second most important kind of innovation for cyclists (37%). Polisport has a collaborative network tool, Rede de Ideias, that allows employees to contribute with innovative ideas for products, business models or processes. This business philosophy is materialized in eight international patents seven industrial design registrations and four international trademarks. Besides R&D department, Polisport develops innovation activities, including design, moulds and prototyping, with universities and technology organizations as partners, namely Universidade de Aveiro, Universidade da Beira Interior (UBI), Centro para a Excelência e Inovação na Indústria Automóvel (CEIIA) and PIEP - Pólo de Inovação em Engenharia de Polímeros.

Figure 4
Awarded Polisport seats



Source: Polisport

(12) Promotion of soft mobility also involves events, bringing professionals together, but also public in general. **European Car Free Day** is an international event for sustainable mobility,

additional to the Commission's proposals to improve the environment in urban areas, comprising legislation on air quality and ambient noise. This event aims to directly involve European citizens in environmental action and it had its first edition in Portugal in 2000. In this day streets are closed to cars and open to pedestrians, roller-skaters, cyclists and public transport operators, showing the benefits of having a safe public space (Environmental Transport Association; European Mobility Week, 2016; European Commission, 2001).

Currently European Car Free Day is part of the (13) **European Mobility Week**. This campaign was designed to create awareness about transport alternatives for European citizens and sought to influence a behavioural change and exploring concrete solutions. Portuguese local authorities are strongly involved since 2002, also being an excellent opportunity for local stakeholders to get together, with the objective to create innovative solutions, test new technologies or planning new measures, besides discussing sustainable mobility and air pollution (European Mobility Week, 2016). Portuguese local authorities participate in both events from the first edition, over the years new stakeholders has joined this events, not only local authorities, but also new collaborative partners and general public (Agência Portuguesa do Ambiente, 2016).

(14) “**De Bicicleta para o Trabalho - Bike to Work**” started in 2011, this experimental initiative was addressed only to Câmara Municipal de Lisboa employees. The interest shown by the private corporations in Lisbon, led to the growth of this initiative in the years to come (48 entities in 2012, 88 entities in 2013, 84 entities in 2014 and 90 entities in 2015). This event is organized, within the scope of Car Free Day, by Lisboa E-Nova with the collaboration of Câmara Municipal de Lisboa and Federação Portuguesa de Ciclismo e Utilizadores de Bicicleta (FPCUB). Bike to work aims to challenge corporations in the municipality of Lisbon to mobilize its employees to commute by bicycle, creating awareness to the need of reducing negative environmental impacts of urban mobility by promoting alternative means of transportation (Lisboa E-Nova, 2015).¹¹

(15) **Cycle Chic®** began as a blog in 2007 documenting through photos the life of Copenhageners on their bicycles, demystifying the bicycle and its use without any special equipment. This blog promotes urban cycling, mainstream bicycle culture and the bicycle as an alternative transport in urban landscape. There are more than 250 “cycle chic” blogs

¹¹ According to its constitution this event is only addressed to business based or with facilities in the Lisbon area. But given the great interest shown by entities based in other municipalities, Lisboa E-Nova accepts their participation, although they may not be eligible for the contest "Bike to Work".

throughout the world, including several in Portugal. Cycle Chic® also organizes bike rides showing that there is no need for proper cycling clothes and aims to make cycling appealing to the masses. The first Cycle Chic Portuguese blog was Cycle Chic Lisboa, in 2010, and the first ride was in 2011. Since then there have been created new communities and events in different locations, including Lisboa, Porto, Braga and Vilamoura.

(16) Since 2007 “**Massa Crítica**” has its monthly rides in several Portuguese locations, promoting non-polluting means of transportation. Currently it takes place in Almada, Aveiro, Beja, Braga, Coimbra, Guimarães, Lisboa, Loulé, Matosinhos, Oeiras, Porto, Setúbal, Sines, Barcelos, Barreiro, Parede, Santa Iria de Azoia, V. N. Famalicão (Massa Crítica, 2016).

The growing interest in smooth mobility as an R&D topic at Universidade de Aveiro associated with the fact that the region has a strong presence of bicycle industrial production, as well as development of innovative municipal projects related to bike commuting and that is also the Portuguese region with the higher percentage of bike commuters, led to the creation of (17) **Plataforma Tecnológica da Bicicleta e da Mobilidade Suave**. This platform mission is to support the creation of favourable conditions for R&D on the bike and soft mobility modes in order to provide an improvement of the environment, the economy, the qualification of the territory and the quality of lives of citizens and communities. To achieve its mission, it is intended to mobilize multidisciplinary teams, local authorities, public administration bodies linked to mobility, companies and civil society organizations, aimed at designing innovative projects aligned with the country's challenges and the guidelines of the European Union.

(18) There have been created several **bike communities** and **civic movements** that play an important role in promoting bike commuting, encouraging alternative means of transportation and creating awareness for reflection on new public policies. One example is **MUBi (Associação pela Mobilidade Urbana em Bicicleta)**, founded in 2009 and a member of European Cyclists' Federation (ECF), is a civic association of cyclists, that promotes the bicycle as the vehicle for daily commuting. MUBi develops community service projects through programs of education, awareness & motivation, and mentorship. Mubi is also involved in monitoring the implementation of public measures related to the use of bicycles, such as infrastructures like cycle paths or parking spaces and the articulation with the public transport system, namely shared bus lanes and bicycle transportation. In addition, this association works actively in the defence of the interests of cyclists at a legislative level, by promoting the adoption of laws and regulations that better serve the needs, the characteristics

and the advantages of bicycle as a means of transport. Some of the projects are **Bike Buddy**, to initiate and support new cyclists, **Sexta de Bicicleta**, an initiative that invites all Portuguese to voluntarily take the challenge of trying to use the bicycle as a means of transportation on Fridays and **Bike to School Day**, involving Educational Institutions to make younger audience aware of the need to reduce the environmental impacts of urban mobility by promoting the bike commuting to school (MUBi, n.d.).

Research Question 2: What are the main reasons that motivate people to not commute by bicycle on their daily journeys?

Non-cyclists were asked about the level of agreement or disagreement about preferring commuting by car or by motorcycle rather than by bicycle, 48% respondents disagree that they would prefer commute by car and 84% disagree preferring commute by motorcycle rather than bicycle, while 69% disagree about preferring public transports rather than bicycle. Non-cyclists consider that the main motives to not commute by bike on the daily journeys is the fact that (1) there is a lack of infrastructures (72%), (2) there are not enough cycle lanes (68%) and that (3) bike commuting is unsafe (63%). But, in general, they don't consider it to be uncomfortable (70%) and having children is not an obstacle (68%). 73 respondents (18%) mentioned other motives such as distance as a main problem (33%), cycling was not suitable for their professional occupation (11%), rather walk than cycle (10%), the lack of infrastructures (10%), such as bike shelters, bike sharing system and reinforcing the lack of cycle lanes, not having time for bike commuting (8%) and other mentioned reasons (not having adequate traffic policies and legislation, such as more *Zona 30* areas or one way streets that cyclists can ride in either direction, possibility of taking bikes in more public transports, lack of civism, not having a good physical condition, lack of equipment, like an electric bike, and poor pavement).

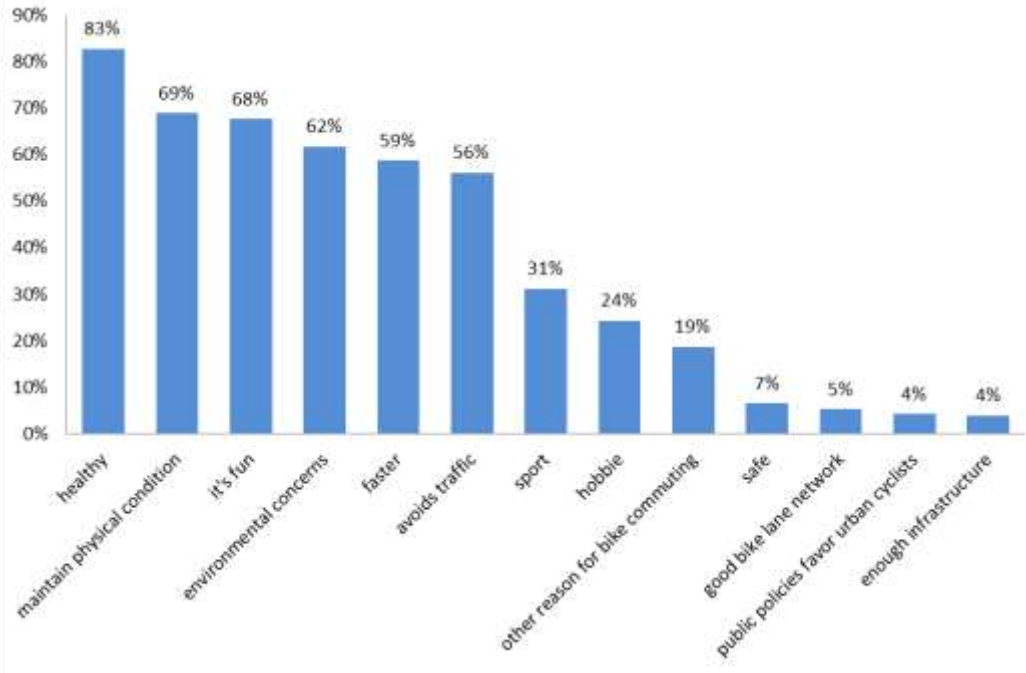
Around 50% of non-cyclists consider becoming urban cyclists if there were adequate infrastructures - such as cycle lanes, bike sharing systems, bike parks and shelters, changing rooms with showers and lockers. 30% claim that if the distance they have to cycle was shorter, the weather conditions were favourable or they had more time they would become urban cyclists. 20% declares that there should be more civic behaviour on the roads so they could

become cyclists. And only 11% claim that there is nothing that would make them turn into urban cyclists.

Research Question 3: What are the main reasons for urban cyclists commute by bike on their daily journeys?

Health (83%), maintaining physical condition (69%), having fun (68%) and environmental concerns (62%) are the main motivations for the majority of cyclists to commute by bike. Bike commuting is faster (59%) and avoids traffic congestion (56%), these are also important motivations for cyclists. Graphic 3 shows the main motivations for commuting by bike.

Graphic 3
Urban cyclists' motivations



Bike commuters main travel purposes are going to work (82%), shopping (46%), social/recreation (such as meet friends or family, going out to dinner or weekend programs) (36%), touring (26%) and going to school or university (20%). Only 10% report that their main purpose to bike commute is to take children to kindergarten, school or extra activities.

Bike commuters choose their route so that they can minimize traveled time (51%), to avoid traffic (47%) and around 40% wants to avoid steep hills, poor pavement and pollution. Only 30% favor the use of cycle lanes.

Table 2 presents data about urban cyclists, namely number of years as a bike commuter, number of km per day and number of days per week using bicycle.

Table 2
Commuting statistics

	days/week	km/day	number of years as bike commuter
N	275	275	279
Mean	5,38	17,76	6,94
SE	,121	,916	,398
Minimum	0	3	0
Maximum	7	100	40
Percentiles			
	25	3,50	7,50
	50	7,00	12,50
	75	7,00	24,00
			10,00

What are the main motives for urban cyclists to commute by bike on a day-to-day basis, considering gender, age and socio-economic status?

The chi-square tests indicated that there was a near significant association between gender and bike commute to maintain physical condition ($\chi^2 = 3.854$, $p = 0.05$). Men (71%) are more likely to report maintaining physical condition as a motivation for bike commuting than women (58%). There was a significant association between gender and bike commute to avoid traffic congestion ($\chi^2 = 4,916$, $p = 0.027$). Men (59%) are more likely to report traffic congestion to be a motivation for bike commuting than women (43%).

The Chi-Square tests showed that there was a significant association between age and bike commute to maintain physical condition, ($\chi^2 = 10.745$, $p = 0.005$). Cyclists aged between 36 and 55 years old (77%) are more likely to report maintain physical condition as a motivation for bike commuting than cyclists older than 55 years old (67%) and cyclists aged between 16 and 35 years old (58%).

There was a significant association between professional status and bike commute to maintain physical condition ($\chi^2 = 10.014$, $p = 0.007$). Part-time employees/Students (50%) are less likely to report maintaining physical condition as a motivation for bike commuting than Full-time employees (73%) and Unemployed/Homemaker (70%).

There was a significant association between academic qualification and bike commute as a hobby ($\chi^2 = 11.854$, $p = 0.003$), as a sport ($\chi^2 = 13.352$, $p = 0.001$), to maintain physical

condition ($\chi^2 = 8.693$, $p = 0.013$), to avoid traffic congestion ($\chi^2 = 7.295$, $p = 0.026$), because there's good bike lane network ($\chi^2 = 10.615$, $p = 0.005$) and because there's enough infrastructures ($\chi^2 = 6,167$, $p = 0.046$). College level or lower qualified cyclists (37%; 47%; 12% and 8%) are more likely to report hobby, sport, good bike lane network and enough infrastructures as motivations for bike commuting than commuters with Bachelor/Post Graduation (22%; 25%, 3% and 2%) or Master/PhD (15%; 26%, 3% and 3%). Those with higher qualifications, Master/PhD (55%), are less likely to report maintaining physical condition as a motivation for bike commuting than College level or lower qualified cyclists (76%) or Bachelor/Post Graduation (72%). Urban cyclists with Master/PhD (69%) are more likely to report avoiding traffic congestion as a motivation for bike commuting than cyclists with College level or lower qualifications (48%) or cyclists with Bachelor/Post Graduation (54%).

There was a significant association between income levels and bike commute as a sport ($\chi^2 = 7.105$, $p = 0.029$). Those with the highest income levels, > 2.000€ (14%), were less likely to report sport as a motivation for bike commuting than those with lower income levels, < 1.000€ (36%) and 1.000€-2.000€ (30%).

There was a significant association between the district and bike commute as a sport ($\chi^2 = 29.750$, $p = 0.019$), because is faster ($\chi^2 = 27.642$, $p = 0.035$) and because there is a good bike lane network ($\chi^2 = 38.517$, $p = 0.001$). In Aveiro (28%), Lisboa (29%) and Porto (29%) is even likely to report sport as a motivation for bike commuting. Urban cyclists are more likely to report being faster as a motivation for bike commuting in Lisboa (66%) and Porto (61%) than in Aveiro (44%). In Aveiro (28%) bike commuters are more likely to report good bike network as a motivation for bike commuting than in Lisbon (3%) or Porto (5%).

Table 3
Reasons for bike commuting

	it's fun	p	it's a hobby	p	it's healthy	p	it's sports	p	maintain physical condition	p	it's faster	p	avoids traffic congestion	p	good bike lane network	p	it's safe	p	environmental concern	p	favorable public policies	p	enough infrastructures	p
Gender																								
Male	69	.278	27	.062	84	.082	33	.145	71	.050	60	.347	59	.027	5	.582	8	.088	61	.550	5	.267	4	.789
Female	62		15		75		23		58		53		43		7		2		65		2		3	
Age																								
16-35	68	.091	29	.256	79	.151	31	.143	58	.005	65	.138	61	.175	4	.465	6	.701	54	.064	1	.055	3	.551
36-55	70		22		86		34		77		56		54		5		7		67		7		5	
55+	44		17		72		11		67		44		39		11		11		56		6		0	
Professional Satus																								
Unemployed/Homemaker	70	.823	23	.723	77	.367	37	.720	70	.007	63	.718	50	.591	10	.243	7	.900	63	.954	7	.238	7	.712
Part-time employee/Student	64		20		78		28		50		62		52		8		8		60		0		4	
Full-time employee	68		25		84		31		73		57		58		4		6		62		5		4	
Academic Qualification																								
College level or lower	69	.579	37	.003	86	.629	47	.001	76	.013	53	.240	48	.026	12	.005	5	.477	52	.077	8	.069	8	.046
Bachelor/Post Graduation	65		22		82		25		72		58		54		3		6		67		3		2	
Master/PhD	72		15		80		26		55		66		69		3		10		62		1		3	
Income																								
< 1.000€	66	.831	28	.210	78	.091	36	.029	65	.168	59	.966	56	.997	6	.778	6	.144	56	.122	4	.870	3	.572
1.000€-2.000€	70		23		87		30		71		58		56		6		5		67		5		6	
> 2.000€	67		14		89		14		81		58		56		3		14		69		6		3	
District																								
Aveiro	41	.156	19	.199	69	.103	28	.019	53	.066	44	.035	38	.161	28	.001	13	.959	50	.477	6	.877	13	.931
Lisboa	73		27		85		29		74		66		60		3		6		62		6		4	
Porto	73		17		78		29		66		61		66		5		2		61		0		2	

Note: Numbers in black are percentages

What are the factors that influence the route choice on daily commute, considering gender, age and socio-economic status?

The Chi-Square tests indicated that there was a significant association between gender and factor that influence the route choice ($\chi^2 = 4.614$, $p = 0.032$). Women (52%) are more likely to report avoiding steep hills to choose the route than men (37%).

There was a significant association between age and choose the route in order to minimize the distance ($\chi^2 = 8,777$, $p = 0.012$). Older cyclists (55+, 0%) are less likely to report shorter distance to choose the route than younger cyclists (16-35, 34% and 35-55, 26%).

There was a significant association between academic qualification and choose the route in order to minimize the distance ($\chi^2 = 19,196$, $p = 0.000$). College level or lower qualified cyclists (21%) are less likely to report avoiding steep hills to choose the route than commuters with Bachelor/Post Graduation (42%) or Master/PhD (55%).

Table 4
Factors that influence route choice

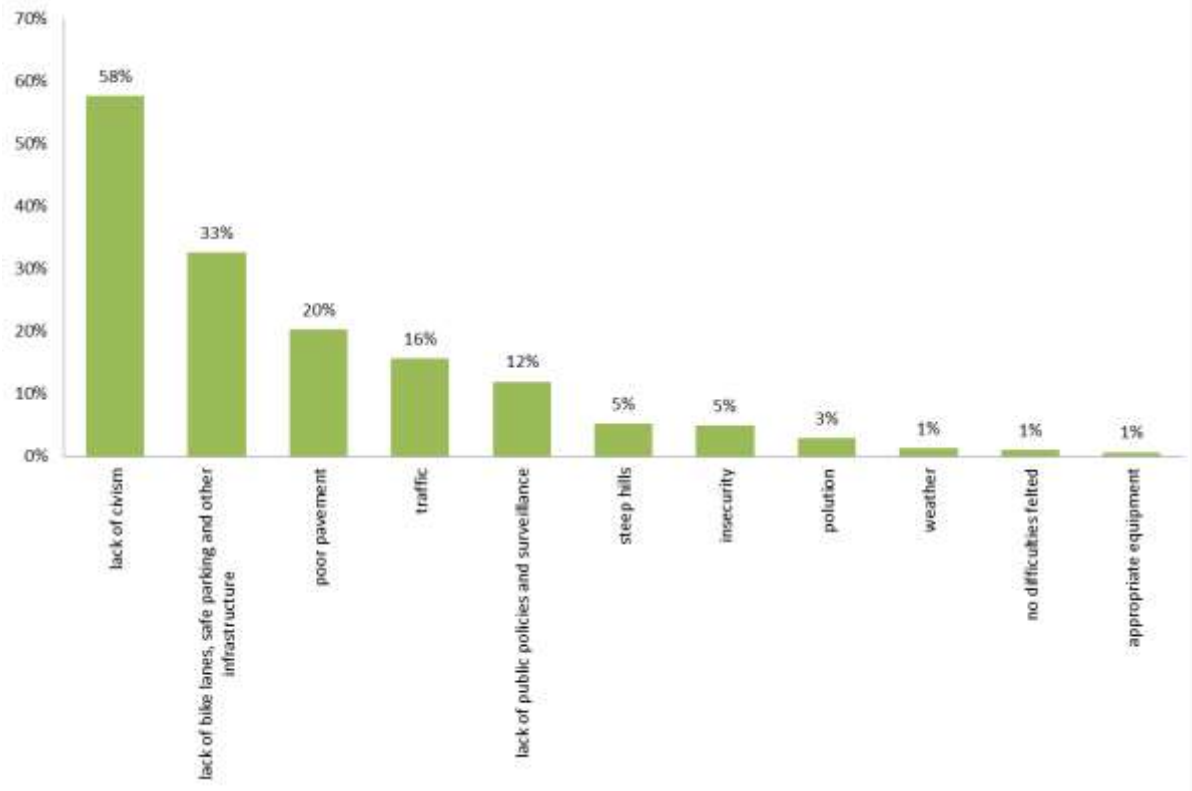
	avoid steep hills	p	avoid poor pavement	p	avoid pollution	p	minimize traveled time	p	minimize traveled distance	p	avoid traffic congestion	p	favor the use of bike lanes	p
Gender														
Male	37	.032	37	.394	39	.321	53	.126	30	.065	47	.749	27	.096
Female	52		43		32		42		18		45		38	
Age														
16-35	39	.974	42	.574	39	.850	58	.111	34	.012	45	.272	27	.232
36-55	40		36		36		46		26		49		29	
55+	41		41		41		41		0		29		47	
Professional Status														
Unemployed/Homemaker	52	.109	48	.524	38	.537	45	.801	24	.214	45	.961	28	.747
Part-time employee/Student	48		38		44		50		38		46		34	
Full-time employee	36		37		36		51		26		47		29	
Academic Qualification														
College level or lower	21	.000	30	.141	30	.078	46	.566	20	.115	40	.074	26	.508
Bachelor/Post Graduation	42		43		44		53		33		46		33	
Master/PhD	55		40		33		51		27		58		27	
Income														
< 1.000€	37	.524	38	.971	37	.475	54	.323	30	.154	49	.762	27	.180
1.000€-2.000€	42		39		34		47		29		45		29	
> 2.000€	46		40		46		43		14		43		43	
District														
Aveiro	19	.054	41	.380	31	.592	50	.278	34	.947	44	.943	47	.533
Lisboa	46		39		37		55		28		46		32	
Porto	44		46		44		49		27		51		22	

Note: Numbers in black are percentages

Research Question 4: What are the main barriers that urban cyclists have to face on their daily bicycle journeys?

In general, the major barriers to bike commuting are lack of civism (58%), including disrespectful and rude drivers, infringements of the Highway Code, like drivers that does not respect the passing distance and over speed driving and pedestrians walking on cycle lanes. The lack of infrastructures (33%) is mentioned mainly due to the few existing cycle lanes and safe bike parking. Graphic 4 shows the reported barriers to bike commuting.

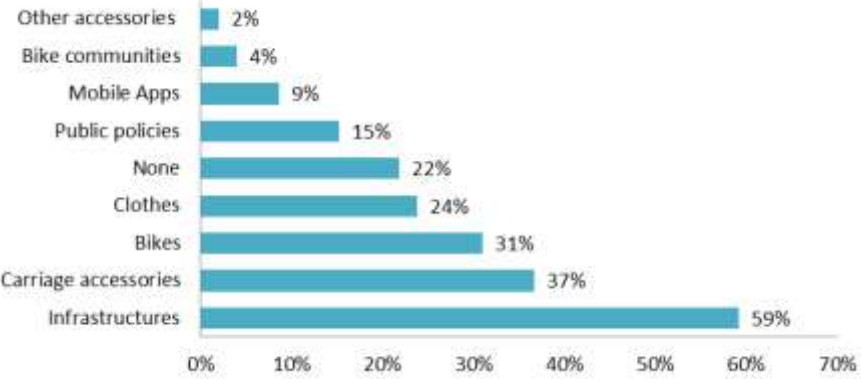
Graphic 4
Barriers to bike commuting



Research Question 5: What were the main innovations that made people start commuting by bike?

The main innovations for urban cyclists are directly related to commuting itself, around 60% of the respondents answer that infrastructures were a contribution to become an urban cyclist. They also consider that commuting related products were important, such as carriage accessories (37%), bikes (31%; such as lighter bikes, cargo bikes or foldable bikes), and clothes (24%; like warm and light jackets or waterproof breathable jackets). And 22% consider that none of the suggested or other innovations were important for the decision of becoming an urban cyclist. Just 4% spontaneously mentioned bike communities as an influencer for bike commuting. Graphic 5 shows the reported innovations that made people start commuting by bike.

Graphic 5
Essential innovations that influence commuters to use the bike



4 Discussion and Final Remarks

4.1 Discussion

Over the last 10 years Portugal has seen several changes in what regards to urban cycling with the support and guidance of the European Union, both in the level of legislation and infrastructure, such as changes in the Portuguese Highway Code in 2014 to benefit urban cyclists, creation of Zone 30 traffic calming areas, rules that enables cyclists to carry the bicycle aboard public transports, bike sharing systems, bike lanes and bike parks. However, the average rate of cycling for everyday travel in Portugal was 1% in 2014, the same as in 2007, while the average in Europe is 8%. This also may indicate some cultural and citizenship differences, along with lack of monitoring and control from national and local authorities, as well as room for a more integrative urban planning policy and implementation of strategic plans which address inter and intra-regional infrastructure investment decision-making, interconnection and mobility management systems.

On the other hand, from the organizational and strategic alliances point of view, partnerships between organizations and universities have proven to be crucial to continuous innovation, such as BikeEmotion consortium that developed a disruptive innovative 4th generation bike sharing system. This open bike-sharing solution allows the user to unlock the bicycle with an authentication card, a mobile application or a text message and it’s possible to adapt the

device to any bicycle and the system to any Portuguese city. The 4th generation bike system is cost effective, while providing advanced technology innovation.

In what regards bike communities, only 4% of urban cyclists spontaneous mentioned it as an influencer to become bike commuter. With the growing number of online communities, blogs and associations as ambassadors for urban cycling, it seems that it can be a great contributor for the increase of cyclists in Portugal.¹² Both present¹³ and complementary research support the idea that online communities are enablers to promote bike commuting, through organization of events, by influencing and involving key stakeholders, including new cyclists, acting as a cultural changer and throughout news and information dissemination for cyclists and non-cyclists, while creating awareness about specific and relevant topics, e.g., rules of the Highway Code, impact of bike commuting for sustainable cities as a way to lower CO₂ emissions and noise pollution, eliminate traffic congestion or increase public health.

Additionally, at this point of the market analysis, processes of group identification and trust are particularly relevant to encourage new and recent bike commuters.¹⁴ Evidence shows that informal information has an important role on travel planning, Bartle, Avineri, & Chatterjee (2013) suggested that cyclists rely more on user-generated information shared within a group, which allows processes of group identification, mostly because it's originated based on "real people's" experience, rather than official's cycling information. In overall, web-based information-sharing in a small group environment can encourage cycling by stimulating social processes (Bartle et al., 2013). Moreover, this can be an effective tool to promote sustainable travel choices, within organizations, such as workplaces or schools.

Other important aspect to consider is about the characterization and key factors that influence bicycle commuting process. For the average of the Portuguese population that uses car, that was 62% in 2011, more than 50% spent in average less than 15 minutes traveling from home to work/place of study (Instituto Nacional de Estatística, 2012), which represents a huge potential for bicycle commuting. Especially because the bicycle is time-competitive with the car for short distance journeys (Dekoster & Schollaert, 1999; Dill & Gliebe, 2008). Although, there are other factors to take in concern, by applying behavioral reasoning theory (BRT),

¹² See table 5.

¹³ Cyclists respondents spontaneously mentioned bike communities as an influencer for bike commuting, as well as the online community effect identified when online survey was launched in social networks.

¹⁴ Although long-standing cyclists are less likely to be affected by a sense of community, because for those, bike commuting is a routine and does not need reflection; therefore, they have more stable attitudes and it's not expectable to be influenced by others.

Claudy & Peterson (2014), concluded that people do not cycle to work because of (1) inconvenience, (2) road safety concerns, and (3) weather conditions. While, our data shows that 48% of non-cyclists disagree that they would prefer commute by car than bicycle, they don't consider it to be uncomfortable and having children is not an obstacle, but in their opinion (1) there is a lack of infrastructures, (2) there are not enough cycle lanes and (3) bike commuting is unsafe. Nevertheless around 50% of non-cyclists consider becoming urban cyclists if there were adequate infrastructures - such as cycle lanes, bike sharing systems, bike parks and shelters, changing rooms with showers and lockers – and more civic behaviour for more safety roads. And just 11% claim that there is nothing that would make them turn into cyclists. Unlike Claudy & Peterson's findings, inconvenience and weather conditions are not barriers for Portuguese commuters, but road safety is a common barrier.

To increase cycle safety, motor vehicle speeds should be reduced, by a variety of methods, including physical traffic calming, a wider use of *Zona 30* areas,¹⁵ poor or defective road surfaces should be repaired, implementation of infrastructures that increase safety at junctions, such as cycle lane markings continued across junctions, cycle pre-signals for bicycle priority and outdoor convex mirror to allow drivers of bigger vehicles to see cyclists at their nearside, to avoid cyclist injuries in multi-vehicle collisions that take place at junctions (Reid & Adams, 2010). Evidence shows that more people bicycling improves the safety of people bicycling (see Graphic 16) (Jacobsen, 2003; Statista, 2015).

Traffic-free paths exclusively for cyclists also increase safety and encourage people to cycle, nevertheless there is little evidence that it will encourage people to cycle on the road with general traffic, therefore, investments on infrastructures like traffic-free paths per se are not enough to make people change their car for a bike for daily commuting (Jones, 2012). On his study, Tim Jones (2012) suggested that bike commuting promotion should combine social marketing with physical measures, such as speed restrictions in urban areas, investment in cycle lanes along main urban street corridors and traffic policies and legislation that benefit cycling and reduce the convenience of the car, through restrictions on car use and car parking. However, this raises another question - how to make it politically acceptable?

In fact, previous research (Claudy & Peterson 2014; McKenzie-Mohr, 2010) suggested that political regulations or financial incentives are usually unsuccessful in changing sustainable

¹⁵ There is evidence that implementation of 30 km/h zone reduces frequency and severity of accidents. (Câmara Municipal de Lisboa, n.d.; Department for Transport, 1999; Lindenmann, 2005)

behaviors, especially if it comes to penalizing motorists, that could even be counterproductive and delay bike commuting adoption (Claudy & Peterson, 2014). However the impacts of the congestion charging scheme imposed for cars entering central London prove otherwise with a positive effect on bike commuting. The number of bikes entering the city centre increased around 50%, whereas the total number of motor vehicles fell by 16% (Transport for London, 2005).

In what regards reasons for cycling, results supported by the current research show that the main motives are health and maintaining physical condition. At the same time air pollution effects on health as well as lack of exercise are a growing economic burden of medical care. Evidence suggests that investments made by large employers in programs that increase health have significant positive returns. «Medical costs fall about \$3.27 for every dollar spent on wellness programs, and absentee day costs fall by about \$2.73 for every dollar spent» (Baicker, Cutler, & Song, 2010, p. 5). Physical inactivity is the fourth leading risk factor for global mortality and it is associated with chronic diseases and depression (Who, 2010). In Portugal, more than half of the population aged 18 or over (4.5 million) is overweight or obese (Instituto Nacional de Estatística & Instituto Nacional de Saúde Doutor Ricardo Jorge, 2016). The World Health Organization (WHO) (2010) recommends physical activity for maintaining health - Adults aged 18–64 years should do at least 150 minutes/week of moderate-intensity aerobic physical activity, or do at least 75 minutes/week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity activity. Urban cycling as a daily routine can provide the necessary levels of physical activity, a 7,5 km distance journey per working day would meet WHO recommendations (de Hartog, Boogaard, Nijland, & Hoek, 2010). Bike commuting will also benefit public health due to the consequent reduction of air pollutants (de Hartog et al., 2010; De Nazelle et al., 2011; Hendriksen, Simons, Garre, & Hildebrandt, 2010). In addition, cycling to work avoids all-cause sickness absence and people who cycle more often and longer distances are absent for fewer days on average (Hendriksen et al., 2010). However, in Portugal, in a period of 12 months, 26% of the employed population reported having been absent from work at least one day due to health problems (Instituto Nacional de Estatística & Instituto Nacional de Saúde Doutor Ricardo Jorge, 2016). Evidence shows that the more people cycle to work the lower the absenteeism and the more productivity (Hendriksen et al., 2010).

The results of this study also allow to differentiate groups based on gender, age and socio-economic status that value cycling to maintain physical condition. Results show that men are more likely to report maintaining physical condition as a motivation for bike commuting than women. As well as cyclists aged between 36 and 55 years old that are more likely to report maintaining physical condition as a motivation for bike commuting than younger and older cyclists. Part-time employees/Students are less likely to report maintaining physical condition as a motivation for bike commuting than Full-time employees and Unemployed/Homemaker. Master/PhD, are less likely to report maintaining physical condition as a motivation for bike commuting than College level or lower qualified cyclists or Bachelor/Post Graduation. Based on this information several measures and campaigns can be addressed to each identified group and may support some potential testing trials, according to WHO recommendations of physical activity, encouraging commuters to bike commute based on their specific motivation, maintaining physical condition.¹⁶

Besides groups identification, the results also allow to associate motivations to distinguish regions. Urban cyclists are more likely to report being faster as a motivation for bike commuting in Lisboa and Porto than in Aveiro, which makes sense because of the cities' dimension and the consequent traffic congestion, since the bicycle is time competitive with the car, as mentioned before. In the other hand, in Aveiro bike commuters are more likely to report good bike network as a motivation for bike commuting than in Lisbon or Porto, that was an expected result due to the fact that the bike have a strong presence in the region, either by its daily use, for the industrial production and for the development of innovative municipal projects.¹⁷

Other motivations to choose this mode of transport are having fun, environmental concerns and speed, while European Commission results show that European bike users were most likely to say that they used it due to convenience (49%) and speed (27%), closely followed by price (24%) and environmental reasons (22%).

In what regards choosing their route, bike commuters respondents concern is to minimize traveled time, avoid traffic, steep hills, poor pavement and pollution and favor the use of cycle lanes. If more infrastructures were provided, such as streets with striped bike lanes, separate

¹⁶ See Chi-Square test results show there was a significant association between professional status and bike commute to maintain physical condition ($\chi^2 = 10.014$, $p = 0.007$).

¹⁷ See Research Question 1: In what regards promoting bike commuting, what were the most relevant public policies, technology innovations and initiatives in Portugal over the last years?

paths, low-traffic residential streets or low-traffic streets running parallel to a major road, with traffic calming structures, giving priority to bicycles over other vehicles, bicyclists would choose longer routes to ride favoring this amenities (Dill & Gliebe, 2008).

Our study also indicates that the main travel purposes are to and from work, shopping, social/recreation, touring and school/university, thus this can mean multiple stops, therefore adequate infrastructures with a well-connected street network would minimize travel distances and times as well as could encourage more frequent travels and more people to bike. As the results from investments made in Zurich demonstrate, improvements in infrastructures were responsible for an impressive increase in cycling since 1981 (Martin-Diener & Martin, 2009).

Several policies already mentioned usually come in bundles, for instance, urban planning providing a pleasant environment including bike amenities and green infrastructure, such as (1) tree canopies, (2) traffic-free paths, (3) public facilities (benches and public spaces), and (4) green space. Such solutions provide added benefits of cooling the air and protecting active travelers from heat, minimizing exposure to traffic, reducing air and noise pollution, increase safety and improving health (De Nazelle et al., 2011). Moreover, evidence shows that built, natural and social environments in which people live influence their physical activity (Edwards & Tsouros, 2006).

The results of this study also show that bike related infrastructures were the main innovations influencing urban commuters to become cyclists. Nonetheless, product innovation was also relevant, such as carriage accessories, bikes - lighter bikes, cargo bikes, electric bikes or foldable bikes - and clothes - warm and light jackets or waterproof breathable jackets. And 22% consider that none of the suggested or other innovations were important for the decision of becoming an urban cyclist. When analyzing Polisport¹⁸ innovative contribution to the bicycle industry, it's possible to claim that disruptive innovation has an important role in product development, making innovative products available and affordable to a larger population, facilitating bike commuting on daily journeys. This is crucial to increase bike commuting rates.

All in all innovation is the basis for the sustainable development of cities and, to raise bike commuting, coordinated measures need to be implemented, involving a variety of key

¹⁸ See Research Question 1: In what regards promoting bike commuting, what were the most relevant public policies, technology innovations and initiatives in Portugal over the last years?

stakeholders. Cultural and behavioral factors also seemed to be determinant for bicycle commute.

«A bicycle-friendly city is a city with more space, less noise, cleaner air, healthier citizens and a better economy. It's a city that is a nicer place to be in and where individuals have a higher quality of life» (The city of Copenhagen, 2011, p. 6). This reflects the relevance of this research study and particularly the scope of research question 1 and applied research methodology.

4.2 Conclusions and Recommendations

In conclusion, to make the shift from car to bicycle it's necessary to invest in infrastructures, improve the travel times and provide short-cuts with a well-connected street network, allowing contraflow cycling on one-way streets, turn certain two-way streets into one-way for cars in order to improve space and cycling environments, providing cycle lanes along main urban street or low-traffic streets running parallel to a major road, develop and implement bike sharing systems, provide bike parks and bike shelters, develop and provide well designed bike lanes within the municipality, with a unified network of neighbourhood paths between homes and schools, workplaces and shops, and connecting urban centers to surrounding suburbs, turn cobblestones streets in cycle routes, implement traffic calming measures, such as speed bumps and *Zona 30* areas, install adequately timed lights for bicycle priority, provide clearly marked crossings¹⁹, provide greenways with shadows, maintain bike infrastructures in a regular basis and facilitate multi-modal transport²⁰. To familiarise and sensitize motor vehicle drivers about changes, several measures should be launched along with a campaign with clear and instructive information, as well as positive information about the opportunity to change to a pleasant and safe²¹ soft mode of transport. Furthermore to promote active travel a map could be designed and offered to commuters, contemplating bike lanes and other facilities and points of interest.

¹⁹ See Figures 5 to 7 in Appendix

²⁰ Based on results from Research Question 2: What are the main reasons that motivate people to not commute by bicycle on their daily journeys?

²¹ Statistics show that probability of getting injured while bicycling is significantly lower than most people believe (Claudy & Peterson, 2014).

The policies mentioned above should contemplate an inclusive plan for cycling integrated into a wider transport planning.²² In order to facilitate interconnection mobility commuting is necessary to develop and implement multi-modal transport by increasing bike-carrying capacity on interior and exterior of public transports²³ - widespread the rule that allows cyclists to carry the bike on board of public transports, in proper interior storage when necessary, like vertical bike racks or hooks and add bicycle racks to buses and surface metro - by settling safe parks and shelters at public transport stops and stations, providing bike lanes that lead to public transport stops and stations, installing bike-sharing docks near main stops and stations, as well as combine public transport cards with bike share system card.

Besides the amenities, commuters must be encourage to cycle for healthier mode of travel. To support this objective it's necessary to implement initiatives like urban cycling sessions in schools, universities, workplaces and organisations, with qualified instructors, in order to build cycle confidence and teach the skills needed for cycling safely on urban environment.

In addition to urban cycling sessions, other measures are required to promote bike commuting in academic communities.²⁴ Besides already approved project U-Bike²⁵ for acquisition of conventional and electric bikes for Universities, facilities like well-connected bike lane network, bike parks and shelters, changing rooms with showers and lockers should be provided, so that U-Bike won't become a stand-alone effort. Moreover, in order to create a bicycle culture, along with the measures it's necessary to create awareness about facilities, training, safety and information. This will encourage students, as well as faculty and staff.

Other initiatives could be created, for instance developing a mobile with a cyclemeter and commuters were invited to record their trips during «European Mobility Week». The information could be synchronized with a website showing daily evolution of each commuter and shared through social networks. At the end rewards could be given to participants and

²² For longer distance trips, combined mobility provides significant opportunities for bike commuters. Thus journey stages to public transport stops or stations can be covered by bicycle. The present research results show that non-cyclists claims that if the distance they have to cycle was shorter or they had more time they would become urban cyclists.

²³ See Figures 8 to 15 in Appendix

²⁴ Recommendation validated by Research Question: What are the main motives for urban cyclists to commute by bike on a day-to-day basis, considering gender, age and socio-economic status?

²⁵ U-Bike Portugal - an initiative funded by Programa Operacional Sustentabilidade e Eficiência no Uso de Recursos (PO SEUR) addressed to the Public Higher Education Institutions (Instituições de Ensino Superior Públicas) for the acquisition of conventional and electric bikes, for the academic community use in long-term rental arrangements. The investment of around 300,000 euros is 85% funded by the PO SEUR to accomplish in the next two years.

information provided about their physical condition evolution within this campaign, so that this could work as an incentive to shift to other means of transport for daily commuting. The app also would allow monitoring the impact of the campaign, to analyze and decide about future developments and applications.

Initiatives to promote active travel should have the cooperation of private sector and a wide range of organisations. There are simple and ease to implement measures, with low or without cost, that could be a huge contribution from corporations in promoting bike commuting and discouraging car use, such as having shelters for bicycles, ending or reducing fringe benefits related to car use and parking, or even introduce a charge for car parking spaces, depending on the distance from workers' home to the workplace. Furthermore, people who did use the park space for bicycles didn't had to pay for it and even, depending on the bike commuting frequency, could receive an extra day for vacation. Another initiative to encourage employees to cycle would be let them take a loan with tax exemption to buy bicycles and other equipment necessary for daily commute, this will benefit the workers, as well as the employer that will profit from a healthier workforce.

Along with initiatives, road safety must be improved²⁶ and it depends ultimately on the users' behaviour. To influence this behaviour there's a need for awareness-raising, through education and training programmes, as well as control and enforcement of traffic regulation, both to motor vehicle drivers and cyclists.

As for bicycle industry, in what regards related with bike commuting, product life cycle is in an introductory phase (very far from maturity), thus cyclists are more focused on primary needs, such as physical infrastructure and bike-sharing systems and less focused in products, which opens ways to promote policy making in order to create scale throughout the growth stage. The adopters are in general not very sophisticated, which reflect the market life cycle in Portugal. Also, address the disruptive innovation to the basis of the pyramid (larger group of the market in easy and affordable way).²⁷

During the process of this research study several barriers were felt due to the lack of relevant data related to bike commuting in Portugal. Therefore the creation of a bicycle barometer

²⁶ Survey results shows that road safety is a concern for non-cyclists that consider bike commuting unsafe (63%) and only 7% of cyclists consider it safe.

²⁷ See Research Question 5: What were the main innovations that motivate people to start commuting by bike on their daily journeys?

would be very useful to count the number of cyclist and to know where they ride, so that investments can be monitored, measured, analysed and documented.

Innovative knowledge and innovative technologies applied to the level of bicycle commuting could lead to disruptive innovation, making cycling much more affordable and accessible to a larger population. This innovation can occur at different levels, such as general and specific legislation, promotion of safety and surveillance, bicycle and accessories, mobile applications and websites that facilitate daily commuting, infrastructures, intermodal transport or initiatives to promote bike as a mode of transport. The coordination of these innovations and measures, between public and private sectors, can determine when and how Portugal will make the shift to soft mobility aligned with European policy orientations.

4.3 Limitations

The use of a random selection procedure for sample selection allows statistical inference on the population, however in this research study the sample was determined by a non-random sampling method once the Portuguese cyclist population is not well defined. The survey was conducted online and mainly spread through Facebook, by email, LinkedIn and word-of-mouth, comprising urban cycling ambassadors, bike shops, organizations and companies, among others, which led to results depending on each personal network, focusing more in some regions than in others. This convenience sample led to conclusive results, although that may lack to be representative of the Portuguese cyclist population, nevertheless allowing a gross estimate of the results, which means that statistical inference is made with restricted assumptions (Battaglia, 2011; Callegaro et al., 2014).

In addition, there are several urban cyclists that also cycle for sport, therefore when asked about the days/week or km/day related with their urban commuting they probably widespread the answer biasing the results. In this case a closed question would have resulted in a more accurate outcome.

The conclusions and limitations sections drove me into new ideas and future research that may contribute to novelty in bike commuting in Portugal, which is going to be approached in the next section.

5 Future Work

It might not exist enough and clear evidence supporting various measures promoting active travel, therefore additional work must be done to evaluate them. My suggestion is as follows:

- (1) Study the usage of bike infrastructures in Portugal, such as separate bike lanes, striped bike lanes, parks and shelters, to measure return on investments made in bike commuting infrastructures.
- (2) Study the barriers felt by urban cyclists can help understand how to break down barriers and encourage new and infrequent cyclists.
- (3) Monitoring the number of urban cyclists in Portugal by region and define their profile in order to know the Portuguese cyclist commuting population, allowing to set a probability sampling for inferential analysis, to support implementation and improvement of future measures to promote bike commuting.
- (4) A full extend research on the cycling commuting impact on the Portuguese Gross Domestic Product, exploring several dimensions, such as bicycle industry, local commerce, employment, environment and health factors, traffic congestion and quality of life. This would highlight the economic and social benefits generated by urban cyclists.

Bike commuting related studies with these length and scope are aligned with European Union guidelines and there is national interest in supporting conditions for R&D on soft mobility matters, for instance Plataforma Tecnológica da Bicicleta e da Mobilidade, which can be the adequate research recipient environment to address the above mentioned future work, while allowing to extend the present study.

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8 Appendix

Appendix 1

Tables, Graphics and Figures

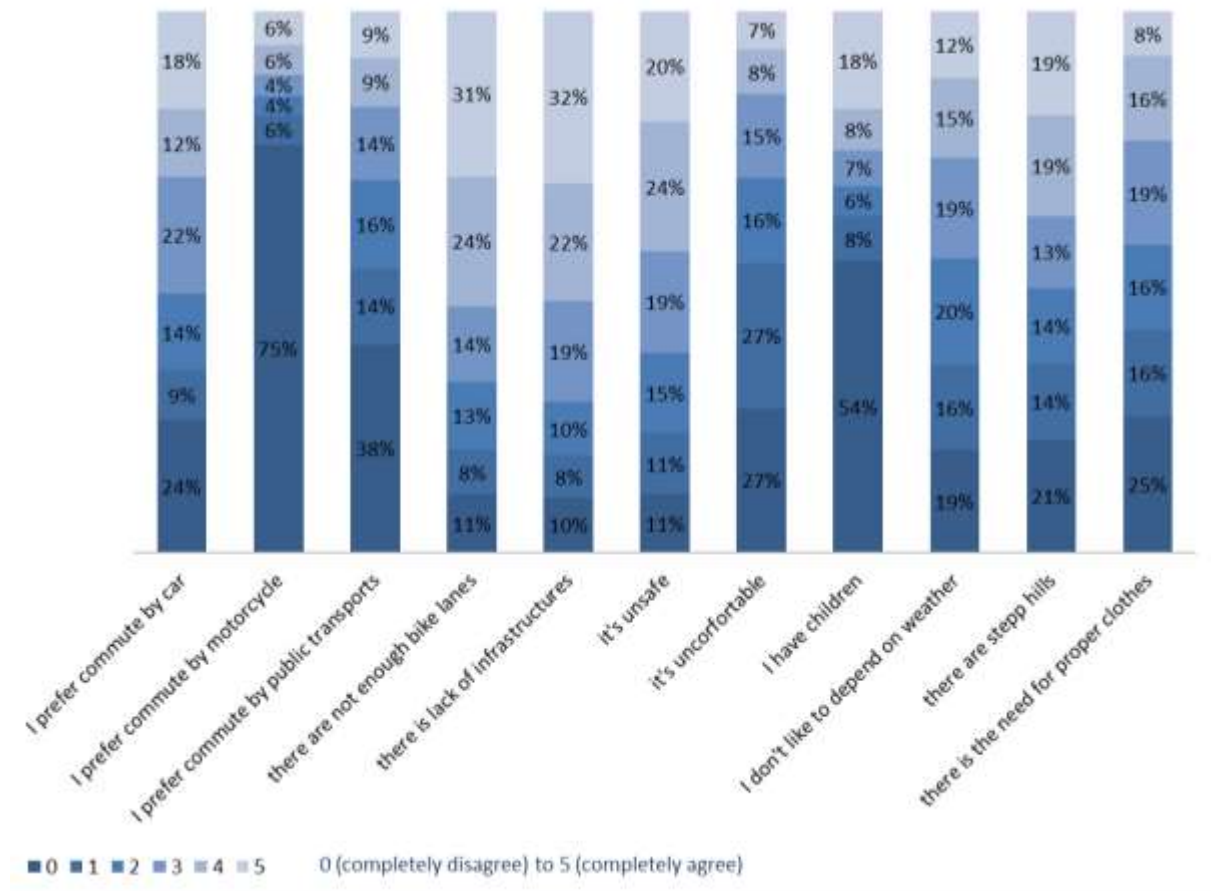
Table 5

Facebook pages

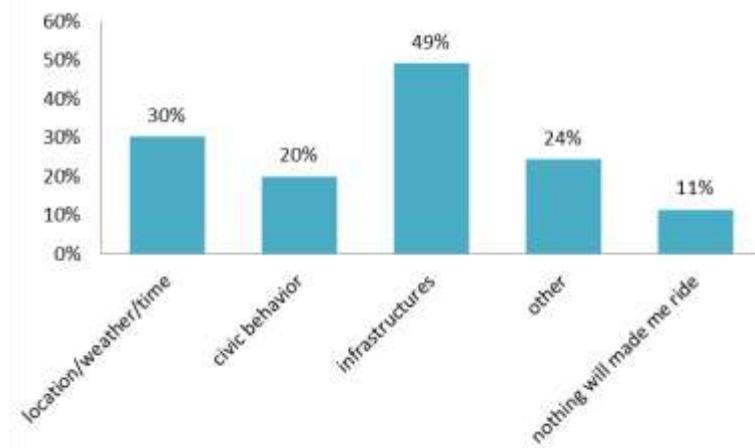
13 Gear – Bike Shop; A bicicleta como meio de transporte; A Minha Rua em Aveiro; Albarda; Amigos da Bicicleta UA; Amigos das Pasteleiras; Ardenne; Atelier de Bicicletas & Artes – Bicicletas Urbanas; B – Cultura da Bicicleta; BeElectric; BI+CA BIKE; Bicicleta Voadora; Bicicletada de Santa Iria de Azóia; Bicicletada Porto; Bicicletas Dobráveis – Dahon; Bicicletas Eléctricas Portugal; Bicicletas Yé Yé – Portugal; Bicultura; Biciway; Biclalx; biclas.com; Bicolor – fixed bikes e acessórios; Bicycle Cycle Chic; BIKE & SEE; Bike a Wish; BIKE BARREIRO; bike.POP; Bikefix Portugal; Bikeplan – Rent a Bike; BikePlanet; BIKES & Company; BikeZone Aveiro; BikeZone Coimbra; BikeZone Leiria; BikeZone Lisboa; BikeZone Lousada; BikeZone Odivelas; Bikezone-setubal Bikezone; BinaClínica; Braga Ciclável; Braga Cycle Chic; BUGA – Bicicleta de Utilização Gratuita de Aveiro; Build my Bike; Ciclaveiro; Ciclismo Urbano em Portugal; Ciclismo Urbano em Portugal; Ciclística; CicloExpresso do Oriente; CiclOficina da FCUL; Cicloficina do Oriente; Cicloficina do Seixal; Cicloficina dos Anjos; Ciclovía da Luz; Ciclovía na Marginal; Ciclovía Rápida Cais do Sodré - Alcântara; Ciclovintage Viseu; Classic Design; Classica Bikes; Clássicas Raras, Motos & Bicicletas; Clube Biciauto; Coimbra Ciclável; Compromisso pela Bicicleta; Crank7 Bikes; Cycle Chic Communities; D’Bikes, Movimento Alternativo; Dona Bicicleta; DouroBike; Easy Cycle; E-Bikes Bicicletas Eléctricas; Eco Tricycle; E-Mobility.pt; Escolinha da Bicicleta; Estrela Bike Lx; Estúpida Ciclovía; eZee – bicicletas eléctricas; Felizzbina; FPCUB - Federação Portuguesa de Ciclismo e Utilizadores de Bicicleta; Há Monstros na Garagem; Happy Bicycle; Histórias da Buga; IloveCycle; Intemporal Bikes; Joni’s Bike Shop; Jornal Pedal; Lisboa On Bike; Lisbon Cycle Chic; LisbonHub – Bike Shop; Lisbonize; Massa Crítica – Porto; Massa Crítica Almada; Massa Crítica da Amadora; Massa Crítica de Aveiro; Massa Crítica de Beja; Massa Crítica de Oeiras; Massa Crítica de Portugal; Massa Crítica Lisboa; Matilha Cycle Crew; Menos Um Carro; Mobilidade Suave; MUBi; MUD Cycles; Murtosa Ciclável; Nova Mobilidade; Oeiras Commute; Oporto CycleChic; Órbita – Bicicletas Portuguesas; Órbita Bikes; Partilha a estrada; Pedais.pt; Pedala Tu Mesmo/a – pedaling yourself; Pedalsempre; Pensão da Bina; Plataforma Tecnológica da Bicicleta; Polisport Bicycle; Portimão Cycle Chic; Portugal Bike Value; PromoBinas; Reciclabicla; Rede Nacional de Ciclismo – Portugal; Ribcap Portugal; Roda Gira; Segurança dos utentes vulneráveis; Sexta de Bicicleta; Sexta de Bicicleta; SlowFast Cycles; Sou ciclista 100 por cento; STRIDA Portugal; TudoSobreRodas; Uma ciclovía na minha rua; Uma Lisboa Ciclista; Uma Lisboa Ciclista; URBAN CICLE CAFÉ; VascãoBikes; Véli; Vélo Café; Velo Culture; Verde Movimento; Verso – Bikes, components & apparel; Weeride Portugal; Zona 30.
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Legend: Most relevant Urban bicycle communities and groups and cycling shops on Facebook

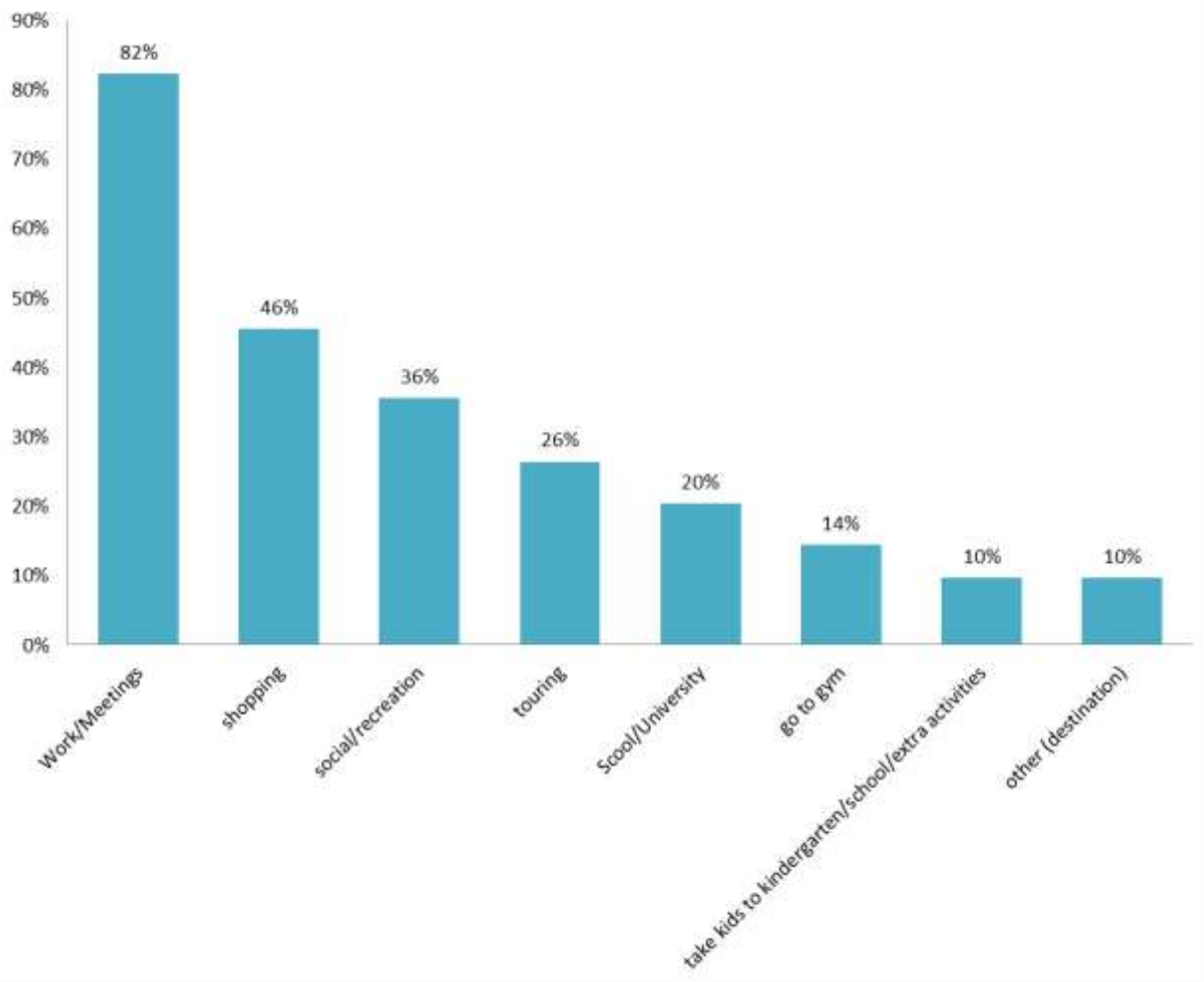
Graphic 6
Non-cyclists' main motives to not commute by bike



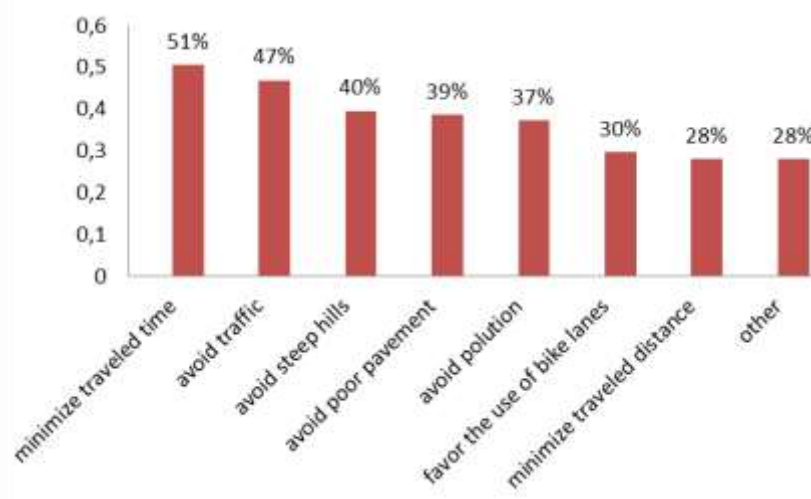
Graphic 7
What would be necessary to become an urban cyclist



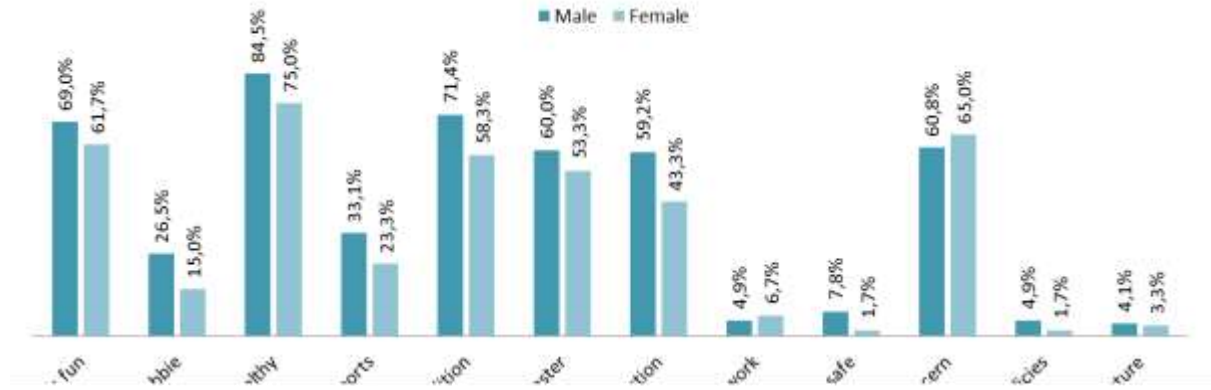
Graphic 8
Bike commuters' travel purposes



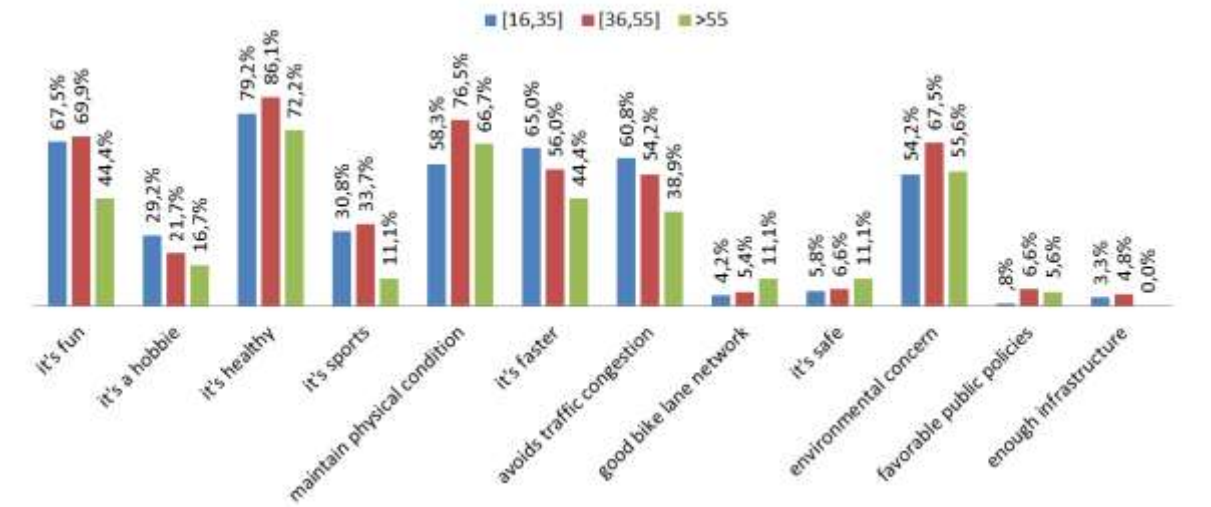
Graphic 9
Bike commuters route choice



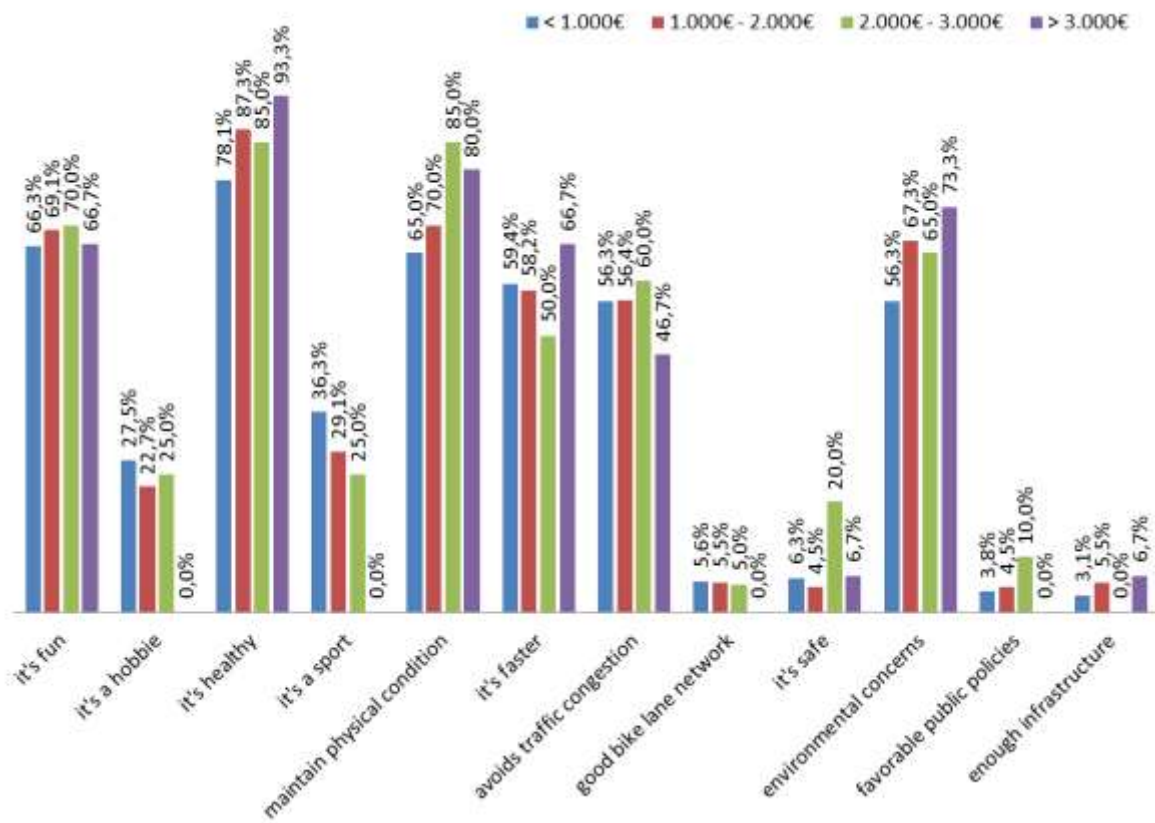
Graphic 10
Motives for bike commuting by gender



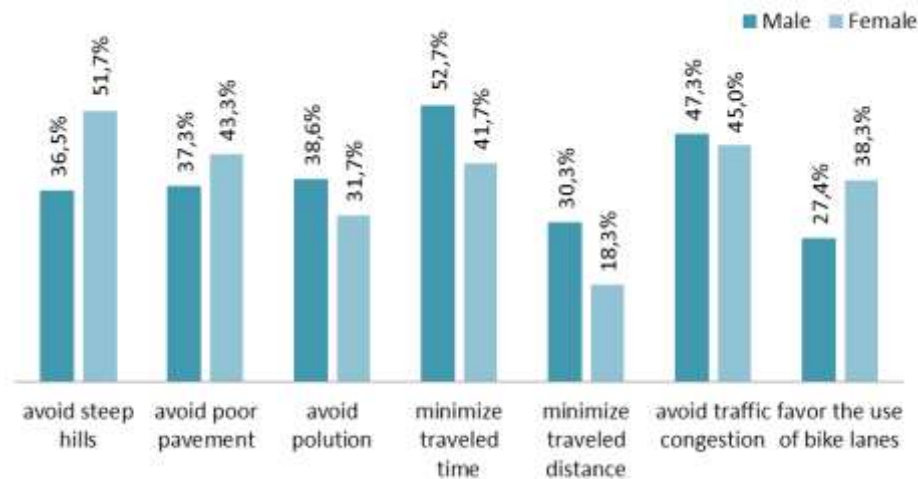
Graphic 11
Motives for bike commuting by age



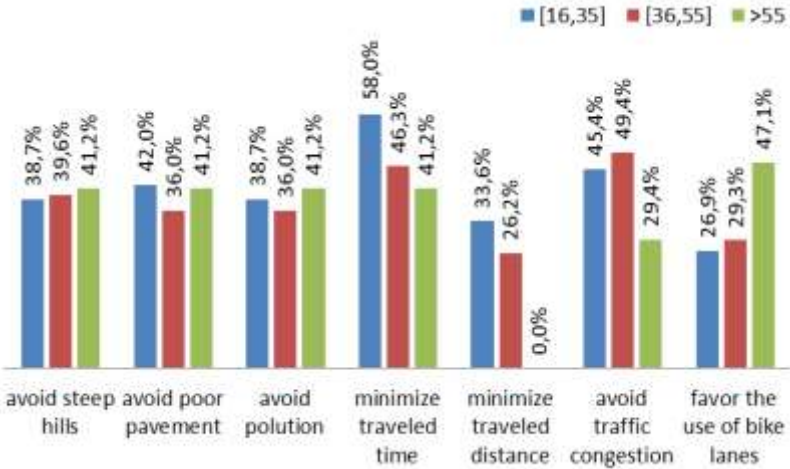
Graphic 12
Motives for bike commuting by income



Graphic 13
Barriers to bike commuting by gender

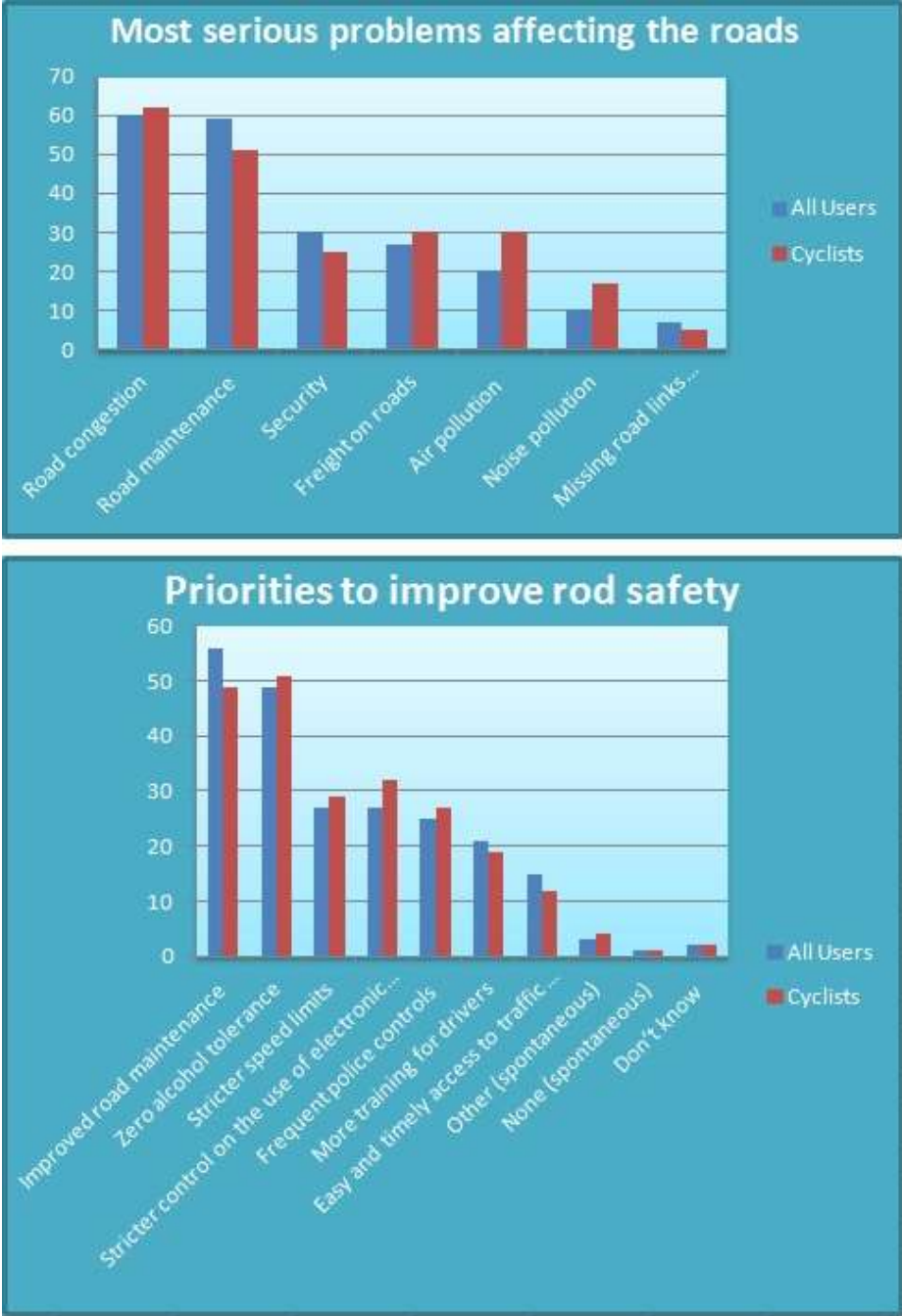


Graphic 14
Barriers to bike commuting by age



The graphics below illustrate what Europeans consider to be the most serious problems affecting the roads and the priorities to improve road safety

Graphic 15
Average of the cyclists compared to all users average answers



Note: The partly-deleted answers are “Stricter control on the use of electronic devices while driving” and “Easy and timely access to traffic information when travelling”

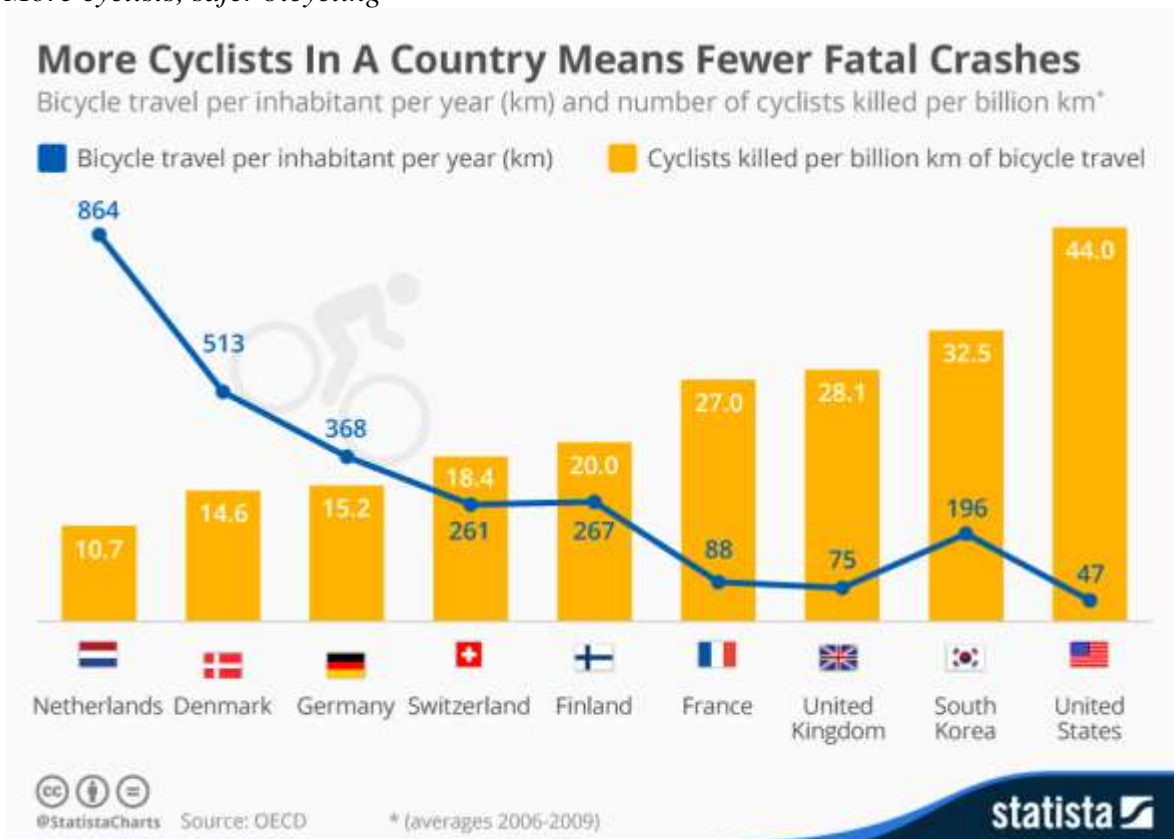
Source: European Commission, 2014

Table 6
Reasons for using bike as a means of transport

QA2 What are the reasons for using this mode of transport? (ROTATE – MAX. 2 ANSWERS)								
	Convenience	Speed	Available facilities	The price	There is no alternative	Security	Environmental reasons	Other (SPONTANEOUS)
EU28	61%	31%	16%	12%	8%	5%	4%	9%
Most often used mode of transport								
Car	72%	42%	16%	3%	6%	5%	1%	5%
Motorbike	66%	44%	4%	21%	5%	1%	2%	10%
Train	51%	28%	20%	25%	9%	4%	8%	7%
Boat	0%	53%	64%	7%	0%	0%	21%	1%
Public transport	45%	16%	23%	26%	13%	5%	5%	10%
Bicycle	49%	27%	18%	24%	5%	3%	22%	11%
Walking	48%	9%	8%	14%	12%	7%	7%	22%

Source: European Commission, 2014

Graphic 16
More cyclists, safer bicycling



Source: Statista

Figure 5
Bicycle crossings



Legend: Clearly marked bicycle crossings, informing pedestrians, cyclists and road users that this patch of the road is intended for cyclists
Source: thisbigcity.net

Figure 6
Marked crossing



Source: National Association of City Transportation Officials

Figure 7
Raise the crossing above street level



Source: Pedestrian and Bicycle Information Center

Figure 8
Bus equipped with bike hooks on the rear



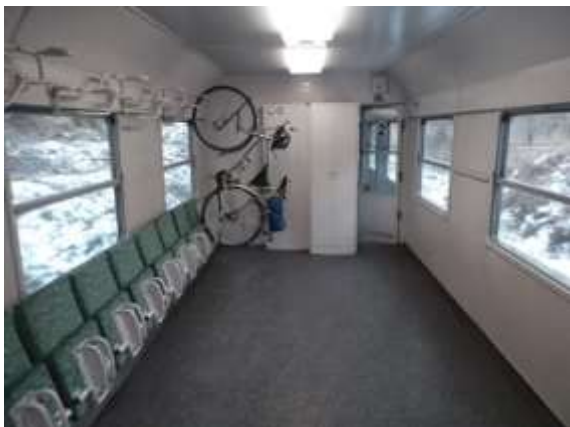
Source: NK bus

Figure 9
Bus equipped with bike rack in the front



Source: Cycle-Works Ltd, Secure Bicycle Parking

Figure 10
Bike hook inside train coach



Source: aeuropeanjourney.blogspot.pt

Figure 11
Bike hook inside train coach



Source: Adventure Cycling Association – America's Bicycle Travel Experts

Figure 12
Bike Coach Train



Source: Cityphile

Figure 13
Specially designed bike/pram/wheelchair compartments



Source: Copenhagenize

Figure 14
Standing bike rack inside Metro coach



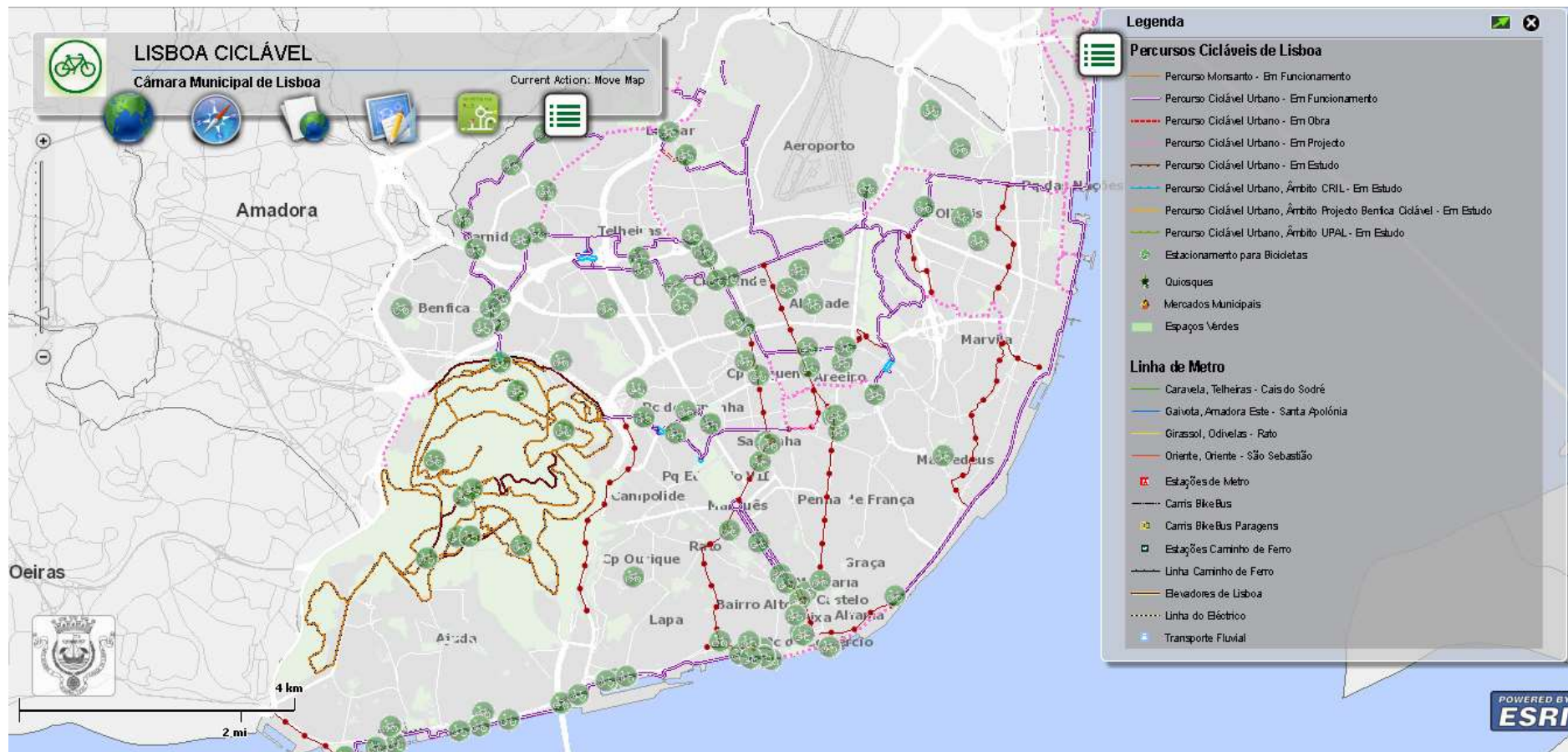
Source: Wikimedia.org
Credit: Payton Chung

Figure 15
Bike rack added to the front of the surface tram



Source: idea connection – Build on the Genius of Others

Appendix 2 Map of Lisbon bike lanes



Source: Câmara Municipal de Lisboa

Appendix 3

Questionnaire

Questionário sobre ciclismo urbano em Portugal

<https://docs.google.com/forms/d/14zr3q4ag5SeSww4NlqfICGPmp5sQIELzQCMsNu7XY8/edit> 1/7

Se tem mais de 16 anos e vive em Portugal, agradecemos a sua colaboração no preenchimento deste questionário, que servirá de apoio a uma Tese de Mestrado em Empreendedorismo e Inovação. O objectivo do estudo é entender as motivações, escolhas de percursos e o impacto da inovação no ciclismo urbano em Portugal.

Todos os dados recolhidos são confidenciais e anónimos.

O questionário demora apenas 5 minutos.

Obrigada,

Carlota Léchaud

Mestrado em Empreendedorismo e Gestão da Inovação

Universidade Europeia Laureate International Universities

* Required

1. Costuma deslocar-se de bicicleta no dia-a-dia? *

Mark only one oval.

- a) Sim *Skip to question 5.*
- b) Não
- c) Nunca

2. Indique numa escala de 0 a 5, o grau de relevância de cada um dos motivos pelos quais não anda de bicicleta em zonas urbanas *

0 corresponde a "nada relevante" e 5 corresponde a "muito relevante"

Mark only one oval per row.

0 1 2 3 4 5

- a) Prefere deslocar-se de carro
- b) Prefere deslocar-se de mota

- c) Prefere deslocar-se de transportes públicos
- d) Considera que não existem ciclovias suficientes
- e) Considera que não existem suficientes infraestruturas de apoio ao ciclismo (ex: parques, balneários no escritório, etc.)
- f) Considera que não é seguro
- g) Considera que é desconfortável
- h) Porque tem crianças
- i) Não gosta de depender das condições climatéricas
- j) Por causa dos declives das ruas
- k) Na sua opinião é necessário roupa/equipamento próprio para andar de bicicleta

3. Se algum factor não estiver especificado na questão anterior, por favor descreva abaixo.

4. O que consideraria necessário para que começasse a deslocar-se de bicicleta no dia-a-dia? *

Stop filling out this form.

5. Com que frequência se desloca de bicicleta? *

6. Há quanto tempo se desloca de bicicleta em percursos urbanos?

7. Tem seguro para seguros de Acidentes Pessoais e de Responsabilidade Civil? *

Mark only one oval.

- a) Sim
- b) Não

8. Quantos quilómetros faz por dia (ida e volta) nos dias de semana e ao fim de semana? *

9. Tem outro meio de transporte próprio? *

Mark only one oval.

- a) Não
- b) Carro
- c) Mota
- d) Carro e mota

10. Desloca-se de bicicleta porque... *

Check all that apply.

- a) é divertido
- b) é um hobby
- c) é saudável
- d) é um desporto
- e) ajuda a manter a condição física
- f) é mais rápido
- g) evita o trânsito
- h) existe uma boa rede de ciclovias
- i) é seguro
- j) tem preocupações ambientais
- k) as novas políticas públicas favorecem os ciclistas urbanos
- l) existem as infraestruturas necessárias
- m) Other:

11. Desloca-se de bicicleta para... *

Check all that apply.

- a) o trabalho/reuniões
- b) a escola/universidade
- c) viajar
- d) levar as crianças ao infantário/escola/actividades extracurriculares
- e) ir ao ginásio
- f) sair à noite/jantar fora/programas de fim de semana
- g) ir às compras
- h) Other:

12. Escolhe o seu percurso de maneira a *

Check all that apply.

- a) evitar subidas
- b) evitar estradas em más condições

- c) evitar a poluição
- d) minimizar o tempo de deslocação
- e) minimizar a distância percorrida
- f) evitar o congestionamento automóvel
- g) privilegiar a utilização de ciclovias
- h) Other:

13. Quais as maiores dificuldades com que se depara nos seus percursos urbanos quando se desloca de bicicleta? *

14. Algum produto inovador contribuiu para que se tornasse um/a ciclista urbano/a? *

Check all that apply.

- a) Casacos leves e quentes
- b) Casacos impermeáveis e respiráveis
- c) Bicicletas mais leves
- d) Bicicletas de carga
- e) Bicicletas longtail
- f) Produtos para transporte de crianças na bicicleta
- g) Acessórios de transporte de objectos – cestos, alforges, sacos para equipamento de desporto, laptops e outras coisas transportáveis
- h) Políticas públicas
- i) Aplicações para telemóveis
- j) Ciclovias
- k) Parques para bicicletas
- l) Infraestruturas
- m) Other:

15. Qual o valor do investimento inicial na bicicleta/acessórios/equipamento necessário? *

16. Quais os gastos anuais que tem com a bicicleta? (manutenção, acessórios, etc) *

17. Está a par das alterações do código da estrada para ciclistas que ocorreram em Janeiro de 2014? *

Mark only one oval.

- a) Não
- b) Sim

18. Se a sua resposta foi "sim", de que maneira as alterações do código da estrada para ciclistas contribuíram para alterar as suas deslocações?

19. É fumador/a? *

Mark only one oval.

- a) Não
- b) Sim

Dados demográficos

20. Género *

Check all that apply.

- a) Masculino
- b) Feminino

21. Idade *

22. País *

23. Cidade *

24. Código postal *

25. Habilitações académicas *

Mark only one oval.

- a) < 12º ano
- b) 12º ano
- c) Licenciatura
- d) Pós-graduação
- e) Mestrado
- f) Doutoramento

26. Estatuto profissional *

Mark only one oval.

- a) Empregado/a fulltime
- b) Empregado/a Parttime
- c) Desempregado/a
- d) Doméstico/a
- e) Estudante

27. Remuneração média mensal *

Mark only one oval.

- a) < 1.000€
- b) 1.000€ 2.000€
- c) 2.000€ 3.000€
- d) > 3.000€

28. Quantos membros tem o agregado familiar? *

29. Qual o número de filhos e idades dos mesmos? *