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Lisbon Smart Cities: Perception and Reality

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Dissertation presented as partial requirement for obtaining
the Master's degree in Information Management

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação
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LISBON SMART CITIES: PERCEPTION AND REALITY

by

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Dissertation presented as partial requirement for obtaining the Master's degree in Information Management, with a specialization in Knowledge Management and Business Intelligence

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To my friends. The support, help and persistence to finish this dissertation and for never letting me given up to write this dissertation.

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ABSTRACT

This dissertation, has an overall overview regarding the concepts raised around smart cities, based on existing studies in the area, tries to give a concept for Lisbon municipality and also identify if the city is smart or not.

Through an interview to a responsible from Lisbon council for the smart cities area and a set of interviews to Lisbon citizens, to have a vision of the perception and reality of the activities occurring in Lisbon city. Based on those answers, a set of analysis was made in order to give an overview about Lisbon municipality, through the six smart cities characteristics.

KEYWORDS

Information and Communication Technologies; Smart Cities; Open Data; Information; Data; Knowledge

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LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|-----------------------|--|
| CO₂ | Carbon Dioxide |
| EU | European Union |
| ICT | Information Communication Technologies |
| INE | National Statistical Institute |
| KPI | Key Performance Indicator |
| SC | Smart City |

1. INTRODUCTION

1.1. BACKGROUND

Cities. Global cities. Urban cities. Mega cities. Smart Cities. Over the past years, there has been an evolution of what a city is and how they will become soon. A city can be consider as a large and permanent human settlement, but this definition can vary from country to country. For instance, in Portugal, a city needs to accomplish the following aspect defined by law to be consider a city – more than 8 000 voters, a hospital, pharmacies, fire departments, museums, libraries, hotels, schools, public transportation, and public spaces as gardens. However, the city definition according to United Nations, for Portugal, says that it should have 10 000 or more inhabitants (United Nations, 2005).

Cities can be consider as “‘magnets of hope’ for a vast array of skilled and unskilled people who flock to them to find better livelihoods and lifestyles.” (Kumar & Dahiya, 2017).

Cities all over the world are evolving and cities in Portugal are not the exception. Portugal has 159 cities since 2013, and there are more people living in those cities, leaving behind rural areas. The graph below shows us the evolution of people living in portuguese cities, and it is possible to predict that in 2030 the value will be around 71% (World Resources Institute, 2009).

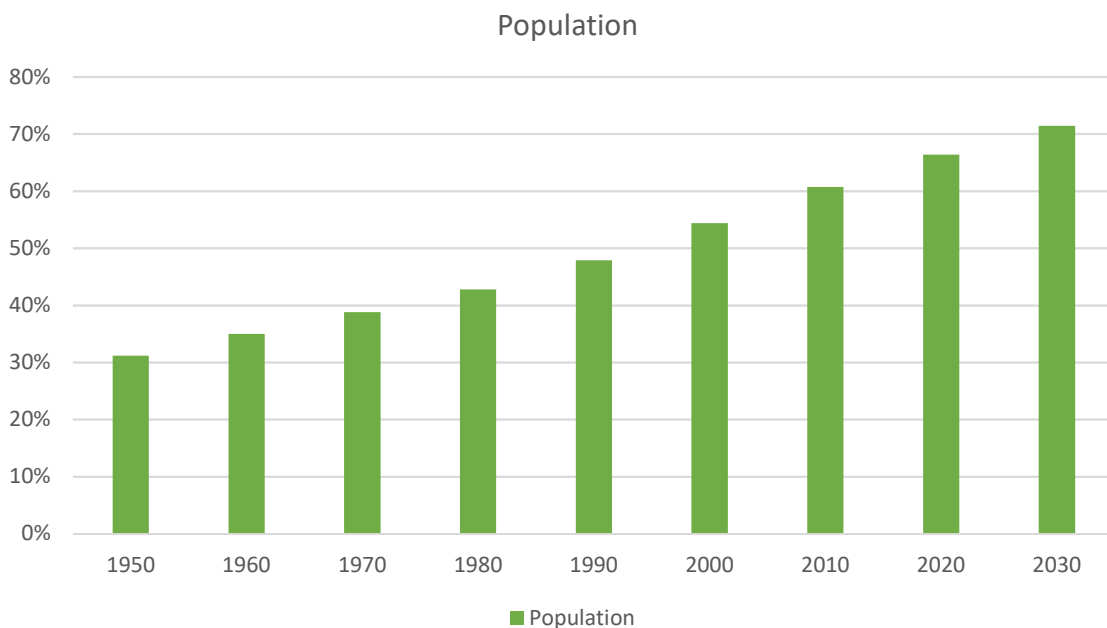


Figure 1.1 – Urban population as a percent of total population

Lisbon is the capital and the largest city in Portugal. According with the last census made, in 2011, there are around 547 733 inhabitants living in Lisbon. However this value has been decreasing since the previous census, in 2010, which register 564 657 inhabitants. This can be explained, because, around Lisbon municipality there are many municipalities and the cost of living is much lower than living in the capital. Commuting around the Lisbon municipality is also easy to do, even if you live far away from the city centre (Câmara Municipal de Lisboa Web Site, 2018).

Can be Lisbon classified as smart city? First, what is a smart city? As well as, the concept of city, it is not well defined yet – it is a concept, which differs from person to person, city to city, country to country, depending of course, on the level of development and the willingness to change from which person. In an undeveloped country, this concept is related with the need of citizens to have access to basic goods, such as a good sewage network, transport infrastructure or even access to basic healthcare needs. On the other hand, if we think about a developed country, this concept is completely different, which means that having access to a good internet network becomes essential and, the communication between citizens is mainly made using smartphones or laptops.

The smart cities concept was first mentioned around the 90s, and from that time onwards, numerous studies on this topic began to emerge, with different approaches and possible solutions. Several companies with a technology background began to develop solutions that would serve the needs of the cities, to help them to be “smarter”. However, like everything, there are benefits and consequences related to the use of technologies – open data utilization, may be a constraint if it is not well used, as the correct use of them, will bring a non-number of advantages.

All over the world, there are some cities that can be considered as smart, applying different methodologies – Amsterdam is an example, where the main motivation is related to sustainability, the goal of reducing CO₂ emissions, local production of energy using renewable energies, among others.

To clarify which cities can be considered smart, it has been created indexes to help to evaluate each one of them. In Portugal, INTELI is the organization responsible for building this index considering five different analysis dimensions – innovation, sustainability, inclusion, governing, and connectivity – having more 123 indicators related with the quantification and qualification of each one of the dimensions mentioned above (INTELI, s.d.).

The investment around smart cities is usually huge, because most of the times, cities do studies about themselves to know in each level are they regarding smartness. However, there are difficulties to implement the results of those studies, since municipalities do not know in which sector they should invest first, and due to municipal budgets, which are short for all the initiatives which could be created.

Thus, one of the biggest problems related with smart cities, it is the undefinition of the concept and the difficulty to pass the projects from paper to reality.

1.2. MOTIVATION

Since the earliest years of civilization, cities are the main center of business and most people have their own personal life. Based on this, the main motivation to write this dissertation is to find out, where we are and what is going to be the future in the cities we are living, in particular, for this case, Lisbon.

To elaborate this dissertation is important to understand which smart cities initiatives are occurring nowadays in Lisbon municipality, how are they being developed and applied, what are the next steps planned and the perception of the Lisbon citizens. In the end, this dissertation will allow us to obtain an overview of existing smart cities initiatives in Lisbon and the real perception of them according with the smart cities characteristics – smart economy, smart mobility, smart governance, smart living, smart people, and smart environment.

Thus, the motivation for this dissertation, is to contribute not only to an area of knowledge, in which this paper is inserted but also for society utilization, in order to obtain more knowledge about how the information technologies are being used and how these technologies increase the citizens participation.

1.3. OBJECTIVES

The main objective of this paper is to review some of the existing literature regarding smart cities – concept, main characteristics, and some cities with successful initiatives in this area. Together, with the literature review, it is going to be study in particular, the activities in Lisbon municipality regarding smart cities initiatives and the citizens awareness.

In order to obtain the best results for this dissertation, the following objectives are mention:

1. Define the smart city concept for Lisbon municipality;
2. Analyse the actual, and the next smart cities initiatives in Lisbon municipality;
3. Identify the level of citizens knowledge regarding smart city concept;
4. Identify the level of citizens knowledge regarding smart cities initiatives in Lisbon municipality;

To achieve those objectives, one questionnaires was make to Lisbon citizens to understand their perception regarding smart cities initiatives. Additionally, one interview was conduct with one responsible from Lisbon municipality to understand all the actual and next smart cities initiatives.

2. LITERATURE REVIEW

2.1. SMART CITIES CONCEPTS

As soon as each study related with smart cities arise, it appears a new and completely different definition about it. This happens because each author has a different opinion about the subject and wants to make it clear, giving us the opportunity to think in a different way about what are the main aspects to build and be a smart city.

Thus, here it will be present a set of smart cities definitions:

| Definitions | Reference |
|---|-------------------------------------|
| We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance. | (Caragliu, Del Bo, & Nijkamp, 2011) |
| A Smart City is a city well performing in a forward-looking way in these six characteristics, built on the ‘smart’ combination of endowments and activities of self-decisive, independent and aware citizens. | (Giffinder, et al., 2007) |
| A smart city is a well-defined geographical area, in which high technologies such as ICT, logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well-being, inclusion and participation, environmental quality, intelligent development; it is governed by a well-defined pool of subjects, able to state the rules and policy for the city government and development. | (Dameri, 2013) |
| All in all, smart city is the product of digital city combined with the Internet of Things. | (Su, Li, & Fu, 2011) |
| A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rail/subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens. | (Hall, 2000) |
| Smarter Cities are urban areas that exploit operational data, such as that arising from traffic congestion, power consumption statistics, and public safety events, to optimize the operation of city services. The foundational concepts are instrumental, interconnected, and intelligent. | (Harrison, et al., 2010) |

| | |
|---|--|
| <p>A Smart City is a city that gives inspiration, shares culture, knowledge, and life, a city that motivates its inhabitants to create and flourish in their own lives. A smart city is an admired city, a vessel to intelligence, but ultimately an incubator of empowered spaces.</p> | <p>(Rios, 2012)</p> |
| <p>The use of Smart Computing technologies to make the critical infrastructure components and services of a city – which include city administration, education, healthcare, public safety, real estate, transportation, and utilities – more intelligent, interconnected, and efficient.</p> | <p>(Washburn & Sindhy, 2010)</p> |
| <p>Smart cities are those that are combining ICT and Web 2.0 technology with other organizational, design and planning efforts to dematerialize and speed up bureaucratic processes and help to identify new, innovative solutions to city management complexity, in order to improve sustainability and “liveability”.</p> | <p>(Toppeta, 2010)</p> |
| <p>The conceptualization of the Smart City by Barcelona is quite extensive. For Barcelona, Smart City implies a high-tech intensive and an advanced city that connects people, information, and city elements using new technologies in order to create a sustainable, greener city, competitive and innovative commerce and a recuperating life quality with a straightforward administration and a good maintenance system.</p> | <p>(Bakici, Almirall, & Wareham, 2013)</p> |
| <p>So-called smart cities will take advantage of communications and sensor capabilities sewn into the cities’ infrastructures to optimize electrical, transportation, and other logistical operations supporting daily life, thereby improving the quality of life for everyone.</p> | <p>(Chen, 2010)</p> |
| <p>Regardless of how many dimensions a smart city may expose, a literature review reveals two main streams of research ideas: 1) smart cities should do everything related to governance and economy using new thinking paradigms and 2) smart cities are all about networks of sensors, smart devices, real time data and ICT integration in every aspect of human life.</p> | <p>(Cretu, 2012)</p> |
| <p>A smart city is a city that efficiently mobilizes and uses available resources (including but not limited to social and cultural, capital, financial capital, natural resources, information and technology) for efficiently improving the quality of life of its inhabitants, commuting workers and students, and other visitors (people).</p> | <p>(Bosch, et al., 2017)</p> |

Table 2.1 – Smart cities concept

Considering all the definitions mentioned above, it is possible to conclude that the definition of smart city has a multidimensional approach, covering a lot of areas such as people, infrastructures, ICT,

internet of things, mobility, traffic, education, government, health, planet, governance, security, sustainability, open data, and crowdsourcing.

However, this brings problems related with the persistent undefinition regarding with what a smart city is. There are authors who referred that this term can be applied to two different kind of “domains” – “hard domains” such as transportations, buildings, energy and natural resources (Neirotti, De Marco, Cagliano, Mangano, & Scorrano, 2014) and “soft domains” such as, education, culture, policy inovations, social inclusion, and government, where the application of ICT are not ussualy decisive (Albino, Berardi, & Dangelico, 2015).

2.2. SMART CITIES CHARACTERISTICS

It is possible to categorize smart cities into six different characteristics – smart economy, smart people, smart governance, smart mobility, smart environment, and smart living (Caragliu, Del Bo, & Nijkamp, 2011). Regarding, the existing study around European cities, it is possible to identify in detail, the domains, and components of each one of the referred characteristics (Giffinder, Kramar, Haindlmaier, & Strohmayer, 2015):

| Characteristics | Domains |
|------------------------|--|
| Smart Economy | Innovative spirit, entrepreneurship, city image, productivity, labor market, and international integration. |
| Smart Mobility | Local transport system, intra and international accessibility, ICT – infrastructure, and sustainability of the transport system. |
| Smart Governance | Political awareness, public and social services, efficient and transparent administration. |
| Smart Living | Cultural and leisure facilities, health conditions, individual security, housing quality, education facilities, touristic attractiveness, and social cohesion. |
| Smart People | Education, lifelong learning, ethnic plurality, and open-mindedness. |
| Smart Environment | Air quality (no pollution), ecological awareness, and sustainable resource management. |

Table 2.2 – Smart cities characteristics and domains

Based on the identified domains, the study was made in a set of European cities, including Lisbon. Pointing out the six characteristics, only two of them were positive (smart governance and smart environment) and all the others were negative (Bosch, et al., 2017).

Thus, a city can be consider as smart when it is well established in the six characteristics previous mentioned, with the help of the citizens which are the main protagonists of the cities.

2.3. SMART CITY INITIATIVES

All around the world, there are a lot of smart cities initiatives in order to improve the cities and the citizen's lives. To help achieving those objectives, a set of institutions are doing studies to evaluate how the cities are, based on a set of criteria's. In this sections, it is presented some initiatives, as well as, the ones Lisbon municipality is implementing in the city.

2.3.1. INTELI

INTELI is an innovation center, oriented to create a new economic and social model of sustainable development of the Portuguese economy, based in two pillars: knowledge and innovation. Some activities areas are cities, energy, and transparency – and for this dissertation, the focus will be the first mentioned area (INTELI, s.d.).

Smart City Index is a tool for urban intelligence analysis, which allows monitoring critical indicators, life, and benchmarks, and propose recommendations to improve cities and regions. Based on an approach made in 2012 within RENER, this study improved and includes more 16 cities than the previous study, which considered only 20 Portuguese cities. The methodology applied for this study was based on five dimensions (governance, innovation, sustainability, quality of connectivity), within 24 sub-dimensions, 93 key indicators and 97 support indicators (INTELI, 2016). Comparing 2012 study with 2016, the municipalities with highest performance regarding urban intelligence in overall, changed except for Cascais:

| Smart City Index 2012 | Smart City Index 2016 |
|-----------------------|-----------------------|
| Lisbon | Porto |
| Almada | Águeda |
| Cascais | Cascais |
| Aveiro | Bragança |
| Vila Nova de Gaia | Guimarães |

Table 2.3 – Smart cities index comparison

The authors conclude that between 2012 and 2016, local governments and urban stakeholder's awareness have increased. 22% of the analyzed municipalities have already defined strategies and 28% have created specific departments regarding the area of smart cities. Based on this, Portugal has a long journey until reach the necessary awareness to implement those strategies.

2.3.2. CITIKeys

European Union's HORIZON 2020 program funded CITIkeys, which is the EU Framework Program for Research and Innovation. The main goal of this project is, with the aid of cities, key performance indicators (KPI) and data collection procedures, monitor smart city solutions across European cities (Bosch, et al., 2017). In addition, this project will provide recommendations for the development of new business models.

This project has created a framework to:

- Support the strategic planning and measure of all the studied cities, and can evaluate the impact of a smart city project comparing before and after situations or comparing expected impact with a reference situation;
- Benchmark projects against others;
- Monitor the progress of the city as a whole towards smart city goals;
- Create indicators which may be used to show to what extent overall policy goals have been reached;
- Assess how the project has contributed to the objectives at city level.

The framework it is based on the following pillars:

- **People** – Long term attractiveness of cities for a wide range of inhabitants and users;
- **Planet** – Contribute to a cleaner city with a higher resource efficiency and biodiversity and being better adapted to impact of future climate changes;
- **Prosperity** – Economic viability, contributing to a prosperous and equal society, supporting affordable, green, and smart solutions;
- **Governance** – Efficient administration and a well-developed local democracy;
- **Propagation** – Potential for dissemination to other locations, other contexts, and other cities.

During this study was created an index, with a scale between 1 (worst score) and 5 (best score), allowing the comparison of KPIs thorough years and cities, analyzing the pillars mentioned.

2.3.3. Lisbon Inteligente

Lisbon is working daily on some initiatives regarding smart cities. There is an online portal, named Lisboa Inteligente, where it is possible to find all the initiatives for Lisbon, organized by smart cities characteristics (Lisboa Inteligente, 2018).



Figure 2.1 – Lisboa Inteligente Portal (Source: <https://lisboainteligente.cm-lisboa.pt/>)

Below there is a brief explanation of each of the initiatives mentioned in the Lisboa Inteligente Portal, which are already implemented or planned in Lisbon municipality:

| Characteristics | Initiatives |
|--------------------------------|--|
| <p>Smart Economy</p> | <p>There are 4 initiatives for this smart city characteristic:</p> <ul style="list-style-type: none"> • Lisboa Robotics Cluster – The aim is to place robotics on the city’s strategic agenda, fostering research and development in the city, innovation and technology. This initiative is in implementation phase; • Smart Open Lisboa – Become Lisbon a live innovation lab in order to solve easily all the citizens issues, allowing the utilization of all the existing data without restrictions. This initiative is in implementation phase; • Laboratório de Dados Urbanos Lisboa – This initiative wants to bring together all the existing data, analytical tools and innovation capabilities in order to return analytical solutions capable to solve real problems in city and improving the services. This initiatives is in conception phase, by NOVA IMS; • Portal Lisboa Aberta – Promote the reuse and creation of goods and services that add value to the contents available. This initiative is in implementation phase. |
| <p>Smart Mobility</p> | <p>Three initiatives are planned for mobility:</p> <ul style="list-style-type: none"> • Gira. Bicicletas de Lisboa – Create a new way of transport in the city, being more environmental friendly. This initiative is in implementation phase, by EMEL; • Sensorização Eixo Central – Increased real-time knowledge about occupancy of parking spaces and mobility, providing solutions in an integrated way. This initiative is in development, by EMEL, as well as, the previous one; • C-Roads – This initiative enables the prioritization of BUS vehicles and emergency lorries at highway intersections, and monitoring pollution patterns. This initiative is in implementation phase. |
| <p>Smart Governance</p> | <p>There are 4 initiatives for governance in Lisbon municipality:</p> <ul style="list-style-type: none"> • Na Minha Rua LX – Online application, with the possibility to install the application in mobile devices, where citizens can report incidents, which need to be solved, related with green spaces, public illumination, mobility, underground works, and others. If the citizens do not have access within the online or mobile application, they can also participate calling to the |

| | |
|--------------------------|--|
| | <p>municipality, or also, go to the civil parishes during the working hours. This initiative is in implementation phase;</p> <ul style="list-style-type: none"> • Urbanismo Digital – This project aims the complete dematerialization of all stages of the urban planning process, in the licensing and post licensing aspects, as for instance, electronic receipts, clearance of fees and preliminary sanitation. This initiative is in implementation phase; • Sistema Gestão Remoção Resíduos – Management of all collection points inserted in circuit and register of containers allocated to each waste production. This initiatives is in conception phase; • Plataforma Gestão Inteligente Lisboa – Creation of a technological solution that provides a complete monitoring, analysis and management capacity of the entire Lisbon municipality. This initiative is in implementation phase; • Centro Operacional Integrado Lisboa – Ensure the intelligent management of Lisbon city, working in a preventive, integrated, articulated and cooperative manner based on the available information. This initiative is in development. |
| | <p>Only one initiative for this characteristic:</p> |
| Smart Living | <ul style="list-style-type: none"> • LISCOOL – System which is going to contribute to the proper use or mutual use of solar energy and improve the economic benefits for consumers. This initiative is in implementation phase. |
| Smart People | <p>None initiative regarding this smart city characteristic.</p> |
| | <p>Two initiatives for environment:</p> |
| Smart Environment | <ul style="list-style-type: none"> • ALFA-AMA Smart Sustainable District – A project which uses participatory and innovative methods and aims to make this neighborhood a sustainable and low carbon place. This initiative is under development; • ME2 – Integrated Smart City Mobility – Promote energy efficiency through integrated of electric mobility and energy consumed at homes. This initiative is in implementation phase. |

Table 2.4 – Lisbon Inteligente Initiatives

Together with the initiatives mentioned above, there is another portal, named Lisboa Participa, where it is possible to find other initiatives for Lisbon municipality (Lisboa Participa, n.d.). Those initiative are not considered in the previous website as smart city initiatives, except Na Minha Rua LX application, but they are relevant for the Lisbon citizens:

- **Orçamento Participativo** – One of the ways of citizen’s participation regarding the governance of Lisbon. The citizens can present offers to the city and vote in which of those they think are better to develop the city. In 2017 were received around 434 proposal, and from them, 128 become a project to be voted by the citizens;
- **Lisboa Ideia** – Citizens who have ideas to improve Lisbon city can submit those in this portal;
- **Lisboa em Debate** – All citizens can give their opinion (online or presently) about how the city is being governed;
- **Lisboa Aberta** – Open data portal, where it is possible to find a set of data about Lisbon, produced by Lisbon city council with help of other private entities who are working together. The main goal of this portal is the share of free data, to enhance the reuse and the production of goods and services that will add value to the available contents;
- **Fórum da Cidadania** – Allows citizens to participate in the governance of Lisbon municipality;
- **Start Up Lisbon** – Founded in 2011 by the Lisbon municipality and two other institutions, is an incubator that support the creation of new companies during the first years of activity;
- **ZER Lisboa** – Since 2011, some areas in Lisbon allows only the circulation of vehicles with specific characteristics regarding the emission of pollutants, in accordance with the European emissions standards. With those rules, the ambition is that citizens prefer to commute within public transportations than by private car.

3. METHODOLOGY

During the investigation process, it is important to define what the methodological principles are and which ones we should use. Based on this dissertation, the approach was related to the existing bibliographic research, as well as, collecting information from the target population.

The research method for this dissertation is a Case Study, an empirical research method. This type of methodology is used when we are trying to investigate a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clear (Yin, 1984). With this method it is possible to use a huge variety of different sources, as for instance, documents, interviews, direct observation, or participative observation; contextualized interpretation of data and the discovery of reality beyond the initial assumptions (Ludke & André, 1986). The main objective of a case study is exploring, describing, and explaining (Yin, 1984).

It is possible to identify five characteristics for case studies (Bodgan & Biklen, 1994):

1. Direct data source and natural environment;
2. The qualitative investigation is descriptive;
3. Researchers give more importance to the process than the final results;
4. Researchers tend to analyse data in an inductive way;
5. Meaning is important for a qualitative approach.

The data collected to write this dissertation is based in three different approaches:

- **Questionnaires and interviews** – Useful because they can be cheaper than personal interviewing and quicker if the sample is large and widely dispersed. Before the only options to conduct questionnaires was using telephone or interview. Nowadays, we can conduct those studies within internet questionnaires. Questionnaires can only produce good results if the questions are clear and precise, so, there are some important points while designing questionnaires. All questionnaires require a title – short, simple, appealing, and inviting; most of the questionnaires are confidential; instructions are useful to help people answering them; the question order is important, and it should move from general to questions (Mathers, Fox, & Hunn, 2007).
- **Documentary analysis** – Relevant, since there are already some studies regarding smart cities, and we should collect, read, and analyze the existing papers. Is a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic (Bowen, 2009).

This dissertation is split into 6 different phases, as below:

- **1st Phase: Bibliographic revision** – This first phase allows to present some existing bibliographic references, regarding studies about smart cities – definition about the smart city concept and the characteristics;
- **2nd Phase: Characterize Lisbon municipality and their initiatives** – The data collected to write this dissertation is based in three different approaches: questionnaires, interviews and documentary analysis;
- **3rd Phase: Methodology** – Discuss the methodology used and why;

- **4th Phase: Questionnaires and interviews creation and distribution** – The final goal of this dissertation is characterize Lisbon smart cities initiatives through the citizens perception and the reality. For this reason, it is important to get data to help to characterize how Lisbon is actually and how it should be soon. During the bibliographic revision, the studies from INTELI in Portugal and CITIkeys for some European cities were consider. Both studies have a list of indicators to evaluate the cities, but to get to some conclusions; questionnaires were make and sent to citizens and municipalities. In this case, the questionnaires were adapted to the Lisbon reality and sent only to citizens living in. The questionnaires were made through Google, since it is a better and an easy way to achieve more people, and they were distributed by e-mail. Nevertheless, all the responses were anonymous. Regarding the interview, was made to a person responsible for the innovation department in Lisbon council;
- **5th Phase: Data treatment and analysis** – All responses to the questionnaires were exported from Google into Microsoft Excel to do a proper analysis;
- **6th Phase: Conclusions and limitations** – After all the phases mentioned above, there is a need to present some conclusions and the limitations for this study in order to improve the further studies in this area.

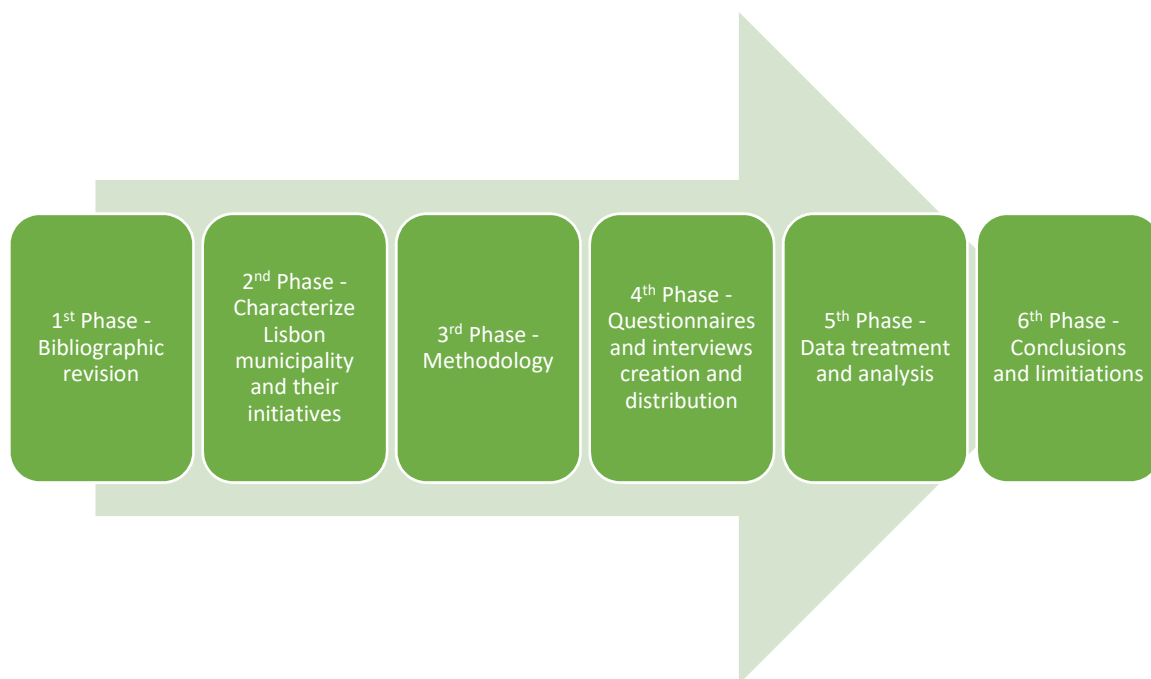


Figure 3.1 – Investigation design

4. STUDY AND RESULTS ANALYSIS

4.1. LISBON MUNICIPALITY

Lisbon is the capital and the largest city in Portugal. This municipality have 82,84 km² and according with last census made in 2011, there are 547 733 residents. By 2015, the population living in Lisbon municipality was about 506 892 residents (INE & Pordata, 2015). This value has been decreasing, because citizens choose to live nearby the capital, than in the city center, due to the high living cost.



Figure 4.1 – Lisbon map (Source: http://www.orangesmile.com/common/img_city_maps/lisbon-map-0.jpg)

Another important information is related with the population living in Lisbon municipality and working by age group, in 2015. From 506 892 residents in Lisbon in 2015, only 289 091 are in working age, and in the table below it is possible to see in detail (INE & Pordata, 2015):

| Age Range | Total | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 |
|-----------|---------|--------|--------|--------|--------|--------|
| Lisbon | 289 901 | 38 179 | 53 372 | 71 475 | 61 244 | 64 822 |

Table 4.1 – Age range for Lisbon municipality

As we can see, the range age with more residents within working age is between 35-44 years old, followed by the citizens with 55-64 and 45-54 years old. Considering only the working age citizens it is possible to say, that the majority of the citizens are in an age range, where the growth age has not been connected to new technologies. Still, some of the people are willing to learn how to work with the technologies and are intended to use them every day.

The region contributes with a higher PIB per capita than any other region in Portugal and Lisbon occupies the 32nd place of highest gross earnings in the world. The main sector area in Lisbon municipality is the tertiary sector. Most of the headquarters of multinationals are based in Lisbon, and it is the political center of the country. In addition, the mass media sector of Portugal are based in Lisbon, with the home of several companies related with television, radio stations and newspapers (Câmara Municipal de Lisboa Web Site, 2018).

Around Lisbon, there are many cities and the set of them is named as Lisbon Metropolitan Area, known generically as Greater Lisbon. Lisbon municipality had 53 civil parishes until November 2012, but a new law reduced the number of civil parishes to 24.

Traveling around Lisbon municipality is not difficult. Metro, trams, trains, buses, airplanes and taxis, are the main used transports to commute. The metro connects the city center to the suburbs and it is expect to reach more places in the next years. Trams were the traditional public transportation in Lisbon, and the oldest. There are still some trams operating in Lisbon, but some of them were replace by buses, which links other points of the city, and also out of the city borders. Trains allows the commuting from people from other points of the country to Lisbon, with daily trains from Porto, or Faro, for instance. Those trains helps also, the link to the airport, allowing the commute of millions of citizens, who are working but also visiting Portugal. It is known, that people spend around 59 minutes per day, commuting, from home to work within Lisbon city. People can also use their cars to reach some parts of the city, however, the traffic is very common to access Lisbon city every day (Câmara Municipal de Lisboa Web Site, 2018).

4.2. INTERVIEW DESIGN

As mentioned in the methodology, an individual interview was conduct, structured based on the literature review, through the smart city concept, the actual situation and the next steps regarding smart cities initiatives in Lisbon.

This interview was made to Engineer João Tremoceiro, which is the Coordinator of the Mission Team for the Development of the Integrated Operational Center and the Chief Data Officer from Lisbon Municipal Council, and due to unavailability of the interviewers to do the interview in person, the same was done by email. The questions and the answers were sent by email.

The interview had 9 questions, and in the next chapter, it is provided a detailed analysis for each answer received, as well as, the question and the answer itself.

4.3. INTERVIEW ANALYSIS

Below, it is going to be presented an analysis in detail, question by question. The interview questions were the mentioned below, with the respective answer and a brief analysis:

1. From your understanding, what is a smart city?

João Tremoceiro: *There are hundreds of definitions for smart cities. Because of that, I will not take the risk to try to defining it. For me the keywords to characterize a smart city are integration, for instance, physical, digital, and human systems; be sustainable; inclusive; prosperous and citizen-centered.*

As in the literature review, there are many definitions for smart cities. The interviewed didn't want to specify one definition, but made it clear, some of the main and fundamental characteristics to build a smart city.

2. According with the above definition, do you consider that Lisbon can be considered a smart city? If not, what are the next steps to make Lisbon a smart city?

João Tremeceiro: *Not yet, but we are making our way. There is a global strategy, implemented with the support of the top decisors, will allow us, to promote the alignment of initiatives and achieve the proposed goals.*

As expected, through the literature review made, Lisbon is not a smart city, yet. According with the information given from the interviewed, Lisbon council is working daily to achieve the same goal as some European capital to be a smart city.

3. Does Lisbon have a roadmap regarding smart city initiatives? If yes, can you please refer some of the planned initiatives? If not, is there a possibility to have a roadmap in the near future?

João Tremeceiro: *One of the main goals for the team I lead is to produce this roadmap for Lisbon. Namely, taking advantage of the different municipal initiatives, which were been individually, developed.*

The roadmap to build a smart city in Lisbon is ongoing, and all the civil parishes around Lisbon have some internal initiatives which are going to be integrated.

4. Is there a platform that allows the communication between the municipality and the citizens, as well as, reporting incidents that are encountered on a daily basis, such as fallen trees, holes in the road...? If so, can this application be integrated within multiple services, or only respond to a specific set of activities?

João Tremeceiro: *Yes, that application does exist. It is "Na Minha Rua", which integrates a variety of municipal services and civil parishes.*

This application was mentioned above in the literature review, and it is used by the citizens with the goal of communicate situations that need to be solved, around Lisbon municipality.

5. If the answer to the previous question is positive, what is the level of use and acceptance by citizens of the existing platform?

João Tremeceiro: *An app has recently been launched, and it will have a promotional campaign coming soon. The number of registrations on the platform is quite high, so I believe it has been a good way of interacting with the citizens.*

There is no information in the answer given regarding the acceptance level by citizens regarding the existing application. However, was mentioned that there is going to be a promotional campaign to promote this application, in order, to have more citizens connected with the municipality, to work together and achieve the best results in building a smart city.

- 6. The visual changes that have been seen over the last few years, in Lisbon city, somehow allow to affirm that the city has tried to approach to other European cities that consider themselves intelligent?**

João Tremeceiro: Yes, in particular by promoting pedestrian and cycling mobility and the use of public spaces and the relationship between the city and the river.

During the last years, a lot of changes have been occurring in Lisbon in order to give better mobility to the citizens and also good public spaces, especially by the river. Those changes are improving Lisbon municipality and the citizens were against those changes before, but in the meantime they are getting used to them and enjoying those changes. The bicycle path created and the possibility to rent bicycles around Lisbon was a great improvement for citizens to commute. The main idea of those changes in Lisbon municipality is to return the city to the citizens, and for them, to use more public transports instead of the utilization of private car. Together with the creation of pleasant public spaces, the citizens and also the tourists (which are much more than before, visiting Lisbon, no matter in which epoch of the year) can take advantage of the city.

- 7. An intelligent city, has six characteristics that define it: intelligent economy, intelligent mobility, intelligent governance, intelligent living, intelligent citizens and intelligent environment. Based on these six characteristics, is Lisbon creating initiatives in order to respond to each one of them? For instance, smart mobility, allowing the creation of a platform in which allows citizens to check the waiting time of a set of public transports or even an application that allows the online payment of all public transports.**

João Tremeceiro: Mobility is one of the main priorities of this municipal executive, because several initiatives are planned in this area, namely the creation of a unique platform to integrate transports and payment system. Other important areas, have to do with the creation of an Integrated Operational Centre and also with the valorisation of the data, which involves the creation of an Urban Data Laboratory. Then there are several vertical projects that go through the areas of waist, citizen's participation, environment, and others.

As before referred, the mobility is one of the main preoccupation of this municipal executive. Like explained before, the creation of bicycle paths in Lisbon is helping the citizen mobility. However, there is still a resistance to change and use more public transportation. In order to change that, Lisbon municipality is planning a creation of an application to pay all the public transportation, which is going to help the citizen's mobility every day. The usage of data to have information regarding all aspects of the municipality, is another area of working. All the citizens should have access to data to be informed about anything they want to know regarding the municipality they live, helping them to be more participant in the city decisions.

- 8. What is the perception that Lisbon citizens have of what a smart city is?**

João Tremeceiro: I have no information to answer this question.

- 9. What is the perception that Lisbon citizens have regarding the initiatives that Lisbon is taking in relation to smart cities?**

João Tremeceiro: I have no information to answer this question.

Regarding the last two questions, about the citizen's perception concerning what a smart city is and the initiatives Lisbon is doing, there is no visibility.

4.4. QUESTIONNAIRES

4.4.1. Questionnaires Design

As mentioned before, the questionnaire was build, after the bibliographic revision and based on the existing questionnaires made from previous studies, with adaptations for the Portuguese reality, in specific for Lisbon municipality reality.

These questionnaires were made using Google Forms and it was written in Portuguese since there were a huge hypothesis that some citizens cannot understand English. All questionnaires were anonymous.

The questionnaire had 13 questions, and in the next chapter, it is provided a detailed analysis for each question, with results interpretation according with Lisbon municipality reality.

The first part of the questionnaire allows us to describe the citizens who answered, with personal information like, gender, marital status and school level, and filter the citizens, since this questionnaire is only for citizens who live in Lisbon municipality. If they live in Lisbon municipality, they were allow to continue answering the questionnaire, if not, the questionnaire ends up immediately.



Figure 4.2 – Questionnaire introduction

The second part of the questionnaire, it is directly related with the smart city concept and the perception of the Lisbon citizens, regarding this concept and the initiatives on going in Lisbon municipality. Moreover, it was ask to the citizens, which initiatives are more important for them, and which should be implement in Lisbon municipality.

4.4.2. Questionnaires Analysis

Below, it is going to be present an analysis in detail, question by question.

The first five questions will allow the characterization of the citizens who have answered the questionnaire. The remaining answers will help us to understand how the citizens evaluate the smart cities initiatives in Lisbon municipality, and what is more and less important for them.

1. Do you live in Lisbon municipality?

This questionnaire received 78 answers from citizens. However, only 72 citizens were from Lisbon municipality, and the remaining 6 were excluded from the study.

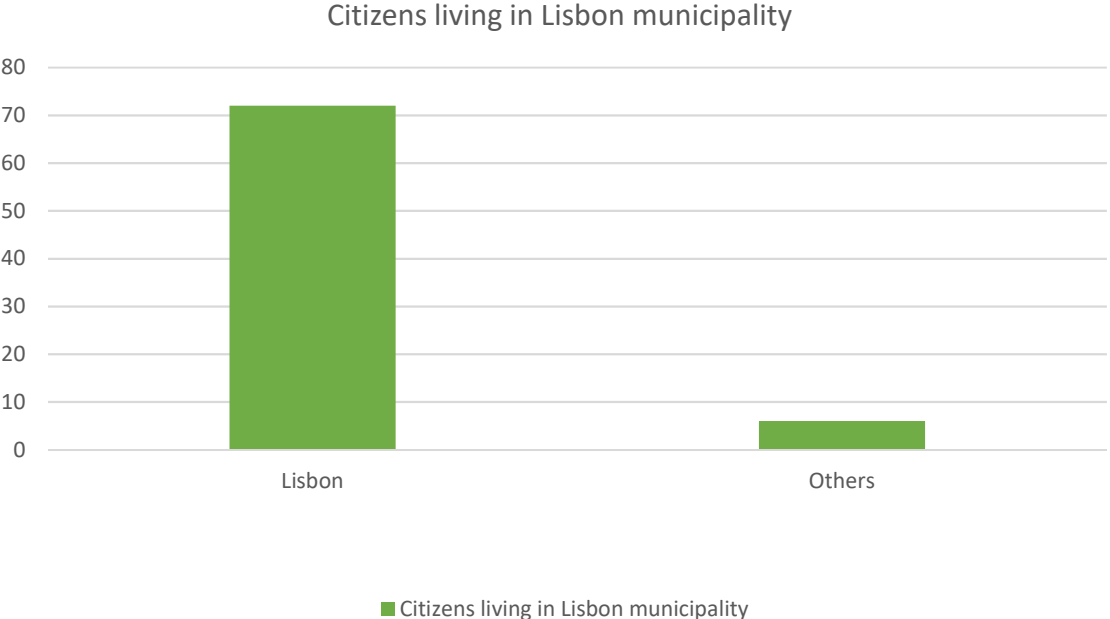


Figure 4.3 – Citizens living in Lisbon municipality

2. What is your gender?

From the 72 citizens who have answered the questionnaire, 37 were female citizens, against 35 male citizens.

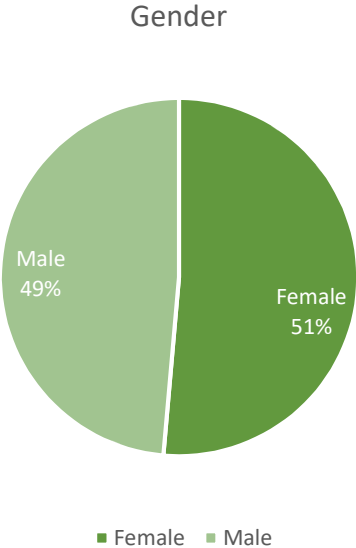


Figure 4.4 – Citizens gender living in Lisbon municipality

3. What is your age range?

By age, 26 citizens were between 18-24 years old, 34 citizens were between 25-39 years old, and 12 were between 40-69 years old, at the time, they answered this questionnaire.

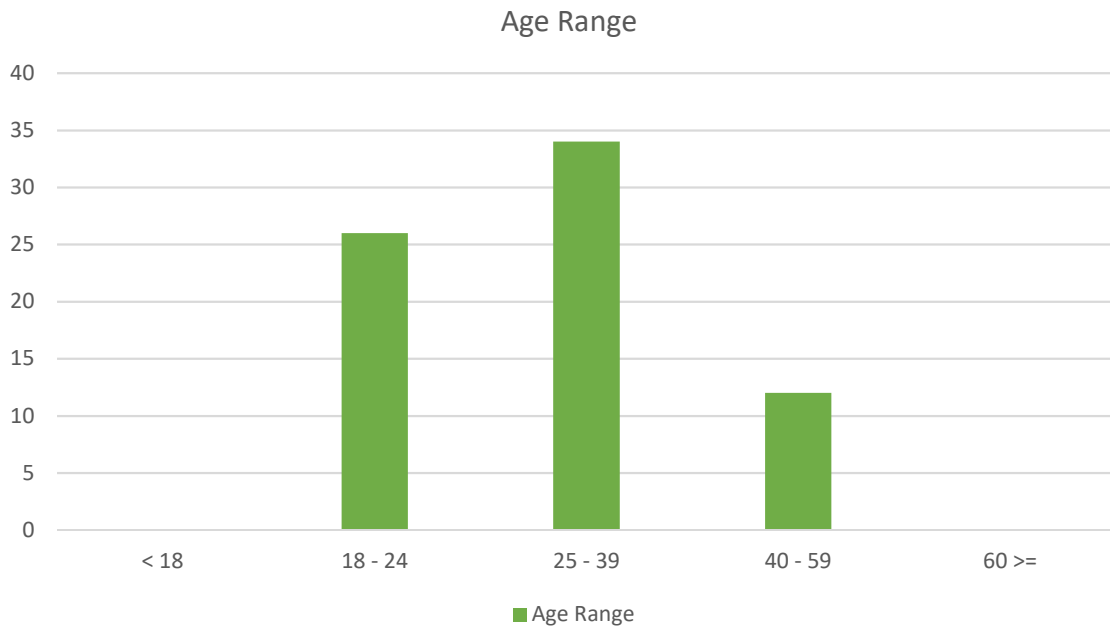


Figure 4.5 – Citizens age range living in Lisbon municipality

4. What is your marital status?

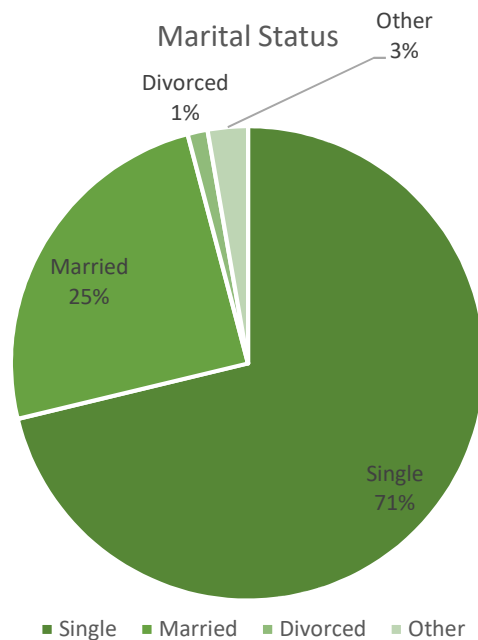


Figure 4.6 – Citizens marital status living in Lisbon municipality

Most of the answers were received from single citizens, with 52 answers. 18 were married citizens, 1 was divorced and 2 of them have other marital status.

5. What is your education level?

This was the last question which allows the characterization of each citizen. Most of the citizens had a bachelor degree (32), followed by 28 with a master degree and 9 with a secondary school. 2 of them only have the PhD and 1 answered that have another education level, than the ones mentioned in the questionnaire.

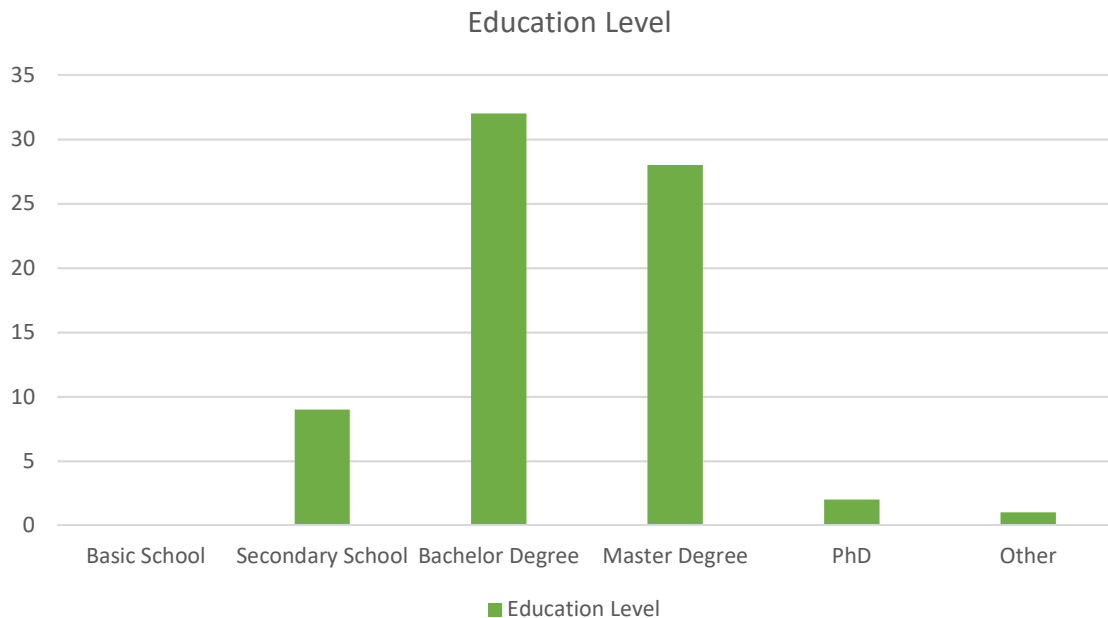


Figure 4.7 – Citizens education level living in Lisbon municipality

6. Do you know what is a Smart City?

66 of the citizens know what is a smart city, against 6, which do not know what is this concept. From this question, further, some of the analysis are made only considering the citizens who answered positively this question, as well as, the global sample, which is 72 answers, depending on the pretend analysis.

7. How is your knowledge level regarding Smart Cities?

To measure the level of knowledge regarding what is a smart city, below there is a graph with this analysis, only considering people, who have answered positively in the previous question. The knowledge level is above the average, with the main percentage of answers greater than level 5, which means, that the citizens already know something about this concept.

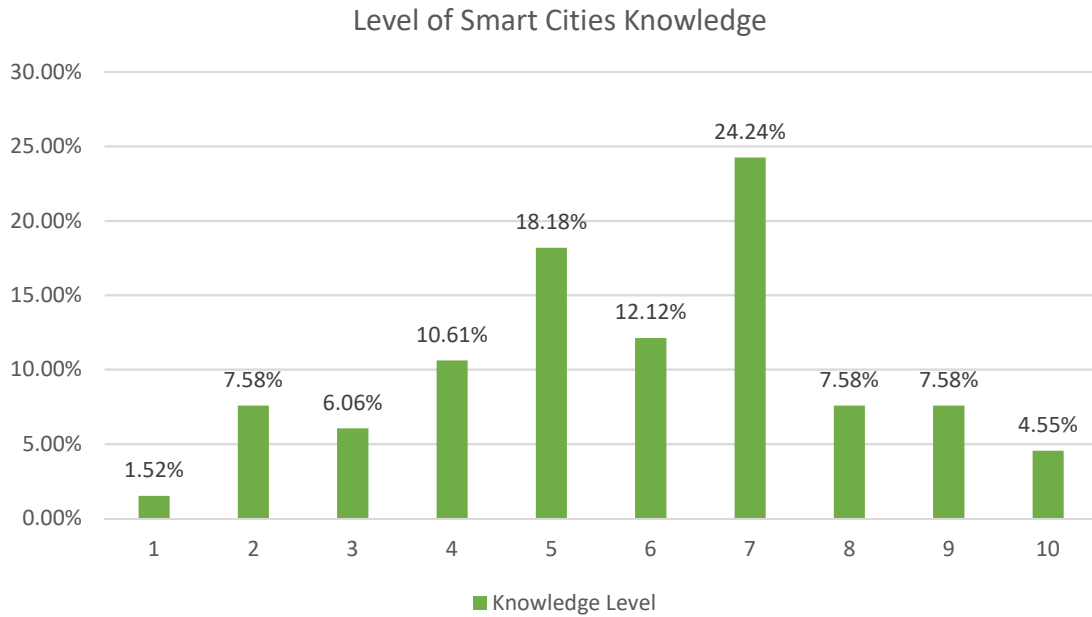


Figure 4.8 – Level of smart cities knowledge

8. What is the level of importance of Smart Cities in Lisbon municipality?

Another analysis that can be made is the importance level that Lisbon gives to smart cities initiatives according to the citizen's perception. Like in the previous question, below there is a graph with this analysis, only considering people who have answered positively in question 6. In this graph, it is possible to see that the opinions from each of the citizens diverge – 13.81% of the citizens gave a level 3, 18.57% of the citizens gave 18.57% and for instance, 14.29% of the citizens gave a level of 7 regarding the perception of smart cities initiatives in Lisbon.

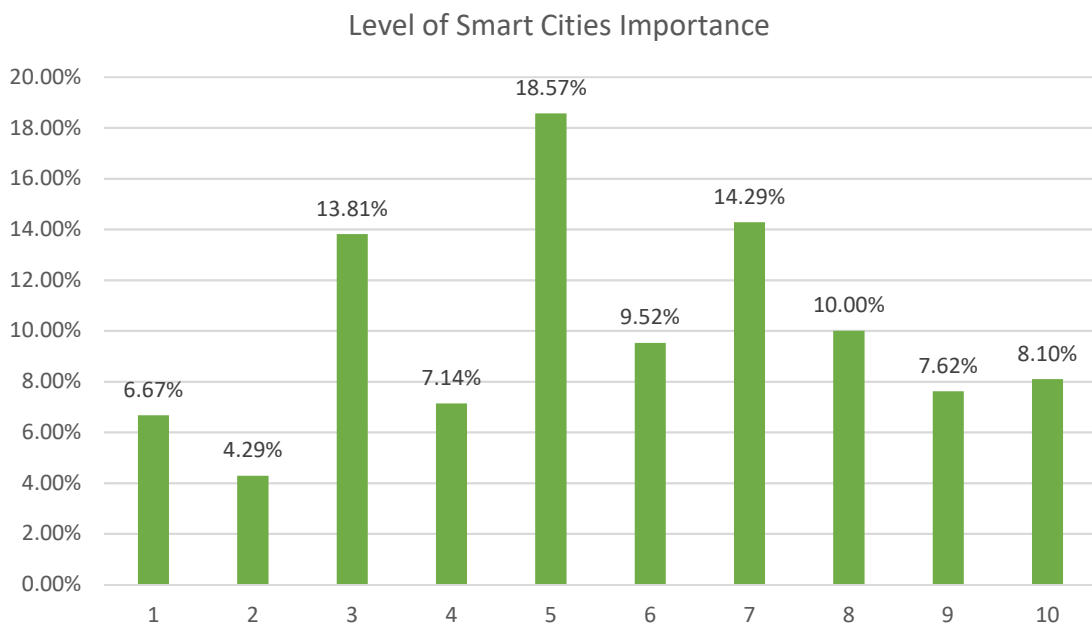


Figure 4.9 – Level of smart cities importance

9. In your opinion, the Lisbon municipality, has made some initiatives in the area of Smart Cities?

Most of the citizens does not know if Lisbon municipality is working within smart cities. For this analysis, it was consider all the citizens, no matter their answer in question 6. When questioning about the smart cities initiatives in Lisbon, only 29 answered positively against 9 that answered negatively and 34 answered unknown.

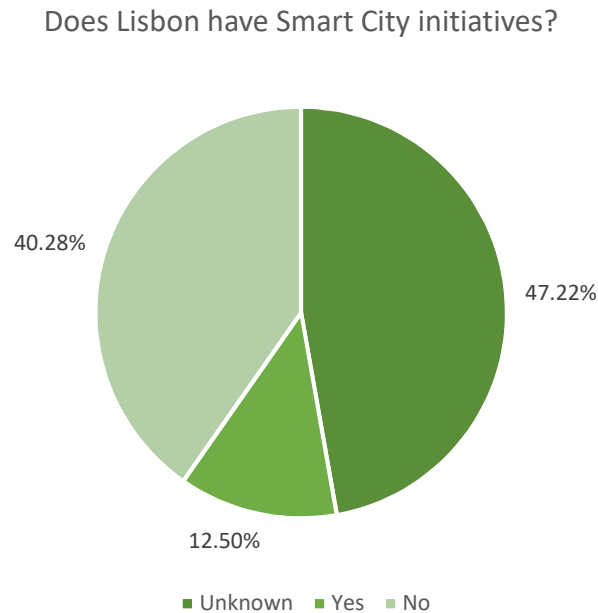


Figure 4.10 – Citizens perception regarding smart cities initiatives

10. Refer initiatives in the Smart Cities area, done by Lisbon municipality.

In this question, a set of options were available for the citizens choose, and it was possible to choose more than one answer option. Moreover, it is going to be analyse only the results for citizens who have answered positively in the previous question.

According with those citizens, Lisbon is working proactively to improve the mobility of the citizens around the city, following by green spaces. In fact, over the past months, it was possible to see many structural changes in Lisbon municipality regarding mobility, since there was many road works. It is possible to use, in many points of the city, bikes points to share between the citizens, giving to them, the liberty to choose between public transportations, or biking to commute. Moreover, for people who need to drive around Lisbon, there are public panels with the information about the number or parking lots available in numerous parking lots.

The other initiatives which were mention from Lisbon citizens was education and culture, followed by information and technology communications, energy and renewable efficiency, economic development, health and last, but not least, social inclusion.

All the initiatives mentioned are important, and central for the proper functioning of the Lisbon city, and if they were mention by the citizens, it is good, because the citizens have the perception of those new improvements.



Figure 4.11 – Existing initiatives in Lisbon municipality

11. Refer initiatives in the Smart Cities area, which the Lisbon municipality should invest.

As well as, the last question, a set of options were available for the citizens choose, and it was possible to choose more than one answer, for initiatives, which Lisbon municipality should invest. In opposition to the previous question analysis, all the citizens who have answered this questionnaire are consider for this analysis.

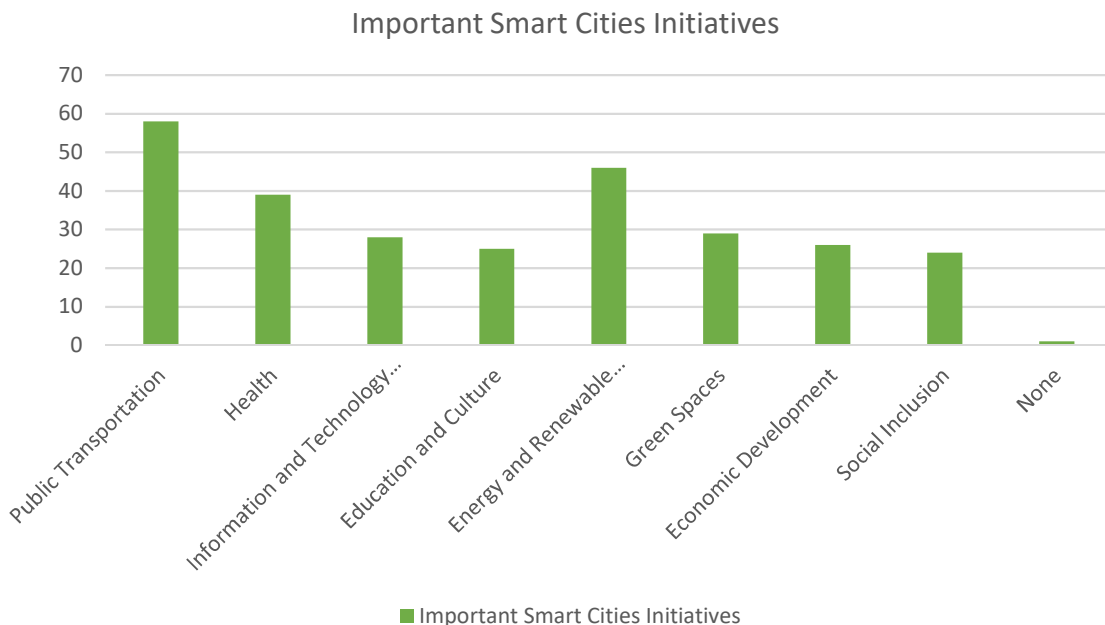


Figure 4.12 – Important smart cities initiatives for Lisbon municipality

The more important initiative, which Lisbon municipality should invest is directly related with one of the six characteristics to be a smart city – smart mobility. Public transportation in Lisbon should be

review, according with the citizens. Trains, trams, metro, and bus serve Lisbon public transportation. However, all of them have some debilities, for instance in metro and trains, there are a set of carriages who are damage, and because of that, there are less transportation during the working hours, not helping the citizens to move into the city. During the peak hours, in some metro stations, citizens cannot enter in the first metro, which appears because it is overcrowded. The same happens with the trains and with some bus routes. Directly linked with smart environment, it is the second most important initiative for Lisbon citizens, which is energy and renewable efficiency.

12. On a scale of 1 to 5, 1 being not important and 5 very important, please mention which smart initiatives you consider relevant.

One of the last questions was to evaluate a set of conditions in order to understand which initiatives are important or not for Lisbon citizens, in a scale of 1 to 5, where 1 means “not important” and 5 “very important”. Another answer option was “without opinion”.

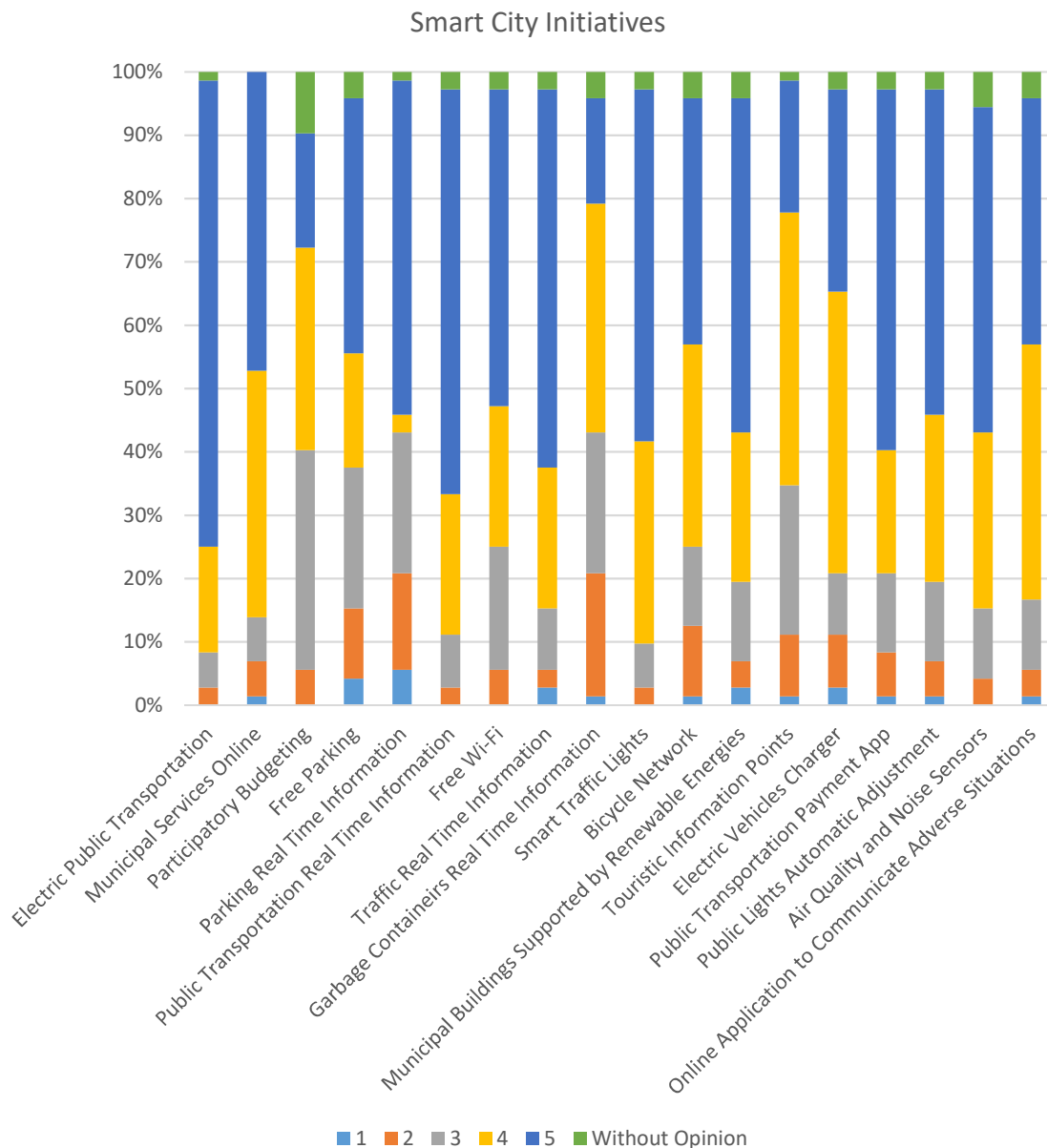


Figure 4.13 – Relevant smart cities initiatives for Lisbon municipality

According with Lisbon citizen's opinion, the most important conditions to be a Smart City are electric public transportation, parking real time information, public transportation real time information, free Wi-Fi, traffic real time information, smart traffic lights, municipal buildings supported by renewable energies, public transportation payment app, public lights automatic adjustment, air quality and noise sensors. As expected, those are the most important aspects for a city to be consider as smart. It is important to have a good mobility into the city, no matter, if there is by public transportation or by car, as well as, good and actual information to move into the city.

13. Is there any other initiative in the Smart Cities area that should be considered? If so, please refer it in the answer space and if it is important or not so important.

In this question, it was offered to the citizens the possibility to write initiatives, which were not mentioned in the questionnaire, but are also important to have a smart city. There was only 4 citizens who have answered this question:

- Census realization, in Lisbon municipality regarding the necessity of daily transports, since there is a supply of scarce demand;
- Knowledge of areas where it is possible to find homeless through an online website or application, in order, which if some citizens want, can help those homeless. Moreover, it was interesting to have more information for areas where it is possible to donate food and clothes to people with those needs;
- Cleaning the urban road, on a daily basis;
- Sensors on the road to have an idea of the state of it, as for instance, if there are few or mainly holes in the streets we are going to pass by, during our daily route.

4.5. DISCUSSION

In this chapter, it is going to be presented all the conclusions regarding the interview and the questionnaires results. The main goal is relate those with the conclusions from the bibliographic revision. It is possible to conclude that the citizen's knowledge regarding Smart City has a long journey to be a common and daily life concept into all the Lisbon citizens.

A definition for Smart City for Lisbon municipality is:

A Smart City is a city, which links the people with technologies, in order, to give to the citizens the best conditions to live in community and with a great level of communication between the municipalities and citizens; the transportation network is relevant, since the citizens use it to commute every day, linking also the technologies with the transportation.

Taking this definition and relate it with the questionnaires results it is possible to say that Lisbon is working to become a Smart City, but still, has a long journey. The creation of online applications to reduce the distance between citizens and the municipality, allowing the constant communication between all the stakeholders, is one of the examples to consider when we should take into account Lisbon municipality as smart city.

Based on the results of the interview and the questionnaire sent to Lisbon citizens, it is possible to confirm what was mentioned before, which is that Lisbon has a long journey to become a smart city.

Lisbon municipality reality and perception are very distant from each other. The first one, is that the municipality has a long journey to achieve the same level as Amsterdam, for instance, in order to be smart. However, the citizens have an important role in the cities and without the help of each one of them, it is difficult to achieve the goals for Lisbon municipality. Citizens have to learn with the municipality and vice-versa, adapting their life's with the changes applied and with the inclusion of the ITC in personal life's every single day.

Regarding the perception of what is a smart city and the initiatives created in Lisbon municipality, it is below the expectation. Citizens are not well informed about smart city initiatives in the municipality. According with the achieved results in the questionnaires, there are few citizens which have knowledge about what is a smart city, but they do not have the information about what is planned or what is done in Lisbon municipality. This situation, is due to, the lack of shared information regarding the initiatives planned. The communication between the municipality and the citizens should be improved in order to have citizens better informed about all the situations in the city.

5. CONCLUSION

5.1. SYNTHESIS OF THE DEVELOPED WORK

This dissertation goal was to help understand the concept of smart city in Lisbon municipality, the perception of citizens and the reality. To obtain the best outcomes, one interview was made to one of the responsible for smart cities initiatives in Lisbon and questionnaires through Lisbon citizens were developed, supported by a Case Study.

Based on the literature review, it is possible to accomplish that the smart city concept is growing fast and cities what to achieve this goal as soon as possible. However, being a smart city is not easy to put in practice as develop studies in the area.

The goals of this dissertation were achieved, based on the results and analysis known in chapter 4. A smart city concept for Lisbon municipality was done, as well as, an analysis of the actual and the future of smart city in Lisbon. With the help of the questionnaires made, it was possible to identify the level of knowledge regarding smart cities and what is the level of knowledge of initiatives in the same municipality.

5.2. LIMITATIONS AND FUTURE WORK

In this dissertation, the main limitation was because, the smart cities concept is extensive, covering many areas, and the number of questionnaires answers does not show in concrete the real perception of the Lisbon citizens. During the interview, given the freedom to the interviewee's answers, some of them came out of context and some of them needed to be adapted to the interview design questions.

For future work, this dissertation could be the basis to be extended to other cities in Portugal, to have a general overview of a set of Portuguese cities, which are working to be considered smart. Furthermore, if the questionnaires were not anonymous, this dissertation could be repeated in the next two to five years to the same sample, in order, to understand if the knowledge level and perception of the Lisbon citizens improved in this area or stayed exactly the same. The same could be done with the interview to the Lisbon municipality in the innovation area.

BIBLIOGRAPHY

- Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology* 22(1), 3-21.
- AML. (2017). Obtido de AML: <https://www.aml.pt/index.php>
- Bakici, T., Almirall, E., & Wareham, J. (2013). A Smart City Initiative: the Case of Barcelona. *Journal of the Knowledge Economy*, 135-148.
- Bodgan, R., & Biklen, S. (1994). *Investigação qualitativa em educação*. Porto Editora.
- Bosch, P., Jongeneel, S., Rovers, V., Neumann, H.-M., Airaksinen, M., & Huovila, A. (2017). *CITYkeys indicators for smart city projects and smart cities*.
- Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, Vol 9, 27-40.
- Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart Cities in Europe. *Journal of Urban Technology*, 45-59.
- Câmara Municipal de Lisboa Web Site*. (2018). Retrieved from <http://www.cm-lisboa.pt/municipio/demografia>
- Chen, T. (2010). Smart Grids, Smart Cities Need Better Networks. *IEEE Network*, 2-3.
- Cretu, L.-G. (2012). Smart Cities Design using Event-driven Paradigm and Semantic Web. *Informatica Economica* 16(4), 57-67.
- Dameri, R. (2013). Searching for Smart City definition: a comprehensive proposal. *International Journal of Computers & Technology*, 11(5), 2544-2551.
- DNA Cascais*. (s.d.). Obtido de <http://www.dnacascais.pt/en/about-dna-cascais/>
- Giffinder, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., & Meijers, E. (2007). Smart Cities - Ranking of European Medium-Sized Cities. *Vienna: University of Technology*, 1-26.
- Giffinder, R., Kramar, H., Haindlmaier, G., & Strohnmayr, F. (2015). *European Smart Cities*. Obtido de <http://www.smart-cities.eu>: <http://www.smart-cities.eu>
- Hall, R. (2000). The Vision of a Smart City. *2nd International Life Extension Technology Workshop*, (pp. 1-6). Paris, France.
- Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszcak, J., & Williams, P. (2010). Foundations for Smarter Cities. *IBM Journal of Research and Development* 54(4), 1-6.
- INE, & Pordata. (16 de junho de 2016). *Pordata*. Obtido de <http://www.pordata.pt>: <http://www.pordata.pt/Municipios/Popula%C3%A7%C3%A3o+residente+total+e+por+grandes+grupos+et%C3%A1rios-390>
- INTELI*. (s.d.). Obtido de <http://www.inteli.pt/pt>
- INTELI. (2016). *Smart City Index Portugal*.
- INTELI. (s.d.). *INTELI*. Obtido de INTELI: <http://www.inteli.pt/pt/go/missao>

- Kumar, T. V., & Dahiya, B. (2017). Smart Economy in Smart Cities. Em T. V. Kumar, *Smart Economy in Smart Cities* (pp. 3-76). Singapore: Springer Nature Singapore Pte Ltd. 2017.
- Lane, D. M., Scott, D., Hebl, M., Guerra, R., Osherson, D., & Zimmer, H. (s.d.). *Introduction to Statistics. Lisboa Inteligente*. (2018). Retrieved from Lisboa Inteligente: <https://lisboainteligente.cm-lisboa.pt/>
- Lisboa Participa*. (n.d.). Retrieved from <https://www.lisboaparticipa.pt/>: <https://www.lisboaparticipa.pt/>
- Ludke, M., & André, M. (1986). *Pesquisa em educação: abordagens qualitativas*. EPU.
- Mathers, N., Fox, N., & Hunn, A. (2007). *Surveys and Questionnaires*.
- Neirotti, P., De Marco, A., Cagliano, A., Mangano, G., & Scorrano, F. (2014). Current trends in Smart City initiatives: Some Stylised facts. *Elsevier*, 25-36.
- Rios, P. (2012). *Creating "The Smart City"*. Detroit.
- Seixal, C. M. (s.d.). *CM Seixal*. Obtido de CM Seixal: <http://www.cm-seixal.pt/seixal-smart-cities/seixal-smart-cities>
- Su, K., Li, J., & Fu, H. (2011). Smart City and the Applications. *IEEE International Conference on Electronics, Communication and Control (ICECC)*, 1028-1031.
- Toppeta, D. (2010). The Smart City vision: How Innovation and ICT can build smart, "liveable", sustainable cities. *Think!*, 1-9.
- United Nations*. (2005). Obtido de <https://unstats.un.org/>: https://unstats.un.org/unsd/demographic/sconcerns/densurb/Defintion_of%20Urban.pdf
- Washburn, D., & Sindhy, U. (2010). Helping CIOs Understand "Smart City" Initiatives. *Forrester*, 1-15.
- World Resources Institute*. (2009). Obtido de <http://www.wri.org/>: <https://docs.google.com/spreadsheets/d/1CN5n085EWsxIKnJBvgGiGFZHtfl-WUCeGyaLehEPIOQ/edit#gid=0>
- Yin, R. K. (1984). *Case Study Research: Design and Methods*. Sage Publications.

ANNEXES

Smart Cities no concelho de Lisboa

Sou aluna da NOVA IMS a completar o mestrado de Gestão do Conhecimento e Business Intelligence.

Este questionário destina-se a todos os cidadãos que vivem no concelho de Lisboa e tem como objetivo compreender se os concelhos podem ser considerados ou não inteligentes com base num conjunto de fatores.

Este questionário não tem respostas corretas ou erradas e é totalmente anónimo.

1. Reside no concelho de Lisboa? *

Sim

Não

2. Género *

Feminino

Masculino

3. Faixa Etária *

Menos de 18 anos

18 - 24 anos

25 - 39 anos

40 - 59 anos

60 anos ou mais

4. Estado Civil *

Solteiro

Casado

Viúvo

Divorciado

Outro

5. Escolaridade *

- Sem nível de escolaridade
- Básico
- Secundário
- Licenciatura
- Mestrado
- Doutoramento
- Outro

6. Já ouviu falar sobre o conceito de Smart City? *

- Sim
- Não

7. Qual o seu grau de conhecimento relativamente ao tema Smart Cities? *

| | | | | | | | | | | | |
|------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Desconheço | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Conheço bastante bem |

8. Na sua opinião, qual o nível de importância do tema Smart Cities no concelho de Lisboa? *

| | | | | | | | | | | | |
|---------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Nenhuma importância | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Bastante importante |

9. Na sua opinião, o concelho de Lisboa, tem efetuado algumas iniciativas na área de Smart Cities? *

- Sim
- Não
- Desconheço

10. Refira as iniciativas na área de Smart Cities, por parte do município de Lisboa: *

- Mobilidade
- Saúde
- Cultura e Educação
- Eficiência Energética e Renovável
- Tecnologias de Informação e Comunicação
- Desenvolvimento Económico
- Espaços Verdes
- Inclusão Social
- Desconheço

11. Refira as iniciativas na área de Smart Cities, que considera que o município de Lisboa deveria investir: *

- Transportes
- Saúde
- Cultura e Educação
- Eficiência Energética e Renovável
- Tecnologias de Informação e Comunicação
- Desenvolvimento Económico
- Espaços Verdes
- Inclusão Social
- Nenhuma área

12. Numa escala de 1 a 5, sendo que 1 é pouco importante e 5 muito importante, refira quais as iniciativas de Smart Cities que considera relevantes:

*

Escolha apenas uma opção por linha

| | 1 - Pouco importante | 2 | 3 | 4 | 5 - Muito importante | Sem opinião |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Rede de transportes públicos elétricos | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Serviços municipais online | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Orçamento participativo | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Estacionamento grátis | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Informação em tempo real sobre a disponibilidade de lugares de estacionamento, tanto através de uma aplicação móvel bem como em pontos espalhados pela cidade | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Informação em tempo real sobre a ocupação dos transportes públicos, através de uma aplicação móvel bem como em pontos espalhados pela cidade | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Acesso gratuito a redes Wi-Fi | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Informação em tempo real sobre o trânsito, através de aplicações móveis bem como de pontos espalhados pela cidade | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Informação em tempo real sobre o nível de ocupação dos contentores de resíduos, através de uma aplicação online bem como em vários pontos espalhados pela cidade | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Gestão inteligente dos semáforos de trânsito e dos peões | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Rede de bicicletas espalhadas pelo concelho para utilização | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Edifícios municipais sustentados por energias renováveis | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Pontos de informação turísticos, espalhados pela cidade ou podendo ser acedidos a partir de uma aplicação móvel | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Locais para carregar veículos elétricos | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Pagamento de todos os transportes públicos através de uma aplicação móvel única | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

| | | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Adaptação da intensidade da iluminação pública conforme as necessidades | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Sensores de qualidade do ar, ruído e outros agentes poluidores | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Criação de uma aplicação móvel para comunicar incidentes encontrados pelos cidadãos diretamente aos municípios | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

13. Existe mais alguma iniciativa na área de Smart Cities que deveria ser considerada? Se sim, refira a mesma no espaço de resposta e se é pouco ou muito importante.

Texto de resposta longa

Obrigada!

O seu contributo foi bastante útil para a realização deste estudo.