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SMART TOURISM – CITY TOURISM RADAR

A Tourism Monitoring Tool at the City of Lisbon

Ana Filipa Marques de Lobão Bernardo

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

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Finally, the time has come to reach the acknowledgements of this work.

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To my parents, who've always believed me, encouraged me to pursue my goals and motivated me through hard times.

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To my partner, who celebrated each accomplishment with his endless patience and constant positive way.

ABSTRACT

The increasing demand for Lisbon has led to an uncontrolled access to the city's main attractions, which is reflected in the number of visitors that can be encountered at the city. Smart Tourism Destinations are gaining relevance in Smart Cities in everyday life, and technology is intricated more than ever in the cities and its citizens. Open Governance is a vital concept in any modern city and data is shared and available like never before. It is proposed a conceptual model to a city tourism dashboard and its materialization using Open Data from the city's public portal, produced by the Lisbon City Council and other partners. It is also suggested a method to the conception of this tool and the main indicators that must be included based on the actual state of the art. It concludes with a proposal of future developments to perform on the smart tourism destinations area.

KEYWORDS

Information and Communication Technologies (ICTs); Information Management; Open Data; Open Governance; Smart Tourism Destinations; Tourism Monitoring Tool.

RESUMO

O aumento da procura de Lisboa como destino turístico conduziu a um acesso descontrolado aos seus principais pontos turísticos, refletindo-se no elevado número de visitantes que se visitam a cidade. As *Smart Tourism Destinations* estão a ganhar cada vez mais importância no dia-a-dia das S*mart Cities*, e a tecnologia está cada vez mais intrínseca nas cidades e nos seus cidadãos. *Open Governance* é um conceito vital em qualquer cidade atual, já que existem dados e informação disponíveis hoje em dia como nunca existiram antes. Neste trabalho, é proposta uma *framework* conceptual para visualizar a informação adequada à tomada de decisão no turismo de uma cidade onde são apresentados os principais indicadores que devem ser incluídos na mesma, com base no estado de arte atual. É também sugerido um método de instanciação desta ferramenta, utilizando dados abertos do portal público de dados abertos produzidos pela Câmara Municipal de Lisboa e por outras entidades. Este trabalho é concluído com uma proposta de futuros desenvolvimentos a realizar na área de *Smart Tourism Destinations.*

PALAVRAS-CHAVE

Dados abertos; Destinos de Turismo Inteligentes; Ferramenta de Monitorização de Turismo; Gestão de Informação; Governança aberta; Tecnologias de Informação e Comunicação (TICs).

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LIST OF ABBREVIATIONS AND ACRONYMS

BI Business Intelligence

CML Câmara Municipal de Lisboa (Lisbon City Council)

CSV Comma Separated Values file

DR Demand Response

DW Data Warehouse

GPS Global Positioning System

ICTs Information and Communication Technologies

INE Instituto Nacional de Estatística (Portuguese Statistics Institute)

IoT Internet of Things

LAC Limits of Acceptable Change

MDSS Marketing Decision Support System

STDs Smart Tourism Destinations

STTs Smart Tourism Technologies

1. INTRODUCTION

1.1. BACKGROUND AND PROBLEM IDENTIFICATION

According to Eurocities (2016), citizens are at the hearth of a Smart City process and technologies are the key enablers. People are the sensors that provide anonymous data, availability of city services and events detection (Goodchild, 2007). Haklay (2013) proposed four levels of citizen participation. The first level is crowdsourcing, the second is distributed intelligence, the third is the participatory science, and the fourth is the extreme participation, characterized by the level of citizenship collaboration. In most cities, citizen science is still in the earliest phase, and by rethinking governance, design and creation, there's an increase of innovative solutions, where data has tremendous importance, while standards and interoperability are crucial for a Smart City (Mitchell, Villa, Stewart-Weeks, & Lange, 2013).

Nowadays, the stream of tourists at any trendy destination is increasing every day, leading to problems on the number of people that circulate, even on smaller or more traditional cities. It is a priority to investigate on tourism demand growth and the social impacts of tourism (Faulkner & Tideswell, 1997). Several investigators have researched on tourism management and smart tourism destinations, but the findings somehow present limitations in the way that further research is needed to validate findings and to expand the theoretical contributions of such (Buhalis & Amaranggana, 2014). Also, "*the application of the concept of sustainable development as an achievable and practical objective for tourism has not yet matured*." (Ko, 2005, p. 431). As so, a need has emerged to take a further look on this matter, which has motivated this Masters' Thesis. Its aim is to research whether it is possible to build an artefact to help monitor the tourism of Lisbon using Open Data from the city Open Data Portal, and also propose the indicators that should be included in such.

1.2. RESEARCH QUESTION AND OBJECTIVES

Although there are currently some Portuguese organizations working on this topic, namely the Lisbon City Council (*Câmara Municipal de Lisboa* – CML), *Turismo de Portugal* and *Turismo de Lisboa* associations, none provides a conceptual model on how to monitor the city tourism yet. Further study was required on how different stakeholders can benefit from a city tourism monitoring tool and this motivated the research question of this work.

Several questions emerge on using Lisbon tourism's Open Data to observe the city tourism. As so, the main objective of this thesis is to investigate if an auxiliary tool that helps monitoring the tourism inside the city can be built using Lisbon Open Data. In this context, it is proposed a model to measure and to help monitoring the urban tourism in the city. As a research approach after a theoretical background review, other examples from other countries dashboards on tourism were analysed. This research may represent an important stage by warning to the need for a deeper knowledge of the tourism development at a particular city, and how can it be explored and managed more intelligently by different participants. Below, the next table summarizes this thesis main objectives.

Table 1: Thesis objectives.

Specific Goals	*How is Lisbon benefitting?*	*How are the citizens benefitting?*
Develop a conceptual model to monitor the tourism in Lisbon using Open Data from the Lisbon Open Data Portal	Able to monitor the local dynamics and development	Evolution of the city in an intelligent manner
Materialize the proposed model in an empirical tool	Able to see and take insights based on the local data	Information is shared visually and is not "just" data
Propose a conceptual model that is usable with Open Data from other cities	Lisbon as an example to other cities in the Smart Tourism Destinations topic	Information visually available

1.3. STUDY RELEVANCE AND IMPORTANCE

According to Turismo de Portugal (2017) in an analysis to the number of nights spent in Portugal in the first quarter of 2017, the frequency increased to 3,3 nights per visitors who came from outside the country, led by Lisbon, having amplified the visitors originated from Brazil, the United Kingdom, the United States of America, Spain and Germany. This growth triggered the tourism sector income to nearly 715 million euros, and the hotel occupancy rate to more than 55%. Considering the above, it may be relevant to search for motives for non-Portuguese visitors to demonstrate such a high interest in this country. Furthermore, it may be even more motivating to track the good examples found on Smart Cities all over the world, but especially from the citizens' countries who visit it.

Let's consider Brazil, where the city of *Natal*, a Smart City, was tested during the 2014 FIFA World Cup. By collecting, processing, sharing, storing and analysing the tourists' behaviour, and also their location, an infrastructure was developed to plan and manage the city, but also to provide an improved visitor experience during the event (Cacho et al., 2016). The app collected information and had sections like the city guide, allowing the tourist to share touristic information, and was connected to a *Business Intelligence* infrastructure, providing information on: the areas of interest for tourists; the areas of interest for tourists in different periods; and the meeting point among different groups of tourists. This project was extremely relevant for the authors to provide practical implications for the cities that currently develop to become Smart Tourism Destinations (STD), and it is stated that one of the next steps would be to analyse the resulting data and collect new data about the smart initiatives on the city, besides the regular visitor and location based information, in order to improve the cities' infrastructures (Corrêa, 2013; Paper, 2015; Rennó, 2014). This seems to be an important point that the present thesis may help contributing to.

However, not only foreign countries develop Smart City projects. Portugal is the first country to have a Smart Island project developed by Vodafone (2017), and a truly living laboratory for this research field at Azores, as well as many other Smart Cities initiatives on a national scale (INTELI, 2014). As so, not only visitors but also the Portuguese citizens may benefit with this initiative, but also international interest is captured with multinational organizations. It is, thus, easy to imagine the main advantages not only for the tourism sector, but also for the public mobility and transports, customer service, and citizens' satisfaction with such initiative.

The two main questions of *Who will be interested in the results of this thesis?* and *Who can benefit from the findings?* can now be clarified, as the present work aims to serve the best interest of all citizens and to benefit them by adding new meaning to the existing information, allowing for its exploration, and also find new possible improvements for the city of Lisbon.

1.4. THESIS METHODOLOGY

The following activity plan sums up the methodology steps proposed for this thesis development. It is based on the Design Science Research Methodology presented by Vaishnavi, Kuechler & Petter (2004).

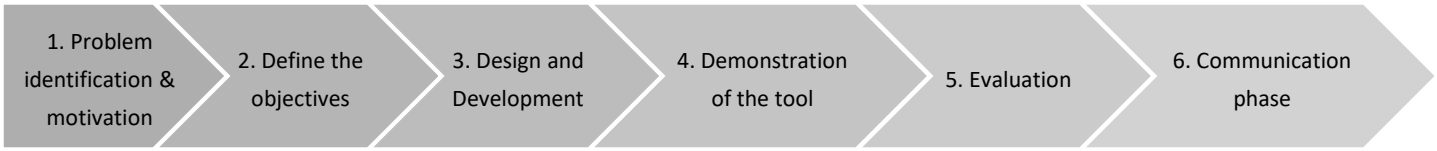


Figure 1: Thesis methodology proposal.

1. **Problem Identification and Motivation**

As stated previously, tourism is increasing in Lisbon but few insights are currently made on the Open Data available at the city council open data portal. As no tourism conceptual model has been proposed, an artefact is suggested on how to monitor it would be valuable to help achieving a better understanding and gain information of the city tourism patterns.

2. **Define the objectives for a solution**

After analysing if it is possible to build an artefact to monitor the tourism of Lisbon using Open Data, the main objectives for a solution are to develop a conceptual model to monitor the tourism in Lisbon using Open Data from the Lisbon Open Data Portal, demonstrate it in an empirical tool and propose it in a way that it can be used within other cities using Open Data.

3. **Design and development**

The design of the monitoring tool will be based choosing among the indicators identified at six tourism dashboards form different countries. This will help gaining insights on the existing work and to start designing the artefact.

4. **Demonstration of the tool**

Mock-ups will be produced and chosen to demonstrate the monitoring tool upon design and development of the artefact. A dashboard will be developed using Microsoft Power BI software (Microsoft, 2019) to assess for the usage of the conceptual model in several reports, using Lisbon Open Data.

5. **Evaluation**

After materializing the conceptual model, an evaluation on how well the artefact supports the solution to the problem will be performed, that is, if nowadays the proposed conceptual model answers to the possibility of monitoring the city of Lisbon using Open Data. The initial objectives for the solution will be compared to the actual solution, by assessing its results in the empirical tool descripted above.

6. **Communication phase**

Upon the evaluation phase is completed on how well the conceptual model answers the initial problem, its utility and novelty will be presented, along with the current limitations and possible future development suggestions, to researchers and relevant audiences in a conference or a scientific magazine.

This thesis will be managed in order to achieve the proposed goals and to follow as much as possible the methodology described at this section, along with other upcoming methods.

2. LITERATURE REVIEW

On this chapter, it is presented the literature review that contains the main references and theoretical concepts found in this thesis. It starts with an analysis on data management, covering the Open Data and Intelligence Systems topics, followed by an exploration on Smart Structures, which cover the Smart Cities, the Smart Tourism Destinations and the Tourism Management subjects.

2.1. DATA MANAGEMENT

The concept of Business Intelligence (BI) is defined differently, as it depends on which area it is being used. According to Côrte-real, Neto, & Fátima (2012), some authors define Business Intelligence as a productive process with a base made of information and knowledge as the result, others define it as a concept that comprises architectures, tools, databases, applications and methodologies. As so, the concept presents a uniqueness for each organization, being influenced by its business rules.

On Britto & Júnior (2006) study on implementing and keeping a continuous improvement program of data quality on data warehouses, the authors explore data quality dimensions, the main problems when acquiring data, its wrong usability, poor quality and its impact, and the challenges on data quality for a Data Warehouse. Organized and clean data is not given its proper importance yet, as the same data may be interpreted differently by users and the management teams are not yet aware of it. Although a framework for data quality when building a Data Warehouse is proposed by the authors, data quality can only be kept if users make its usage a routine, and understand the solution itself. This way, data quality can be measured, analysed and improved throughout time, improving the organization results. It is, thus, an urge that good practices are promoted and tracked at the user level, so data follows the correct path for higher quality. At the present work, this component of BI could be tracked by the city council Chief Information Officer and a robust team that controls quality and assures all users, at the organization and outside of it, have the same understanding on data.

Following this topic, Côrte-real et al. (2012) proposed a model that assesses an organization using BI, allowing it to maximize IT resources fully. Maturity measures the ability of an organization for continuous improvement at a certain area. Maturity models may be subjective, as they focus on BI effects on specific and possibly problematic areas only, and do not indicate how to improve a situation, but they can be adapted to an organizational culture and maturity factors, as well as on its economic position, technical architecture and users' needs. This way, at the present thesis, this concept may be useful to help assessing the city council ability of improving the accessibility to the open data.

2.1.1. Open Data

According to the Open Data Guide (Dietrich et al., 2012, p.6), *"Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike."* Open data is defined by the Open Definition as having:

1. Availability and Access: the data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the internet. The data must also be available in a convenient and modifiable form.
2. Re-use and Redistribution: the data must be provided under terms that permit re-use and redistribution, including the intermixing with other datasets.
3. Universal Participation: everyone must be able to use, re-use and redistribute - there should be no discrimination against fields of endeavour or against persons or groups. For example, 'non-commercial' restrictions that would prevent 'commercial' use, or restrictions of use for certain purposes (e.g. only in education), are not allowed.
4. Machine Readability: Data must be available in form readily processable by a computer and where the individual elements of the work can be easily accessed and modified.

Open Data is defined, according to Open Knowledge International, as non-confidential data, produced with public money, that can be edited and used by everyone, without restrictions on its usage or distribution (Janssen, Charalabidis, & Zuiderwijk, 2012; Neto, Neves, Rego, & Cartaxo, 2017). *"Open means anyone can freely access, use, modify, and share for any purpose (subject, at most, to requirements that preserve provenance and openness)"* (Open Knowledge Foundation, 2009, n.a.).

The Open Government concept proposed by Sandoval-Almazan, Luna-Reyes, Rojas-Romero, Gil-Garcia & Lun (Sandoval-Almazan, Luna-Reyes, Rojas-Romero, Gil-Garcia, & Luna, 2012) implies a change from the traditional principle of accountability to a state of citizen empowerment, which was studied by exploring the use of open data and mobile apps in the top countries according to the UN 2010 e-Government Survey. The findings were that although not all countries offered mobile apps to their citizens, several apps created citizen value, where private companies and citizens are getting involved in the creation of such. All these tools and applications potentiate the e-government to allow citizens to create and access content and communicate to government officials, which can add value to the existing information and allow citizens to generate networks that can solve urgent public problems. All the above can be an illustration for the national panorama and constitute a mode of integrating the citizens on the local issues that a city may face. However, public free apps are important to be publicized, as citizens will choose it only if its importance is made available and promoted publicly. This way, the app interacts and establishes a direct contact between open data and the citizens. At the next table, the concepts of Open Data and Open Government are explored.

Table 2: Open Data literature review.

Authors	*Keywords*	*Concepts*	*Study Objectives*
Sandoval-Almazan, Gil-Garcia, Lunas-Reyes, Lunas, & Rojas-Romero (2012)	Government apps, apps, mobile apps	*Change in focus from the traditional principle of accountability to a concept of citizen empowerment.*	Explore the use of open data and mobile apps in the top countries (UN 2010 e-Government Survey).

Authors	*Keywords*	*Concepts*	*Study Objectives*
Janssen, Charalabidis, & Zuiderwijk (2012)	Systems theory; institutional theory; adoption; diffusion; open data; open government; governance; transformation	*Open data - non-privacy-restricted and non-confidential data produced with public money and made available without any restrictions on its usage or distribution.*	Benefits of and barriers to open-data systems using people's experiences with open data obtained from interviews and a group session."
Neto, Neves, Rego, & Cartaxo (2017)	Open data; smart cities; Portugal	*Open data - data that can be used, modified and shared by an individual for any purpose.*	"Provide an overview of the open data landscape in Portuguese cities"

Where does the community positions Open Data? Janssen et al. (2012) analysed Open Data systems benefits and barriers by interviewing people and promoting group sessions on their study. A step was taken from a closed to an open system of public data, as the government also benefits while learning with the public feedback, and these systems reinforce existing structures instead of changing them. However, Janssen et al. (2012, p. 260) state that "*Open Data has no value itself, it only becomes valuable when used*", and the barriers presented on its use, complexity, legislation, quality and participation, may make the data private in practical terms. The data provider is not where the success for the Open Data lies, but on its quality, and the use it can have in real case scenarios. As so, open data traits have to improve along with a culture of open government but also with tools and infrastructures to use this data and help users make sense of it. This way, the public engagement may exceed the current level, and promote the use of collective intelligence of all the citizens.

At Portugal, a study on the Open Data national scenario was performed by Neto et al. (2017). It is known that the public sector is following the public entities strategy on providing Open data to the citizens. Recently, a Portuguese telecommunication company just released a portal on tourism where locally positioning data is displayed in striking interactive dashboards, allowing to know where most tourist go when visiting Portugal. This data is private and was collected based on the company's users GPS signal, so it has a huge commercial importance and unfortunately is not yet available as Open Data. Nevertheless, there are three Open Data portals in the country, organized by Lisbon (http://lisboaaberta.cm-lisboa.pt/), Porto (https://dadosabertos.cm-porto.pt/) and Oeiras (http://dadosabertos.cm-oeiras.pt/), that display datasets from different sectors and a Data Index that gives insights on data quality and possibilities of improvement. However, the current legislation at Portugal is what compels the municipalities to display Open Data, which makes it a legal obligation, and not so much of a business enhancer, possibly compromising the current Open data quality at the country.

2.1.2. Intelligence Systems

As stated before, adding value to Smart Cities solutions that make the decision-making process more efficient is a current need to make these more effective. But in which way do decision support systems contribute to Smart Cities?

Silva, Khan, & Han (2017) promote the Smart City concept as an enhancer of the urban citizens life quality, involving other city areas like community, transportation, healthcare and parking, among others. The authors add that the collaboration of these solutions with Big Data analytics assures a more flexible and real-time data processing, leading to more intelligent decisions. A framework to deploy solutions that enable real-time decision making, data collection autonomous processes, and user-centric energy customizing is proposed, using data originated in daily operational activities on a city, and later on, real-time data that comes from connected devices within the city suburbs.

Unquestionably, Big Data can be used for future Smart Cities development and planning based on the existing data from various sources. The proposed system can efficiently process data independently of its size, and generates warning events in real time, but does not reflect a general solution to every system present in a smart city, as it was designed for specific goals. The next table sums up some concepts from Intelligence Systems.

Table 3: Intelligence Systems literature review.

Authors	*Keywords*	*Concepts*	*Study Objectives*
Wöber (2003)	Marketing decision support systems (MDSS); Tourism statistics; Internet	*Marketing decision support system (MDSS - supports organizations in collecting, storing, processing, and disseminating information, and in the decision-making process by providing forecasts and decision models.*	Provide insights into a successful implementation of a MDSS in tourism, and discuss the information needs in tourism management.
Silva, Khan, & Han (2017)	Smart City; Smart City architecture	*Smart City enhances the quality of life of urban citizens, involving multiple disciplines, that is, smart community, smart transportation, smart healthcare, smart parking, and many more.*	Exploit realistic smart city architecture to enhance data processing efficacy to enable real-time decision-making.
Yoo, Goo, Huang, Nam, & Woo (2017)	Smart tourism technology, Elaboration likelihood model, Self-efficacy, Human-computer Interaction, Travel decision support satisfaction	*Smart tourism technologies (STTs) in this study refer to any forms of IT that tourists interact for information search, transaction, communication, and content generation.*	Answer “What central and peripheral routes in STTs influence tourists' travel decision support satisfaction”

Other systems that are helpful on supporting an organization in storing, processing, and disseminating information are the Marketing Decision Support System (MDSS), as these provide forecasts and decision models. Wöber (2003) displays a case of success when implementing a MDSS at a tourism scenario and the necessary information in tourism management. According to the author, it is necessary to have a database that contains tourism market research data, several program models to convert methods/models to simple outcomes, and administrative programs that assist the maintenance of the database and control what activities users search for at this sector, obtaining market research data for those activities. A program is presented, with a relatively user-friendly interface and few technical knowledges required to operate it, but the major problem lies on the methods to measure so. The user behaviour data shows the need to improve data processing in tourism market research results at the present and future focus.

Another concept on intelligence systems are the Smart Tourism Technologies (STTs), which are any forms of IT that tourists interact whit when looking for information, transaction, communication and content generation. The recent study of Yoo, Goo, Huang, Nam, & Woo (2017) aims to understand the connection between STTs and tourist's behaviour and emotions, by collecting data at an individual level from a travel club at South Korea and contributing the current literature in tourism. The authors identified the factors that influence the tourist decision support satisfaction in the smart tourism context as the used technology self-efficacy, which controls the STT-supported travel planning and decision-making process. This model may be limited, as the sample was small and may reflect the uniqueness of the travel club population, but it also shows that that self-efficacy toward STT use plays a critical role in determining which decision route a user is taking, which has not been investigated before as a critical factor that determines the information processing when using STTs.

2.2. SMART STRUCTURES

The Smart City concept emerged on the problems that modern cities faced as a result of a higher influx of citizens in the urban areas. As so, living in a city has become an increasing challenge, both to citizens and governance (Perera, Zaslavsky, Christen, & Georgakopoulos, 2013). Some companies have started to develop solutions to support cities as they evolve, such as NEC Global that states that cities have a three-stage process when evolving, displayed at the next figure.

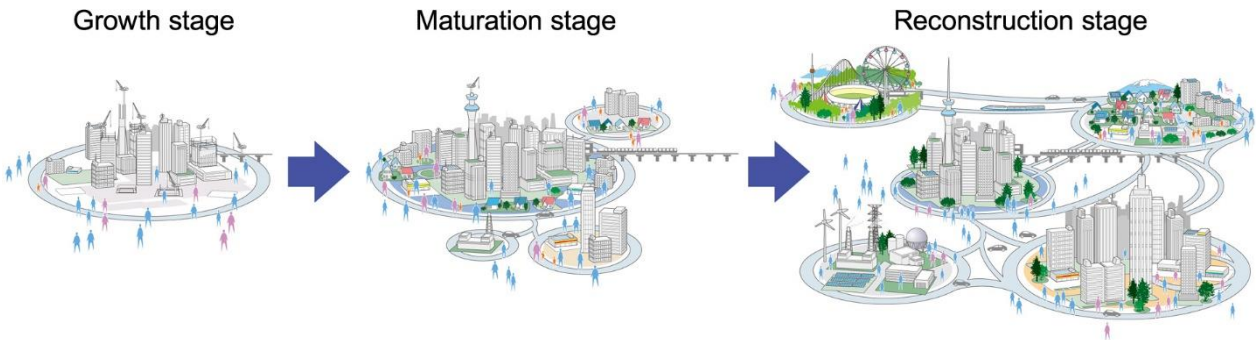


Figure 2: NEC Global three-stage process evolution process of a city. *(Accessed on 21st November 2017 at http://www.nec.com/en/global/ad/campaign/smartcity/).*

The initial growth stage is marked by the quick development of the city infrastructure, to answer industrial growth and an increase in its population. The second stage is where a maturation phase prevails, where a stabilization in the city development is presented, quality is prioritized, which didn't occur before, and goods and services are improved. The final stage, as the city, goes through a reconstruction phase, and a renewal of its services and further development, there is a collaboration among cities to meet new challenges and to work on satisfying residents' expectations (NEC Global, 2017).

2.2.1. Smart Cities

It is not only important to understand Smart Cities applications, benefits and advantages, but also the current technologies and its capabilities on merging in different phases of Smart Cities solutions. As so, the concepts of Smart and Intelligent City are explored in the table below.

Table 4: Smart Cities literature review

Authors	*Keywords*	*Concepts*	*Study Objectives*
Deakin & Waer (2011)	Innovation and creative partnerships; intelligent cities; networks; smart cities; smart communities; methodology	*Intelligent city is the application of electronic and digital technologies to communities; the use and inclusion of information technologies to transform life in a region (..) promoting innovation, learning, knowledge and problem solving."*	*Reflect upon the anxieties currently surrounding such developments, (…) that have more to do with cities meeting the corporate needs of marketing campaigns than the social intelligence required for them to be smart.*
Komninos (2011)	Amplification intelligence; Amsterdam Smart City; Bletchley Park; Cyberport Hong Kong; instrumentation intelligence; intelligent cities; intelligent ecosystems; orchestration intelligence; smart cities	*'Smart' and 'intelligent' are easily assigned to any digital application associated with cities – often just for marketing purposes – without making clear what intelligence is being improved and how.* *Spatial intelligence - ability of a community to use its intellectual capital, institutions and material infrastructure to deal with a range of problems and challenges.*	*Discuss the use of ICTs and institutional frameworks that support innovation ecosystems of cities and increase the problem-solving capability of communities and cities.*

Starting by exploring the concept of a Smart City, what makes a city truly smart or intelligent? Deakin & Al Waer (2011) compared both notions by taking Hollands (2008) work on the stated definition of a city as smart as the starting point to study the transition from a Smart to an Intelligent City. The networking role, the innovation and the partnerships creativity are seen as easy to gather and to develop on strengthening actions, but should not be discarded when meeting a city capacity-building and knowledge-transfer needs. Moreover, some partnerships tend to form short-term measures that contribute to aesthetic features, and not so much to a general knowledge among citizens on social, cultural, environmental and civic values on transposing a city to a Smart City.

Furthermore, the majority of Smart Cities solutions did not have a complete impact on the city challenges, such as its sustainability, competitiveness and employment. According to Komninos (2011), knowledge on making a city intelligent is still lacking, as cities tend to be digital only. As so, we assist to a few challenges on making a city not only technologically capable, but also spatially intelligent, even having the technological resources fully present. And that creates a need to engineer the integration of solutions between the digital and physical properties for each city ecosystem, as key to a higher spatial intelligence. The relation between a smart city and an intelligent city, can be on the level of citizen participation, as stated by Haklay (2013) on the four levels of participation presented before.

2.2.2. Smart Tourism Destinations

According to Buhalis & Amaranggana (2014), Smart Tourist Destinations represent a destination where technology is embedded within the city, having as top priorities the improvement of tourists travel experience; efficiently gathering and distributing information at the destinations; enabling an efficient allocation of tourism resources; and distributing this sector benefits at the local society. Following this idea, the Information and Communications Technologies (ICTs) improve city services, by coordinating them and leading to engaged and better-informed citizens. The concepts of Smart Tourism Destinations are explored in the next table.

Table 5: Smart Tourism Destinations literature review.

Authors	*Keywords*	*Concepts*	*Study Objectives*
Buhalis & Amaranggana (2014)	Smart tourism destinations Internet of things; Smart city; Travel and tourism; Technology	*ICTs will coordinate all activities and services, leading to connected, better informed and engaged citizens.* *Smart City - environment where technology is embedded within the city (…) to improve citizens quality of life, while also improve city services efficiency.*	*Take advantage from the development of Smart Cities by conceptualizing framework for Smart Tourism Destinations.*

Authors	*Keywords*	*Concepts*	*Study Objectives*
Zacarias, Cuapa, De Ita & Torres (2015)	Smart Tourism; GPRS; WAP; TSP; Google Maps API	*Smart City World Heritage*	*To know about the effects that tourists can experiment when they are visiting a place instead of knowing how they manage or plan their vacation.*
Cacho, Mendes-Filho & Lopes (2016)	Smart city, Smart tourism destination, Mobile application, Mobile tourist guide	*A destination is considered "smart" when it makes extensive use of technologies (…) to improve the travelers experience, and empower the tourism industry with the tourist data collected within the destination.*	*To describe a smart city initiative presenting a mobile tourist guide developed for Natal, Brazil.*

Every tourist has a limited knowledge of the visited destination, but the development of crowd-sourced applications by using their input can give a valuable insight on their demands and expectations. Some cities have even started presenting exploratory smart city case studies by producing mobile tourist guides, which is the case of Natal, a city at Brazil, that used the FIFA World CUP 2014 event to collect more knowledge on smart cities' initiatives and mobile applications. By personalizing and making tourists aware of tourism services locally available, the tourist experience improved, and also empowered the tourism industry with the collected data from every user at the city of Natal, allowing the visitors and citizens to get real-time services anytime and the interconnection of all the local organizations (Cacho et al., 2016).

Nevertheless, it is important not only to know the vacation plan of a tourist, but also the effects that one can experiment when visiting a certain place. Zacarias, Cuapa, De Ita & Torres (2015) present in their study two interfaces to a mobile app, a traditional and a minimalist one, having stated that the minimalist interface had greater acceptance among users. The brief textual interface was better accepted at the minimalist interface, but the traditional, which present icons, was accepted as one that the user perceives naturally. As so, sentiment analysis may also have an important role when developing a mobile tourist guide by creating an application that not only enriches the tourist knowledge on a particular subject, but also makes it more enjoyable.

2.2.3. Tourism Management

Tourism impact at a particular community and the acceptability of the changes is relevant to assess. That's when Tourism Management arises - the tourism demand increases and the social impact must be planned locally. The following table organizes the Tourism Management subjects.

Table 6: Tourism Management literature review.

Authors	*Keywords*	*Concepts*	*Study Objectives*
Faulkner & Tideswell (1997)	Tourism demand growth; social impact of tourism	Tourism with a social impact in the local community	Framework designed for a comparative study of the social impacts of tourism in destination communities along the eastern seaboard of Australia.
Ahn, Lee & Shafer (2002)	Sustainable tourism development; Limits of acceptable change; Tourism development zones; Indicators	*Limits of acceptable change (LAC) planning framework has good potential as a tool that can assist in operationalizing the sustainability concept.*	*Use the LAC framework as a guide to examine and inform the process of sustainable tourism development on a regional scale.*
Ko (2003)	Tourism sustainability assessment; Systems; Dimensions; Indicators; Tourism sustainability assessment maps (TSAMs)	*The application of the concept of sustainable development as an achievable and practical objective for tourism has not yet matured.*	*To develop a procedure for the assessment tourism sustainability.*
Park & Jamieson (2009)	Tourism impacts, indicators, collaboration, Delphi method, destination-monitoring system, tourism stakeholders	HTD - Hawaii Tourism Dashboard; Indicators of Tourism Impacts; Indicators of Tourism Impacts on Destination and Community; Indicators of Destination Sustainability	*Development processes of the Hawaii Tourism Dashboard (HTD)*

Authors	*Keywords*	*Concepts*	*Study Objectives*
Boes, Buhalis & Inversini (2015)	Conceptualizing Smart Tourism Destination Dimensions	Smart city; ICT; Smart tourism destinations; Technology	*Smart City - concept that introduces ICTs within an urban area to incorporate urban processes in contemplation of enhancing the competitiveness of the city (Caragliu et al. 2011) while simultaneously enhancing the quality of life for its citizens (El Segundo 2014).*

Regional tourism planning may assist on a viable sustainable tourism, and so Ahn, Lee, & Shafer (2002) used the LAC (Limits of Acceptable Change) framework, initially developed by Stankey, Cole, Lucas, Petersen, & Frissell (1984) to manage change in designated wilderness, to examine locals attitudes towards tourism development and types of tourism services, local conditions and perceptions on how local conditions might change due to the tourism demand. The authors concluded that the three examined communities differed in their evaluation, but a technical process like LAC may be helpful on defining and operationalize tourism sustainability as its development begins. Faulkner & Tideswell (1997) also investigated this matter and stated that the locals are aware of the positive effects of tourism on their life quality, economic and employment benefits are recognized, and some communities even adapt to tourism and develop a resilience that “enables impacts to be accommodated".

Both studies are important on anticipating and avoiding future questions, but the application of the sustainable tourism concept as a tourism objective is still undeveloped (Ko, 2005). The integration of ICTs (Information and Communication Technologies) alone is not sufficient to transform a city into a Smart Tourism Destination, as human capital, leadership, social capital and innovation are fundamental requirements to develop a Smart City supported and enabled by ICTs. Like Cloud Computing and the Internet of Things (IoT), ICTs are the infrastructure providers for developing a Smart Tourism Destination, by simultaneously improving its citizens quality of life and the city competitiveness (Boes, Buhalis, & Inversini, 2015). In order to raise tourism sustainability in Hawaii, Park & Jamieson (2009) developed a diagnostic tool to monitor Hawaii’s tourism conditions, raise public awareness on tourism and assist decision making and policy development by the local government and industry. As stated by the authors, developing a process with indicators to assess accurately tourism development and activities was one of the challenges, but it is expected to ultimately contribute to make the state more sustainable and to develop an explanatory model that determines the level of its sustainability as a tourism destination.

3. DASHBOARD RESEARCH METHODOLOGY

3.1. CONCEPTUAL MODEL

As a research approach after a theoretical background review, six developed countries' dashboards on tourism were analysed, and its main indicators are presented in a conceptual model to allow for the creation of the future dashboards. This research represents an important phase by alerting to the need of better understanding tourism processes at a particular city, and how can it be intelligently explored.

3.1.1. Tool Design

Conceptualizing the reviewed theoretical background and after data collection, a tool for measuring and to help monitor the urban tourism in a city is proposed in the figure below.

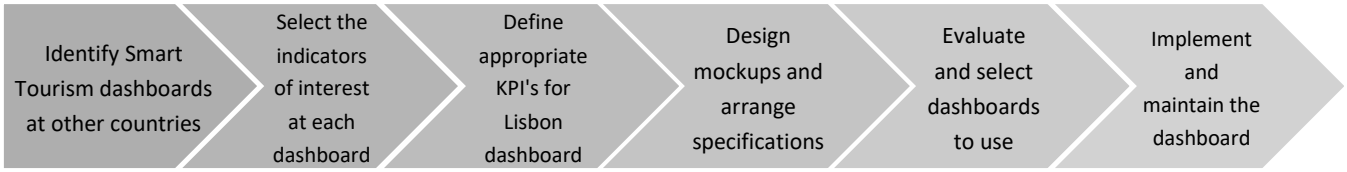


Figure 3: Methodological approach on the tourism management tool design.

A tool design proposal has utmost importance on a smart tourism destination. Few authors have proposed such and a "change in focus from the traditional principle of accountability to a concept of citizen empowerment" is the main point on exploring open data (Janssen et al., 2012; Sandoval-Almazan et al., 2012). Based on the current state of the art in this area, it is essential to collect cases where similar work has been done. The monitoring tool design began with the identification of relevant dashboards, followed by a selection of relevant indicators on each. After being assessed for their objectives and measurable KPIs (Key Performance Indicators) (Zahra, 2011), the design of mock-ups followed with the appropriate visual presented to each indicator. Finally, the results were evaluated and explored on its relevance and appropriateness, and finally implemented and trailed on the tool future conditions and importance.

3.1.2. Conceptual Model Proposal

Based on the previous method, a selection of the indicators that were required to use on a tourism monitoring tool was made and assembled on the next table and originated five major categories – Expenditures, Travel, Activities/Satisfaction, Visit and Accommodation. The indicators were chosen based on the authors' publications and the number of different indicators that referred to the same topic, as summarized on the table below.

Table 7: Proposed conceptual model on the indicators to present on a smart tourism destination.

Dimension	*Indicators*	*Source*	*Reference*
Expenditures	Average expenditures by industry	New Zealand Tourism Portal	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/documents-image-library/key-tourism-statistics.pdf
	Average expenditure growth by month/year	New Zealand Tourism Portal	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/tourism-research-data/monthly-regional-tourism-estimates
	Average expenditure per foreign visitor (by year/month/total)	Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
Travel	Monthly arrivals	Australia Tourism Portal	http://www.tourism.australia.com/en/markets-and-research/tourism-statistics/international-visitor-arrivals.html
	Monthly arrivals per country of origin	Australia Tourism Portal	http://www.tourism.australia.com/en/markets-and-research/tourism-statistics/international-visitor-arrivals.html
	Number of visitors by country of origin	Hawaii Tourism Portal	http://dbedt.hawaii.gov/economic/current_economic_conditions/tourism-dashboard/
		New Zealand Tourism Portal	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/documents-image-library/key-tourism-statistics.pdf http://webrear.mbie.govt.nz/summary/new-zealan
		Australia Tourism Portal	http://www.tourism.australia.com/en/markets-and-research/tourism-statistics/international-visitor-arrivals.html
		Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
		UAE Tourism Portal	https://www.visitdubai.com/en/tourism-performance-report
	Transport type	Scientific paper	Park & Jamieson (2009)

Dimension	*Indicators*	*Source*	*Reference*
Travel	City number of Visitors (compared with the previous year)	USA Tourism Portal	https://www.trade.gov/travelindicators/travel-performance-indicators.pdf
		Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
	Number of visitors per country region	Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
	Average growth per city	New Zealand Tourism Portal	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/documents-image-library/key-tourism-statistics.pdf
	Total arrivals by purpose of visit	New Zealand Tourism Portal	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/documents-image-library/key-tourism-statistics.pdf
	Travel Promotion Fees Collected	USA Tourism Portal	https://www.trade.gov/travelindicators/travel-performance-indicators.pdf
	Travel preparation level	Scientific paper	Huang, Goo, Nam, & Yoo (2017)
Activities/ Satisfaction	Level of satisfaction with the available public transportation Level of satisfaction with the available activities in the city/country Number of visited main points of interest	Scientific paper	Ko (2005)
Visit	Length stay	Hawaii Tourism Portal	http://dbedt.hawaii.gov/economic/current_economic_conditions/tourism-dashboard/
		New Zealand Tourism Portal	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/documents-image-library/key-tourism-statistics.pdf

Dimension	*Indicators*	*Source*	*Reference*
Visit	Length stay	England Tourism Portal	https://www.visitbritain.org/latest-england-research-reports
	Length stay by accommodation type	New Zealand Tourism Portal	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/documents-image-library/key-tourism-statistics.pdf
	Satisfaction level	Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
	Willingness of visiting the country/city again	Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
	City of Arrival	Hawaii Tourism Portal	http://dbedt.hawaii.gov/economic/current_economic_conditions/tourism-dashboard/
	Rate of returning visitors (not the first time visiting the city)	Scientific paper	Gomezelj & Mihalič (2008)
	Safety feeling level compared with other cities	Scientific paper	Gomezelj & Mihalič (2008)
Accommodation	Accommodation occupancy rate	New Zealand Tourism Portal	http://webrear.mbie.govt.nz/summary/new-zealan
		Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
	Average nights spent	New Zealand Tourism Portal	http://www.mbie.govt.nz/info-services/sectors-industries/tourism/tourism-research-data/ivs/international-visitors-nights-interactive-map
	Average nights spent per visitor's country of origin	New Zealand Tourism Portal	http://webrear.mbie.govt.nz/summary/new-zealan
	Number of traveling companion partner(s)	Scientific paper	Soukiazis & Proença (2008)

Dimension	*Indicators*	*Source*	*Reference*
Accommodation	Hotel Performance	Hawaii Tourism Portal	http://dbedt.hawaii.gov/economic/current_economic_conditions/tourism-dashboard/
	Hotel Inventory by category and performance KPIs (YTD)	UAE Tourism Portal	https://www.visitdubai.com/en/tourism-performance-report
	Room Occupancy	England Tourism Portal	https://www.visitbritain.org/latest-england-research-reports
		Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
	Total sales per room	Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf
	Average room rate	Japan Tourism Portal	http://www.mlit.go.jp/common/000991725.pdf

A diagram based on the proposed conceptual model was designed, where the indicators above were grouped in clearer and in most relevant sub-categories, as shown below.

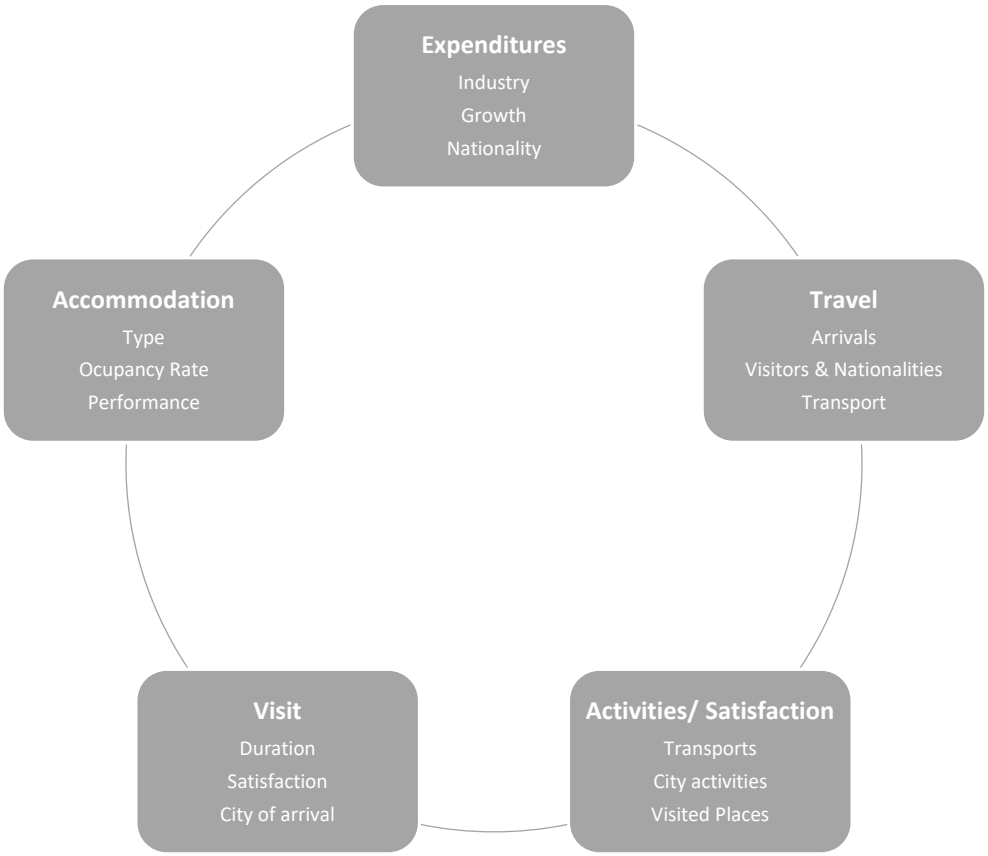


Figure 4: Conceptual model proposal diagram.

The chosen indicators are useful since they endorse future dynamic exploration and analysis on upcoming developed dashboards, allowing the local government and the citizens to improve their knowledge on valuable metrics at the city.

3.1.3. Proposed Mock-ups

The initial mock-up concept was thought with no data and as a visual support for future reports to design according to each dimension, so the location of each visual could be pre-determined before starting to develop the empirical tool. It facilitated on defining the relevant information to present and how categories could be represented.

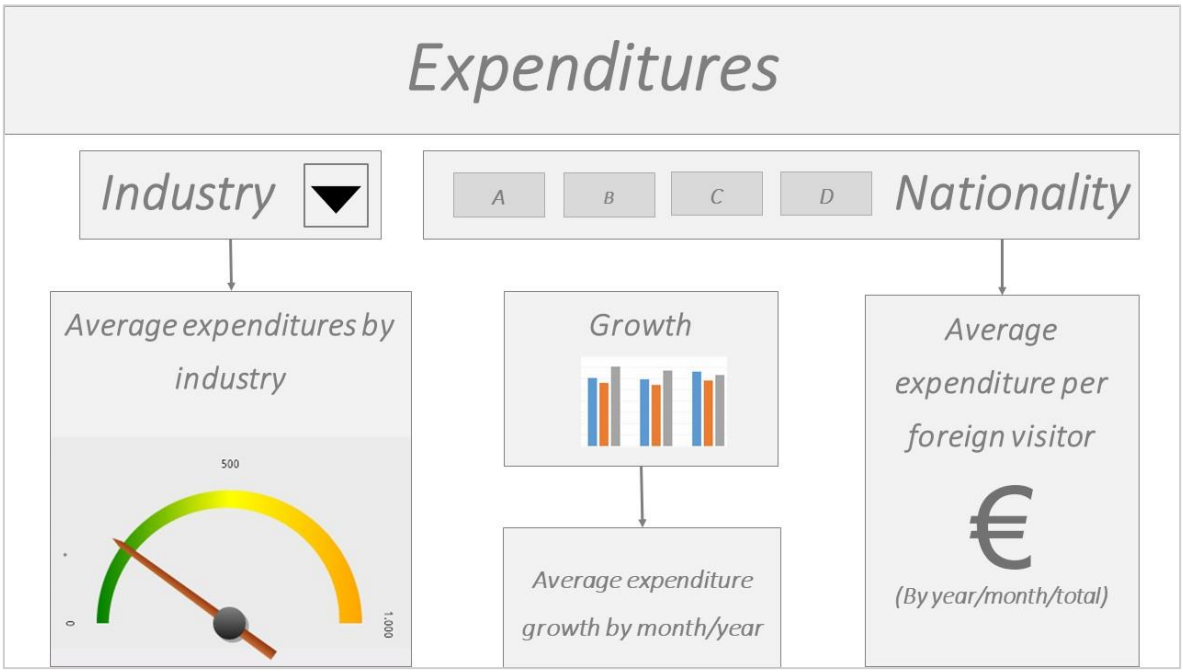


Figure 5: Expenditures category mock-up proposal.

Figure 6: Travel category mock-up proposal.

Figure 8: Activities/Satisfaction category mock-up proposal.

Figure 7: Visit category mock-up proposal.

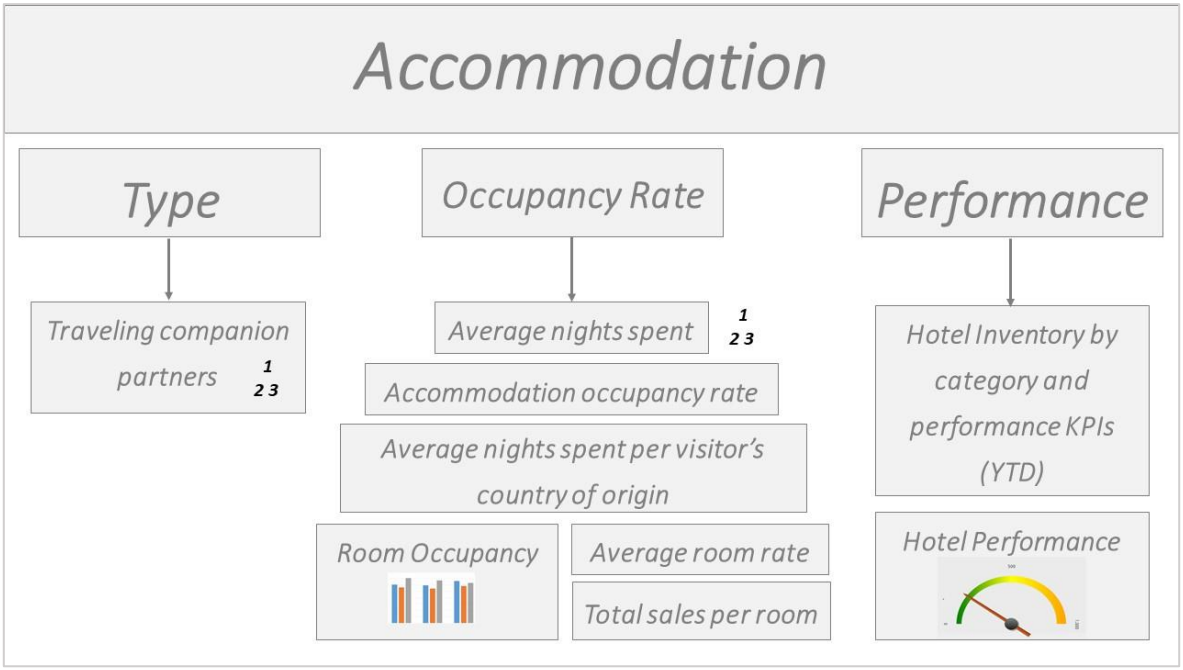


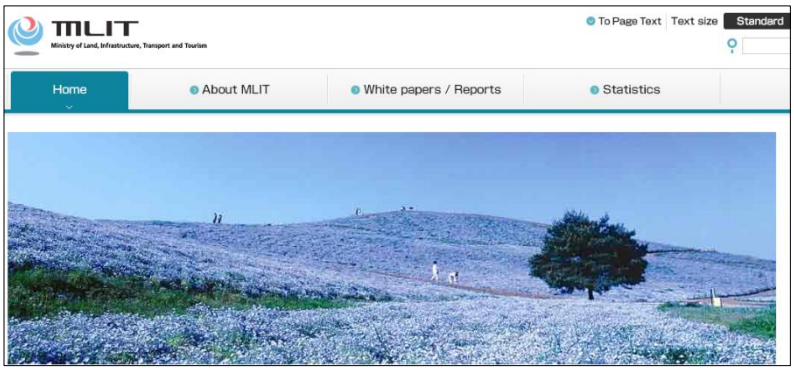
Figure 9: Accommodation category mock-up proposal.

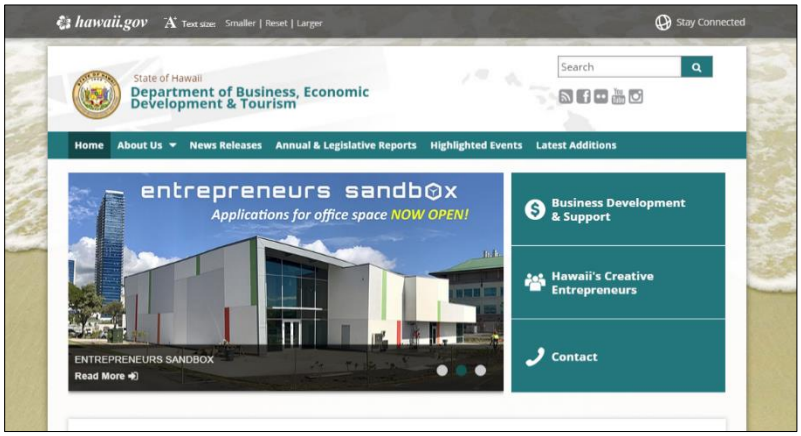
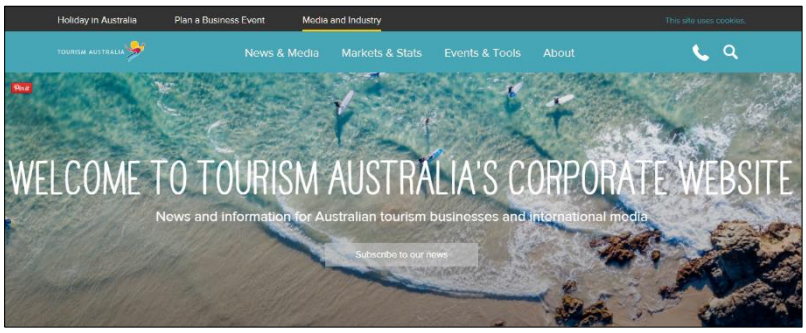
3.2. Data Collection and Preparation

Data collection was performed in two stages. Initially, several articles on tourism management and Smart Tourism Destinations were examined, but few had useful information on managing tourism demand or on any tool that had been developed to do so, as the topic is early and very few practical cases have been presented so far in scientific publications. As so, a second approach was taken where six countries have been considered regarding tourism dashboards:

Table 8: Countries analysed for tourism dashboards.

Portal	*Origin*	*Homepage*
https://mbienz.shinyapps.io/tourism_dashboard_prod/	New Zealand	

Portal	*Origin*	*Homepage*
http://www.mlit.go.jp/	Japan	
https://www.visitdubai.com/	United Arab Emirates	
https://www.trade.gov/travelindicators/	United States of America	

Portal	*Origin*	*Homepage*
http://dbedt.hawaii.gov/	Hawaii	
http://www.tourism.australia.com/	Australia	

These countries' dashboards on tourism were chosen as they presented solid produced work on this subject. All the displayed indicators were registered in a frequency table (see Appendix A), and its analysis contributed to realize that the studied indicators were spread across several dashboards or reports, and were not present at a single site or document, which also occurs on the Open Data used for the present thesis – Lisbon Open Data. Following this, the table below summarizes the sources, datasets and the obtained datasets after some data profiling and cleansing, which were used to develop a dashboard on Lisbon's tourism areas.

Table 9: Source files and obtained datasets.

Sources	*Datasets*	*Obtained Datasets (Excel)*
Accessed on November 2017: http://tomslee.net/airbnb-data-collection-get-the-data	Airbnb_lisbon_2017-07-27 CSV file	Airbnb (July 2017)
Accessed on January 2018: https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESTipo=ea&PUBLICACOESColeccao=107668&selTab=tab0&xlang=pt	"INE 2016 - Estatiscas Turismo: Quadro 6.2.24 - Estada média, segundo o tipo dos estabelecimentos, por regiões (NUTS II)" Excel file "ET_2017: Quadro 2.24 - Estada média, segundo o tipo dos estabelecimentos, por regiões NUTS II" Excel file	Nights per accommodation type (2016 and 2017)
Accessed on January 2018: http://travelbi.turismodeportugal.pt/pt-pt/bi/Paginas/default.aspx?datasetId=ACAF829121D04B2AB24F196BBF3B3940 http://dados.cm-lisboa.pt/dataset/taxas-ocupacao-estabelecimentos-hoteleiros on January 2018.	"Hospedes 2016 AM Lisboa_Tipologias" and "Hospedes 2017 AM Lisboa_Tipologias" from TravelBI (Guests per accommodation type) "Taxas de ocupação 2016 Tipologias - LISBOA" and "Taxas de ocupação 2017 Tipologias - LISBOA" from CML open data portal (Occupancy rates)	Guests per accommodation (2016 and 2017)
Accessed on January 2018: https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESTipo=ea&PUBLICACOESColeccao=107668&selTab=tab0&xlang=pt	"INE 2016 - Estatiscas Turismo: Quadro 6.2.25 - Estada média na hotelaria, segundo as regiões (NUTS II), por países de residência" "ET_2017: Quadro 2.25 - Estada média na hotelaria, segundo as regiões (NUTS II), por países de residência"	Nights per country of origin (2016 and 2017)
Accessed on April 2018: http://travelbi.turismodeportugal.pt/pt-pt/bi/Paginas/default.aspx?datasetId=780E95AA10F8470592C8C1DA15D81FCB	TravelBI_hóspedes e dormidas (2016-2017)	Guests per country of origin (2016 and 2017)
Shared by Turismo de Lisboa on 20th February 2018	"LISBOA CIDADE - estabelecimentos hoteleiros (moradas)" Excel dataset	Lisbon Hotels addresses (2017)
PowerBI file obtained on 15th of December of 2017 through advisor share.	Lisbon parishes PowerBI file	Parishes (Up to date)

Afterwards, the Lisbon tourism data was collected and the datasets to create the tourism tool were obtained according to this table. As it can be observed, some datasets were created by modifying or aggregating some original datasets, which were obtained at TravelBI, INE, CML open data portal and at a non-organizational site. The main treatment per dataset are described next.

- **Airbnb (July 2017)**

This dataset belongs to a non-organizational website, as there was no Airbnb public data available at the moment of the data collection at any Lisbon organizational site. It was obtained through a zipped file and extracted to the most recent CSV document, containing all the Airbnb addresses in Lisbon up to 27th July 2017. This file needed no treatment, as it was ready to use.

- **Nights per accommodation type (2016 and 2017)**

The original two datasets were accessed at INE website and contained the 2016 and 2017 tourism statistics in Portugal, referring to the average stay according to the type of accommodation by NUTS II regions, which contain among others the Lisbon metropolitan area (Lisbon city and peripheric areas).

Initially, the "Other accommodation types" category was not represented at this dataset for both 2016 and 2017, as only the “Guests per accommodation” dataset contained this category. As so, as the “Local Lodging” shows significance in the dataset and the "Other accommodation types" category doesn’t specify what types of accommodation are included for the “Guests per accommodation” dataset and by mapping the other category between both datasets, the “Local Lodging“ was considered as the "Other accommodation types" category at the “Nights per Accommodation Type” dataset to ease value comparison and allow for a relevant analysis at the tourism management tool designed at PowerBI.

- **Guests per accommodation (2016 and 2017)**

The original two datasets consisted of the “Guests per accommodation type”, obtained at the TravelBI portal, and the “Occupancy rates” found at the CML open data portal, for both years of 2016 and 2017.

At the first dataset the 2017 data was updated according to the most recent published dataset, as several values existed for the same year throughout the year of 2018 while these were being accessed on the portal. For the “Occupancy rates” dataset, a new category emerged for one and two stars hotel for both years, as the one star hotel category was no longer represented after September 2017. The approach taken was to average both categories’ values and consider this a single category. Also, the tourist apartment category was no longer represented after September 2017. No approach was taken here and there are simply no records for these months.

- **Nights per country of origin (2016 and 2017)**

The original two datasets were accessed at INE website and contained the 2016 and 2017 tourism statistics in Portugal, referring to the average stay according to the guests´ country of origin by NUTS II regions, which contain among others the Lisbon metropolitan area (Lisbon city and peripheric areas).

All the countries are individually specified for these datasets, but in the "Guests per Country" datasets there's a category for "Other countries" and the countries that are included in this category are not specified. As so, to ease the future comparison between both datasets, the category "Other countries" doesn't include Finland, Netherlands and Norway data, as these values aren't available in the "Guests per Country" dataset for both years.

- **Guests per country of origin (2016 and 2017)**

The original two datasets were obtained at TravelBI portal, and contained the 2016 and 2017 data of Lisbon visitors per country. As in the “Guests per accommodation” dataset, the data for 2017 had to be updated according to the most recent published dataset, as several values existed for the same year throughout the year of 2018 while these were being accessed on the portal.

Contrary to the “Nights per country” dataset, this dataset did not specify all the countries, as it happens in the category “Other countries”. As so, the category “Scandinavia” and the lowest values of guests’ countries – Belgium and the Netherlands – were added to the “Other countries” category. This was chosen as those countries were not all represented at the “Nights per country” dataset and seemed the most logical decision to take. It is important to also mention that this dataset is no longer available at the original portal due to an aggregation per year data modification, opposing the month detail that existed initially.

- **Lisbon Hotels addresses (2017)**

The original dataset was shared by *Turismo de Lisboa* on 20th February 2018, after a request made on a meeting with this entity and the advisor Miguel Neto on 16th February 2018. This dataset contains data from all the hotels that existed on 2017 at the city of Lisbon.

Initially, only the hotels’ name, type and the address were available at the dataset. This data was required to create an interactive parish map at the designed tool, and a manual insertion was performed as no parishes were specified, so this data would be relevant when developing the visual tool of the thesis.

- **Parishes (Up to date)**

The original was constituted by a PowerBI file obtained through advisor sharing, containing all the parishes present at Lisbon in 2018, and was ready to use.

3.3. INDICATORS CONSTRUCTION, TREATMENT AND RELATIONS

Considering the indicators presented at section 3.1.2. Conceptual Model Proposal, each dataset was constituted by some specific measures, which will be explained in detail next.

- **Airbnb (July 2017)**

This dataset original attributes were the **room type, parish, latitude** and **longitude**. The created measures at PowerBI, using DAX scripting language, were:

- The number of Airbnb accommodations per parish, as **AIRBNB**, calculated as:

```
AIRBNB = COUNT('Airbnb_Jul_2017'[Parish])
```

- The percentage of Airbnb accommodations per parish, as **%AIRBNB**, calculated as

```
% AIRBNB = [AIRBNB]/ Parishes[ACCOMMODATIONS] * 100
```

Figure 10: Airbnb (July 2017) dataset attributes and created measures (view from PowerBI relationships tab).

- **Nights per accommodation type (2016 and 2017)**

This dataset original attributes were the **accommodation** (type)**, year** and **average nights**. No further measures were created.

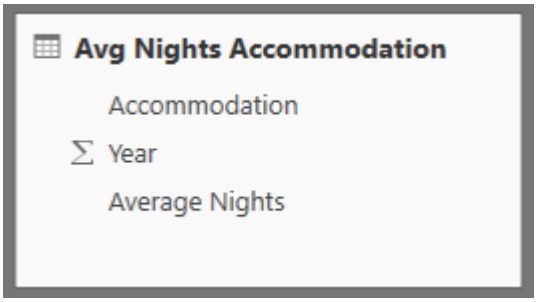


Figure 11: Nights per accommodation (2016 and 2017) dataset (view from PowerBI relationships tab).

- **Guests per accommodation (2016 and 2017)**

This dataset original attributes were the **accommodation type, month, year**, **number of guests, earnings** and **average bed occupancy rate**. No measures were created at PowerBI, but instead at the resulting dataset on Excel, which were:

- The number of the month, as **MONTH NR**,
- The percentage of guests, as **%GUESTS**, calculated as

$$\%Guests = \frac{Number\ of\ guests\ (month)}{Total\ number\ of\ guests\ (year)}$$

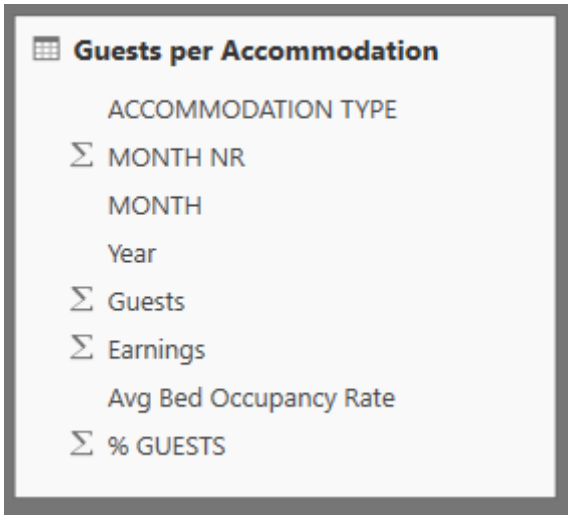


Figure 12: Guest per accommodation (2016 and 2017) dataset attributes and created measures (view from PowerBI relationships tab).

- **Nights per country of origin (2016 and 2017)**

This dataset original attributes were the **average nights, year** and **country**. No further measures were created.

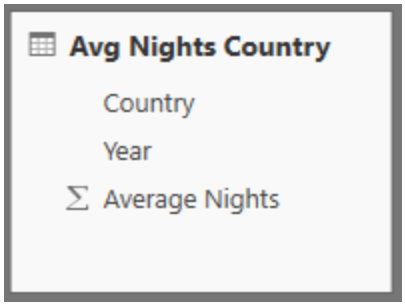


Figure 13: Nights per country (2016 and 2017) dataset attributes and created measures (view from PowerBI relationships tab).

- **Guests per country of origin (2016 and 2017)**

This dataset original attributes were the **country, month_name, year** and **guests**. No measures were created at PowerBI, but instead at the resulting dataset on Excel, which were:

- The number of the month, as **Month**,
- The percentage of guests, as **%GUESTS**, calculated as

$$\%\boldsymbol{Guests} = \frac{\boldsymbol{Number\ of\ guests\ (month)}}{\boldsymbol{Total\ number\ of\ guests\ (year)}}$$

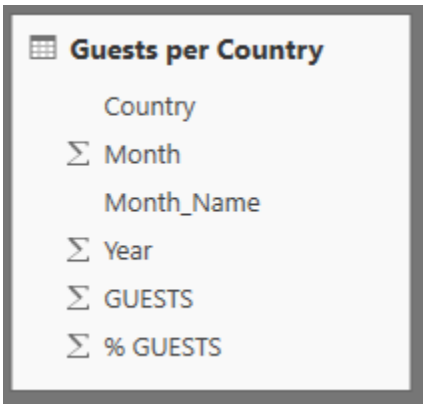


Figure 14: Guests per country (2016 and 2017) dataset attributes and created measures (view from PowerBI relationships tab).

- **Lisbon Hotels addresses (2017)**

This dataset original attributes were the **hotel** and **address.** The **parish, classification** and **zip code** were manually added at the resulting dataset on Excel, which were. The created measures at PowerBI, using DAX scripting language, were:

- The number of Hotels per parish, as **HOTELS**, calculated as:

```
HOTELS = COUNT (Moradas_Hoteis[Parish])
```

- The percentage of Hotels per parish, as **%HOTELS**, calculated as

```
% HOTELS = (Moradas_Hoteis[HOTELS]/Parishes[ACCOMMODATIONS]) * 100
```

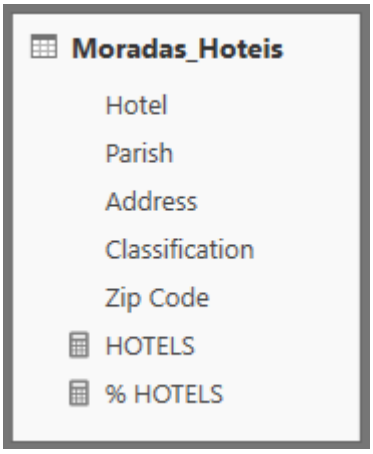


Figure 15: Lisbon Hotels addresses (2017) dataset attributes and created measures (view from PowerBI relationships tab).

- **Parishes (Up to date)**

This file original attribute was Lisbon **parish**es**.** The **ACCOMMODATIONS** was the created measure at PowerBI using DAX scripting language as the total number of hotels (in 2017) and Airbnb (up to July 2017) accommodations per parish, being calculated as:

```
ACCOMMODATIONS = 'Moradas_Hoteis'[HOTELS] + 'Airbnb_Jul_2017'[AIRBNB]
```

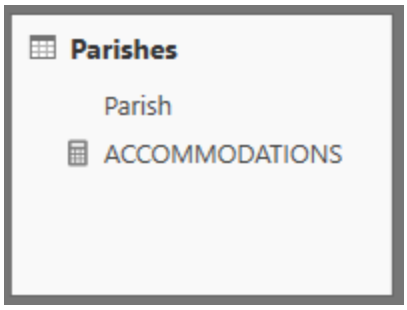


Figure 16: Parishes (up to date) file attributes and created measures (view from PowerBI relationships tab).

Besides the indicators, there were also introduced two relations between the Airbnb - Parishes, and Parishes - Lisbon Hotels addresses datasets at the PowerBI tool. This was important to map so the first report at the PowerBI tool (Parishes) could exhibit the selected parish for both Airbnb and Hotels accommodations in the displayed maps.

- **Airbnb (July 2017) – Parishes**

This relation was set from many – to one, as many parishes at the **Airbnb (July 2017)** dataset corresponded to a single parish at the **Parishes** dataset.

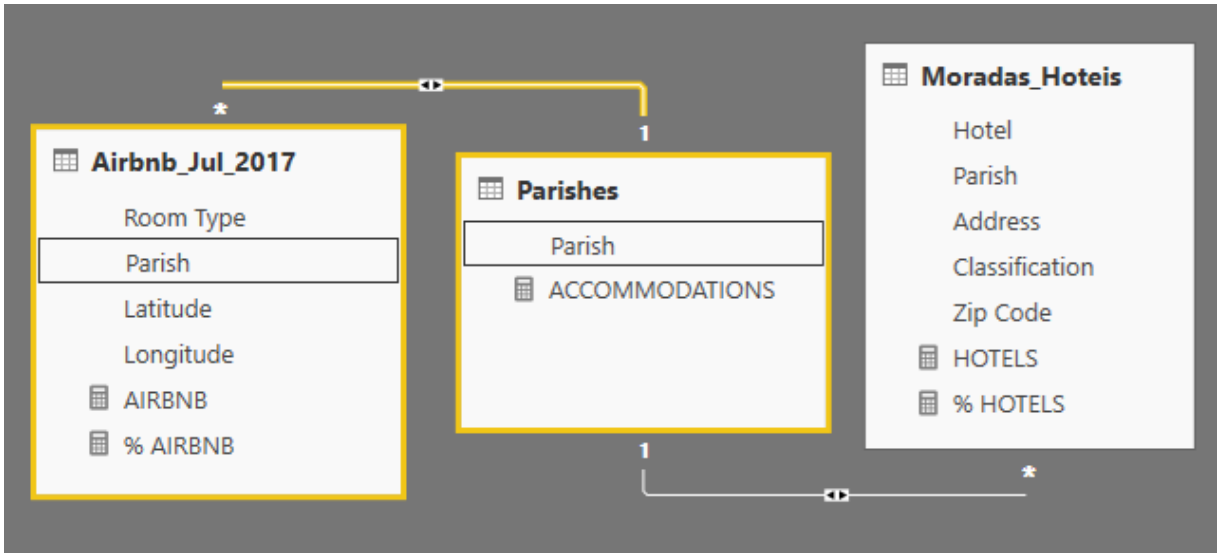


Figure 17: Airbnb (July 2017) – Parishes many to one relation (view from PowerBI relationships tab).

- **Parishes - Lisbon Hotels addresses (2017)**

This relation was set from many to one, as one parish at the **Parishes** dataset corresponded to many parishes at the **- Lisbon Hotels addresses (2017)** dataset.

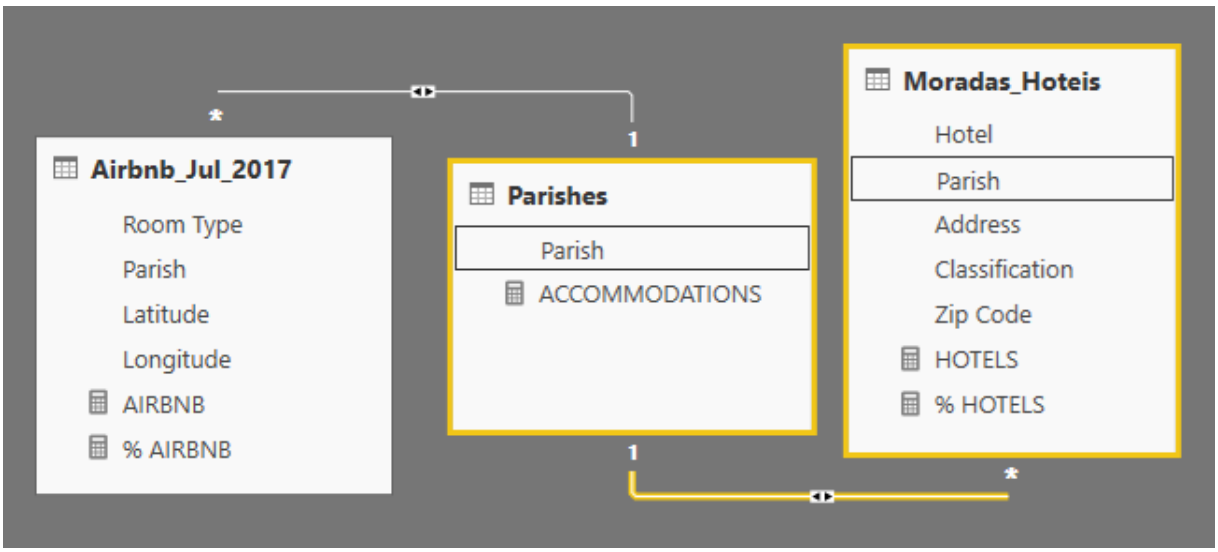


Figure 18: Parishes - Lisbon Hotels addresses (2017) one to many relation (view from PowerBI relationships tab).

4. EMPIRICAL OUTPUT

After the data collection, treatment and the tool design at Microsoft PowerBI, the final Lisbon tourism management tool development was performed and is presented at this chapter. In order to test the proposed conceptual model and its resulting prototype, some laboratorial tests were performed to assess the information adequacy in the resulting dashboard and its future utilization by the stakeholders, which corresponds to the fifth step of this thesis methodology - Evaluation.
This tool is intended to be made available online at the CML or at the *Turismo de Lisboa* (Lisbon's tourism entity) portal. Initially, this chapter also contains an analysis on the current Open Data portal in Lisbon, which is an output of the empirical analysis and will follow next.

4.1. LISBON AS A SMART TOURISM DESTINATION

4.1.1. Lisbon Open Data portal

Since 2017, Lisbon has been displaying an open data portal at http://lisboaaberta.cm-lisboa.pt/ intitled *Lisboa Aberta*, or open Lisbon, where the council follows the idea that the data produced by municipal services, companies and other public entities that have a high activity in the city should be available to anyone, contributing to a clear strategy where all the citizens can be involved and the city can increase the quality of the offered services. The site, represented in the picture below, is currently available in ortuguese only, and the plan for Lisbon open data is part of a tool of planning and coordination of the annual activities, which the city council and its partners are dedicated to follow.

Several Portuguese entities contributed to the datasets available at the portal. *Transporlis* (https://www.transporlis.pt/) publishes the city transports' data; *Turismo de Lisboa* (https://www.visitlisboa.com/) and *Turismo de Portugal* (http://www.turismodeportugal.pt/) publish the city tourism data; *Eletricidade de Portugal (EDP* - https://www.edp.pt/*)* publishes the electricity sector data; *Intituto Português do Mar e da Atmosfera (IPMA* - https://www.ipma.pt/*)* publishes the meteorology data; and the *Instituto Nacional de Estatística* or *Statistics Portugal* (https://ine.pt/) publishes **several categories** of data. The quality and consistency are kept by the entities through regular updates. The portal also contains several other fields of interest, such as economy, innovation, energy and communication, environment and sports, and allows for the user registration for regular notifications on new datasets publications.

Figure 19: Lisboa Aberta front page displaying the available dataset categories.

4.1.2. TravelBI portal on national tourism

Lisbon is clearly a big data producer, and other portals and apps have emerged recently to achieve the definition of a smarter city. TravelBI (http://travelbi.turismodeportugal.pt/) is a portal that belongs to the Portuguese tourism entity *Turismo de Portugal* (http://www.turismodeportugal.pt/), and contains the statistics for tourism for the whole country and allows to look for lodging, market trends, consumer behaviour, international tourism and the main markets in Portugal. Although there is the option for the English display, only the Portuguese version was available at the moment of this thesis creation.

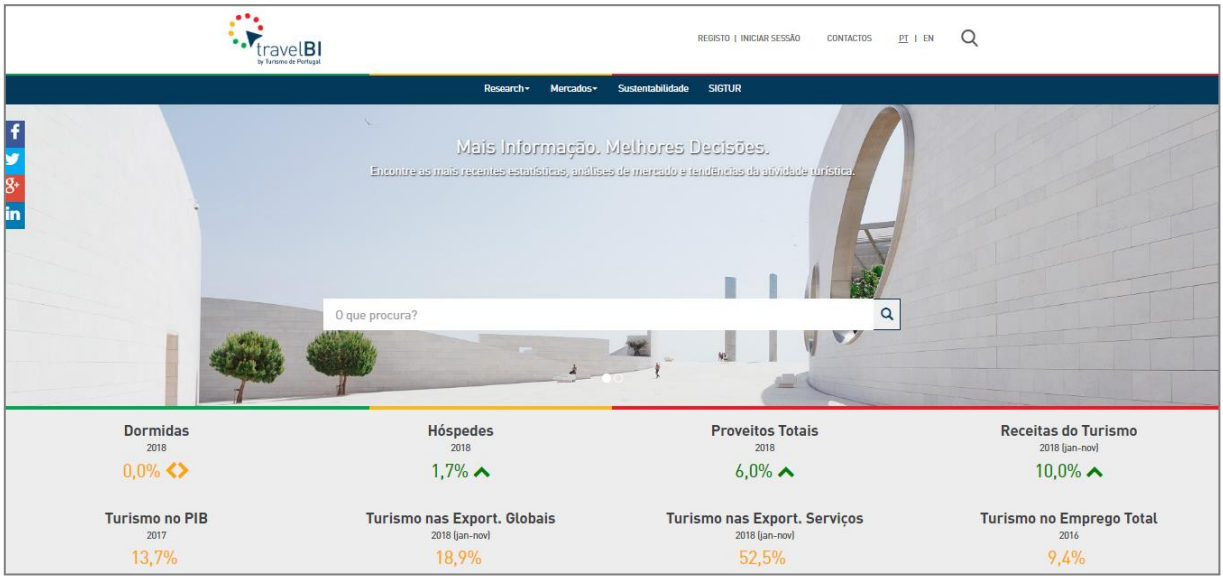


Figure 20: TravelBI front page displaying the current measures on the Portuguese tourism data.

4.2. PROPOSED TOURISM MONITORING TOOL

For the present thesis, a Tourism Monitoring Tool was designed based on the proposed conceptual model, constituted by five categories:

- **Parishes**

At this report, displayed in the next figure, all the city parishes can be selected at the parish list or directly in any of the maps. The number of Hotels and Airbnb accommodations and its rate comparing to the total number of leisure accommodations at Lisbon are exhibited, and can be seen when making a mouse over the maps. It is possible to see that the Airbnb accommodations reached 98,5% of all the city lodging in July of 2017, which is a phenomenon and can indicate that the tourism at the city has largely increased in the past years with the increase of Airbnb lodging in the city, specially at the coastal and central parishes like *Estrela, Misericórdia, Santo António, Santa Maria Maior, São Vicente* and *Arroios.* Regarding the hotels, these spaces are heavily located near downtown, in parishes like *Avenidas Novas, Santo António, Santa Maria Maior* and *Arroios*, and only constituted 1,5% of the total city accommodations in 2017.

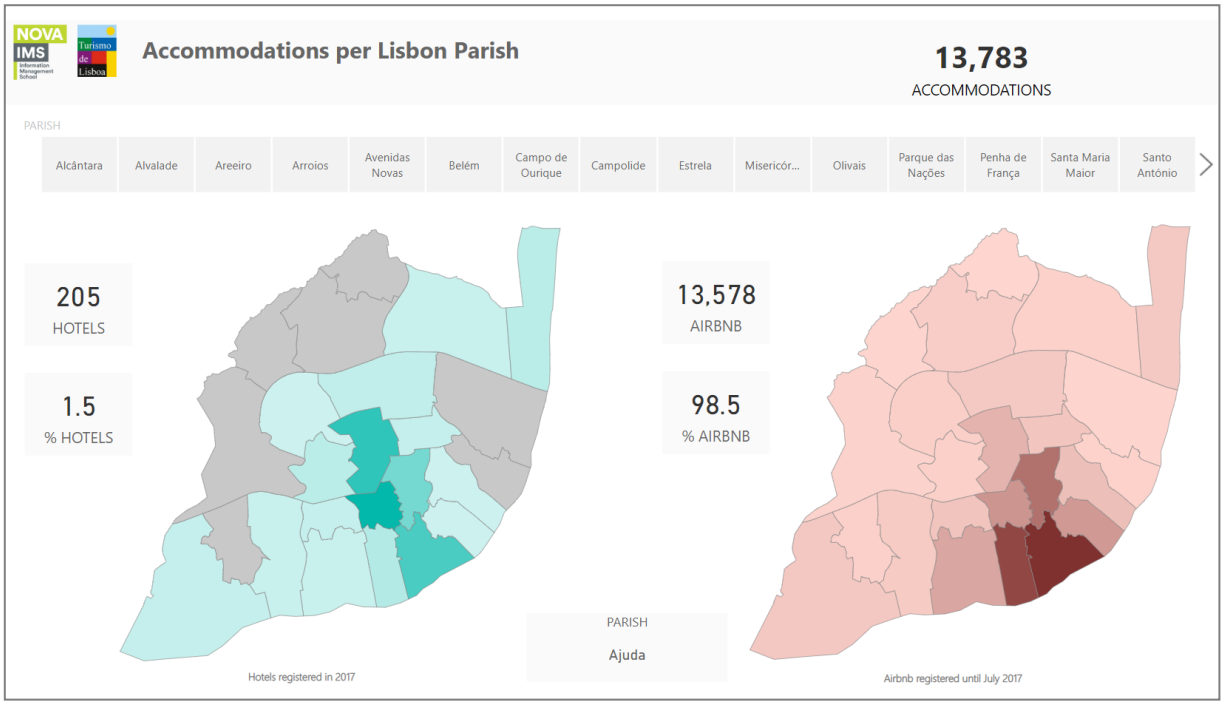


Figure 21: Accommodations per Lisbon Parish final report (at PowerBI report tab).

- **Guests per Country**

At this report, displayed in the figure below, the number and the rate of guests are displayed per country and also by making a mouse over the maps. It is possible to select the data per year and month, showing an interesting evolution of the tourism trend in the city, and also the country of interest.

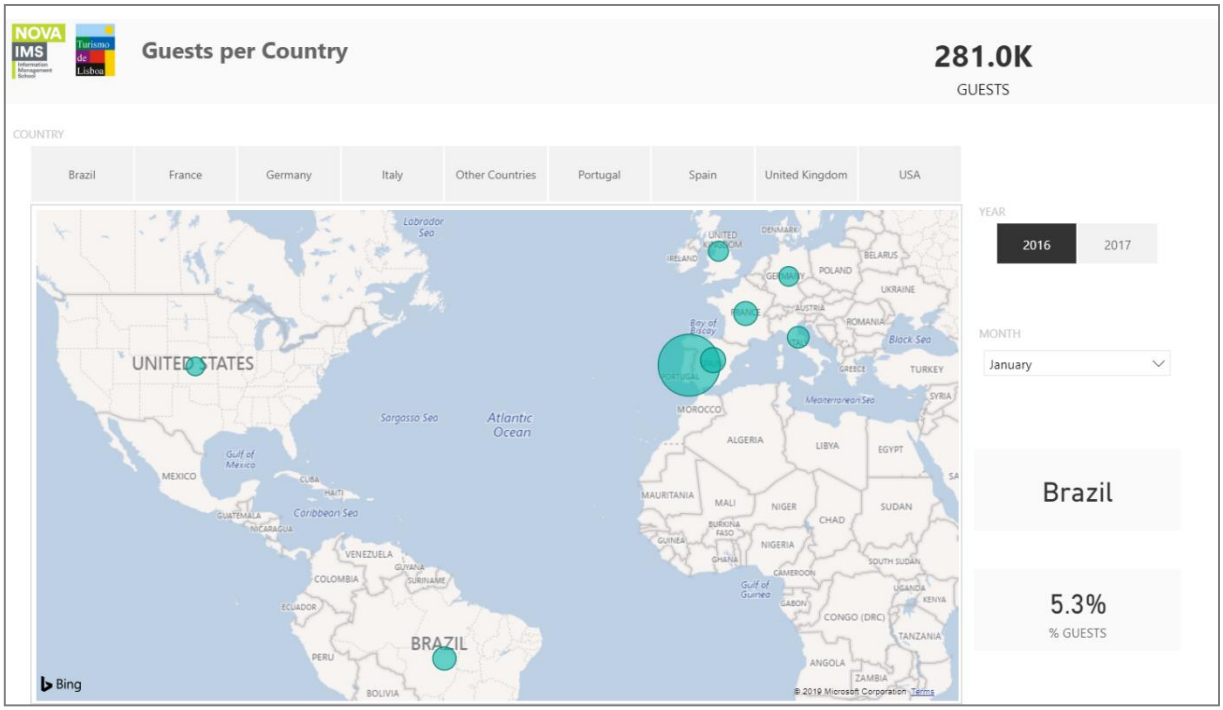


Figure 22: Guests per country final report (at PowerBI report tab).

Although the highest value of guests in Lisbon occurs for the Portuguese guests, with 32,1% for 2016 and 28,3% for 2017 of the total number of guests for these years, this trend is followed by the "Other countries" category, Spain and France for both years. It is important to remind that the countries at the other countries' category are not disclosed in the original datasets.

- **Guests per Accommodation**

At this report, displayed in the next figure, the number and rate of guests per accommodation type are represented. The chattered column chart displays a comparison of both years trend, clearing stating that the number of guests increased from 2016 to 2017 in all categories, except for the "Inn/Hostel". This increase was from 5,6 million to 6,2 million guests, summing to 11,8 million guests in Lisbon city for both years.

It is possible to state that the most chosen type of accommodation for both years is the four star hotel, followed by the three and the five stars, throughout all year. Also, the rate of guests should be ignored for both years and only considered when only one of the years is selected, as there's no possible way of solving this value if both years are selected, which was intended to have the bar chart comparison.

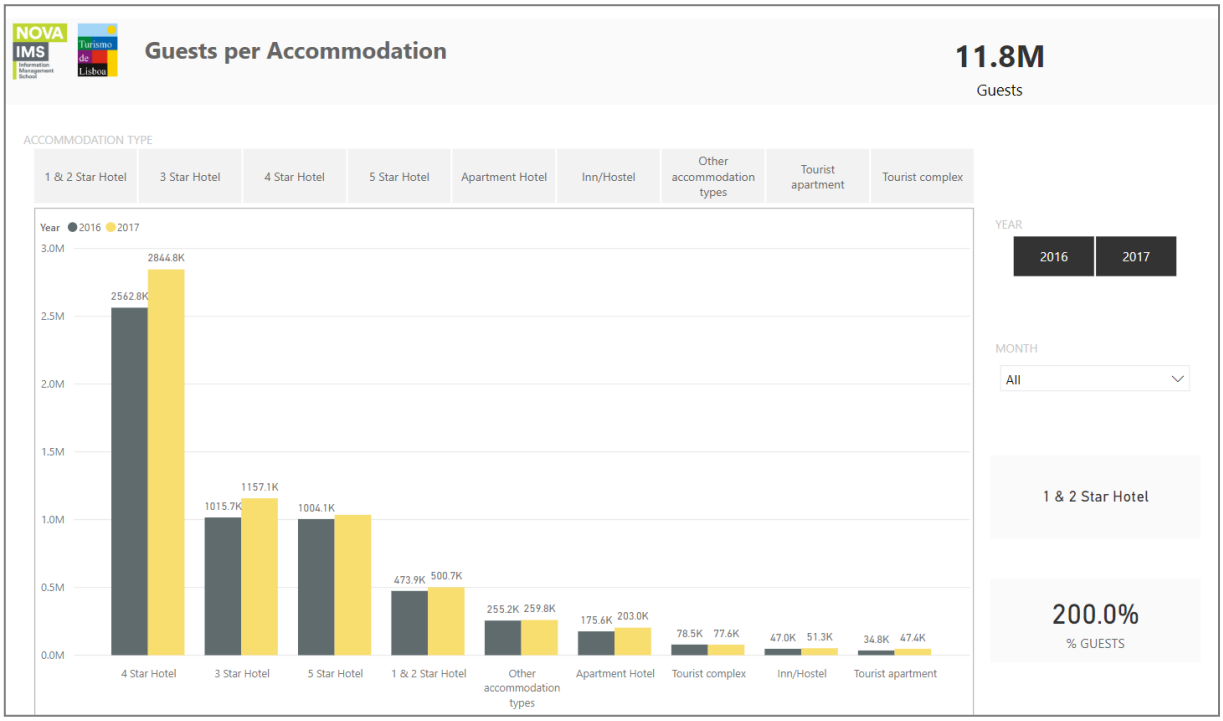


Figure 23: Guests per accommodation final report (at PowerBI report tab).

- **Occupancy per Accommodation**

At this report, displayed in the figure below, the bed occupancy rate evolution and the yearly earnings for both years of 2016 and 2017 are shown, according to the type of accommodation. Using the mouse over the funnel visual, the accommodation with highest rate for is the three star hotel, followed by the Inn/Hostel and the four star hotel for the year of 2016, and for 2017 the trend changed with the three star hotel with the highest rate, followed by four star hotel and the one and two star hotel.

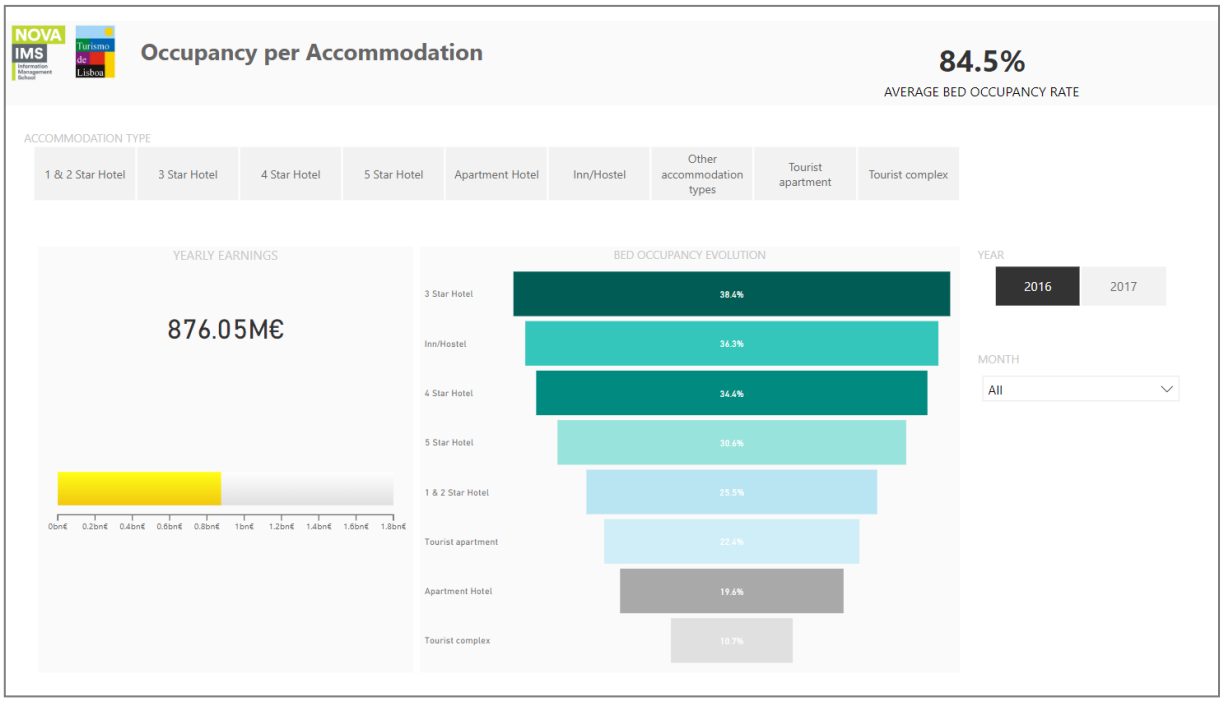


Figure 24: Occupancy per accommodation final report (at PowerBI report tab).

It is also possible to see that at the year of 2016 the total earnings were close to 876 million of euros, and in 2017 it increased to 1,065 million.

- **Stay per Accommodation**

At this report, displayed in the next figure, the average number of nights spent at Lisbon are displayed according to the type of accommodation and year. By passing the mouse over the trend per accommodation visual, the apartment hotel and the tourist apartment are the types of accommodation where the guests spend more nights for both years.

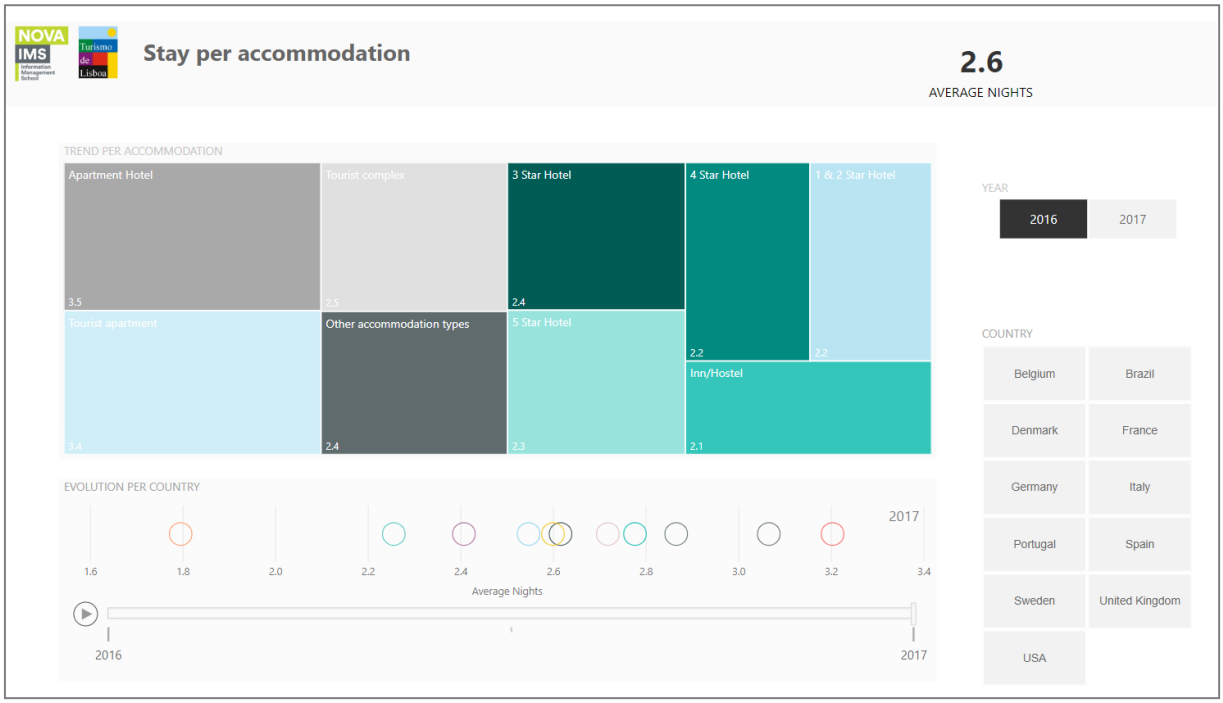


Figure 25: Stay per accommodation final report (at PowerBI report tab).

Also, the visual at the bottommost allows for the study of the evolution of nights spent at Lisbon for each country between 2016 and 2017. At the tool, by clicking the play button the circle correspondent to a selected country, or all the countries represented, will move towards a higher or a lower value of average spent nights. Denmark, Sweden and Germany are the countries with a higher average number of spent nights at Lisbon for both years.

5. DISCUSSION

5.1. TOURISM MONITORING TOOL

As stated before, a tool design proposal is important on a Smart Tourism destination, and changing from the traditional focus to a citizen empowerment concept, as suggested by Janssen et al. (2012) and Sandoval-Almazan et al. (2012), is the core of exploring Open Data. This was the trigger to start identifying similar tools and to select important indicators in each analysed dashboard, leading to the design of mock-ups. This approach started by observing six countries tourism dashboards – New Zealand (MBIE - Ministry of Business, 2019b, 2019a, 2019c, 2019d), Japan (Agency, 2013), United Arab Emirates (Marketing, 2018), United States of America (Office, 2016), Australia (Australia, 2017) and England (VisitEngland, 2018) – as they presented solid produced work on this field.

The proposed model allows a dynamic exploration and analysis on future developed dashboards, allowing the local government and the citizens to improve their knowledge on valuable metrics at the city. If published at a public portal or domain, those tools can provide a graphic perspective and the access to clean public data, transforming it in relevant information and even knowledge within the community. It also may improve the concept of spatial intelligence (Komninos, 2011), where the citizens can make use to their intellect and infrastructures to deal with different society challenges (Buhalis & Amaranggana, 2014).

5.2. DATA PREPARATION

As this thesis data preparation and clean-up was complex, it is important to expose the steps involved in the generation of some datasets:

- **Guests per country**: Constituted by Belgium, the Netherlands and other countries, the original category “Other countries” did not specify all of its constituting countries. As this is the second highest value for the number of guests for 2016 and 2017, it is extremely important to have this information so the right conclusions can be drawn. It is also relevant to mention that the original open dataset used to build the current one is no longer available at the source portal, as an aggregation per year data modification occurred, opposing the initially existing monthly detailed. This step

- **Guests per accommodation:** For the “Occupancy rates” dataset, a new category emerged for one and two star hotel for both years, as the one star hotel category was no longer represented after September 2017. The chosen approach was to average both categories’ values and consider this a single category. Also, the tourist apartment category was no longer represented after September 2017. No action was taken here and there are simply no records for these months. It is also important to remind that for the category “Other accommodation types”, the type is not identified in the original datasets and were not fully represented at both datasets, for 2016 and 2017, and some data loss may have occurred, which may have compromised the data quality and the conclusions that the used open data allows.

- **Occupancy per Accommodation**: Although there were more guests at three, four and five star hotels, the average bed occupancy rate is rather different. In 2016, the three star hotel scored the highest occupancy rate, followed by the Inn/Hostel and the four star hotel. For 2017, the trend changed with the three stars hotel having the highest rate, followed by four stars hotel and the one and two stars hotel. This may suggest that a big part of the three and four stars hotel may have more than one bed on the same room, or that the statistics were not correct as some updates were made to the dataset during the following months of being published. It is also possible to see that for 2016 the total earnings were close to 876 million of euros, and for 2017 it increased to 1,065 million, possibly explained by the increasing number of guests.

- **Stay per Accommodation:** This dataset contains countries that are not the same as the **Guests per country** dataset, and the number of spent nights is shown to Sweden, Germany and Denmark These countries were not available on the other dataset and may not give a clear information on the stay duration at Lisbon per guest country.

6. CONCLUSIONS

This master thesis main goals are: to develop a conceptual model to monitor the tourism in Lisbon using Open Data from the Lisbon Open Data Portal, to materialize the proposed model in an empirical tool, and to propose a conceptual model that is usable with Open Data from other cities. To achieve those goals, a design science research methodology was conducted, and it is now possible to compare the accomplishments with the work done so far.

The development of a conceptual model to monitor the tourism in Lisbon was achieved, as the proposed model allows the city direction to monitor its dynamics and development in a long term using present and historical data from the past years, whereas its citizens can benefit from the evolution of the city in a more intelligent and informative way. However, the Lisbon Open Data is still not structured nor available in a way that provides the necessary insights for these points to be fully achieved. Although the methodological approach on a tourism monitoring tool design was followed, the conceptual model covers the primary indicators in a city tourism and the prototype validates this model considering a real scenario, where the lack of open data availability and with the desired quality constitute a limitation on this topic.

The proposed model was tested through a digital dashboard prototype, using Lisbon Open Data portal datasets and creating dashboards in one category - Accommodation. To achieve more solid results in accordance to this goal, the empirical tool should:

- Include all the proposed categories – Visit, Expenditures, Travel and Activities/Satisfaction –, which was not possible to achieve in the present thesis due to data unavailability, unstructured data or lack of data quality. The tested category represented the one with the higher number of indicators presented in the model, being chosen for that reason.

- Be deployed in a real environment, such as in a public website like the city council or the data portal itself, where maintenance is a regular basis that keeps data updated, and all the historical data should be included in this tool. Although that was not part of the second goal of this thesis, it is believed that the empirical tool constitutes an important resource to the city management by helping to gain insights on the city development, and constitutes a clearer perception for all the citizen when containing this type of data.

Finally, having used Lisbon's data as a sample and considering the previous constraints, the proposed model is expected to be used in other cities using their Open Data, and thus making Lisbon the first trial on this prototype.

6.1. RESEARCH FINDINGS

The quality of government data and the creation of a culture of open government, together with the availability of tools and instruments to use the data with, is crucial and justifies further research on this impending topic. Also, the fast technology advancement turns a smart tourism destination in a living lab, where tests and research can be conducted before truly implementing innovative technologies and changing real-life environments, fostering innovation and improvements. In a local government, it

is imperative that quality assurance, a component of BI, is tracked by the Chief Information Officer and a robust team that controls quality and assures all users, inside and outside the community, have the same insights on data. Also, maturity can have importance in measuring the ability of an organization for continuous improvement in a particular area.

Open data is a concept that displays its status as citizens use government data to develop new apps and for other purposes, which should be promoted as a trend of collaboration between both. As very few countries reveal information displayed statistically or visually, the size of analysed countries in the present thesis is small, and a monitoring tool should be developed further to

6.2. PRESENT LIMITATIONS AND FUTURE RESEARCH

This study presents several limitations that can encourage future research. Firstly, the main data gathered for the construction of the conceptual model was only originated from developed countries, and may hide other relevant indicators that were not presented and may have biased the proposal. Also, the sample may not be representative, as very few countries were investigated due to the lack of information on tourism. It is necessary to research on tourism in other countries, which may promote the usability of such indicators and test whether it applies to other cases, or if a new model should be projected. The categories proposed in the conceptual model - Visit, Expenditures, Travel and Activities/Satisfaction – should also be included in future research and prototyping.

Secondly, the access to the Open Data should be maintained and unaltered at all times. During the data research period for this thesis, a high number of URLs, portal names and addresses changed in a short period of time, and were not guiding the user to the most recent location where the data should’ve been moved to.

Thirdly, it is important to also mention that the datasets from the Lisbon Open Data Portal were replaced by the most recent ones and kept only the previous two years of data with a monthly granularity, being the oldest datasets aggregated per year and lacking the month detail that can be useful in future works that require higher precision. The reason may be that the portal was still very recent by the time of data collection, but data from all the previous years should be available at any time and not changed in a less detailed form. Further developments need to be done on a tourism monitoring tool, as it currently constitutes the first step of testing the usefulness of the proposed and broadly used metrics and its replicability.

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APPENDIX

Appendix A – Final analysis table on the research of New Zealand, Japan, United Arab Emirates, United States of America, Australia and England Tourism Dashboards.

Country	City Destination	Tourism	Health	Transportation	Education	Expenditures (by year or month or total)	Expenditures by industry	Expenditure growth by month/year	Expenditure per foreign visitor
Hawaii	Statewide, Hawaii, Honolulu, Maui, Kauai	x				x			
New Zealand	Full country	x				x	x		
New Zealand	Full country	x							
New Zealand	By country region	x						x	
New Zealand	By country region	x				x			
Australia	Full country	x							
USA	Full country	x				x			

Country	City Destination	Tourism	Health	Transportation	Education	Expenditures (by year or month or total)	Expenditures by industry	Expenditure growth by month/year	Expenditure per foreign visitor
England	England	x				x			
Japan	Full country	x							x
UAE	Dubai	x							

Country	City Destination	Length stay	Length stay by accommodation type	Accommodation occupancy rate	Monthly arrivals	Monthly arrivals per country of origin	International visitors & nights interactive map	Number of Visitors (vs last year)	Number of visitors per country region	Number of guests from the same country per country region	Number of Visitors by Country of Origin
Hawaii	Statewide, Hawaii, Honolulu, Maui, Kauai	x									x
New Zealand	Full country	x	x								x

Country	City Destination	Length stay	Length stay by accommodation type	Accommodation occupancy rate	Monthly arrivals	Monthly arrivals per country of origin	International visitors & nights interactive map	Number of Visitors (vs last year)	Number of visitors per country region	Number of guests from the same country per country region	Number of Visitors by Country of Origin
New Zealand	Full country						x				
New Zealand	By country region										
New Zealand	By country region	x		x							x
Australia	Full country				x	x					x
USA	Full country							x			
England	England	x									
Japan	Full country			x				x	x	x	x

Country	City Destination	Length stay	Length stay by accommodation type	Accommodation occupancy rate	Monthly arrivals	Monthly arrivals per country of origin	International visitors & nights interactive map	Number of Visitors (vs last year)	Number of visitors per country region	Number of guests from the same country per country region	Number of Visitors by Country of Origin
UAE	Dubai										x

Country	City Destination	Nights spent per visitor country of origin	City of Arrival	Hotel Performance	Hotel Inventory by category and performance KPIs (YTD)	Average growth per city	Total arrivals by purpose of visit	YOY (Year Over Year growth)	Travel Promotion Fees Collected	Room Occupancy	Satisfaction and willingness to visit the country again (compared with last year)
Hawaii	Statewide, Hawaii, Honolulu, Maui, Kauai		x	x							
New Zealand	Full country					x	x				
New Zealand	Full country										

Country	City Destination	Nights spent per visitor country of origin	City of Arrival	Hotel Performance	Hotel Inventory by category and performance KPIs (YTD)	Average growth per city	Total arrivals by purpose of visit	YOY (Year Over Year growth)	Travel Promotion Fees Collected	Room Occupancy	Satisfaction and willingness to visit the country again (compared with last year)
Hawaii	Statewide, Hawaii, Honolulu, Maui, Kauai		x	x							
New Zealand	By country region										
New Zealand	By country region	x									
Australia	Full country							x			
USA	Full country								x		
England	England									x	
Japan	Full country									x	x

Country	City Destination	Nights spent per visitor country of origin	City of Arrival	Hotel Performance	Hotel Inventory by category and performance KPIs (YTD)	Average growth per city	Total arrivals by purpose of visit	YOY (Year Over Year growth)	Travel Promotion Fees Collected	Room Occupancy	Satisfaction and willingness to visit the country again (compared with last year)
Hawaii	Statewide, Hawaii, Honolulu, Maui, Kauai		x	x							
UAE	Dubai				x						

Appendix B – Guests per country original dataset for 2016 and 2017 - "HÓSPEDES em estabelecimentos hoteleiros, aldeamentos e apartamentos turísticos e outros."
Downloaded from: http://travelbi.turismodeportugal.pt/pt-pt/BI/paginas/default.aspx?datasetId=780E95AA10F8470592C8C1DA15D81FCB.
Accessed on 4th June 2018.

	janeiro		fevereiro		março		abril		maio		junho	
País de Residência	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**
Alemanha	10,768	13,018	14,569	17,370	29,131	30,375	33,822	38,845	39,303	40,948	34,056	39,727
Brasil	19,640	34,088	17,476	24,625	15,453	30,568	20,924	35,631	31,090	42,886	26,879	42,956
Espanha	24,183	26,813	28,207	29,203	53,937	33,656	31,813	55,075	41,060	33,679	40,261	39,963
EUA	8,010	12,465	8,968	11,407	15,400	22,103	23,230	30,208	31,444	40,855	30,960	41,646
França	21,164	24,358	25,464	28,112	30,297	36,525	45,534	47,101	60,387	55,523	52,644	47,454
Itália	15,689	16,500	13,768	13,167	18,602	17,992	20,316	22,066	18,966	20,379	21,048	21,781
Reino Unido	11,670	13,858	16,075	20,391	20,661	27,580	23,841	31,490	31,092	32,749	30,779	33,433
Outros Países	53,478	91,623	61,121	91,403	79,101	121,733	94,440	146,015	114,032	169,270	109,530	162,895
Portugal	**116,400**	**127,386**	**122,156**	**125,604**	**136,373**	**142,904**	**138,883**	**149,675**	**153,126**	**151,972**	**151,726**	**150,297**
Total Global	**294,879**	**360,109**	**324,036**	**361,282**	**422,318**	**463,436**	**462,988**	**556,106**	**553,788**	**588,261**	**528,834**	**580,152**

	julho		agosto		setembro		outubro		novembro		dezembro	
País de Residência	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**
Alemanha	24,179	25,971	26,523	27,611	39,618	42,029	43,409	46,127	21,310	24,936	11,762	14,705
Brasil	30,782	44,568	26,247	34,627	35,174	43,190	41,129	45,202	29,430	33,120	24,884	28,286
Espanha	60,440	53,643	86,812	77,721	41,151	41,940	39,896	36,156	31,124	31,043	38,578	42,580
EUA	31,893	42,412	25,240	34,788	35,391	45,615	33,136	45,771	20,486	25,873	13,022	16,673
França	46,762	39,942	66,652	59,308	52,419	48,445	50,854	45,823	31,799	32,108	26,261	25,537
Itália	22,304	22,665	36,572	37,882	19,662	20,398	19,105	20,928	15,143	17,696	17,957	18,810
Reino Unido	32,079	32,471	28,107	28,545	32,597	33,171	30,101	30,136	19,991	21,111	12,204	12,755
Outros Países	120,978	172,941	111,301	159,644	122,864	182,568	120,603	179,000	83,926	127,784	62,536	91,855
Portugal	**162,290**	**162,762**	**160,403**	**166,692**	**151,151**	**152,768**	**145,640**	**144,508**	**131,050**	**131,174**	**138,870**	**143,564**
Total Global	**570,230**	**597,375**	**598,395**	**626,818**	**566,627**	**610,124**	**558,655**	**593,651**	**407,281**	**444,845**	**359,656**	**394,765**

Appendix C – Guests per accommodation type for 2016 and 2017 - "2017 DORMIDAS E HÓSPEDES POR TIPOLOGIA 2018|2017 dados".
Downloaded from: http://travelbi.turismodeportugal.pt/pt-pt/bi/Paginas/default.aspx?datasetId=ACAF829121D04B2AB24F196BBF3B3940.
Accessed on 4th June 2018.

	janeiro		fevereiro		março		abril		maio		junho	
Tipologias	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**
5*	48,609	57,246	55,459	59,247	73,822	76,776	83,668	90,303	100,347	101,494	98,146	98,902
4*	132,896	168,398	145,290	163,835	187,887	213,460	210,024	254,872	252,225	274,074	237,885	270,493
3*	58,600	70,486	62,439	70,851	80,607	90,910	83,770	102,299	97,295	106,147	92,081	105,299
2* e 1*	28,443	31,036	30,161	30,360	37,727	37,908	38,416	44,512	45,563	44,714	43,189	46,504
Hotéis-Apartamentos	6,133	8,287	8,064	10,654	13,304	13,525	13,504	20,924	18,678	20,472	18,382	19,740
Pousadas	2,594	2,425	2,655	2,358	3,266	3,483	3,786	4,847	5,060	5,191	5,001	4,702
Aldeamentos Turísticos	2,339	3,714	3,088	5,311	4,741	5,458	6,534	9,819	6,667	7,246	7,373	7,470
Apartamentos Turísticos	1,618	2,833	1,794	2,495	2,596	3,279	2,711	4,464	3,109	4,400	3,178	4,502
Outros	13,647	15,684	15,086	16,171	18,368	18,637	20,575	24,066	24,844	24,523	23,599	22,540
Total Global	**294,879**	**360,109**	**324,036**	**361,282**	**422,318**	**463,436**	**462,988**	**556,106**	**553,788**	**588,261**	**528,834**	**580,152**

	julho		agosto		setembro		outubro		novembro		dezembro	
Tipologias	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**
5*	101,611	101,358	107,451	104,344	105,673	106,744	100,300	104,782	71,562	74,892	57,487	59,086
4*	255,704	276,860	267,884	288,486	259,124	277,828	261,567	271,166	188,640	204,176	163,664	181,196
3*	99,277	108,564	103,209	117,548	95,995	112,980	96,720	108,272	76,121	86,137	69,607	77,640
2* e 1*	49,017	47,530	49,383	51,059	45,322	47,716	41,646	47,271	33,684	36,884	31,385	35,188
Hotéis-Apartamentos	19,978	21,037	20,524	22,118	18,280	20,608	18,133	20,524	9,766	12,742	10,883	12,374
Pousadas	4,833	5,112	4,978	5,569	4,778	5,563	4,646	5,495	2,799	3,382	2,612	3,127
Aldeamentos Turísticos	10,928	7,310	12,157	7,713	7,796	8,222	8,015	6,881	4,139	4,067	4,731	4,408
Apartamentos Turísticos	3,643	4,687	3,666	4,285	4,150	4,442	3,260	4,540	2,644	3,675	2,401	3,769
Outros	25,239	24,917	29,143	25,696	25,509	26,021	24,368	24,720	17,926	18,890	16,886	17,977
Total Global	**570,230**	**597,375**	**598,395**	**626,818**	**566,627**	**610,124**	**558,655**	**593,651**	**407,281**	**444,845**	**359,656**	**394,765**

Appendix D – Guests per accommodation type for 2016 and 2017: Bed Occupancy Rate – "Taxas de Ocupação 2016|2017".
Downloaded from: http://travelbi.turismodeportugal.pt/pt-pt/bi/Paginas/default.aspx?datasetId=519E7BE7FBE24FAB8B72865F9D432986.
Accessed on 2nd July 2018.

	janeiro		fevereiro		março		abril		maio		junho	
Tipologias	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**
Hotéis	34.4%	39.9%	40.1%	46.6%	54.0%	54.8%	60.1%	71.7%	67.2%	67.9%	66.4%	68.1%
5*	30.6%	32.0%	34.6%	38.5%	49.3%	44.4%	55.8%	61.1%	62.4%	61.3%	61.0%	60.2%
4*	34.4%	41.8%	41.0%	48.2%	54.8%	57.9%	61.0%	76.3%	67.8%	71.8%	68.1%	72.1%
3*	38.4%	44.4%	44.0%	52.6%	58.0%	59.3%	63.4%	73.2%	70.9%	66.2%	69.4%	68.7%
2*	39.2%	45.4%	43.9%	51.6%	55.6%	61.6%	62.7%	75.4%	72.9%	69.9%	67.9%	68.3%
1*	11.9%	25.3%	54.4%	36.8%	67.0%	41.2%	50.7%	54.7%	61.5%	51.2%	50.2%	61.0%
Hotéis-Apartamentos	19.6%	17.6%	29.0%	28.8%	46.9%	39.9%	50.7%	63.6%	56.0%	61.3%	61.1%	67.6%
Pousadas	36.3%	30.8%	44.2%	39.4%	49.6%	47.7%	59.0%	69.8%	60.3%	66.5%	64.5%	67.0%
Aldeamentos Turísticos	10.7%	10.1%	14.7%	14.4%	19.9%	12.5%	21.5%	26.4%	20.5%	21.8%	28.9%	31.0%
Apartamentos Turísticos	22.4%	28.5%	30.2%	3.7%	38.3%	13.5%	55.2%	5.2%	27.2%	2.6%	70.2%	3.8%
Total Global	**32.7%**	**37.4%**	**38.7%**	**44.3%**	**52.6%**	**52.7%**	**58.4%**	**70.0%**	**65.0%**	**66.3%**	**65.2%**	**67.1%**

	julho		agosto		setembro		outubro		novembro		dezembro	
Tipologias	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**
Hotéis	73.0%	72.5%	82.1%	79.9%	73.3%	72.3%	70.2%		49.8%		43.2%	
5*	72.0%	67.4%	80.0%	74.6%	68.2%	66.8%	65.1%	63.9%	43.3%	45.4%	34.2%	35.0%
4*	72.7%	76.7%	82.9%	85.1%	74.5%	76.9%	72.2%	69.9%	50.6%	54.8%	45.5%	45.4%
3*	75.7%	69.3%	83.7%	76.5%	75.9%	68.8%	73.3%	68.4%	55.9%	55.9%	48.0%	48.2%
2*	73.7%	71.5%	82.7%	74.6%	79.4%	70.7%	70.6%	65.7%	56.1%	55.5%	50.2%	47.4%
1*	52.7%	51.3%	70.1%	64.8%	64.8%	64.2%	54.0%		35.2%		40.3%	
Hotéis-Apartamentos	80.0%	83.3%	84.5%	91.8%	62.6%	66.3%	56.1%	61.3%	30.7%	38.4%	27.7%	32.6%
Pousadas	66.5%	73.8%	83.8%	88.7%	72.9%	70.1%	64.7%	66.0%	36.9%	43.3%	39.6%	44.2%
Aldeamentos Turísticos	41.3%	34.2%	48.1%	38.7%	30.6%	26.4%	20.0%	23.0%	11.9%	11.8%	14.3%	12.9%
Apartamentos Turísticos	65.3%	3.3%	79.7%	1.2%	66.1%	2.4%	60.9%		46.5%		34.8%	
Total Global	**72.6%**	**72.4%**	**81.5%**	**79.8%**	**71.5%**	**70.7%**	**67.9%**		**47.4%**		**41.3%**	

Appendix E – Nights per Country and Accommodation 2016 and 2017: Average night per accommodation – "Quadro 6.2.24 - Estada média, segundo o tipo dos estabelecimentos, por regiões NUTS II."
Downloaded from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESpub_boui=277048338&PUBLICACOESmodo=2.
Accessed on 2nd July 2018.

2016

Unidade: Nº de noites

NUTS	Total dos Alojamentos Turísticos	Total Hotelaria	Hotéis					Hotéis-Apartamentos	Apartamentos turísticos	Aldeamentos Turísticos	Pousadas
			Total	*****	****	***	** / *	Total			
A.M. Lisboa	2.35	2.34	2.29	2.34	2.25	2.39	2.20	3.47	3.37	2.53	2.10

Quintas da Madeira	Total TER e TH	Turismo no Espaço Rural				Turismo de Habitação	Alojamento Local
		Agro-turismo	Casas de Campo	Hotéis Rurais	Outros TER		
//	1.99	…	2.66	…	//	2.09	2.43

2017

Unidade: Nº de noites

NUTS	Total dos Alojamentos Turísticos	Total Hotelaria	Hotéis					Hotéis-Apartamentos				Apartamentos turísticos	Aldeamentos Turísticos	Pousadas
			Total	*****	****	***	** / *	Total	*****	****	*** / **			
A.M. Lisboa	2.34	2.34	2.29	2.33	2.25	2.35	2.24	3.29	…	3.28	…	3.03	2.88	2.30

Quintas da Madeira	Total TER e TH	Turismo no Espaço Rural				Turismo de Habitação	Alojamento Local
		Agro-turismo	Casas de Campo	Hotéis Rurais	Outros TER		
//	1.93	…	2.34	…	…	2.05	2.37

Appendix F – Nights per Country and Accommodation 2016 and 2017: Average nights per country – "Quadro 6.2.25 - Estada média na hotelaria, segundo as regiões (NUTS II), por países de residência". Downloaded from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESpub_boui=277048338&PUBLICACOESmodo=2.
Accessed on 2nd July 2018.

2016

Países de Residência	Total	AM Lisboa
HOTELARIA		
TOTAL	**2.86**	**2.34**
PORTUGAL	**2.04**	**1.78**
ESTRANGEIRO	**3.39**	**2.57**
EUROPA	**3.68**	**2.66**
União Europeia	3.71	2.66
Alemanha	4.38	2.83
Áustria	3.40	2.78
Bélgica	3.41	2.76
Dinamarca	4.30	3.15
Espanha	2.39	2.43
França	2.98	2.65
Irlanda	4.85	3.03
Itália	2.45	2.59
Países Baixos	4.60	2.85
Polónia	3.64	2.46
Reino Unido	4.85	2.63
Suécia	4.15	3.03
Outros UE	3.46	2.80
Rússia	3.13	2.89
Suiça	3.10	2.56
Outros Europa	3.35	2.69
ÁFRICA	**2.99**	**3.16**
Angola	3.22	3.62
Outros África	2.81	2.72
AMÉRICA	**2.39**	**2.46**
Brasil	2.37	2.67
Canadá	2.75	2.32
EUA	2.32	2.28

Outros América	2.21	2.36
ÁSIA	**1.84**	**1.96**
China (s/ HK)	1.67	1.70
Japão	1.83	2.00
Outros Ásia	1.94	2.14
OCEANIA / n.e.	**2.15**	**2.27**

2017

Países de Residência	Total	AM Lisboa
HOTELARIA		
TOTAL	**2.82**	**2.34**
PORTUGAL	2.03	1.79
ESTRANGEIRO	3.29	2.54
EUROPA	3.64	2.67
União Europeia	3.66	2.66
Alemanha	4.32	2.86
Áustria	3.33	2.71
Bélgica	3.43	2.78
Dinamarca	4.37	3.20
Espanha	2.37	2.41
Finlândia	4.69	3.11
França	2.95	2.60
Irlanda	4.77	3.00
Itália	2.43	2.55
Países Baixos	4.64	2.86
Polónia	3.44	2.42
Reino Unido	4.80	2.72
Suécia	4.13	3.06
Outros UE	3.06	2.67
Noruega	4.13	3.02
Rússia	2.97	2.84
Suiça	3.14	2.57
Outros Europa	2.81	2.63
ÁFRICA	2.86	3.00
Angola	2.96	3.31
Outros África	2.79	2.70
AMÉRICA	2.34	2.42
Brasil	2.32	2.62
Canadá	2.69	2.27
EUA	2.28	2.26
Outros América	2.18	2.36

ÁSIA	1.85	1.93
China (s/ HK)	1.61	1.66
Israel	2.10	2.35
Japão	1.83	1.99
Outros Ásia	1.97	2.10
OCEANIA / n.e.	2.23	2.35
Austrália	2.29	2.41
Outros Oceania / n. e.	2.07	2.20