ISCTE Business School
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MODEL OF EVALUATION OF PERFORMANCE TO PORTUGUESE CITIES

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ANDRE FILIPE CARDEAL SANTOS

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The best way to predict the future is to create it.

Peter Drucker

Abstract

Sustainability is a deep concern to governance entities worldwide. Governments and NGOs are working together in politics and policies to pursue this global objective. In particular UN, with several goals defined through the last decades, assume a leading role within this topic. To achieve the targets defined, diverse strategies and frameworks came up. As backbone of these strategies arose the Indicators. It enables a periodic measure and allows a process of continuous monitoring. The ISO37120 set of indicators, for certain characteristics, stands out between its contenders. During this thesis, its intended to explore this standard. Through a critical analysis developed with inputs of a specialist, ISO37120 characteristics, advantages and disadvantages are examined. This work is sustained on a *double-face* characteristic of the standard: its global application. After this work, the objective is to show that it is possible to develop a model, based on ISO37120, specifically for the municipalities in Portugal. In that way, Portuguese cities were stratified by population density and, through a survey, selected which categories were considered more relevant for the assessment, according citizens point of view of their municipalities' particular context. Once collecting all the answer, a correlation analysis is done, to comprehend which Indicator has more influence on the overall classification of the category.

This analysis was done taking into account the sample results, that in turn, facing its dimension, cannot be extrapolated to the overall population. Despite that, this model presents itself as a preliminary study about the subject.

Keywords: Sustainability, Population Growth, Sustainable Development Goals, Standardization, Indicators, Municipalities

JEL Classification:

Q010: Sustainable Development, Sustainable Governance, Sustainable Growth, Sustainable Regional Development

Q560: Environment and Development; Environment and Trade; Sustainability; Environmental Accounts and Accounting; Environmental Equity; Population Growth

Resumo

A Sustentabilidade é uma preocupação real para as entidades governamentais de todo o mundo. Governos e ONGs trabalham em conjunto no desenvolvimento de políticas que ambicionam este objetivo global. A ONU, em particular, com vários objetivos definidos nas últimas décadas, assume um papel de liderança neste tópico. Para atingir as metas definidas, surgiram diversas estratégias e frameworks. Na base dessas estratégias estão os Indicadores, que permitem uma medição periódica através de um processo de monitorização contínua. O conjunto de indicadores ISO37120 destaca-se de entre seus concorrentes e, ao longo desta tese, pretende-se explorar esta norma. Através de uma análise crítica desenvolvida com contribuições de um especialista, são abordadas as características, prós e contras. A base deste trabalho é uma característica de dupla face da norma: é globalmente aplicável. Após este trabalho, pretende-se mostrar que é possível desenvolver um modelo, baseado na ISO37120, especificamente para os municípios portugueses. Para tal, estratificaram-se as cidades portuguesas por densidade populacional e, através de um questionário, analisou-se quais as categorias consideradas mais relevantes para a avaliação, do ponto de vista dos cidadãos, no contexto particular dos seus municípios. Depois de recolher todas as respostas, elaborou-se uma análise de correlação para compreender qual o indicador tem mais influência na classificação geral da categoria.

Esta análise foi realizada com base nos resultados da amostra que, por sua vez, perante a sua dimensão, não podem ser extrapolados para a população em geral. Apesar disso, o modelo apresenta-se como um estudo preliminar sobre o tema.

Palavras-chave: Sustentabilidade, Crescimento Populacional, Objetivos de Desenvolvimento Sustentável, Padronização, Indicadores, Municípios

Classificação JEL:

Q010: Desenvolvimento Sustentável, Governo Sustentável, Crescimento Sustentável, Desenvolvimento Regional Sustentável

Q560: Meio Ambiente e Desenvolvimento; Meio Ambiente e Comércio; Sustentabilidade; Contas e Contabilidade Ambiental; Equidade Ambiental; Crescimento populacional

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1. Introduction

Migration phenomena is deeply involved in society development. Probing for better conditions has been considered the original trigger, but other external factors promote several changes in the root cause of this practice. During the 18th century, Europe faced Industrial Revolution and, from that moment on, Migration increase to numbers never seen before. That was the turning point of an important social phenomenon, and since then the numbers are growing exponentially.

By the year of 1950, there was about 750Mi people living in the urban areas and today this number extraordinarily reach 4.1Bi. Facing this, urban cities had to change their governance, organization and policies to host more 3.5Bi people in less than 70 years. Cities had to reinvent themselves to answer this challenge considering the fact that this number never stops (Ritchie & Roser, 2018).

Society evolves, and cities must follow that growth. Its needs are not stable as it changes through time. Our grandparents did not had electricity in their house; thus, their main need was to get it. Today, the millennial generation knows the possibility of running out of potable water 100 year, thus the main need is to save it to future generations and work on parallel solutions. City mayors and/or administrators must be able to understand those needs and prepare a bearable response to it. This challenge is very complex once society is an open system influenced by internal factors such laws and policies, and external such, for instance, economic crisis, natural disasters or new scientific discoveries.

During the second half of the 20th century some scientists, politicians and other personalities start to raise a flag about an issue called *sustainability* and thinking about the future of Earth. By the year of 1987, the UN request to the World Commission on Environment and Development a *global agenda for change*, asking for new strategies to sustainable development, ways of co-operation between country's to achieve common objectives, ways and means to deal more effectively with environmental concerns and to help defining shared perceptions of environmental issues and the efforts needed to successfully deal with it. It was a long-term agenda and outline ambitious goals to world population (World Commission on Environment and Development, 1987). Was an extensive report where the *sustainable development* topic was finally discussed and defined as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission

on Environment and Development, 1987). As conclusions, the authors of the also called Brundtland Report state that they were *"unanimous in our conviction that the security, well-being, and very survival of the planet depend on (…) changes, now"* (World Commission on Environment and Development, 1987).

Back to 21st century, these concerns are present in our quotidian. Today there are already some strategies taught in schools and well established in society that aim sustainable development. From the simple ones as recycling, to scientific complexity such renewable energy sources, world community is doing this path. These strategies were designed because issues were analysed, and it was concluded that We were going in the wrong direction and must do something to mitigate that.

In 2015, the United Nations define 17 Goals to Sustainable Development, which focus our biggest challenges today, such those associated with poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. The Goal number 11 focuses precisely in cities sustainable development, arguing that *efficient urban planning and management practices are in place to deal with the challenges brought by urbanization*. At the same time, the International Standards Organization, ISO, developed a global framework with 100 indicators to help cities to analyse their situation and compare with others to, eventually, improve their status.

Both of these initiatives are a tremendous incentive to municipalities draw their path to sustainable development.

This project starts with a set of questions related to performance and smart cities. This set of questions made me start looking and searching for literature in that direction.

To clarify a set of concepts, web of science was used and, the search, focus on key words and expressions such *smart cities, performance evaluation, smartness, big data in cities* and/or *cities evolution.* At the end of this first search, peer-reviewed journal articles and papers were selected, to analyse and investigate. High percentage of these articles addressed the concepts and the influence of IoT (Internet of Things) in the existence of *smart cities*. Despite understanding its importance, that was not the project subject that was delineated for the thesis, and so, it was decided to go further and searching for topics such *sustainability, governance* and *sustainable development.* Quickly, the research hit papers where the centre of discussion was the ISO 37120 and sustainability. Ever since that moment, the research started to be more incisive and the models of ISO and 2030 Agenda came up as baseline to this dissertation.

Thus, with the subjects more structured, each of the models were analysed and concluded that those were related, as the ISO standard contributes to Sustainable Development Goals of UN. Both models were developed to provide monitoring, consulting and evaluation parameters of public services, to promote sustainable growth in a homogeneous way (Moschen, Macke, Bebber, & Benetti Correa da Silva, 2019). And so, ISO 37120 starts to be deeply analysed on the literature, to comprehend this standard purpose, evolution, dimensions and gaps.

1.1. Objectives & Research Questions

This dissertation will focus on the global goal of Sustainable Development. The main objective of this thesis is to propose a model to evaluate the performance, in terms of sustainability and quality of life, explicitly to Portuguese municipalities. The main questions that this thesis aims to answer are:

1. ***Is it possible to adapt ISO37120 into Portuguese municipalities?***
2. ***Are Sustainability and quality of life requirements different within Portuguese municipalities?***
3. ***How can a framework of indicators help Portuguese municipalities reach 2030 Agenda targets?***

During this thesis, these questions will be addressed. Based on the Literature and in the methodology used throughout this work, Discussion and Conclusion sections will elucidate the importance of these topics.
To reach the defined objective, these questions are essential and must be fulfilled.

2. Literature Review

2.1.Sustainable Development

The first sustainability idea emerged by the hand of a German forester called Hans Carl von Carlowitz, when in his book titled *Sylvicultura Oeconomica* formulated the idea of sustainable use of forests (Carlowitz, 1713). The book was published in 1713 when Europe faces the need for vast quantities of wood and forests progressively become deforested. Von Carlowitz suggests the conservation and planting of trees, to reduce the risks of people suffer great difficulties. Forests management, in von Carlowitz idea, should contribute to its sustainability, by getting the most significant harvest without overexploiting it, guaranteeing its regeneration (Carlowitz, 1713)(Turcu, 2013).

Through the years, despite the comprehensive definitions along with the literature, Sustainability and Sustainable Development have not a specific and unambiguous definition. In many definitions, there are different approaches to goals, strategies or methods (Schaltegger, Hansen, & Spitzeck, 2016). Nevertheless, the definition of von Carlowitz (1713) was the kick-off for many other authors to give their inputs and to spread the ideal of Sustainability (World Ocean Review, 2015).

Already in the ‘80s, WCDE becomes the first institution to defines Sustainable Development globally. The Brundtland Commission, in 1987, define it as the *development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (World Commission on Environment and Development, 1987). This definition is built under two key concepts: *needs*, which manly refers to the poor around the world and who needs should be a priority; And, the idea of limitations imposed by technology and social structure on the environment's. Environment and Development are the main concerns, being Sustainable Development an effort to link both economic progress and environment stability while a long-term value of the environment is guaranteed. Herewith, the Brundtland Report was unique in the literature, once it addressed the need for economic development without compromising natural resources. Dernbach (2003), based on the previous definition, argues that Sustainable Development protects and restores the environment, rather than damages or pollutes it. The idea of Sustainable Development address the global environmental degradation and global poverty, without harm economic development, social well-being, peace and security - similarly to the definition from the Brundtland Report - is also defended by the author (Dernbach, 2003).

The meeting following the General Assembly of 1987, was the conference known by *Earth Summit* (United Nations Conference on Environment and Development), in Rio de Janeiro 1992. The principal purpose of holding this conference was that Sustainability was too complicated for each of the member states face it individually. Therefore, the Earth Summit was the table for all member states, to share knowledge and to collaborate with each other. As outcomes, some significant documents with a common target – achieve Sustainable Development – were developed. A political declaration of principle to environment and development - *Rio Declaration on Environment and Development*; An action plan to implement Sustainable Development - *Agenda 21*; and a document with recommendations for preservation and sustainable development in forests - *Forrest Principles.*

To monitor the outcomes of the Earth Summit, the UN create a department dedicated to Sustainable Development. The UN Commission on Sustainable Development (CSD) was officially established in December 1992, as a functional commission of the UN Economic and Social Council. It was the entity responsible for promoting and overseeing the outcomes of Rio Conference - CSD (United Nations Commission on Sustainable Development, 2019).

After all debates, a complete definition of Sustainable Development emerged. Was delineated that the concept of Sustainable Development considers three base pillars - which are economic, social and environmental – as well as the interlinkages between them. These three dimensions are intrinsically related, in such a way that the progress of Sustainable Development depends on the development of each dimension independently, and on the development generated collectively (Forum & Secretariat, 2011).

2.1.1. Sustainable Development by the United Nations

This thematic is a deep concern for the United Nations. Since the 1990s, the path has been mapped, and objectives were defined, aiming sustainable development worldwide. See, below, the main events and outcomes since the 90s until today:

Table 1 - Sustainable Development main events by UN

Event	Main Outcomes	Description
1992 **Earth Summit** R.J, Brazil.	Agenda 21	Agenda 21 was adopted by around 180 countries It comprehends a global plan of action, undertaken by governments and big institutions. Following the conference, the UN created the Commission on Sustainable Development (CSD) – to monitoring and controlled the

		implementation of the actions stated on the Agenda.
2000 **Millennium Summit** NY, USA	Millennium Declaration: Millennium Development Goals (MDGs)	Millennium Summit in NY, Millennium Development Goals were elaborated. It is main objective was to reduce poverty worldwide within by the year of 2015.
2002 **World Summit on S.D.** South Africa	Johannesburg Declaration on Sustainable Development and the Plan of Implementation	It was adopted at the World Summit on Sustainable Development in South Africa and endorsed the global commitments to poverty eradication and the environment. It was built on Agenda 21 and the Millennium Declaration by including more emphasis on multilateral partnerships
2012 **UNCSD (Rio 20)** R.J, Brazil.	"The Future We Want"	This document was adopted by members of the UN. Here they decided, to introduce a process to develop a set of SDGs to build upon the MDGs. On the forum, the UN also establish the UN High-level Political Forum on Sustainable Development. It also contained other measures for implementing SD, including obligations for future programmes of work.
2013 **Open Working Group** General Assembly	-	Open Working Group to develop a proposal on the SDGs.
2015 **Sendai Framework for Disaster Risk Reduction**	-	Based on the previous Hyogo Framework, it defines feasible goals and a framework for disaster risk reduction. Climate change adaption and disaster risk reduction were two dimensions highlighted by UN members;
2015 **Addis Ababa Action Agenda on Financing for Development**	-	This framework aims to align financing flows and policies with economic, social, and environmental priorities
2015 **Paris Agreement on Climate Change**	-	The first world's extensive climate agreement. The main goal assents to decrease global warming by the reduction of greenhouse gas emissions and increases the usage of renewable energy and energy efficiency. Its long-term goal is to reduce the increase of global average temperature and limit it to 1.5 ºC, once it reduces the risks and effects of climate change;

2015 **Transforming our world: the 2030 Agenda for Sustainable Development**	-	Adopted at the UNSDS in New York, it describes the 17 Sustainable Development Goals,

2.1.2. Since *Habitat Agenda* to SDGs

United Nations Agency for Human Settlements – UN-HABITAT - section was created after the Habitat I Conference, in Vancouver 1978, where the main concern was to prevent issues promoted by rapid urban growth worldwide. Following this, during the late 80s, Indicators start to be used in a collective form when UN-HABITAT start to help countries and cities to collect and apply indicators data using *Housing Indicators Programme* (United Nations Human Settlements Programme, 2004). This framework focuses mainly on housing issues and aspires to help defining policies who face those problems (Flood, 1997).

The success of the project led to its improvement and orientation to other assignments, such as sustainable urban development, and, in preparation to the Habitat II Conference, in Istanbul, the *Urban Indicators Programme* (1993) was developed, having a strong focus on urban issues and concerns. This framework, *per si*, was conceptualized to collect essential data on cities aiming the monitoring of its performance (Flood, 1997). Hence, during the conference in Istanbul, in 1996, a large number of stakeholders evolving representatives of high-level governments, personalities from the private sector, NGOs, media, researchers and academics, discuss universal goals such human shelter, healthier and safe cities, anticipating the new millennium changes. Its main outcome was named *Habitat Agenda,* a statement where the need to improve the quality of human settlements to instigate well-being and quality of life is highlighted, and that defined commitments and recommendations to countries worldwide (United Nations Human Settlements Programme, 2004).

UN-HABITAT was responsible for monitoring the progress of the Agenda implementation, and, to report trends worldwide. To achieve that, developed a system of indicators composed of 20 key indicators and nine qualitative subsets, which were the minimum required to accomplish those commitments defined (United Nations Human Settlements Programme, 2004).

2.1.3. Millennium Sustainable Development Goals (MDGs)

MDGs were the principle outcome of the Millennium Summit in 2000, which take place in New York. The Summit was the result of previous meetings with participation of a thousand ONGs from worldwide. During this meeting, the forum approached several issues such as poverty eradication, environmental protection, human rights and protection of the vulnerable and, as a consequence of the discussions, in the Millennium Summit Declaration was established.

MDGs represent a global partnership commitment. As all people share the same principles of dignity, equity and equality, global leaders have the responsibility to sustain and improve. In particular, Leaders had an obligation to all humans and especially to future generations. (United Nations, 2000). Globalization as a particular focus in the MSGs. Facing this phenomenon, the UN had to guarantee that it takes a positive impact on everyone's life. Although it provides great opportunities, costs and benefits are unevenly distributed, where countries, in developing and *third world countries* face serious difficulties under this circumstance. On the other hand, established countries, had more flexibility and are well structured, conditions that facilitate the process.

Therefore, policies and measures must be developed to help the *vulnerable* countries, allow them to participate and cooperate to a shared future. Through this plan, globalization is moving toward a fully inclusive and equitable scenario. The policies and measures were formulated and implemented with the inputs of every countries, despite its conditions. For this cooperation, the UN enumerate some values which consider being vital for international relations in the 21st century: **Freedom, Equality, Equality, Solidarity, Tolerance, Respect for Nature and Shared Responsibility.** (United Nations, 2000)

Figure 1- MDGs by UN
(source United Nations)

2.1.4. Transforming our world: the 2030 Agenda for Sustainable Development

2030 Agenda focuses on actions oriented to people, to the planet and to reach prosperity. It is a *guide* to achieve Sustainable Development, where the principal requirement is to eradicate poverty, in any dimension of the concept (United Nations, 2015).

Towards the path of the world, the UN define these steps to change into a sustainable and a resilient direction. To achieve it, partnerships and collaboration between all stakeholders are the keys.

The Agenda aims to achieve Sustainable Development in a balanced and integrated way through three main dimensions: economic, social and environmental. For that, there are 17 SDGs defined, with 169 targets segregated through those three (United Nations, 2015).

This plan is a re-form of Millennium Development Goals. Facing a new reality, new issues and new subjects appear. Consequently, MDGs become outdated. By adding new goals and targets the Agenda fulfil that gap, being a direct evolution of the MDGs (Woodbridge, 2015).

The SDGs are centred and concerned with fives "P's": **People –** To end poverty and hunger and provide to humans' tools to have a life with dignity, equity in a healthy environment; **Planet –** Protect the earth from degradation, through efficient consumption and production, as a sustainable managing of natural resources, supporting the needs of our generation and the future ones; **Prosperity** – A prosperous life, with economic, social and technological progress; **Peace –** Promote peaceful, inclusive societies without fear and/or violence; **Partnership –** Global solidarity focus on particular needs, is the required attitude (United Nations, 2015).

Based on these five concepts, worldwide leaders worked together, as a team, to develop a universal policies agenda and draw a path to SD. These policies were created to be universally applicable, despite the technological, economic or social level, where Governments define how to incorporate global goals and targets within their country strategies.

The 17 Sustainable Development Goals are:

1. *End poverty in all its forms everywhere;*
2. *End hunger, achieve food security and improved nutrition and promote sustainable agriculture;*
3. *Ensure healthy lives and promote wellbeing for all at all ages;*
4. *Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all;*

5. *Achieve gender equality and empower all women and girls;*
6. *Ensure availability and sustainable management of water and sanitation for all;*
7. *Ensure access to affordable, reliable, sustainable and modern energy for all;*
8. *Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;*
9. *Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;*
10. *Reduce inequality within and among countries;*
11. *Make cities and human settlements inclusive, safe, resilient and sustainable;*
12. *Ensure sustainable consumption and production patterns;*
13. *Take urgent action to combat climate change and its impacts;*
14. *Conserve and sustainably use the oceans, seas and marine resources for sustainable development;*
15. *Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss;*
16. *Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels;*
17. *Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development*.

    (United Nations, 2015)

Figure 2 - SDGs by UN
(Source United Nations)

2.2.Cities

Cities play an important and unique role in people's life, and urbanization has a tremendous impact on the world economy. About 80% of the global gross domestic product is generated in cities. In terms of population, World Bank data estimates that today over 4Bi people lives in cities, which represents more than half of the earth population. This trend will continue to grow and, by 2050, it is predicted that the urban population will double and 7 out of 10 people will live in cities (Ritchie & Roser, 2018).

In this context, world city leaders must be able to strategically plan cities path to a sustainable direction, to provide services, infrastructure, houses and green areas, ensuring the quality of life to their citizens.

With this emphasis, urban cities, if well managed, may contribute to global sustainable growth. Nevertheless, facing this fast-growing of population, urbanization also brings challenges, and if the leaders are not aware, it could be catastrophic. Those mentioned above - services, infrastructures, houses and green areas – and others such jobs, health care or education, can be part of the solution if well managed, or part of the problem, if not considered. Climate, *per si*, is a field where urban cities contribute most worldwide, which is not positive. More than 70% of global greenhouse gas emissions came from it, being consumed 2/3 of the entire world energy. This increases the climate risk and makes cities more vulnerable to environmental disasters such as storms or increased sea level.

To protect and guarantee the future of communities, governments must take steps to promote and disseminate well-being and quality of life. These actions should lead the city to become more inclusive, secure and resilient, following the path of sustainability.

The phenomenon of rapid urbanization is a serious matter in urban cities. Monitoring cities performance on sustainability become highly significant. It is the only way to understand the as-is state and take the actions needed to reach the primary goal.

2.3. Population and Population Density

The UN (2019) project that by 2050 the world population reaches 9.7Bi people. A 26% increase in today's population (UN DESA, 2019). It brings serious concerns in terms of sustainability and to SDGs.

In terms of global trends, the decrease of mortality rate and increase of fertility rates, increase in food production which nourishes the population, and the increase of urbanization and migration, are promoting this population growth (UN DESA, 2019).

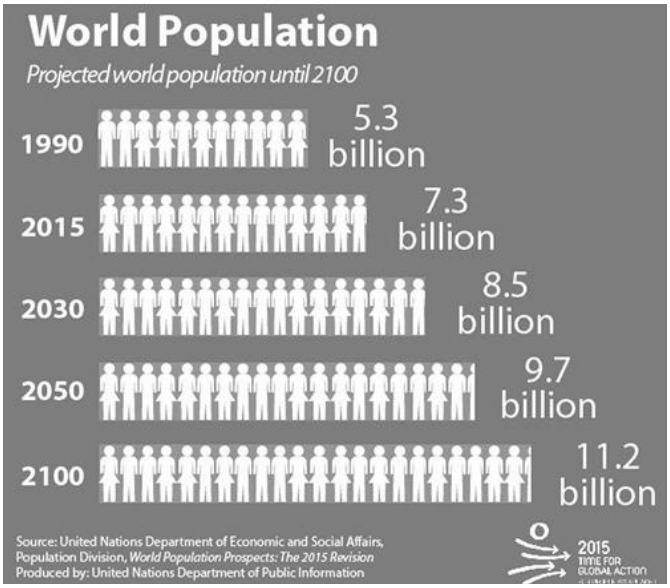

Figure 3 - Population growth by UN (Source United Nations)

For Biology, *population* refers to the total number of organisms living in the same area (Biology Dictionary, n.d.). *Population Biology* studies the characteristics, size and distribution of population, as well as how it is influenced (Biology Dictionary, n.d.). A key measure on this field is population density, once it gave a unique vision about the relation population/space (Weinstein, Boulder, & York, 2015).

$$Density = Quantity \div Area$$

Density is the distribution of a quantity per unit of space or the number of individuals per unit area (Khan Academy, n.d.). For instance, for Portugal, the Population density is 111,7 inhabitants per kilometre square, in average (see figure below). For the UK, it is about 279,1 (UN DESA, 2019). The country with the highest population density rate is Macau, with 21419,59 inhabitants per km2 (UN DESA, 2019).

This measure allows the comparison between geographic areas. It reflects many aspects of the urban system, so much that it is a relevant input of city planning policies, being considered by

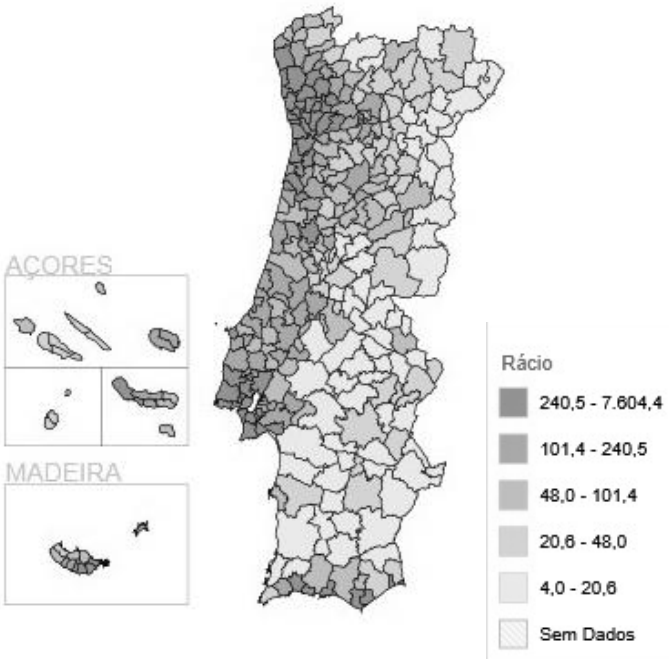

Figure 4 - Population Density in Portugal, by municipalities (2018) (source Pordata)

literature as on policy making tool to decision makers (Millward, 2008) (Ehrlich, Kemper, Pesaresi, & Corbane, 2018).

With population density, governments can understand the intensity and the distribution of population and the level of urbanization (Ramírez-Aguilar & Lucas Souza, 2019), once it is an element of urban form (Jenks & Jones, 2010). Predictably, municipalities that are urban centres with high levels of employment, diversified commerce and industry, and tendentially with high road traffic, are considered high densely municipalities.

Urban Planners see population density as an opportunity (Urban Hub, 2016) to better understand and to define population needs. Millward (2008), share the same idea, and argues that to assess of the intensity of residential development it is the right measure. Although, it is important to mention that Density is more useful to small areas, instead of big regions or countries (Rosenberg, 2019).

It is a measure that is used to several purposes and to understand specific phenomena's (Weinstein et al., 2015). It is possible to assess different types of density by using specific types of individuals/populations. Weinstein and Pillai (2015) also argue that it is possible to assess, for instance, the density of ethnic groups, races, families living in poverty, and much more. Following this idea, Ehrlich, Kemper, *et al.*, (2018) claim that with population density it is possible to quantify the spatial extent of human presence and it is used to evaluate social impacts on climate issues, both on local or global scale. Ehrlich, Kemper, *et al.*, (2018) also add that this measure combined with other variables/indicators might bring interesting results. For

instance, by crossing information of people living in poverty and population density it is possible to assess the exposure of people to that risk.
To the SDGs, population density play an important role. For some of those, is required the definition of the urban areas, and therefore, population density is the primary measure. As SGDs are all about monitoring, this assessment is used over time in distinct goals defined on SDGs (Ehrlich et al., 2018).

2.4. Indicators

According to Cambridge Academic Content Dictionary, the noun *Indicator* means "*something that shows what a situation is like*", and on the economic and finance field, "*something that shows what a situation is like or how it is changing".* In this way, the OECD states that an indicator *"is a quantitative or a qualitative measure derived from a series of observed facts that can reveal relative positions in a given area"*. Thus, to define the *as is* state, the use of Indicators it is the natural process. When evaluated at regular intervals, it can point out the direction of change across different units and through time, identify trends and outliers, and be very helpful to benchmarking and monitor performance. Once knowing the as is state, it is possible to identify *where* to go – targets – and by policies and strategies move in that direction.

For cities, to monitor their performance in a wide range of fields, it is particularly important. By the earlier 20th century, governments use most economical and social indicators to assess performance. Unemployment Rate, GDP (gross domestic product), GNP (gross national product), Balance Sheets or Inflation, are examples of Indicators that have been used by governments to assess their cities or countries. Although, some global events that occur had a great impact on many grounds, and the need expanding the assessment fields emerged. World War II is the turning point, where some international groups such World Health Organization (WHO), the OECD and UN start to track the cities and nations performance in the various campus. Health, Economic and Social issues and phenomena start to be measured and collated to assess productivity and performance.

Since the 90s, this concern for monitoring has proliferated to other sectors such as public administration and services – as education or public health. Also, the measurement of cities *character*, with characteristics as competitiveness, quality of life and well-being being considered, monitored and evaluated.

In this way, governments can assess cities corner to corner, defining their strengths and weaknesses, and finding their opportunities and threats. By the end of the day, with the help of indicators, municipalities were able to assess their performance, study trends and monitoring their improvements on the various dimensions and use all the conclusions to make decisions and communicate the accomplishments to all the stakeholders (Singh, Murty, Gupta, & Dikshit, 2012). Indicator points to the right direction and the right attitude should be *No policies without indicators, no indicators without policies* (Flood, 1997). Indicators and policies, to be efficient and effective, should, and must, have a parallel evolution (Flood, 1997).

2.4.1. Framework of Indicators – ISO

International Organization for Standardization is an NGO based in Geneva who promotes standards worldwide. Fields as Technology, Agriculture and Healthcare are covered and normalized by ISO standards through specification for products, services and systems.

At present, ISO has members from 161 countries, 245 technical committees and several subcommittees responsible for developing the standards, and at the moment more than 22.000 International Standards and documents were published, covering almost features of technology and manufacturing processes (ISO, n.d.-a).

International Standards guarantee an excellent level for products and services. For consumers, it ensures products safety and good quality, being ISO a stamp of quality assurance certificate. On the other side, for companies, it helps to minimize waste and to increase productivity. Furthermore, ISO is the bridge to entering new markets and to act globally (ISO, n.d.-a).

The process for developing ISO Standards is triggered by need. If a market needs, people who will be impacted and will use it is engaged in the process of creation. Their level of expertise will help to develop the standard. It is an interrelation between the 161 national standards bodies, the Experts and the Central Secretariat, which coordinates all the process and publish the standards (ISO, n.d.-a).

Scientific Management is the mother of Standardization (Taylor, 1911). It leads to uniformity, reducing the variance level and increasing efficiency (Gilson, Mathieu, Shalley, & Ruddy, 2005).

2.4.1.1. ISO Technical Committee 268 (ISO / TC268) - Sustainable Cities and Communities

This Technical Committee (TC) was created in 2012 with the scope of standardization within Cities and Communities. The TC divides itself into working groups, to develop requirements, frameworks, supporting and techniques and tools, aiming sustainable development. The committee concern is to help Cities and Communities - both rural and urban - to become more sustainable

The outcomes of TC268 contribute directly to the UN SDGs - previously addresses in this dissertation. It has already contributed with five ISO standards. The application of these undertakes the path to sustainability, encouraging the development and implementation of integrated approaches to achieve the targets of the 2030 Agenda the main goals (ISO TC 268, 2013).

Whether the location, the context or the stakeholders, suppliers and service providers need to have guidelines and recommendations to improve their service and to become resilient on it. This committee purpose is to help to build the bridge between the need to increase efficiency and the need for sustainability. It is expected that through this standardization, the ultimate goal become clarified. Moreover, along with the vast number of Sustainable Development definitions present in the literature, such as the various frameworks and assessment tools, turn this into a blurry reality. TC268 engage cities representatives and experts to develop those standards and to contribute with their know-how to spread and share knowledge globally.

As ISO is responsible for more than 20k standards and recommendations to help companies, society and other types of organizations, standards are created upon a strong and solid base, providing the tools and awareness to a better performance aiming resilience and sustainability (ISO, 2017).

2.4.1.2. ISO 37101 - Sustainable development in communities

This ISO developed a management system for sustainable development**.** This standard was published in 2016 and establishes a managerial system for Sustainable Development in communities, aiming consistency with policies in that purpose. It helps to link Sustainable Development to communities by turning it in something measurable. It is achievable through the transparency of the use of programs, implement strategies, develop projects, plans or

services, and sharing the results with the community. This community engagement will improve their contribution to the sustainable process. ISO 37101 also requires the measure of progress towards sustainability.

For ISO, this standard should be implemented by an organization designated by the community, which should establish an organizational framework and provide the resources needed to support management environmental, economic and social performance outcomes. It is also stated that it is applicable to any community, despite size, structure or type, or even despite the context of its location, being this a point which will be discussed in the next paragraphs.

2.4.1.3. ISO 37120 - Sustainable development of communities

This ISO is a set of indicators for city services and quality of life, It was primarily published in 2014, and as it is now on the second edition. This standard follows the ISO37101, and it defines and establish methodologies with indicators to measure and manage performance in cities, and introduced a mutual basis for reporting, comparison and benchmarking. It helps cities municipalities and city leaders to set tangible targets. This approach enables cities to evaluate their *as-is* state and compare it to other cities and seeing where they stand in relation to other cities, no matter where in the globe. By knowing the *as-is*, cities can define a *to be* state and strategically delineate a plan to improve, achieving quality of life and sustainability.

ISO 37120 standard is divided by nineteen different areas, which are Economy, Education, Energy, Environment and Climate Change, Finance, Governance, Health, Housing, Population and Social Conditions, Recreation, Safety, Solid Waste, Sport and Culture, Telecommunication, Transportation, Urban/Local Agriculture and Food Security, Urban Planning, Wastewater and Water (ISO, 2018).

There are 132 indicators categorized in three levels – mandatory, supportive and profile – and defined how to measure it. In total, there are 25 profile, 46 fundamental and 59 supporting indicators to measure and report.

In the ISO 37120 publication, were found the areas, indicators and also the way to collect them. Please, see the example of the *city's unemployment rate*, which is part of the Economy category, and is considered a core indicator.

"City's unemployment rate (core indicator)

A city's unemployment rate shall be calculated as the number of working-age primary residents who during the survey reference period were not in paid employment or self-employment, but available for work and seeking work (numerator) divided by the total labour force (denominator). The result shall be multiplied by 100 and expressed as a percentage. Unemployment shall refer to individuals without work, actively seeking work in a recent period (past four weeks) and currently available for work. Persons who did not look for work but have a future labour market stake (arrangements for a future job start) are counted as unemployed (International Labour Organization). Discouraged workers or hidden unemployed shall refer to persons who are not actively seeking work because they believe the prospects of finding it are extremely poor or they have restricted labour mobility, face discrimination and/or structural, social and cultural barriers. They are not counted as part of the labour force and are therefore not considered to be unemployed. Not actively seeking work shall refer to people who have not taken active steps to seek work (e.g. job searches, interviews, informational meetings) during a specified recent period (usually the past four weeks).

Labour force shall refer to the sum of the total persons employed and unemployed who are legally eligible to work and who are primary residents of the city."

(ISO, 2018).

This standardization, promoted by the ISO standards, offers a more rational municipal management. Indicator act as a decision-making tool, once express the real picture of the city and, knowing this, the actions are taken more accurately. Also, as it is applicable in large scale – this ISO standard is globally applicable – cities may learn from each other's, for instance, a strategy applied by city A to answer to low performance on indicator X, may be used by city B who has the same lack of performance on such indicator. This stimulates cities to interact with others and benchmark them against other cities globally, being possible to classify cities for their performance. For this, WCCD stipulates five levels of recognition for cities, according to the number of indicators collected. Thus, cities can be recognized with the Aspirational medal, when there are 30-45 core indicators collected; Bronze medal, when collect 46-59 indicators where 46 are core and the others 13 are supporting; Silver medal, with 60-75 indicators with 46 core and between 14-29 supporting; Gold medal, collecting 76-90 indicator with 46 core and 30-44 supporting; and, with 91-100 indicators, divided by 46 core and 45-54 supporting, collected, the Platinum medal is the top level certification a city can get.

As examples of this practice, cities like Los Angeles, London, Helsinki, Buenos Aires or Amsterdam had assessed themselves using this framework. In fact, Amsterdam had assessed its performance in 2014, 2015 and in 2016, being an example of how this framework must be used – on a yearly basis, to monitor and evaluate the progress. In Portugal, there are two cities recognized as certificated with ISO37120: Sintra, in 2017, with a Platinum medal and Porto in

2016 and 2017 with a Gold and Platinum medals respectively (World Council on City Data, n.d.)

2.4.2. World Council on City Data (WCCD)

WCCD is a global platform which aims to build liveable and better cities globally, through city data. Sustainable Development Goals are also part of WCCD goals, and such, its portal means to help cities leveraging their quality – reducing the gap between them – by globally comparable data, achieving this way their commitments with SDGs (James, 2017). It is the official partner of ISO37120 to list and centralize the information about cities who use and apply the standard. Cities registered in WCCD must have its data verified by a third-party and then provide it to WCCD Open City Data Portal (James, 2017).

Data is distributed by the 17 themes and 100 indicators and there are around 1.2M combination available, where it is possible to forecast, benchmarking, monitoring and analyse trends.

To facilitate the link with ISO37120, the portal is divided in profile – which provides background information (such, for instance, Population, Land Area, Population Density) of the city -, core and supporting indicators, as it is grouped by themes according to different sectors and services. It follows the logical order of standard. Please, see figure below.

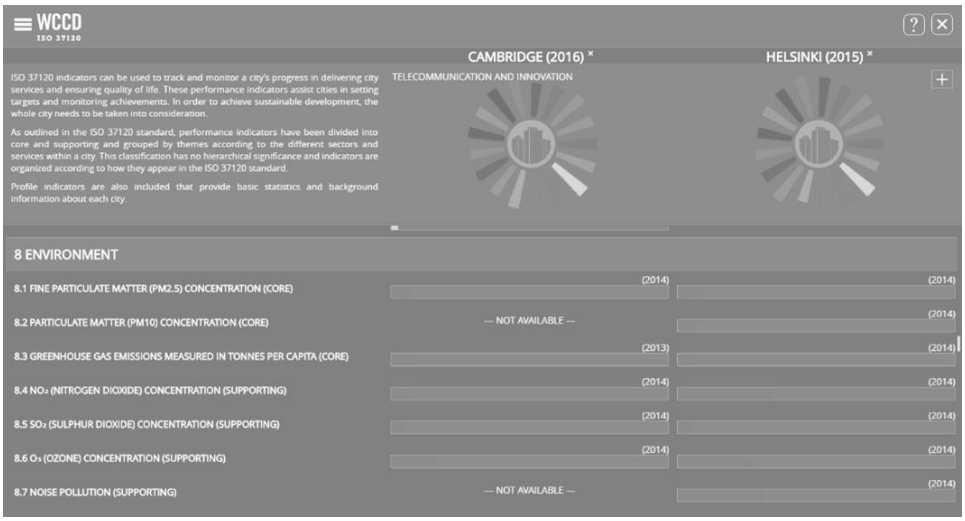

Figure 5 - WCCD Data Portal
(Source WCCD Portal)

2.4.3. ISO 37120 Critical Analysis

ISO standardization offers to consumers offers a product quality assurance, guaranteeing its safety, reliability and confidence needed to use. It is the mission of ISO and, it is addressed to any object aiming standard coverage (ISO, n.d.-b).

ISO helps governments and private organizations to increase their efficiency and to reduce or eliminating their waste (for instance, of time, of productivity, of resources) (ISO, n.d.-a).

The International Standard 37120 does that for cities. Governments, using this tool, can understand what is wrong with their community, in an overall view, and take some actions to change the scenario. It is important to mention that ISO37120 is an assessment tool and, therefore, it should be considered for decision making (Ahvenniemi, Huovila, Pinto-Seppä, & Airaksinen, 2017).

The approach should be surrounded by a PDCA – Plan, Do, Check and Act - cycle: define goals and processes needed to achieve results (Plan); Implement procedures and practices (Do); Monitor and control the procedures and practices implemented, report and measure it against the goals defined in *plan* phase (Check); and, afterwards analysing the results take some actions to reach the goals (Act) (Fitsilis, 2018). This decision-making process brings founded and quality decisions *to the table*. Inevitably, cities, proceeding with this get better results in their way to sustainability and quality of life. Knowing their actual performance, it is easier to define objectives to evolve into a favourable level of performance and offer high quality of life to its communities, making the Governance much more effective.

ISO 37120 came in 2014 to answer to a relevant issue of sustainability frameworks: There were no standardized indicators (Mcmanus & Haughton, 2006)(Tanguay, Rajaonson, Lefebvre, & Lanoie, 2010)(Shen, Jorge Ochoa, Shah, & Zhang, 2011)(McManus, 2012).

Nevertheless, through an interview with consultants who are experts in the implementation of this standard, it was realized that this is an unusual scenario. Governments commonly use the ISO37120 as *advertising material* to campaigns and to promote their work as government, using the international certification as a stamp of proper management. It is not necessarily bad – it can demonstrate that there was a concern to realize where they could improve –, but the process is frequently abandoned halfway. Once getting the certification according to their level of analysis, the D, C and A of PDCA are forgotten.

Despite this common uncomplete use of the standard, the process of getting indicator collected, help governments to know where they stand when comparing to other cities. This competitive environment has a positive impact on cities, as among them they can learn and share knowledge

and practices, helping each other to evolve straightforward to the common objective. ISO 37120 presents itself as a standard that might be used by any municipality despite its location, dimension and level of development, which aims to know its performance. As a global standard, it precisely allows benchmarking and shared knowledge. On the other hand, this global coverage is not fair when it comes to cities personality. The city uniqueness might not be captured by global and standardized indicators, and so the use of the framework as a tool for decision making might be skewed (Deng, Liu, Wallis, Duncan, & McManus, 2017; Elisa K. Tatham, Daniel A. Eisenberg, 2014; Krank, Wallbaum, & Grêt-Regamey, 2013; Moreno Pires, Fidélis, & Ramos, 2014; Sharifi & Murayama, 2015; Turcu, 2013).

It is also possible that cities have already established a strategy and a method of reporting sustainability and performance. This new *pack* of indicators might not fit in (Elisa K. Tatham, Daniel A. Eisenberg, 2014; Moreno Pires et al., 2014).

Each city has its own characteristics, which are the base to its economy and social environment. For instance, a city as Nazaré (Portugal), traditionally known as a *fishing town*, where one strong pillar of economy and social life is the fishing activity, cannot compare itself with a city as New York (USA), globally known as a financial and commercial metropole, or to a city in deep India where no electricity and sanitation exists. This is not a reasonable comparison.

Unsurprisingly, developed cities had a higher range of services, almost in every sector/area, being able to assess more (probably all) indicators, getting a better certification. Less developed cities are, historically, linked to some particular sector/industry, and are directly connected to each other: when the industry has good results, and it is profitable, the city follows that trend; when the business is not going well, the city suffers side effects. Metropolis, *per si*, have a high diversity of businesses, which support the economy and social life.

This standard is also very wide in the fields of assessment. It has +100 indicators, based and developed *to cities by cities*, divided by 19 themes, already mentioned above. This allows a deep and full range assessment, giving a complete performance evaluation. For instance, section 6 – Education – have as core indicator the *percentage of female school aged population enrolled in schools;* on section 12 – Health –, also a core indicator, the *number of in-patient hospital beds per 100.000 population;* and, last example, on section 18 – Transportation – the core indicator of *annual number of public transport trips per capita* (ISO, 2018). It allows the governance to get fully detailed information about its city and community.

It is undoubtedly a transversal assessment, but is it suitable for every city? Might be, however consultants state that in some cases it is as complete as it becomes impossible to measure. In some cases, there are indicators that not fit in the real context. Here are again the first *cons*

mentioned in this paragraph. For instance, in the Education section (6) one core indicator is the *percentage of students completing primary education.* In Portugal it is mandatory, so it might be redundant to measure. Otherwise, in under-developed countries, this might be important to measure and to monitor progress. The needs are different, and so, to be more effective, the indicator must be adapted according to some criterions.
This dissertation aims to develop a model specifically to Portuguese cities, where the indicators will be used to measure according to cities characteristics and biggest needs.
First, cities context in Portugal will be explained, and thus, limits of the model will be defined.

2.4.4. Measurement Challenges

Measurement is not linear as it should be, it faces some challenges in the overall process of collecting, implementing and continuous monitoring.
These global standards – as mentioned on the critical analysis of ISO 37120 – flawed, in part, for being too wide. The indicators are, in some cases, very difficult to obtain. Especially in countries under-development. In these, city-data is very difficult to get, because the governments do not collect the data (Bosworth, 2017). Sometimes, the data that exists is not detailed, which may compromise the overall analysis and, in the worst-case scenario, be the basis to decisions misaligned with reality (Bosworth, 2017).
Still, in the indicators field, the frameworks had as an advantage the possibility to compare cities between each other. Despite being true, it has some criteria to do that correctly. This is only possible if the data is well collected from trustworthy sources and with consistency on the analysis (Mavrič & Bobek, 2015).

2.4.5 INE & Pordata

In Portugal, as a 1st world country (World Population Review, n.d.), to get general statistic data it is reasonably simple. Portugal has two main sources – which are INE (National Institute of Statistics) and PORDATA – who are powered by Census, EU Statistics, Public Entities data, private studies and other databases.
PORDATA divides its statistics by three groups: municipalities, Portugal and Europe. In terms of municipalities statistics, PORDATA, *per si*, has about 773 tables divided by 15 subjects. In the portal, it is possible to see indicators data individually (by chosen a municipality) or in general. In Portugal, it presents statistics of the country. Moreover, in Europe, it is possible to

see statistics of European countries and even to compare them, in a similar way of the municipality's comparison.

These two entities are good sources of data, where municipalities can access to information about themselves and analyse the overall scenario. However, it does not allow a global comparison, when relating to ISO 37120. It demonstrates the values; the user has to manage that information.

ISO has a framework to allow the comparisons and it is global. By the end of the day, it is no nonsense to say that databases as INE and PORDATA will supply ISO indicator analysis.

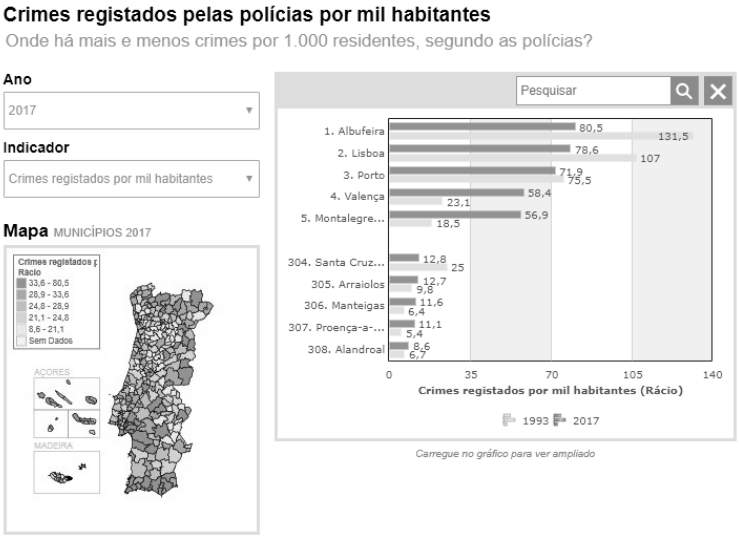

Figure 6 – Pordata example of number of crimes per 1,000 inhabitants (Source Pordata website)

2.5. Portugal Segmentation – State of the Art

2.5.1. Territorial Division

Portugal has two different territorial divisions, which are the administrative division - through *freguesias, municípios* and the *distritos* – and, statistical division – with UE standardization strategy NUTs, LAUS, Census among others.

The Administrative Division is the older division legally established. On the Portuguese Republic Constitution (PRC) of 1976, the government determines *autarquia local* as a legal entity to represent the people within territorial limits and it is responsible to promote the public interests. In continental Portugal, there are 3 levels of *autarquias locais,* the *freguesias,*

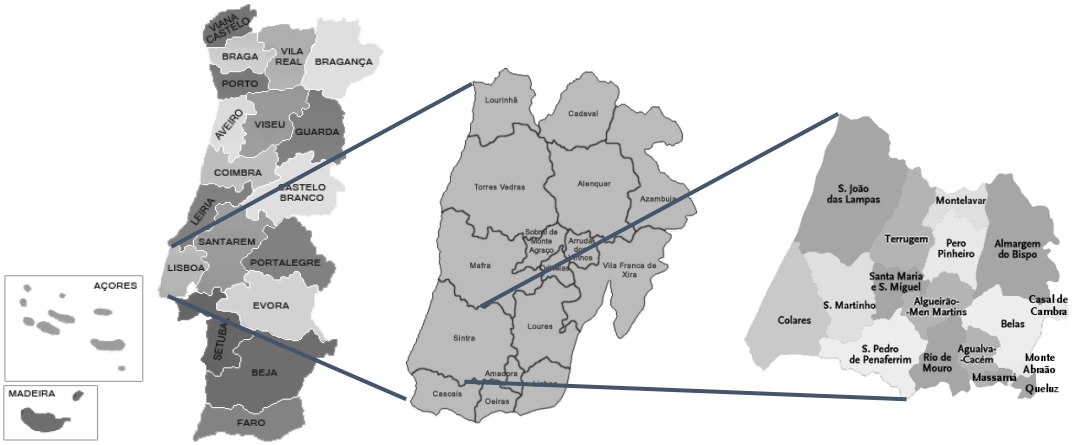

Figure 7 - Portugal Administrative Divisions - Sintra example.

municípios and *distritos*. In the autonomous regions, the *autarquias locais* are simply *freguesias* and *municípios.* In the same PRC, it gives to both archipelagos their own political and administrative capacity, mostly due to their particularities in economic, social, cultural and geographical dimensions. By the same year of 1976, the Political-Administrative Constitution of Autonomous Regions of Madeira and Azores, was approved and the 1st level of *autarquia local* is assumed for the archipelagos. Nevertheless, despite of *distritos*, it is used *ilha* (island) (INE, n.d.).

In this way, the Administrative Division is structured as:

Table 2 - Portuguese Administrative Division

1st Level	Distrito (continental Portugal) Ilha (Madeira and Azores)
2nd Level	Município
3rd Level	Freguesia

Nowadays, Portugal has 18 *distritos* and two islands – Azores and Madeira. Then, those 18 districts are segregated in 308 *Municipios* (old *concelhos*). In the islands, they are also segregated in *municípios*, in which Madeira as 11 and Azores 19. The third level of division is about parishes. Portugal, since 2013 (during this year, Portugal reorganize its territorial division with the *RATF* program - *Reorganização Administrativa do Território das Freguesias*), has 3092 parishes (Freguesias de Portugal, n.d.).

The figure above represents how the divisions work. It is the example of Sintra. Sintra is part of Lisbon district - who has 16 municipalities - and aggregates 17 parishes. Each of these had the *junta de freguesia*, responsible for the governance of the parish. Sintra, as a municipality,

has the *câmara municipal*, responsible for the governance of its territory. It is the executive body of the municipality (Quintela, 2019).

2.5.2. Statistical Division

Despite Administrative Divisions, it has been necessary to develop some different territorial divisions for statistical purposes (INE, n.d.). Facing different scenarios of population growing, urbanization or even the continuous search of statistical information, the analysis must arrange different levels and criteria. The most well-known statistical division is NUTS - Nomenclature of Territorial Units for Statistics.

2.5.2.1. NUTS

Was developed under the needs of policy making and design, regional issues analysis and with the main objective of construct a single, coherent system for dividing up the EU's territory in order to produce European statistics (Dijkstra & Poelman, 2017). NUTS started as a gentleman's agreement and, by nearly 00s it achieves legal status, being approved and regulated by the European Parliament in 2003. European Commission state that since that moment on "…all Member States' statistics transmitted to the Commission, which are broken down by territorial units, should use the NUTS classification, where applicable" (European Parlament, 2008). NUTS guarantee stability in the statistics, as this classification assures that data refers to the same regional units for a certain range of time (legally imposed of 3 years, at least) (Eurostat).

Currently, the classification in force refers to NUTS 2016. It is a hierarchical system for the division of EU economic territory to collect, develop and harmonize EU statistics, analyse the regions in a socio-economic dimension and to frame the policies regionally. This is valid since 1st January of 2018, and it has 104 NUTS 1, 281 NUTS 2 and 1341 NUTS 3 regions. These levels are determined according to the principle of population. NUTS 1 refers to main socio-economic regions, NUTS 2 to regions and NUTS 3 for sub-regions (INE, 2015).

Note the following table:

Table 3 - NUTS demographic dimension limits

Level	***Minimum***	***Maximum***

NUTS 1	3.000.000	7.000.000
NUTS 2	800.000	3.000.000
NUTS 3	150.000	800.000

There are other two principles. NUTS classification favours administrative divisions of each country, which is supportive of the availability of data and increases policies implementation capacity. Moreover, it is also susceptible to amendments, regular or extraordinary. Despite not being common to happen within a period of 3 years, when a relevant event occurs, it might be susceptible to revision. As an example of that, when Portugal required to the EU Commission an extraordinary revision due to a relevant reorganization of the administrative structure. Portugal reduces the number of NUTS 3 from 30 to 25 and 16 of them suffer changes in territorial dimensions, and 12 receive a new designation (Economia e Finanças, n.d.).

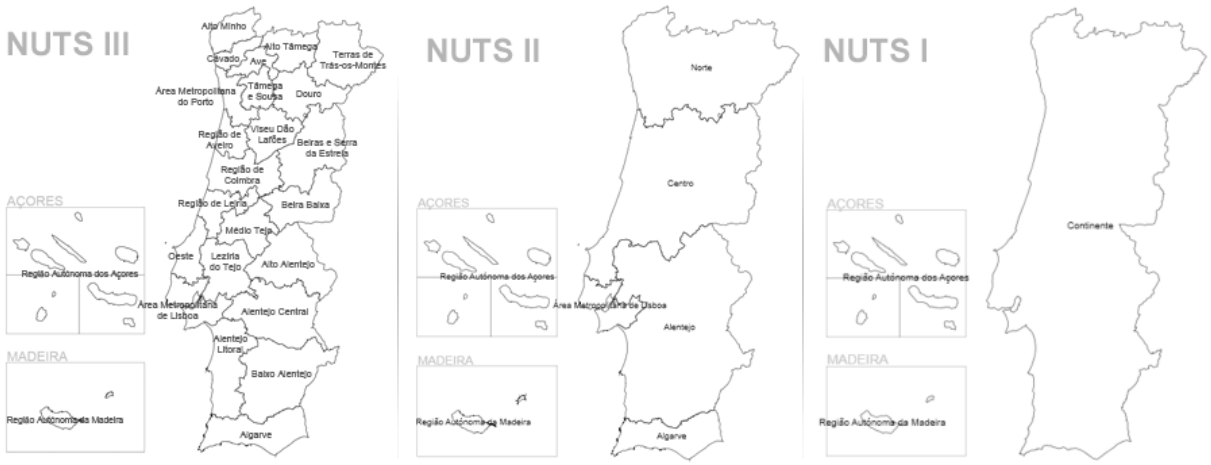

Figure 8 - NUTS in Portugal
(Source Pordata)

2.5.2.2. LAUs

LAUS (also developed by Eurostat) aims to meet the demand on statistics at the local level. NUTS, as mentioned above, were developed up to regional level. Therefore, there was the need to be more specific in statistics. Thus, NUTS 3 regions were subdivided and then all territory was covered: LAU 1 and LAU 2 (Eurostat, n.d.)

Until the year of 2016, these two levels exist: LAU level 1 (which replaced former NUTS IV), who covers the municipalities; and, LAU level 2 (replacing NUTS V), corresponding to parishes.

Although, since the year of 2017 only one level has been kept in force. LAU are administrative divisions of low level, under province, *distritos* and municipalities (Eurostat, n.d.). See the table below.

Table 4 – NUTS and LAU example of Portugal

<table>
<tr><th><u>Level</u></th><th colspan="3"><u>Structure</u></th><th colspan="3"><u>Portugal Example</u></th></tr>
<tr><td>NUTS 1</td><td colspan="3">Continental + Autonomous Regions</td><td colspan="3">Portugal Continental</td></tr>
<tr><td>NUTS 2</td><td colspan="3">Intermunicipal Entities Groups
+ Autonomous Regions</td><td colspan="3">Centre</td></tr>
<tr><td>NUTS 3</td><td colspan="3">Intermunicipal Entities
+ Autonomous Regions</td><td colspan="3">Região De Leiria</td></tr>
<tr><td>LAU 1</td><td>Municipalities</td><td rowspan="2">LAU
(Since 2017)</td><td rowspan="2">Parishes</td><td>Leiria</td><td rowspan="2">LAU
(Since 2017)</td><td rowspan="2">União das Freguesias de Leiria, Pousos, Barreira e Cortes</td></tr>
<tr><td>LAU 2</td><td>Parishes</td><td>Batalha</td></tr>
</table>

2.5.2.3. Geography of Census

Census is about population and habitation. It requires the collection of information's based on territories with small dimension being essential to public administration (UN, 2008). Thus, INE (National Statistical Institute in Portugal) developed a system which divided *freguesias* (city parishes) into statistic sections and sub-sections, being more accessible to collect the data. For **Statistic Sections,** it means a territorial unity of a unique *freguesia* with about 300 habitations. By **Statistic Sub-Section,** it is known as the territory that identifies the smallest homogeneous area of construction or not, within the statistic section. It corresponds to the quarter in the urban areas and the *Place*, or part of it, in the rural areas. For **Place,** it is understood as a territorial limitation which corresponds to a population agglomerate of ten or more habitations and does not matter if it belongs to more than one *freguesia* (INE, n.d.)

In Portugal, around 18.000 sections and 266.000 sub-sections were identified in the 2011 Census.

3. Conceptual Framework

In light of these matters, this dissertation aims to propose a model based in the segmentation of the different ISO indicators applied to different classes of demographic density in Portugal.
In a way to create an effective and more assertive model, the intention is to reduce the scope of it from Global to Local. With the motto "think global and local", the model proposed will help Portuguese municipalities to assess their performance in relevant matters on their real context. It aims to be a decision-making tool and help governments to determine the path to achieve sustainability and be complementary with the 2030 Agenda targets, by defining the most appropriated indicators which have been classified with the most statistical significance. This strategy will allow municipalities to select the ISO categories which are most significant to achieve a better and desirable sustainable performance in order to be compliant with the 2030 Agenda.
As mentioned above, ISO 37120 is recognized as the first successful effort to performance analysis of cities (Pharos Navigator, 2019), as well as matches a high number of Sustainable Development Goals. Therefore, being this two characteristics part of the objectives, this framework will use ISO indicators.
As mentioned above in the *Literary Revision,* EU territory is divided and classified, to produce harmonized statistics (Eurostat), and it is applicable to every country. NUTS 1, 2 and 3 are the core of the EU statistics. However, this study aims to be explicity applicable to Portugal. It means that NUTS levels do not cover the need, once it is too general for the objective. Remember that the highest level of NUTS in Portugal is represented by regions (see figure 8). Thus, I've focused on LAU levels. When created, Eurostat developed two levels, but, currently, only the old LAU-2 is in force. For the Portuguese context, it means parishes. As discusses above in the *Administrative division* paragraph, parishes are the lowest level of territorial administrative division. Nonetheless, it is too small and limited in terms of action. *Municipios, per si,* fill the gap between LAUS and NUTS. On the one hand, it is composed by parishes, on the other, regions are a set of municipalities. Example: the municipality of Coimbra aggregates 18 parishes and is one of the 19 municipalities that belong to NUTS 3 *Região de Coimbra*. In this way, the proposed model recommends the use of the Administrative Division of 2nd level – *Municipios* – to assess municipality performance.
As it is not possible to assess all 308 municipalities, this thesis organizes classes of municipalities, separated by population density intervals.

Using the ISO categories and Indicators, it was analysed which of these are more relevant to each class and defined a top 5 indicators.

Despite not being possible to extrapolate this model to all Portuguese municipalities - due to some limitations mentioned on the section of conclusion – the objective is to propose an assessment system where municipalities can allocate themselves within a class and analyse specific categories by measuring specific indicators. Within the class, there are similar municipalities who can compare and cooperate with each other. By sharing knowledge and strategies, a collaborative environment might be developed, aiming for the ultimate goal of Sustainability.

4. Methodology and Methods

The present chapter aims to identify the methodological options applied on the development of this study. According to Richard Kallet (2004), this section aims to clarify how was data collected, and, how was it analysed. The author also emphasizes the importance of the methodology to describe all techniques used during the overall process of identify, select and analyse the data/information (Kallet, 2004).

The survey had **134** answers. These distributed by **36** municipalities, which is about ~**12%** of all municipalities in Portugal and, the sample, has an average of ~4 answers by city, with a standard deviation of ~7 and an amplitude of 41.

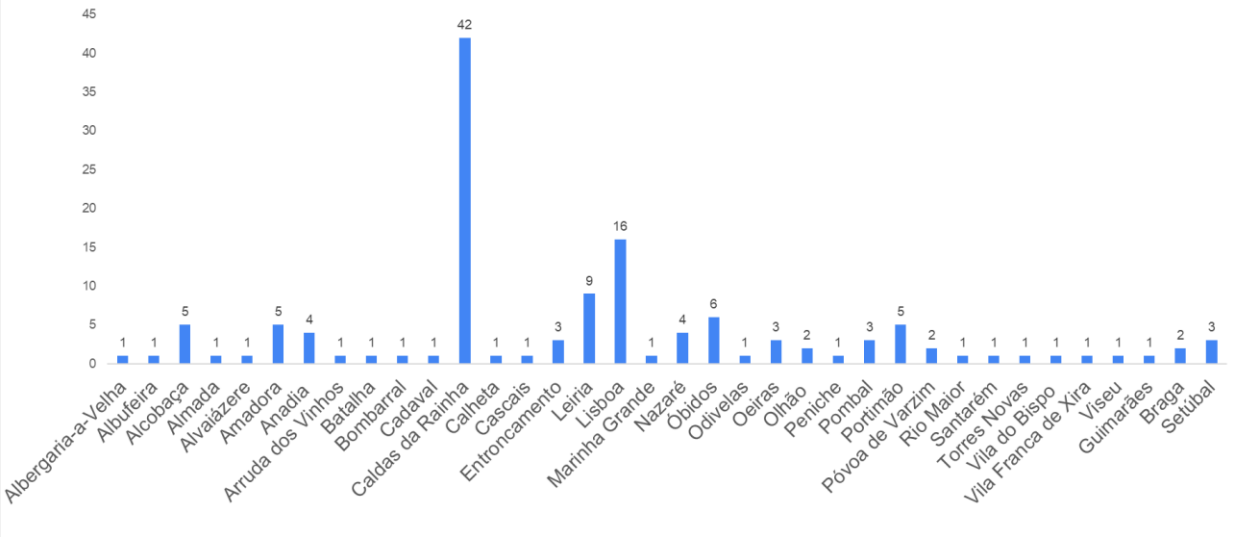

Figure 9 - Distribution of Answers by Municipalities

Below, you can see the cities from where the answers come, as well as their population density.

Table 5 - Sample of Municipalities with Density Population (inhabitants / km2) (Source Pordata)

Municipality	***Pop. Density (inh/km^2)***	***Municipality***	***Pop. Density (inh/km^2)***
Albergaria-a-Velha	159,0	Lisboa	6446,2
Albufeira	290,3	Marinha Grande	206,6
Alcobaça	138,9	Nazaré	183,9
Almada	2478,8	Óbidos	83,2
Alvaiázere	45,4	Odivelas	5484,3
Amadora	7363,4	Oeiras	3751,3
Anadia	134,6	Olhão	346,9
Arruda dos Vinhos	171,8	Peniche	357,9
Batalha	152,8	Pombal	88,2
Bombarral	144,5	Portimão	305,5
Braga	989,6	Póvoa de Varzim	771,3

Cadaval	81,4	Rio Maior	77,7
Caldas da Rainha	202,3	Santarém	111,0
Calheta (Açores)	29,9	Setúbal	526,2
Cascais	2119,9	Torres Novas	136,0
Entroncamento	1471,9	Vila do Bispo	29,4
Guimarães	656,0	Vila Franca de Xira	430,3
Leiria	224,6	Viseu	195,8

We divide the municipalities who answered in 4 classes, according to their population density data, retrieved from Pordata (2019). The result of municipalities per class is presented in the table below.

Table 6 – Distribution categories of municipalities through Classes

A (< 100)	*Vila do Bispo, Calheta, Alvaiázere, Rio Maior, Cadaval, Óbidos, Pombal;*
B (100 ≤ 400)	*Santarém, Anadia, Torres Novas, Alcobaça, Bombarral, Batalha, Albergaria-a-Velha, Arruda dos Vinhos, Nazaré, Viseu, Caldas da Rainha, Marinha Grande, Leiria, Albufeira, Portimão, Olhão, Peniche;*
C (400 ≤ 1000)	*Vila Franca de Xira, Setúbal, Guimarães;*
	Póvoa de Varzim, Braga;
D (> 1000)	*Entroncamento, Cascais, Almada, Oeiras, Odivelas, Lisboa, Amadora.*

This distribution reduces the gap mentioned above, of having reduced number of answers un some cities, not being representative of the municipality itself.

4.1. Interview and Empirical Knowledge

To complement the literature, it was needed some expert judgements concerning ISO. The papers and articles reviewed were not enough to get complete knowledge of it. Despite having reviews from an outside point of view, from an implementer view – with the pains of implementing well described – it was difficult to get.

In the 19th of June 2019, occur a meeting-lunch with a Consultant from a consulting company expert in the implementation of the standard within municipalities. It was the beginning of this project, was needed to get a better understand of the *ISO37120* and, in particular, about implementation issues, from a professional point of view and, following the ideas of Zhang and

Wildemuth (2017), the better way to achieve those answers was through an unstructured interview and using open questions (Wildemuth, 2017).

4.2. Survey

4.2.1. Pilot Test & Final Survey

The survey passed for two steps. First, a pilot testing, between the 17th and 20th of September 2019. The pilot survey (Appendix 1) was created containing two sections. The first had a demographic question, to know the location of the inquiry. The second section has a table with 48 indicators (48 lines), and it was asked to classify, in importance scale, the sixteen more important. It was distributed by email to 5/10 people from different places, with different ages and backgrounds. The purpose of the pilot testing was to get feedback regarding the structure of the survey, the complexity and the issues on asking the questions (van Teijlingen & Hundley, 2002).

After collecting the answers, a few changes were made. Based on the feedback, the introduction was modified, to be more objective, as well as the description and guidelines of the second section/question, who were quite unclear. The second question was also modified as it changes the layout and answer method from Classification to a Matrix table, with the application of Likert scale. In this, the inquiries evaluate each indicator in a scale of relevance and priority, from 1 to 5. It had 46 Indicators, exactly the number of indicators of ISO 37120 classified as principal (ISO, 2018). All questions were mandatory to proceed with the survey and, to be less exhaustive, the 46 indicators were distributed by 4 separated sections (Appendix 2).

It was developed using "Google Forms" and shared by email and social networks. The survey was *living* for 15 days, between 21st of September and 5th of October 2019, and there were no prior conditions to answer it.

4.3. Data Analysis

As defined by Hout (2002), descriptive statistics are the technics and rules that summarize the data collected about a sample and a population (Huot, 2002). Kenton (2019) follow the same idea adding that it is used to summarize the data collected during an investigation, in tables, figures and graphs, and aims to report general and detailed information about it (Kenton, 2019).

To evidence that information, it is used measures as maximum, minimum, average, standard deviation, amplitude, among others.

We use qualitative data. This type of data characterizes and approximate de information, once it is about the perception of the people (Surendran, n.d.).

The *Survey*, in the chapter above, was developed based on the ISO 37120 Standard. It has +100 indicators divided by profile, principal and supportive (ISO, 2018). The principal indicators (46) are those who are mandatory to evaluate the performance and sustainability of cities. Without those, cities are not recognized as having the ISO standard implemented. Remember that, as mentioned in the *Literature Review*, to achieve the first recognition level, cities must collect between 35 and 46 core indicators. (*ISO 37120 - Sustainable development of communities - Indicators for city services and quality of life* section) For the survey purpose, those were the indicators used.

Once collected all the answers, Microsoft Excel was used to handle and organizes the information. There were 136 answers, divided by 36 municipalities. The distribution was not homogeneous once the number of answers by municipality had a standard deviation of 7.2 answers and an amplitude of results of 41, which represents a considerable variability.

One of the objectives of the project (and the principal objective of the survey) was to understand which categories and indicators were identified as more important to assess for the municipalities. Thus, for municipalities with more than 1 answer, the average was calculated and considered for the statistics. Despite having municipalities with many answers, it was noticed that also have others with only one answer. The distribution of answers was not flattened. Facing this scenario, it was statistically reckless to analyse accurately each city, once one answers were not representative of the real context.

Therefore, to better organize the collected information, were developed classes where aggregate cities with similar characteristics, creating homogeneous subgroups with related data (Dabbura, 2018). By grouping data in different classes, these can be recognized by different characteristics (Stern, Hurni, Wiesmann, & Ysakowski, 2011). To find the better way to segment population, it was investigated this topic within the Literature. Were found two key measures to characterize territory: Population and Population Density. As mentioned on the *Literature Review*, the population refers to the total number of organisms living in the same area (Biology Dictionary, n.d.). While population density allows a specific relation between population/space (Weinstein et al., 2015). Were also found out that *Population Density* allows the comparison between geographic areas and governments can understand the intensity and the distribution of population through the geography (Millward, 2008) (Ehrlich et al., 2018). Part of the objectives

of this dissertation was to allow a comparison between the municipalities, and, once that *population density* allows (Ehrlich et al., 2018; Millward, 2008), it was chosen as criteria. Consequently, the classifying method, was used the *Equal Interval*, with the application of equal data interval along the classes (Stern et al., 2011). That classification was applied only to the sample (36 municipalities) and not on the entire population (all 308 municipalities in Portugal), and used the value of 300 as interval, having an underflow bin of less or equal than 100 and as overflow bin more than 1000. This scale was used because the aim was to divide the municipalities into classes, according to their population density data, in the qualitative scale of *very low density, low density, medium density, high density* and *very high density*. However, during the statistics was noticed that the intervals *medium density* and *high density* had 3 and 2 answers each. This would make a good statistical analysis impossible, once the sample was too short. Thus, was decided to bring together those intervals by creating only one – *medium-high density*.

Once with the classes defined and organized, the analysis of the indicators and categories selected class by class begins.

To analyse the most relevant categories and indicators for each of the classes in which the municipalities in the sample fall, it was grouped the answers of municipalities belonging to the same class; for the first time, cities names were taken out the and start using only the classes name/interval. ***"Quality and Sustainability"*** was added as an independent variable on the table, once it was the focus of the assessment. Its value was given by the average of the indicators from the category.

The statistical analysis is divided into 2 steps:

1. Analysis and Organization of the data;

Once the answers of the survey were collected, the treatment of data started. As mentioned above, the sample was organized and arranged within classes. To determine the top categories chosen by inquiries, a Descriptive Statistic was made to get the data summarized. The information taken from this analysis was used to structure the classification and proceed for the following steps

2. Pearson Correlation between Categories and its Indicators;

Pearson correlation allows understanding the correlation between a dependent and independent variable. In this case, between *Quality and Sustainability* and the *Indicators*. This correlation measures the strength and direction of the relationship between the variables. With this exploration, it is possible to analyse which indicator contributes more to the overall classification of the category.

As there were 17 categories with different number of Indicators, this scrutiny was done to every category. The principal question that was needed to answer was: *Which indicator contributes more to the general appreciation of its category in the class?*

It is important to mention that there are Categories that only have one Indicator. That so, Pearson Correlation is not applicable in these cases, since the correlation will be 1 and it will skew the results. In the *Results* section, there are tables which contains the analysis of the correlation and those categories who it is not applicable are identified as *N/A* (not applicable).

5. Results

As mentioned above, there were 134 answers distributed for 36 municipalities. The following graphs represent the distribution of answers:

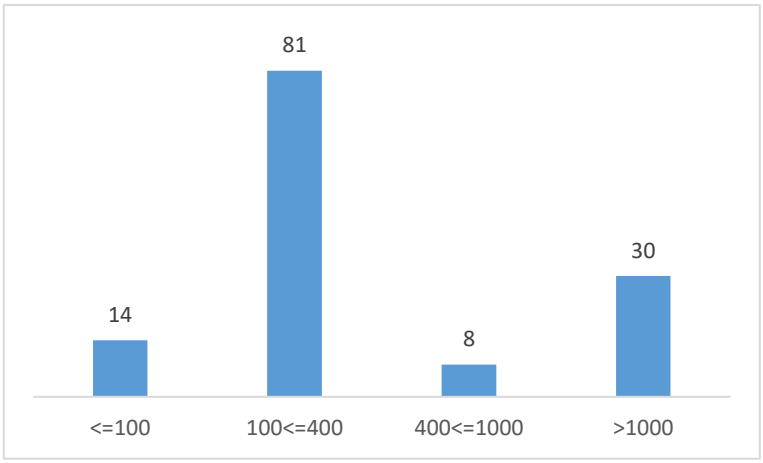

Figure 10 - Distribution of answers by class (absolute numbers)

The distribution of answers follows directly the distribution of municipalities by classes intervals; however, it is not direct. This is because for cities with more than one answer, for assessment purposes, it was considered the average – see Appendix 3 to find all the answers to the survey. For instance, Caldas da Rainha had 42 answers but, to analyse the results, the average of all indicators, from total answers, was considered.

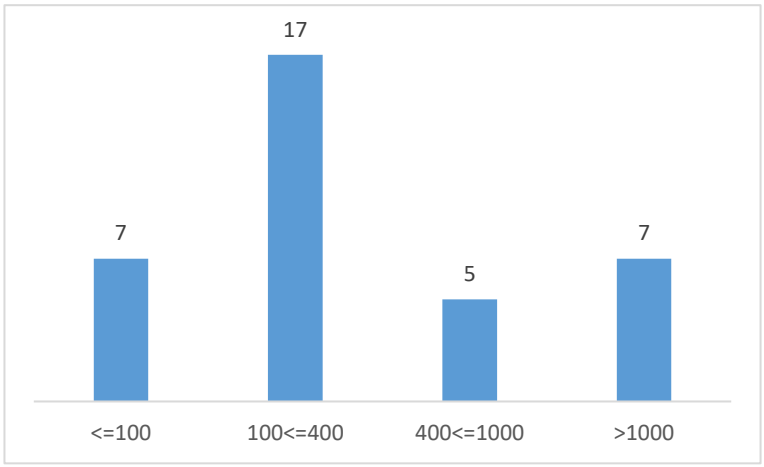

Figure 11 - Distribution of answers by class

In terms of percentage, the interval of 100≤400 represents almost half of our sample (~47%). It is followed by the extremes – ≤100 and >1000 – both with 19% and, at last, with 14% the 400≤1000 interval.

5.1. Class A - Very Low Density

There were 14 answers divided by 7 cities. With an average of **~2** answers by city and a standard deviation of **1.7**, the answers distribution is represented in the figure 14.

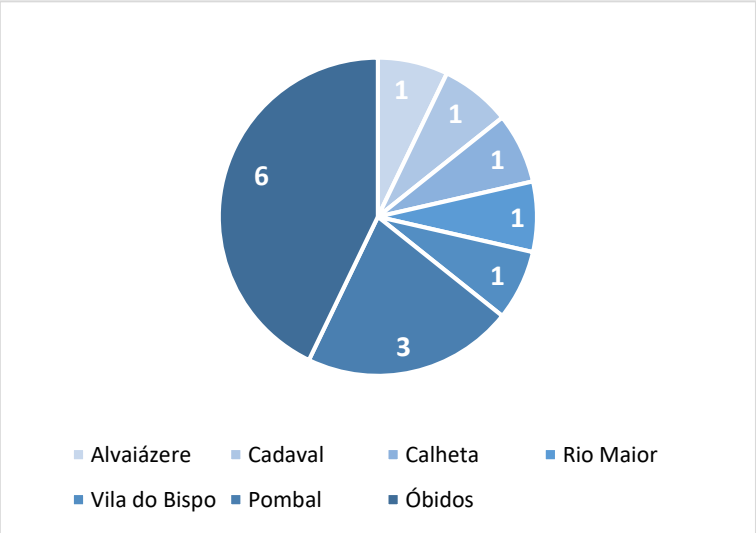

Figure 12 – Class A answers distribution

As previously mentioned, for the analysis, were considered the cities average. Thus, the analysis of the 7 cities brings the following results.

Table 7 – Class A overall results per Category

Category	Average	Std. Deviation
Urban Planning	4,64	0,51
Solid Waste	4,57	0,58
Education	4,52	0,54
Governance	4,43	0,59
Water	4,35	0,52
Wastewater	4,34	0,40
Housing	4,20	0,82
Health	4,18	0,94
Economy	4,08	1,14
Environment & Climate Change	4,07	0,74
Energy	4,06	0,95
Population & Social Conditions	3,99	1,08
Urban/Local Agriculture and Food Security	3,83	0,85

Sports and Culture	3,62	1,38
Finance	3,59	0,98
Security	3,37	1,25
Transportation	3,37	1,07

Table 8 - Pearson's Correlation of Indicators on Category

Category	**Indicator**	**Pearson Correlation**
Urban/Local Agriculture and Food Security	N/A	*N/A*
Economy	N/A	*N/A*
Governance	N/A	*N/A*
Urban Planning	N/A	*N/A*
Population & Social Conditions	N/A	*N/A*
Sports and Culture	Number of cultural institutions and sporting facilities per 100 000 population	*0,999*
Education	Percentage of students completing secondary education: survival rate	*0,988*
Solid Waste	Percentage of the city's solid waste that is recycled	*0,984*
Security	Number of fire-related deaths per 100 000 population	*0,984*
Finances	Debt service ratio (debt service expenditure as a percentage of a city's own-source revenue)	*0,976*
Energy	Final energy consumption of public buildings per year (GJ/m2)	*0,971*
Wastewater	Percentage of city's wastewater receiving centralized	*0,964*
Housing	Percentage of city population living in inadequate housing	0,947
Transportation	Annual number of public transport trips per capita	0,941
Health	Number of physicians per 100 000 population	0,904
Environment & Climate Change	Particulate matter (PM10) concentration	0,896
Water	Total domestic water consumption per capita (litres/day)	0,867

5.2. Class B - Low Density

With the surveys, were obtained 81 answers in this class. Those were segregated within 17 cities.

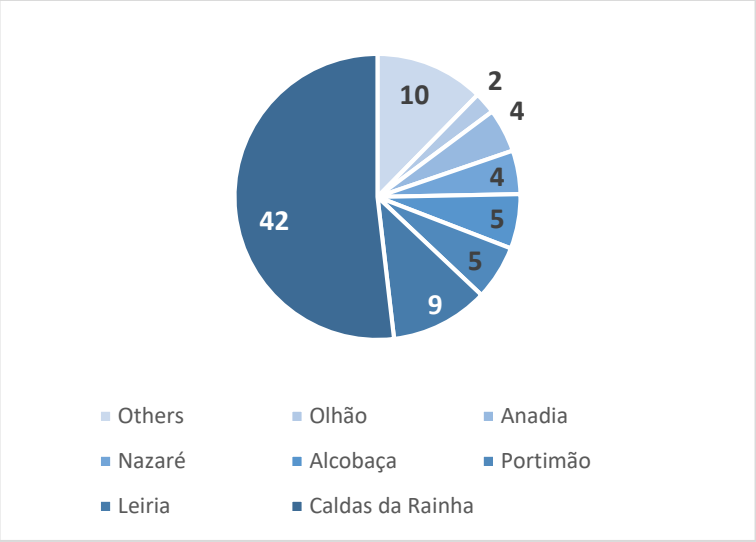

Figure 13 – Class B answers distribution

Others, in figure 15, are the set of cities who have only one answer. This way, there were 10 cities with a single answer to the survey.

The Class B sample had an average of answers of **~4,7** per city, with a standard deviation of **9,6** and an amplitude of **41** answers.

On the next table, you can find the average and standard deviation assigned to each of the categories in the assessment.

Table 9 – Class B overall results per Category

Category	Average	Std. Deviation
Education	4,36	0,82
Transportation	4,35	0,61
Water	4,28	0,98
Health	4,26	0,88
Urban Planning	4,24	0,64
Wastewater	4,19	0,91
Energy	4,12	0,82
Solid Waste	4,12	0,95
Security	4,08	1,04
Economy	4,06	0,82
Housing	4,06	0,84
Population & Social Conditions	4,03	0,99
Sports and Culture	3,95	0,64
Governance	3,77	1,01
Environment & Climate Change	3,68	0,85
Finance	3,67	1,05

Urban/Local Agriculture and Food Security	3,49	0,88

Table 10 - Pearson's Correlation of Indicators on Category

Categoria	**Indicador**	**Pearson Correlation**
Urban/Local Agriculture and Food Security	N/A	N/A
Economy	N/A	N/A
Governance	N/A	N/A
Urban Planning	N/A	N/A
Population & Social Conditions	N/A	N/A
Water	Percentage of city population with sustainable access to an improved water source	0,982
Finances	Debt service ratio (debt service expenditure as a percentage of a city's own-source revenue)	0,975
Security	Number of homicides per 100 000 population	0,973
Wastewater	Percentage of city's wastewater receiving centralized	0,971
Transportation	Annual number of public transport trips per capita	0,958
Sports and Culture	Number of cultural institutions and sporting facilities per 100 000 population	0,954
Environment & Climate Change	Fine particulate matter (PM2.5) concentration	0,944
Education	Percentage of students completing primary education: survival rate	0,94
Housing	Percentage of city population living in inadequate housing	0,891
Solid Waste	Percentage of the city's solid waste that is disposed of in a sanitary landfill	0,891
Health	Number of in-patient hospital beds per 100 000 population	0,875
Energy	Number of gas distribution service connections per 100 000 population (residential)	0,866

5.3. Class C - Medium-High Density

Resulting from the union of the classes medium and high density were obtained 9 answers, distributed by 5 cities, as represents the following figure.

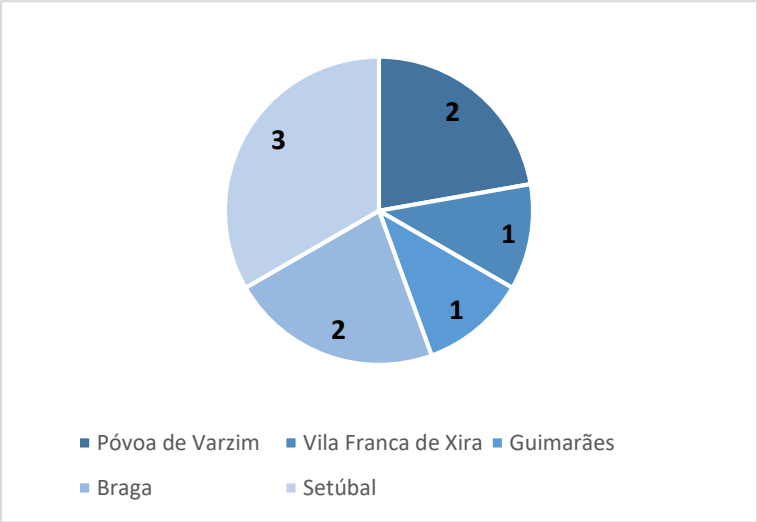

Figure 14 – Class C answers distribution

It has an average of **~1,8** answers by city, **0,75** of standard deviation and an amplitude of **2** answers.

This assessment result in the next distribution of categories.

Table 11 - Class C overall results per Category

Category	Average	Std. Deviation
Urban Planning	4,40	0,37
Health	4,39	0,44
Population & Social Conditions	4,30	0,40
Housing	4,22	0,32
Environment & Climate Change	4,19	0,38
Education	4,13	0,46
Urban/Local Agriculture and Food Security	4,10	0,66
Wastewater	4,03	0,44
Solid Waste	4,03	0,60
Water	3,98	0,50
Governance	3,97	0,52
Security	3,90	0,46
Finance	3,90	0,26
Energy	3,89	0,46
Transportation	3,85	0,53
Sports and Culture	3,75	0,36
Economy	3,67	0,99

Table 12 - Pearson's Correlation of Indicators on Category

Categoria	Indicador	Pearson Correlation
Urban/Local Agriculture and Food Security	N/A	N/A
Economy	N/A	N/A
Governance	N/A	N/A
Urban Planning	N/A	N/A
Population & Social Conditions	N/A	N/A
Solid Waste	Percentage of the city's solid waste that is treated in energy-from-waste plants	0,999
Environment & Climate Change	Particulate matter (PM10) concentration Greenhouse gas emissions measured in tonnes per capita	0,995
Transportation	Kilometres of public transport system per 100 000 population	0,985
Wastewater	Percentage of city's wastewater receiving centralized treatment	0,965
Water	Percentage of city population with potable water supply service	0,964
Finances	Debt service ratio (debt service expenditure as a percentage of a city's own-source revenue)	0,943
Security	Number of firefighters per 100 000 population	0,942
Education	Percentage of students completing secondary education: survival rate	0,907
Energy	Final energy consumption of public buildings per year (GJ/m2)	0,903
Sports and Culture	Number of cultural institutions and sporting facilities per 100 000 population	0,824
Housing	Percentage of population living in affordable housing	0,756
Health	Number of in-patient hospital beds per 100 000 population	0,702

5.4. Class D - Very-High Density

On class D were considered the cities with more than 1000 inhabitants per km2. Were obtained answers from 7 cities, with a total number of 30 surveys answered. The figure 17 represents the distribution of answers.

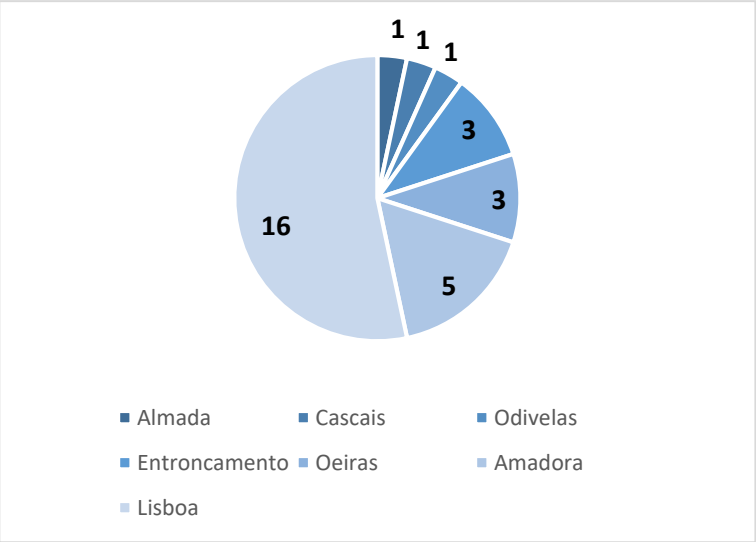

Figure 15 – Class D answers distribution

The city of Lisbon represents more than half of the sample (~53%). The sample has an average of **~4,3,** with a standard deviation of **5.** The amplitude of the sample is **15.**

These answers result in the following categories distribution.

Table 13 – Class D overall results per Category

Category	Average	Std. Deviation
Urban Planning	4,47	0,38
Population & Social Conditions	4,44	0,68
Health	4,36	0,61
Economy	4,35	0,39
Transportation	4,33	0,37
Water	4,21	0,93
Housing	4,11	0,56
Solid Waste	4,10	0,47
Finance	4,09	0,53
Energy	4,09	0,51
Wastewater	4,03	0,77
Governance	3,91	0,42
Sports and Culture	3,86	0,61
Security	3,83	0,89
Education	3,64	1,01
Environment & Climate Change	3,55	0,79
Urban/Local Agriculture and Food Security	2,82	1,21

Table 14 - Pearson's Correlation of Indicators on Category

Categoria	Indicador	Pearsons Correlation
Urban/Local Agriculture and Food Security	N/A	N/A
Economy	N/A	N/A
Governance	N/A	N/A
Urban Planning	N/A	N/A
Population & Social Conditions	N/A	N/A
Water	Compliance rate of drinking water quality	0,991
Sports and Culture	Number of cultural institutions and sporting facilities per 100 000 population	0,987
Education	Percentage of students completing primary education: survival rate	0,984
Environment & Climate Change	Particulate matter (PM10) concentration	0,981
Housing	Percentage of city population living in inadequate housing	0,967
Wastewater	Percentage of city population served by wastewater collection	0,957
Health	Number of physicians per 100 000 population	0,957
Security	Number of natural-hazard-related deaths per 100 000	0,945
Transportation	Annual number of public transport trips per capita	0,882
Finance	Debt service ratio (debt service expenditure as a percentage of a city's own-source revenue)	0,787
Energy	Percentage of total end-use energy derived from renewable sources	0,738
Solid Waste	Total collected municipal solid waste per capita	0,597

6. Discussion

The sample collected demonstrates a high dispersion on the data. The high values of amplitude and standard deviation validates the idea. It is confirmed by literature, (Rumsey, 2010) that endorses dispersion as a result of high variability, data dispersion and the presence of outliers in the sample.

Looking to the **top 5** categories within all classes, it is possible to say that 11 of 17 categories present in the assessment were selected at least one time. On the top of the selection, chosen on all 4 classes, is Urban Planning, followed by Health, selected 3 times. Water and Education. Consequently, selected by 2 classes, are Water, Education, Population & Social Conditions and Transportation. With only one selection, Solid Waste, Economy, Housing, Environment & Climate Change and Governance.

Wastewater, Energy, Finance, Security, Urban/Local Agriculture and Food Security and Sports and Culture, per si, were not selected within the top 5 categories relevant to the assessment. The distribution is represented on the table below.

Table 15 – Top 5 categories distribution: General and Classes

Category	Frequency	**<100**	**100<=400**	**400<=1000**	**>1000**
Urban Planning	4	1	5	1	1
Health	3	-	4	2	2
Water	2	5	3	-	-
Education	2	3	1	-	-
Population & Social Conditions	2	-	-	3	2
Transportation	2	-	2	-	5
Solid Waste	1	-	-	-	-
Economy	1	-	-	-	4
Housing	1	-	-	4	-
Environment & Climate Change	1	-	-	5	-
Governance	1	4	-	-	-
Wastewater	-	-	-	-	-
Energy	-	-	-	-	-
Finance	-	-	-	-	-
Security	-	-	-	-	-
Urban/Local Agriculture and Food Security	-	-	-	-	-
Sports and Culture	-	-	-	-	-

When looking in a perspective of global classification of categories, the categories Urban Planning and Health, are those who have higher classification (> ~4,30). Transportation, Environment & Climate Change, Finance, Sports and Culture, Security, Urban/Local Agriculture and Food Security are on the bottom of the table with an average lower than 4. With Pearson Correlation was possible to go further and analyse a correlation between Quality and

Sustainability and the Indicators. It was revealed, for the top 5 categories, the indicators that had more influence on it.

The inquiries from Class A municipalities outline Urban Planning, Solid Waste, Education, Governance and Water as top five high relevance categories to assess.

Table 16 - Pearson Correlation for top classified categories (Class A)

Urban Planning	Green area (hectares) per 100 000 population
Solid Waste	Percentage of the city's solid waste that is recycled
Education	Percentage of students completing secondary education: survival rate
Governance	Women as a percentage of total elected to city-level office
Water	Total domestic water consumption per capita (litres/day)

This class was the only to select the categories of Solid Waste and Governance as a priority and relevant to assess. It is interesting the choice of this last category as one of the most relevant for assessment, moreover when looking to the indicator. It is revealing of equality concerns within these cities. At the local level, on small and rural regions, politics are, usually, more conservative and tend to avoid changes, as defend Ana Pereira (2018). However, these results might represent a paradigm shift (Pereira, 2018).

This class also highlights Education. It is one of the keys to achieving the global goal of sustainability, once Education allows to cultivate important values and to develop proper behaviours. As defended by António Martins (2006) education brings, not only the previous advantage, but also the opportunity of students to learn and teach to older generations. With this, they can change minds and raise new concerns (Martins, Mata, & Costa, 2006).

B Class shares with the previous, 3 of the top 5 indicators. Are them Education, Water and Urban Planning on first, third and fifth positions in order of relevance. Besides that, also Transportation on second and Health on fourth emerge in this class.

Table 17 - Pearson Correlation for top classified categories (Class B)

Education	Percentage of students completing primary education: survival rate
Transportation	Annual number of public transport trips per capita
Water	Percentage of city population with sustainable access to an improved water source
Health	Number of in-patient hospital beds per 100 000 population
Urban Planning	Green area (hectares) per 100 000 population

With the increase of population density, the flow of people rises and naturally, issues related to Transports come to light. This idea follows the vision of Jean-Paul Rodrigue (2017), that states that the greater the city is, the more complex transportation management becomes (Rodrigue, Comtois, & Slack, 2006). Also, Health suffers this impact of population growth, which has impacts on medical facilities and planning (Perrott & Holland, 2005).

Water is only shared between the lowest classes – Class A and B. It is mentioned in two dimensions: the availability of piped water and the consumption on domestic use. It reveals that people who answer the survey and belong to Class A or Class B municipalities are sensitized to water questions, considering it a priority to achieve sustainability and quality of life.

Also, the Education category is shared by the lowest classes. It is considered relevant, however, the Indicator with more emphasis is different. While for Class A is the number of students finishing high school, for Low is finishing primary school. It is not possible to determine what the causes are; nonetheless, it is manifestly evident that Education is a concern within the lowest classes of the sample.

The C class raises other thematic concerns. For the first time, Population & Social Conditions, Housing and Environment & Climate Change emerged on a top 5. Urban Planning and Health are repeating, in where the first appears again on the top place and Health issues gain importance.

Table 18 - Pearson Correlation for top classified categories (Class C)

Urban Planning	Green area (hectares) per 100 000 population
Health	Number of in-patient hospital beds per 100 000 population
Population & Social Conditions	Percentage of city population living below the international poverty line
Housing	Percentage of population living in affordable housing
Environment & Climate Change	Particulate matter (PM10) concentration Greenhouse gas emissions measured in tonnes per capita

As stated by Perrot and Holland (2005) with the population growth and changes in population density, Health management adaptation capacities becomes essential to answers the demands. Thus, it is explicable why this category was listed as one of more relevance. Population & Social Conditions also appear for the first time and will keep on top of the succeeding class. This is a topic that follows the concerns of UN mentioned in the Literature Review, of guaranteeing life with dignity and progress on social life (see section Transforming our world:

the 2030 Agenda for Sustainable Development). As with, once the population and population density growing, more inequalities are known. This view is shared with Behrens and Robert-Nicoud (2014), that defends that inequalities are more visible in large cities and, these, compared with small cities, are more unequal (Behrens & Robert-Nicoud, 2014). Housing category was also selected and, when looking to the indicator, it has characteristics shared with Social Conditions. An interesting relation and it is not mistaken to admit that this class has highlighted special concern with its Social conjuncture.

In the case of the category Environment, despite nowadays promote concerns worldwide, it is only present in this class, even being present three times within categories top 10. In terms of indicators, the Pearson correlation was precisely the same between Particulate matter (PM10) concentration and Greenhouse gas emissions measured in tonnes per capita.

Urban Planning has a curious course. Despite emerging on every class top 5, on this case, it is the last of the top 5 overrated. However, what is important to retain is that it is considered the most relevant category when it comes to assess the quality and sustainability of life. It has only one indicator – number of green areas per 100.000 inhabitants - and its significance seems to be common to every municipality, despite its dimension and population density. On the D Class, as you can see below, it appears (again) in first place.

Table 19 - Pearson Correlation for top classified categories (Class D)

Urban Planning	Green area (hectares) per 100 000 population
Population & Social Conditions	Percentage of city population living below the international poverty line
Health	Number of physicians per 100 000 population
Economy	City's unemployment rate
Transportation	Annual number of public transport trips per capita

In D class, Economy makes its debut on the top 5. It is the unique economic/financial indicator on all top 5 categories, what is surprising.

Health remains, compared to Medium-High and High classes. Nevertheless, the indicator with more contribution to the category is the number of physicians within 100.000 inhabitants. The concern is quite different. On the others, it was in terms of the capacity of medical facilities, while in here it is about human resources availability. This can be justified with the highest number of medical facilities existing in the most populated and high density municipalities and for the decrease of medical facilities on small cities, as indicated in the Territorial chapter of Portuguese National Territorial Cohesion Program of 2016 (República Portuguesa, 2016).

Population & Social Conditions follows the path defined by literature and gains more importance on municipalities with higher density (Behrens & Robert-Nicoud, 2014), being present on both classes of the second half of our scale.

Transportation emerges again, after being demoted on the last class. Following Jean-Paul Rodrigue (2017) idea, it is normal that this category appears among the high population density classes, once the flow of people is massive. This selection is in total accordance to literature.

As a summary of these ideas, the model is represented on the figure below. Municipalities allocate within the classes, according to their demographic density, and assess the categories and corresponding indicators.

Table 20 - Model of Evaluation Cities Performance

Density Classes	Categories	Indicators
< 100	**Urban Planning**	Green area (hectares) per 100 000 population
	Solid Waste	Percentage of the city's solid waste that is recycled
	Education	Percentage of students completing secondary education: survival rate
	Governance	Women as a percentage of total elected to city-level office
	Water	Total domestic water consumption per capita (litres/day)
100 ≤ 400	**Education**	Percentage of students completing primary education: survival rate
	Transportation	Annual number of public transport trips per capita
	Water	Percentage of city population with sustainable access to an improved water source
	Health	Number of in-patient hospital beds per 100 000 population
	Urban Planning	Green area (hectares) per 100 000 population
400 ≤ 1000	**Urban Planning**	Green area (hectares) per 100 000 population
	Health	Number of in-patient hospital beds per 100 000 population
	Population & Social Conditions	Percentage of city population living below the international poverty line
	Housing	Percentage of population living in affordable housing
	Environment & Climate Change	Particulate matter (PM10) concentration Greenhouse gas emissions measured in tonnes per capita
> 1000	**Urban Planning**	Green area (hectares) per 100 000 population
	Population & Social Conditions	Percentage of city population living below the international poverty line
	Health	Number of physicians per 100 000 population
	Economy	City's unemployment rate
	Transportation	Annual number of public transport trips per capita

When crossing the Categories and the Indicators chosen, with the targets of the 2030 Agenda, it is possible to see that those selected on top 5 contribute to 12 of the 17 goals.

Table 21 - Summary table with all Categories and Indicators selected as most relevant to assess, SDGs to which they contribute

Category	Indicator	SDGs
Economy	• City's unemployment rate	8
Education	• Percentage of students completing primary education: survival rate • Percentage of students completing secondary education: survival rate	4; 10
Environment & Climate Change	• Particulate matter (PM10) concentration • Greenhouse gas emissions measured in tonnes per capita	11; 13
Governance	• Women as a percentage of total elected to city-level office	5; 10
Health	• Number of in-patient hospital beds per 100 000 population • Number of physicians per 100 000 population	3
Housing	• Percentage of population living in affordable housing	10; 11
Population & Social Conditions	• Percentage of city population living below the international poverty line	1; 10
Solid Waste	• Percentage of the city's solid waste that is recycled	11; 12; 14
Transportation	• Annual number of public transport trips per capita	11
Urban Planning	• Green area (hectares) per 100 000 population	11; 15
Water	• Total domestic water consumption per capita (litres/day) • Percentage of city population with potable water supply service	6; 12

7. Conclusion

Urban Planning is a unique category being selected by all four classes. On (A) Very-Low, (C) Medium-High and (D) Very-High Density, it was classified as more relevant category and, on (B) Low Density class as the 5th more. Even with this difference, what is important to retain is that it is a category in which citizens deposit high significance to get sustainability and quality of life. It is represented by the indicator "Green area (hectares) per 100 000 population", which, despite being different categories, also can be linked to environmental concerns, once these green areas are plenty of benefits. Since the possibility of physical activity and relaxing space to the population quality of life, to environmental contribution with the production of oxygen and filtering air from pollution. It is straight linked to Sustainable development, and this view is shared with the World Health Organization (WHO, 2016), and it is a goal of 2030 Agenda of United Nations (United Nations, 2015).

Contrary to Urban Planning, Governance and Economy are only present in one category. Governance has been chosen exclusively by A- class. Despite being a concern to every country/city, is in this class that inequalities are more established, due to difficulties with change management in terms of values and mindsets (Pereira, 2018), and that was the argument of the indicator - Women as a percentage of total elected to city-level office. Economy - the only economic/financial category on top 5 - was exclusively selected by D class. Its indicator refers to the "unemployment rate". Nevertheless, it was not possible to find literature which validates this idea. Despite being selected only one time each, Governance and Economy are two matters covered within 2030 Agenda. Both indicators are mentioned individually and in cooperation (United Nations, 2015).

Water is an essential topic for the two lowest classes of the sample, referred in two different dimensions: total domestic water consumption per capita (litres/day) and the percentage of city population with potable water supply service. It brings two distinct concerns, which are the availability of potable water and the monitorization of the consumption per capita. Water is an old concern for UN. Was part of MDGs (see section Millennium Sustainable Development Goals (MDGs)) and it is part of 2030 Agenda (see section Transforming our world: the 2030 Agenda for Sustainable Development), and it looks like it is a concern also for citizens from, essentially, cities with low population density.

The more densely populated the city is, more concerns relating to Health the citizens have. That is what the results of the survey shown. However, these concerns are not the same. Classes of Low (B) and Medium-High (C) density highlighted as relevant for the achievement of Quality

of Life and Sustainability the number of hospital beds per 100.000 inhabitants, while Very-High (D) emphasize the number of physicians for the same population. This difference on Indicator choice is explainable by high populated cities having more medical facilities (private or public) than low populated ones. Thus, with a different context, the needs differ. Although, both contribute to SGDs and to Quality of Life by being important in the promotion of well-being and healthy life.

As the population and population density grows, the social environment tends to be saturated and to create disparities within people. This idea is validated by Euromonitor International (2013), who confirms that the bigger the city is, the more unequal. Population & Social Conditions is a concern from municipalities allocated on the second half of the sample, with the indicator "percentage of city population living below the international poverty line" having special importance between these.

The cities with low population density consider Education a relevant top category to assess. The Literature argues in that way, as mentioned above. Education is key to sustainability once core concepts and best practices to sustainability are learned and might be shared (Martins et al., 2006).

The ISO 37120 is a contributor to Sustainable Development Goals of 2030 Agenda. The standard contributes predominantly to 9 of the 17 goals, which are: Good Health and Well Being (3rd), Quality Education (4th), Gender Equality (5th), Clean Water and Sanitation (6th), Decent Work and Education Growth (8th), Reduce Inequalities (10th), Sustainable Cities and Communities (11th) , Climate Action (13th), and Peace, Justice and Strong Institutions (16th). (ISO, 2018) By using ISO as the baseline of assessment, these goals were, a priori, covered. However, the analysis of results reinforces its importance. The analysis allows to understand that citizens recognize these goals as important to aim Sustainability and Quality of life.

As mentioned on the Objective & Research Questions section, the principal objective of this thesis was to adapt the ISO 37120 to the real context of Portuguese municipalities, guaranteeing that Sustainability and Quality of Life goals were the focus; and the targets of 2030 Agenda were the purpose. Despite this study not being able for extrapolation to entire Portuguese municipalities, due to the sample dimension, this sample analysis allows to assuming that it is possible, answering then to one of the research questions indicated. Facing the 17 SDGs targets, the top 5 analysis encompasses a set of indicators that contributes to 12 of them (see table 19).

Based on our sample, we are able to conclude some ideas. There are some differences on categories level of relevance, according to the dimension and context. The lowest density populated municipalities value more Water and Education than those with high density. These,

per si, value more Population and Social Conditions. Also, Health is growing on a scale of importance in harmony with the increase of population density. Urban Planning is a concern to every municipality in the study.

The model presented within this thesis, allows Portuguese municipalities to better assess themselves, without wasting time and resources on the evaluation of indicators and categories which are not applicable for their context. Municipalities are segmented by demographic density, which is related to the top relevant ISO categories and indicators for assessment. These, per si, are complementary with the 2030 Agenda. By using the model, municipalities apply a significant strategy to achieve a better and desirable sustainable performance. This way, the study answers to the initial research questions. It is possible to adapt the ISO37120 into Portuguese municipalities; Different municipalities have different concerns regarding sustainable and quality of life achievement; and, with this model, Portuguese municipalities can define the path to the 2030 Agenda targets.

In future opportunities, it is recommended the application of this study within other cities which fit an interval of the classes – A, B, C or D. By this, it is possible to evaluate if the Categories and Indicators selected are similar to those gathered during this project, guaranteeing this way the reliability of this model.

7.1. Limitations & Future Studies Recommendations

Are recognized some limitations in this work. First of all, the reduced number of answers composing the sample. The survey had answers from 36 within a universe of 308 municipalities in Portugal, which are the focus of this work. This, in percentage terms, represents approximately 12% of the total population. This way, it is not possible to say that this work can be extrapolated for the entire population. However, it can be seen as a preliminary study within this topic.

Within the sample of 36 municipalities, the distribution of answers was not homogeneous. There is a big disparity of answers (see Figure 11). For instance, there is, on the one hand, Caldas da Rainha with 42 answers, and, on the other, Cadaval with only 1. To mitigate this, was used the strategy of clustering the sample and, despite reducing the disproportion, it still had a considerable variation (see Figure 12). This high number of answers from Caldas da Rainha is justified by being a significant part of the authors' personal network. Inevitably, it might be considered a biased sample. Future studies must take into account these weaknesses and mitigate it. It should be guaranteed a higher number of answers from every region of

Portugal. As a suggestion, it is recommended to divide the collecting of the answers within NUTS III, guaranteeing a complete assessment all over the country.
Yet on geographic concerns, the municipalities who answered are distributed on north, centre and south of Portugal, and also in Azores. The analysis proceeds, including all the answers. However, as mentioned within the *Literature Review*, the autonomous regions of Madeira and (in this case) Azores, had its specific characteristics and its governance autonomy. A simple answer from Calheta, is not representative of a total of 9 islands/municipalities that compose Azores archipelago. In consequence, in future studies, it should be separated from the continental Portugal analysis. Also, the distribution is mostly in the coastline, being the interior not represented.
In the future, and to sprawl the study and the range of assessment, it is recommended to use all ISO indicators (principal and supportive).

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9. Appendices

Appendix 1

Modelo de Avaliação de Performance para as Cidades Portuguesas

Este questionário enquadra-se no âmbito de uma Tese de Mestrado em Gestão de Serviços e Tecnologia, realizado no ISCTE Business School.

A Tese é intitulada de *Modelos de Avaliação de Performance para as Cidades Portuguesas*, e visa desenvolver um modelo de avaliação único e aplicável às cidades portuguesas, com o objetivo de comunicar ao cidadão o estado atual da sua cidade e o seu posicionamento perante cidades semelhantes. Pretende-se também que, ao nível governativo, este modelo seja utilizado como uma ferramenta de suporte à tomada de decisão, uma vez que o resultado será o retrato detalhado do desempenho do município em diversas áreas.

Os resultados deste questionário serão utilizados meramente para fins académico-científicos.

Obrigado pela colaboração.

Concelho / Municipio: *Ex: Oeiras*

O método de avaliação desenvolvido pela ISO® apresenta 17 categorias constituídas, cada uma delas, por um conjunto próprio de indicadores. Todas as categorias são utilizadas para avaliar e monitorizar cidades ao longo de um período de tempo.

Pretende-se, com este questionário, fazer um levantamento dos dezasseis indicadores que se considerem mais relevantes no contexto específico de uma cidade/município.

Na página seguinte, é apresentado um conjunto de indicadores que visam aferir o nível dos serviços e a qualidade de vida dos cidadãos, em diversos domínios.

Selecione os **16** indicadores que considera mais relevantes e prioritários de avaliação, e visibilidade para o cidadão no contexto real do seu município, e ordene-os numa escala de importância de 1 a 16.

Exemplo:

% de águas residuais que não recebeu tratamento	1
Consumo doméstico total per capita (lts/dia)	2
...	...
Hectares de áreas verdes por 100,000 habitantes	16

% da população com serviço de energia elétrica		% de águas residuais que recebeu tratamento terciário	
% de águas residuais que não recebeu tratamento		% de energia de fonte renovável, como parte da energia total consumida	
% de águas residuais que recebeu tratamento primário		% de estudantes a terminar a escola primária - Taxa de Aprovação	
% de águas residuais que recebeu tratamento secundário		% de estudantes a terminar a escola secundária - Taxa de Aprovação	
% de população com serviço de água potável		% de mulheres eleitas para órgãos públicos	
% de população servida com águas residuais		% de população com acesso a saneamento	
% de Resíduos Sólidos reciclados		% de população com acesso a fonte(s) de água potável	
Concentração de matéria de partículas no ar (PM10)		Consumo doméstico total per capita (lts/dia)	
Concentração de partículas de matéria fina no ar (PM2.5)		Divida pública (divida de despesas como % das fontes próprias de receita do município)	
% de população com colheita regular de Resíduos Sólidos		Energia consumida por edifícios públicos (kWh / m2)	
Emissões de gases de efeito de estufa, medidos em tonelada per capita		Esperança média de vida	
Hectares de áreas verdes por 100,000 habitantes		Número de camas de hospital por 100,000 habitantes	
Km de sistema de transporte público de grande capacidade por 100,000 habitantes		Número de conexões de Internet por 100,000 habitantes	
Km de sistema de transporte público ligeiros por 100,000 habitantes		Número de telemóveis por 100,000 habitantes	
Levantamento do valor total comercial e industrial, como % do valor total de todas as propriedades		Número de homicídios por 100,000 habitantes	
Mortalidade até aos 5 anos por cada 1000 nascimentos		Número de médicos por 100,000 habitantes	
Número anual de viagens de transportes públicos per capita		Número de mortes relacionadas com desastres naturais por 100,000 habitantes	
Número de automóveis individuais per capita		Número de mortes relacionadas por incêndios por 100,000 habitantes	
Número de Bombeiros por 100,000 habitantes		Número de polícias por 100,000 habitantes	
Participação eleitoral nas últimas eleições autárquicas (como % dos eleitores registados)		Total de energia elétrica usada em habitação, per capita	
Rácio estudante/professor na escola primária		Total de Resíduos Sólidos colhidos pelo município, per capita	
Taxa de desemprego		% de mulheres em idade escolar a frequentar a escola	
% da população a viver em *bairros de lata*		m2 de espaços interiores públicos de recreio per capita	
% da população a viver na pobreza		Número de sem-abrigos por 100,000 habitantes	

Appendix 2

Modelo de Avaliação de Performance para as Cidades Portuguesas

Este questionário enquadra-se no âmbito de uma Tese de Mestrado em Gestão de Serviços e Tecnologia, realizado no ISCTE Business School.

A Tese é intitulada de Modelos de Avaliação de Performance para as Cidades Portuguesas, e visa desenvolver um modelo de avaliação único e aplicável às cidades portuguesas, com o objetivo de comunicar ao cidadão o estado atual da sua cidade e o seu posicionamento perante cidades semelhantes. Pretende-se também que, ao nível governativo, este modelo seja utilizado como uma ferramenta de suporte à tomada de decisão, uma vez que o resultado será o retrato detalhado do desempenho do município em diversas áreas.

Os resultados deste questionário serão utilizados meramente para fins académico-científicos.

Obrigado pela colaboração,

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*Obrigatório

1. **Concelho / Município** *

Classificação de Indicadores

O método de avaliação desenvolvido pela ISO® apresenta 19 categorias constituídas, cada uma delas, por um conjunto próprio de indicadores. Todas as categorias são utilizadas para avaliar e monitorizar cidades ao longo de um período de tempo.

Pretende-se, com este questionário, fazer um levantamento dos indicadores que se consideram mais relevantes no contexto específico de uma cidade/município.

Posteriormente, será feiro o levantamento dos resultados e criado o modelo de avaliação. De acordo com as respostas ao questionário, os municípios semelhantes entre si serão agrupados em clusters. Os indicadores classificados como mais relevantes, consoante cada tipo de município, serão trabalhados e serão a base de avaliação de performance de cada um dos clusters.

Abaixo, é apresentado um conjunto de indicadores que visam aferir o nível dos serviços e a qualidade de vida dos cidadãos, em diversos domínios.

2. **Classifique os indicadores, numa escala de 1 a 5, de acordo com a sua relevância, prioridade de avaliação e visibilidade para o cidadão, no contexto real do seu município.** *
Considere 1 "Irrelevante e não prioritário" e 5 "Muito relevante e de máxima prioridade".
Marcar apenas uma oval por linha.

	1	2	3	4	5
% da população da cidade com acesso a água potável	◯	◯	◯	◯	◯
% da população da cidade com acesso a água canalizada	◯	◯	◯	◯	◯
Água consumida para uso doméstico per capita (litros/dia)	◯	◯	◯	◯	◯
Índice de qualidade dos serviços de água potável	◯	◯	◯	◯	◯
% da população servida por sistema de drenagem de águas residuais	◯	◯	◯	◯	◯
% de águas residuais que recebem tratamento centralizado	◯	◯	◯	◯	◯
% da população com acesso a saneamento básico	◯	◯	◯	◯	◯
Área de agricultura urbana por 100.000 habitantes	◯	◯	◯	◯	◯
Concentração média anual de partículas em suspensão na atmosfera (PM10 - partículas de pequena dimensão))	◯	◯	◯	◯	◯
Concentração média anual de partículas em suspensão na atmosfera (PM2.5 - Partículas de muito pequena dimensão))	◯	◯	◯	◯	◯

Classificação de Indicadores

Página 2

3. **Classifique os indicadores, numa escala de 1 a 5, de acordo com a sua relevância, prioridade de avaliação e visibilidade para o cidadão, no contexto real do seu município.** *

Considere 1 "Irrelevante e não prioritário" e 5 "Muito relevante e de máxima prioridade".
Marcar apenas uma oval por linha.

	1	2	3	4	5
Emissões de gases de efeito estufa (ton/hab)	◯	◯	◯	◯	◯
Número de equipamentos culturais e instalações desportivas por 100.000 habitantes	◯	◯	◯	◯	◯
Número de instituições culturais e instalações desportivas por 100.000 habitantes	◯	◯	◯	◯	◯
Taxa de desemprego	◯	◯	◯	◯	◯
Proporção de mulheres a frequentar o ensino em idade escolar	◯	◯	◯	◯	◯
% de alunos a completar o ensino primário	◯	◯	◯	◯	◯
% de alunos a completar o ensino secundário	◯	◯	◯	◯	◯
Rácio de aluno/docente no ensino primário	◯	◯	◯	◯	◯
Consumo final de energia per capita (GJ/ano)	◯	◯	◯	◯	◯
Contribuição das energias renováveis para o consumo final de eletricidade	◯	◯	◯	◯	◯

Classificação de Indicadores

Página 3

4. **Classifique os indicadores, numa escala de 1 a 5, de acordo com a sua relevância, prioridade de avaliação e visibilidade para o cidadão, no contexto real do seu município.** *

Considere 1 "Irrelevante e não prioritário" e 5 "Muito relevante e de máxima prioridade".
Marcar apenas uma oval por linha.

	1	2	3	4	5
% da população com contrato de fornecimento elétrico	◯	◯	◯	◯	◯
Número de conexões à rede distribuição de gás por 100.000 habitantes	◯	◯	◯	◯	◯
Consumo energético anual por edifícios públicos (GJ/m2)	◯	◯	◯	◯	◯
Rácio de serviço da dívida	◯	◯	◯	◯	◯
% de despesas de capital no total de despesas	◯	◯	◯	◯	◯
% de mulheres a ocupar cargos de eleição, no município	◯	◯	◯	◯	◯
% de população a viver em alojamentos inadequados	◯	◯	◯	◯	◯
% da população a viver em habitações acessíveis	◯	◯	◯	◯	◯
Área verde por 100.000 habitantes	◯	◯	◯	◯	◯
% da população que vive abaixo do limiar internacional de pobreza	◯	◯	◯	◯	◯
% da população servida pelo sistema de recolha de resíduos sólidos	◯	◯	◯	◯	◯
Total de resíduos sólidos urbanos recolhidos per capita	◯	◯	◯	◯	◯
% dos resíduos sólidos encaminhados a Reciclagem	◯	◯	◯	◯	◯

Classificação de Indicadores

Página 4

5. **Classifique os indicadores, numa escala de 1 a 5, de acordo com a sua relevância, prioridade de avaliação e visibilidade para o cidadão, no contexto real do seu município.** *

Considere 1 "Irrelevante e não prioritário" e 5 "Muito relevante e de máxima prioridade".
Marcar apenas uma oval por linha.

	1	2	3	4	5
% dos resíduos sólidos encaminhados para aterro	◯	◯	◯	◯	◯
% dos resíduos sólidos encaminhados para operações de valorização energética	◯	◯	◯	◯	◯
Esperança média de vida	◯	◯	◯	◯	◯
Lotação hospitalar para doentes internados, por 100.000 habitantes	◯	◯	◯	◯	◯
Número de médicos por 100.000 habitantes	◯	◯	◯	◯	◯
Taxa de mortalidade antes dos 5 anos, por 1000 nados vivos	◯	◯	◯	◯	◯
Número de bombeiros profissionais/sapadores por 100.000 habitantes	◯	◯	◯	◯	◯
Número de mortes por incêndio por 100.000 habitantes	◯	◯	◯	◯	◯
Número de mortes por desastres naturais por 100.000 habitantes	◯	◯	◯	◯	◯
Número de agentes da polícia por 100.000 habitantes	◯	◯	◯	◯	◯
Número de homicídios por 100.000 habitantes	◯	◯	◯	◯	◯
Distância da rede de transportes públicos	◯	◯	◯	◯	◯
Número de viagens realizadas em transportes públicos per capita	◯	◯	◯	◯	◯

Classificação de Indicadores

Página 4

5. **Classifique os indicadores, numa escala de 1 a 5, de acordo com a sua relevância, prioridade de avaliação e visibilidade para o cidadão, no contexto real do seu município.** *

Considere 1 "Irrelevante e não prioritário" e 5 "Muito relevante e de máxima prioridade".
Marcar apenas uma oval por linha.

	1	2	3	4	5
% dos resíduos sólidos encaminhados para aterro	◯	◯	◯	◯	◯
% dos resíduos sólidos encaminhados para operações de valorização energética	◯	◯	◯	◯	◯
Esperança média de vida	◯	◯	◯	◯	◯
Lotação hospitalar para doentes internados, por 100.000 habitantes	◯	◯	◯	◯	◯
Número de médicos por 100.000 habitantes	◯	◯	◯	◯	◯
Taxa de mortalidade antes dos 5 anos, por 1000 nados vivos	◯	◯	◯	◯	◯
Número de bombeiros profissionais/sapadores por 100.000 habitantes	◯	◯	◯	◯	◯
Número de mortes por incêndio por 100.000 habitantes	◯	◯	◯	◯	◯
Número de mortes por desastres naturais por 100.000 habitantes	◯	◯	◯	◯	◯
Número de agentes da polícia por 100.000 habitantes	◯	◯	◯	◯	◯
Número de homicídios por 100.000 habitantes	◯	◯	◯	◯	◯
Distância da rede de transportes públicos	◯	◯	◯	◯	◯
Número de viagens realizadas em transportes públicos per capita	◯	◯	◯	◯	◯

Appendix 3.1

	Água	Água	Água	Água	Águas residuais	Águas residuais	Águas residuais	Alimentação	Ambiente	Ambiente	Ambiente	Cultura e desporto	Cultura e desporto
Concelho / Município	% da população da cidade com acesso a água potável	% da população da cidade com acesso a água canalizada	Água consumida para uso doméstico per capita (litros/dia)	Índice de qualidade dos serviços de água potável	% da população servida por sistema de drenagem de águas residuais	% de águas residuais que recebem tratamento centralizado	% da população com acesso a saneamento básico	Área de agricultura urbana por 100.000 habitantes	Concentração média anual de partículas em suspensão (PM 2.5)	Concentração média anual de partículas em suspensão (PM 10)	Emissões de gases de efeito estufa (ton/hab)	Número de equipamentos culturais e instalações desportivas por 100.000 habitant	Número de instituições culturais e instalações desportivas por 100.000 habitant
Alvaiázere	4,00	4,00	4,00	4,00	4,00	4,00	4,00	3,00	3,00	3,00	5,00	5,00	5,00
Cadaval	5,00	5,00	4,00	3,00	4,00	4,00	5,00	3,00	3,00	3,00	3,00	1,00	1,00
Calheta	5,00	5,00	5,00	5,00	5,00	5,00	5,00	3,00	3,00	3,00	1,00	2,00	2,00
Obidos (media)	4,14	3,57	4,00	3,29	3,86	3,71	4,29	4,29	3,86	3,86	3,86	3,57	3,57
Pombal (média)	5,00	4,33	4,33	4,67	4,33	4,33	4,67	4,67	4,00	4,67	5,00	4,00	4,33
Rio Maior	5,00	5,00	4,00	4,00	4,00	4,00	5,00	3,00	4,00	4,00	5,00	3,00	3,00
Vila do Bispo	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
Albergaria-a-Velha	5,00	5,00	4,00	5,00	5,00	5,00	5,00	4,00	4,00	4,00	4,00	5,00	5,00
Alcobaça (média)	4,67	3,33	2,67	3,67	2,67	3,00	3,67	3,00	3,33	3,67	3,67	3,33	3,33
Anadia (média)	4,00	4,75	4,00	4,25	4,50	4,25	4,50	3,75	4,25	4,00	4,00	4,00	3,00
Arruda dos Vinhos	1,00	1,00	2,00	3,00	3,00	1,00	1,00	1,00	1,00	1,00	5,00	3,00	3,00
Batalha	5,00	5,00	4,00	5,00	5,00	4,00	5,00	4,00	4,00	4,00	5,00	5,00	5,00
Bombarral	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
Nazare (media)	4,75	4,25	4,25	4,50	4,25	4,25	4,25	4,00	4,00	3,50	3,75	4,00	3,75
Santarém	5,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00	4,00	4,00	4,00	4,00	4,00
Torres Novas	4,00	5,00	5,00	4,00	3,00	3,00	4,00	3,00	3,00	3,00	3,00	4,00	4,00
Viseu	4,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00	4,00	4,00	5,00	4,00	4,00
Albufeira	2,00	2,00	4,00	2,00	3,00	3,00	5,00	4,00	2,00	2,00	3,00	3,00	3,00
Caldas da Rainha (média)	4,67	4,33	4,17	4,33	4,25	4,08	4,42	3,75	3,67	3,75	3,58	3,92	3,50
Leiria (Media)	4,89	4,67	4,44	4,78	4,22	4,22	4,78	3,67	3,56	3,56	4,56	3,56	3,78
Marinha Grande	4,00	4,00	5,00	3,00	4,00	4,00	4,00	2,00	2,00	2,00	5,00	3,00	4,00
Olhão (média)	4,00	5,00	5,00	4,50	4,50	4,50	4,50	3,50	4,00	4,00	4,50	4,00	4,50
Peniche	5,00	5,00	5,00	5,00	5,00	4,00	5,00	3,00	3,00	3,00	4,00	4,00	4,00
Portimão (média)	5,00	5,00	4,40	4,60	4,20	4,20	4,40	3,60	3,80	3,40	4,40	4,20	4,40
Vila Franca de Xira	5,00	5,00	4,00	4,00	3,00	4,00	5,00	3,00	4,00	4,00	4,00	4,00	3,00
Braga (média)	3,5	3,5	3,5	4	4	4	4	4	4	4,5	4,5	4,5	3
Guimarães	3	4	3	4	4	4	4	5	4	4	4	4	4
Póvoa do Varzim (média)	4,50	4,50	4,50	4,50	4,50	4,50	4,50	4,50	4,50	5,00	5,00	4,00	4,00
Setúbal (média)	3,67	4,00	3,67	3,67	4,00	3,33	3,67	4,00	4,00	3,67	3,67	3,67	3,33
Almada	5,00	5,00	4,00	5,00	5,00	4,00	5,00	1,00	1,00	1,00	5,00	5,00	5,00
Amadora (média)	5,00	4,60	3,60	4,60	3,80	4,00	5,00	2,80	3,60	3,40	3,60	3,80	3,40
Cascais	1,00	1,00	4,00	3,00	3,00	4,00	2,00	1,00	3,00	3,00	5,00	3,00	3,00
Entroncamento (Média)	4,00	4,33	4,00	4,33	3,33	3,67	3,67	3,33	3,33	3,00	4,33	3,33	3,67
Lisboa (média)	4,69	4,56	3,81	4,44	4,25	4,06	4,44	3,63	3,75	3,69	4,13	3,50	3,63
Odivelas	5,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00	4,00	4,00	4,00	4,00	4,00
Oeiras (média)	4,33	5,00	4,00	4,67	3,33	3,00	4,00	4,00	3,00	3,67	5,00	4,33	4,33

Appendix 3.2

	Economia	Educação	Educação	Educação	Educação	Energia	Energia	Energia	Energia	Energia	Finanças	Finanças	Governo	Habitação	Habitação	Planeamento urbano	População
Concelho / Município	Taxa de desemprego	Proporção de mulheres a frequentar o ensino em idade escolar	% de alunos a completar o ensino primário	% de alunos a completar o ensino secundário	Rácio de aluno/docente no ensino primário	Consumo final de energia per capita (GJ/ano)	Contribuição das energias renováveis para o consumo final de eletricidade	% da população com contrato de fornecimento elétrico	Número de conexões à rede distribuição de gás por 100.000 habitantes	Consumo energético anual por edifícios públicos (GJ/m2)	Rácio de serviço da dívida	% de despesas de capital no total de despesas	% de mulheres a ocupar cargos de eleição, no município	% de população a viver em alojamentos inadequados	% da população a viver em habitações acessíveis	Área verde por 100.000 habitantes	% da população que vive abaixo do limiar internacional de pobreza
Alvaiázere	5,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00	3,00	4,00	3,00	3,00	5,00	3,00	3,00	4,00	4,00
Cadaval	2,00	4,00	5,00	4,00	3,00	3,00	3,00	5,00	1,00	1,00	1,00	3,00	4,00	3,00	5,00	5,00	2,00
Calheta	3,00	5,00	2,00	3,00	3,00	3,00	4,00	3,00	2,00	2,00	3,00	3,00	1,00	1,00	3,00	2,00	1,00
Obidos (media)	3,14	3,71	4,00	4,00	3,71	4,00	3,71	4,00	3,86	3,14	3,14	3,57	3,57	4,00	3,43	3,86	3,29
Pombal (média)	4,33	4,33	4,33	4,33	4,00	4,00	4,67	4,33	4,33	4,67	4,00	4,33	4,00	4,33	4,67	5,00	4,67
Rio Maior	5,00	5,00	5,00	5,00	5,00	3,00	5,00	5,00	4,00	5,00	4,00	4,00	5,00	5,00	5,00	5,00	5,00
Vila do Bispo	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
Albergaria-a-Velha	4,00	5,00	5,00	5,00	5,00	4,00	5,00	5,00	4,00	5,00	3,00	3,00	5,00	5,00	5,00	5,00	5,00
Alcobaça (média)	2,67	4,67	3,33	3,00	3,00	2,67	3,33	3,33	3,33	3,33	3,67	3,67	4,00	4,00	2,67	3,00	3,00
Anadia (média)	3,00	4,75	3,50	3,75	4,25	4,00	4,25	4,25	3,75	4,00	3,75	4,25	4,25	4,50	4,00	4,25	4,00
Arruda dos Vinhos	5,00	4,00	3,00	5,00	5,00	5,00	5,00	1,00	1,00	3,00	1,00	1,00	1,00	5,00	3,00	4,00	2,00
Batalha	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00	5,00	5,00	5,00	5,00
Bombarral	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
Nazare (media)	3,25	4,75	4,00	4,00	4,50	4,50	4,25	4,50	4,25	4,25	3,50	4,25	4,25	4,00	4,25	4,25	4,25
Santarém	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	3,00	4,00	3,00	4,00	4,00	4,00	5,00
Torres Novas	3,00	5,00	5,00	5,00	5,00	4,00	3,00	4,00	4,00	4,00	3,00	4,00	3,00	2,00	3,00	3,00	2,00
Viseu	5,00	5,00	5,00	5,00	5,00	4,00	5,00	5,00	5,00	5,00	5,00	4,00	5,00	4,00	5,00	5,00	5,00
Albufeira	3,00	2,00	1,00	2,00	3,00	2,00	5,00	4,00	2,00	4,00	2,00	3,00	3,00	2,00	4,00	4,00	3,00
Caldas da Rainha (média)	3,50	4,25	4,58	4,42	4,08	3,67	3,83	4,42	4,00	4,25	3,92	4,00	3,67	3,58	4,00	4,17	4,08
Leiria (Media)	4,56	4,33	4,78	4,67	4,78	4,44	4,67	4,33	4,22	4,44	4,33	4,33	4,22	4,33	4,67	4,78	4,44
Marinha Grande	5,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00	4,00	2,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
Olhão (média)	4,50	4,50	4,50	4,00	5,00	5,00	4,50	4,00	3,50	4,00	2,50	2,50	3,50	3,00	3,50	3,50	3,50
Peniche	4,00	4,00	5,00	5,00	4,00	4,00	4,00	5,00	4,00	4,00	3,00	3,00	3,00	4,00	4,00	4,00	4,00
Portimão (média)	4,60	3,80	4,00	3,60	4,40	4,20	4,40	3,60	4,00	4,00	4,20	4,00	3,20	4,00	3,60	4,20	4,20
Vila Franca de Xira	5,00	4,00	5,00	5,00	4,00	4,00	3,00	5,00	4,00	2,00	3,00	4,00	3,00	4,00	4,00	4,00	5,00
Braga (média)	2	4,5	3	3,5	4	4	4	4,5	4	3,5	4	4	4	4	4,5	4,5	4
Guimarães	4	4	5	4	4	4	4	4	3	3	4	4	4	4	4	4	4
Póvoa do Varzim (média)	4,00	4,50	4,00	4,00	4,50	4,50	4,50	4,00	3,50	4,50	4,00	4,00	4,50	4,50	4,50	4,50	4,50
Setúbal (média)	3,33	4,67	3,67	3,33	4,00	4,33	4,33	4,33	3,67	3,67	3,67	4,33	4,33	3,67	5,00	5,00	4,00
Almada	5,00	2,00	5,00	5,00	5,00	3,00	5,00	4,00	4,00	5,00	5,00	4,00	4,00	5,00	4,00	5,00	5,00
Amadora (média)	4,60	3,40	4,00	3,80	4,00	4,00	4,40	4,20	4,00	3,20	3,80	3,80	3,40	4,80	4,00	4,80	4,60
Cascais	4,00	1,00	1,00	2,00	2,00	5,00	5,00	3,00	3,00	4,00	4,00	4,00	4,00	3,00	3,00	4,00	3,00
Entroncamento (Média)	4,33	3,33	4,33	4,33	4,00	4,67	4,00	3,00	3,33	4,00	4,33	4,33	4,00	4,00	4,00	4,67	4,00
Lisboa (média)	3,88	3,56	3,81	4,00	3,88	3,88	4,31	4,44	4,00	3,69	3,50	3,56	3,31	4,00	4,13	4,19	4,50
Odivelas	4,00	4,00	5,00	5,00	4,00	5,00	5,00	4,00	4,00	4,00	3,00	5,00	4,00	4,00	4,00	4,00	5,00
Oeiras (média)	4,67	2,33	3,33	4,33	4,33	4,67	4,67	4,67	3,33	3,67	4,67	4,33	4,67	5,00	4,67	4,67	5,00

Appendix 3.3

	Resíduos sólidos	Resíduos sólidos	Resíduos sólidos	Resíduos sólidos	Resíduos sólidos	Saúde	Saúde	Saúde	Saúde	Segurança	Segurança	Segurança	Segurança	Segurança	Transportes	Transportes
Concelho / Município	% da população servida pelo sistema de recolha de resíduos sólidos	Total de resíduos sólidos urbanos recolhidos per capita	% dos resíduos sólidos encaminhados a Reciclagem	% dos resíduos sólidos encaminhados para aterro	% dos resíduos sólidos encaminhados para operações de valorização energética	Esperança média de vida	Lotação hospitalar para doentes internados, por 100.000 habitantes	Número de médicos por 100.000 habitantes	Taxa de mortalidade antes dos 5 anos, por 1000 nados vivos	Número de bombeiros profissionais/sapadores por 100.000 habitantes	Número de mortes por incêndio por 100.000 habitantes	Número de mortes por desastres naturais por 100.000 habitantes	Número de agentes da polícia por 100.000 habitantes	Número de homicídios por 100.000 habitantes	Distância da rede de transportes públicos	Número de viagens realizadas em transportes públicos per capita
Alvaiázere	5,00	4,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00	4,00	2,00	2,00	2,00	1,00	4,00	2,00
Cadaval	5,00	5,00	5,00	5,00	3,00	5,00	5,00	1,00	1,00	2,00	1,00	1,00	3,00	1,00	3,00	1,00
Calheta	2,00	3,00	2,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
Obidos (media)	3,57	3,57	3,71	3,43	3,86	3,43	3,86	3,86	3,57	3,57	3,57	3,71	3,71	3,86	2,86	3,29
Pombal (média)	4,67	4,67	5,00	5,00	4,67	4,33	4,33	4,67	4,33	4,00	4,67	3,67	3,00	4,33	3,67	4,67
Rio Maior	5,00	5,00	5,00	4,00	4,00	4,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	3,00	3,00	3,00
Vila do Bispo	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	3,00	5,00	5,00	5,00	4,00	2,00	5,00	5,00
Albergaria-a-Velha	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00	5,00	4,00	5,00	5,00	5,00	5,00
Alcobaça (média)	4,00	3,33	2,67	2,33	3,33	4,00	3,33	3,67	4,33	3,00	2,67	2,67	3,00	3,33	3,33	3,00
Anadia (média)	4,00	4,00	4,00	4,00	4,50	4,25	4,75	4,50	4,75	3,75	4,75	4,00	4,00	4,25	4,50	4,75
Arruda dos Vinhos	2,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	2,00	5,00	5,00	2,00	5,00	5,00	5,00	5,00
Batalha	5,00	5,00	5,00	4,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00
Bombarral	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
Nazare (media)	4,25	4,00	3,75	4,50	4,50	4,25	3,75	3,75	4,75	4,25	4,25	4,25	4,25	4,75	4,25	4,25
Santarém	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	4,00	4,00
Torres Novas	3,00	3,00	3,00	3,00	3,00	4,00	4,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	3,00	3,00
Viseu	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
Albufeira	2,00	2,00	4,00	2,00	4,00	2,00	2,00	4,00	1,00	3,00	1,00	1,00	3,00	2,00	4,00	4,00
Caldas da Rainha (média)	4,00	4,17	3,83	4,25	4,17	4,67	4,42	4,17	4,08	4,50	4,00	3,92	3,92	4,00	4,08	4,25
Leiria (Media)	5,00	4,89	4,89	4,44	4,56	4,78	4,67	4,67	4,56	4,56	4,44	4,44	4,67	4,11	4,22	4,56
Marinha Grande	5,00	5,00	5,00	5,00	5,00	3,00	5,00	5,00	4,00	5,00	5,00	5,00	5,00	5,00	4,00	4,00
Olhão (média)	3,50	3,50	3,50	5,00	4,00	4,00	4,50	4,50	4,00	4,50	3,50	4,00	5,00	4,50	5,00	5,00
Peniche	4,00	4,00	3,00	1,00	1,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	4,00
Portimão (média)	3,80	3,80	4,60	4,20	4,60	4,60	4,20	4,40	3,60	4,40	3,60	3,40	4,40	4,40	4,40	4,40
Vila Franca de Xira	4,00	3,00	4,00	2,00	2,00	5,00	3,00	4,00	5,00	4,00	4,00	4,00	5,00	4,00	4,00	4,00
Braga (média)	4	4	4,5	4,5	4	4	4,5	5	5	3	4	3,5	3	4	3,5	4
Guimarães	5	4	4	4	4	4	4	5	4	3	4	3	3	4	2	4
Póvoa do Varzim (média)	4,50	4,50	4,50	4,50	4,50	4,50	4,50	4,50	4,50	4,00	4,00	3,50	4,00	4,50	4,50	4,50
Setúbal (média)	5,00	4,00	4,00	4,33	4,00	3,67	4,33	4,67	4,67	4,00	4,67	4,33	4,33	4,67	3,67	4,33
Almada	3,00	3,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	2,00	2,00	2,00	5,00	5,00	5,00	5,00
Amadora (média)	4,40	4,00	4,40	4,00	3,80	4,60	5,00	5,00	4,60	4,60	3,80	3,40	4,60	4,80	4,80	3,80
Cascais	4,00	4,00	4,00	4,00	4,00	3,00	5,00	4,00	2,00	4,00	3,00	1,00	3,00	2,00	4,00	4,00
Entroncamento (Média)	4,00	4,33	4,33	4,33	4,00	4,33	4,00	4,33	4,00	4,33	3,67	3,67	4,33	4,00	4,67	4,33
Lisboa (média)	4,38	3,94	3,88	4,00	4,13	4,13	4,25	4,44	3,81	3,88	3,75	3,56	4,00	4,31	4,44	3,88
Odivelas	5,00	5,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Oeiras (média)	4,33	3,33	3,67	3,67	3,67	4,67	5,00	5,00	5,00	5,00	5,00	4,33	5,00	5,00	4,33	4,33