MASTER'S THESIS
Master's degree in Tourism Management & Planning

DETERMINATION OF THE INFLUENCE OF TOURISM BEHAVIOUR OF A SMART DESTINATION ON BUSINESS CONFIDENCE

Author:
Ivelina Mirkova Blagoslavova

Supervisor:
Prof. Dr. Eduardo Parra López

In collaboration with:
Prof. Dr. Rosa María Aguilar Chinea
Jesús Miguel Torres Jorge
Sergio Díaz González

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ABSTRACT

This Master's Thesis (from now, MT) aims to provide entrepreneurs with a tool, capable of determining the influence of tourism behaviour on business confidence in a smart destination. The notions of Business Intelligence (BI), Artificial Intelligence (AI), Machine Learning (ML), Big Data, Analytical Hierarchy Process (AHP) and smart destination will be discussed. Furthermore, the focus is going to lie on the determination of strategic key indicators regarding tourism behaviour for the destination of Puerto de la Cruz. A formal explanation of a KPI will be provided. A thorough data mining process is involved in order to create a System of Tourism Intelligence (from now, STI) which incorporates both structured and unstructured data. Valuations of experts in the field are implemented in the STI by means of Analytical Hierarchy Process (AHP) in order to obtain an index of business confidence. The STI of Puerto de la Cruz is going to be compared and contrasted with already existing STIs in Spain and other examples.

Key words:

Smart Tourism Destination (STD), Business Intelligence (BI), Artificial Intelligence (AI), Machine Learning (ML), Big Data, System of Tourism Intelligence (STI), Key Performance Indicator (KPI), Analytical Hierarchy Process (AHP), Data Mining, Information and Communication Technology (ICT)

1. MOTIVATION

Over the course of study of the Master's program in Tourism Management and Planning, my knowledge regarding the importance and impact of tourism has been substantially enriched. If we apply Butler's destination lifecycle model on most of the destinations and micro-destinations on the Canary Islands, the outcome would be that they have all reached their maturity levels. The mission of all agents of tourism, from city councils to entrepreneurs and academic researchers, is to contribute to the development of the destination they live in and govern. For this reason, it is of vital importance that all stakeholders of tourism contribute that the destination lifecycle curve follows the path from a stagnation point to rejuvenation.[1] The focal point of my MT lies on Puerto de la Cruz for several reasons. First of all, as a place where tourist activity first started in 1886 it became clear to me that an implementation of a technological tool like a STI would result most beneficial. Over the last decade, Puerto de la Cruz has been struggling due to issues like obsolete infrastructure, low quality tourist demand, lack of investors, among others. Since, according to the mayor of the city, Lope Afonso, 32% of the Canary Islands' GDP stems from the tourism sector, drastic measures need to be implemented to revive this particular tourist destination. There already exists a plan for Modernisation and Improvement and an increase of municipal competitiveness elaborated by the Urban Consortium. This Plan has in its agenda the refurbishment of 35% of the accommodation units of Puerto de la Cruz. An additional objective is to contribute to the creation of new products.[2]

In this line of thought, my motivation to write this MT is to contribute to the modernisation plan of the city and try to give an answer the following questions that arise while investigating ways to improve a smart tourist destination:

- In what way does being a "smart" destination add value to tourists' experience?
- Do all stakeholders of business need to become "smart"?
- What is the value that a STI adds to a smart tourist destination?
- How new Information and Communication Technologies (ICTs) can improve a destination's competitiveness and alleviate sustainability, environmental and accessibility issues?
- What is the importance of generating a business confidence index for a smart destination?
- Is there a way to effectively measure the carrying capacity of a destination?
- Why is it important to be able to determine the carrying capacity?

[1] See Butler, R.W. (1980). The Concept of a Tourist Area Cycle of Evolution: Implications for Management of Resources, Canadian Geographer, XXIV, I.
[2] See Mesa D. (2018). El II Plan de Modernización recoge la renovación del 35% de la oferta alojativa de Puerto de la Cruz, Ayuntamiento de Puerto de la Cruz.

The following sections are going to provide a global overview of the economic, environmental and sociocultural impact of Travel and Tourism on a tourist destination and outline the objectives of the creation of a System of Tourism Intelligence.

2. INTRODUCTION

According to the latest report of the World Travel and Tourism Council (2017), the total contribution of Travel and Tourism to GDP in 2016 amounted 10,2% of GDP and the predictions are, that by 2027, 11,5% of the world's GDP will come from this sector. On the other hand, if we focus on the impact of tourism on employment, 9,6% of total employment (direct and indirect) is derived from Travel and Tourism and the trend is of a continuous growth.[3] These numbers illustrate the enormous weight of tourism not only on the economy but also give us a hint on the dimensions of the environmental and sociocultural effects produced by this multidimensional sector. The latter is connected to the controversial term of carrying capacity (CC) in tourism. One definition of the concept, proposed by Zelenka et al. (2014) states that:

[Carrying capacity is] "the rate of flexibility of the given natural or social system with respect to the acting external influence and the related reversibility or irreversibility of changes after or during the activity of external influence and desirability or undesirability (acceptability or unacceptability) of the resulting state of the given natural or social system."[4]

In other words, and expressed in a simplified manner, when applied to tourist destinations, carrying capacity is an indicator that intends to measure the impact of tourist activity on the ecosystem of a territory. However, there is no consensus regarding a unified definition of CC. Moreover, some authors argue that a measurement of CC is an impossible task, due to the heterogeneity of the concept and the subjectivity of determining whether an impact is reversible or not in the long run. McCool et al. claim that carrying capacity cannot be defined by solely the number of visitors that enter the territory of a certain destination. The authors stipulate that other factors like the activities in which tourists engage, their geographic distribution, behaviour and the specifics of the infrastructure of the area, among other factors, play a significant role to determine the limits of external impacts on an ecosystem. Moreover, resources are limited and following Malthus' scarcity theory, emerges the relatively newer concern of how to calculate an index which assures "safe" levels for the ecosystem.[5] The term ecosystem

[3] See Travel & Tourism Economic Impact 2017 World.
[4] See Zelenka et al. (2014). The concept of carrying capacity in Tourism, Amfiteatru Economic Journal, ISSN 2247-9104, The Bucharest University of Economic Studies, Bucharest, Vol. 16, Iss. 36, pp. 641-654.
[5] See McCool et al.(2001). Tourism Carrying Capacity: Tempting Fantasy or Useful Reality, Journal of Sustainable Tourism, Vol. 9,- Issue 5.

encompasses not only the biosphere per se, but also sociocultural and economic environment. If a tourist destination reaches a point of maximum load (CC) and oversaturation of visitors, the impact does not only translate into the demolition of natural resources, but also into a loss of local identity and culture. The coexistence of tourists, residents and nature needs to be in balance in order for a tourist destination to be sustainable.

The growing advances of Information and Communication Technology (ICT) have imminently led to changes in tourist behaviour. These contemporary behavioural patterns involve higher expectations from the side of the consumers, a demand for a vast information pool, greater independence in the purchase, lesser tolerance for delays and waiting times, greater sophistication levels of their needs, higher environmental consciousness, among many others. Moreover, nowadays the vast majority of tourists are inclined to openly state their opinion in social media networks and one can observe an increase of their criticism towards the products and services they purchase.[6]

3. OBJECTIVES

3.1 General Objectives

The main objective of this MT is to explain the methodology implemented in the creation of the System of Tourism Intelligence of Puerto de la Cruz and particularly the part of tourism behaviour. As an outcome, by means of artificial intelligence and machine learning applied on a vast pool of data, an indicator of business confidence of this smart tourist destination is generated. Since the STI is an automated, self-learning software, it provides instant information to stakeholders of tourism and adapts to the dynamically changing tourism variables.

3.2 Specific Objectives

The specific objectives can be grouped in three phases:

a) Firstly, a more concrete objective is the selection of the bundle of variables or KPIs that determine tourism behaviour with the collaboration of experts and local stakeholders of tourism.

b) Likewise, the collection and extraction of data out of the existing big data pool of official and reliable governmental sources, the transfer of information and uploading into the system is the second stage of constructing the STI.

c) The final specific goal is the generation of an index, measuring business confidence through self-learning algorithms and the implementation of the Analytic Hierarchy Process.

[6] See Wang X. et al. (2016). How smart is your tourist attraction? Measuring tourist preferences of smart tourism attractions via a FCEM-AHP and IPA approach, Tourism Management 54 .

4. LITERATURE REVIEW

4.1 Smart Tourism Destinations (STD)

There is no consensus among specialists regarding a formal definition of smart tourism. As we are going to observe further on in this MT, the key concepts included in this research typically cannot be formally conceptualized, due to lack of unanimity among experts.

To begin with, it is important to be able to distinguish between the terms "smart" and "intelligent". These two terms are commonly used as interchangeable concepts, however, there exist nuances that lead to the conclusion that they cannot be used as synonyms. The term "intelligence" is related to the realm of technology and is based on learned experience by means of algorithms. Section 4.2 is going to further elaborate on this topic and provide detailed information on it.

On the other hand, the term "smartness" has a broader meaning since it reflects the ability of human beings to use the outcomes of intelligent systems, combine them with own previous experiences and implement them to improve their quality of life.[7]

The term of smart tourism appears with the development of the so-called "smart cities" which represent the synergies between information and communication technology (ICT) and tourism sources. ICT encompasses areas such as artificial intelligence, internet of things (IoT), among others, which are intended to be implemented in the governance of smart cities in order to improve the economy, environmental issues, mobility, urban planning, accessibility, the quality of services provided to tourists and to local residents.[8]

According to Wang et al. (2015), research and literature so far have focused on several areas of smart tourism: smart cities, smart tourism destinations, smart hotels, smart recommendations for tourists, smartphone applications on tourism, gamification and augmented reality, smart cards and smart guides. Wang et al. (2015) contribute to the research of an unexplored branch in smart tourism, and namely smart tourist attractions and measure tourists' preferences by a Fuzzy Comprehensive Evaluation Method (FCEM) - Analytic Hierarchy Process (AHP). The AHP is going to be explained in detail in section 5.4 and implemented in the development of the System of Tourism Intelligence (STI) of Puerto de la Cruz.[9]

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[7] See Li et al. (2017). The concept of smart tourism in the context of tourism information services, Tourism Management 58, 293-300.
[8] See Xiang et al. (2015). Smart destinations: Foundations, analytics and applications, Journal of Destination Marketing & Management 4, 143-144.
[9] See Wang X. et al. (2016). How smart is your tourist attraction? Measuring tourist preferences of smart tourism attractions via a FCEM-AHP and IPA approach, Tourism Management 54.

Smart Tourism Destinations (STD) emerge along with "smart cities" and should be studied from two perspectives: from the customers' and from the governance's standpoint. Customers perceive smart destinations as technology oriented environments, where services regarding local tourism supply are personalized and adapted to their needs by means of ICT.

On the other hand, destination and city governance are in favour of and work towards the implementation of "smartness" in order to boost their competitive level among other destinations. The data produced and collected in the destination, as well as the abundant amount of User Generated Content (UGC) provided by tourists on the Internet, enable local governments and businesses to improve the precision of their decisions. As an outcome of that, the generation of personalized products and services increases, city infrastructure improves, the quality of life of residents ameliorates, tourists are provided with better experiences, among many other advantages.[10]

As one might observe, most research dedicated to smart tourism has been performed by countries like China and Korea and backed up with numerous empirical findings in distinct fields of investigation. The importance of this phenomenon for the better understanding of "modern" tourism behaviour is starting to attract academics and stakeholders of tourism from Europe as well. In order to perform a better analysis, it results essential to determine the standpoint from which one evaluates the pros and cons of being smart.

From the perspective of the council, opting for smartness translates into governmental or European Union subsidies, which would aid improve local tourism management and the image of the destination. Companies, on the other hand, see an opportunity for investment. As for tourists, it cannot be clearly defined whether smartness can be considered in all cases as a categorical positive feature. This depends on the specific type of tourism demand that a concrete destination has and the degree of smartness. According to Femenia-Serra et al. (2018), not all tourism stakeholders have to strive to adopt smart techniques in their businesses. If going smart does not meet the necessities of tourism demand, then no value is added and the effect could be even the opposite. Femenia-Serra et al. (2018) express a critical standpoint that argues that the expectations of smart destination management are not in exact accordance with the real tourism behaviour at the destination. The researchers conducted an online survey among a sample of Spanish "Millennial" tourists[11] with tourism oriented university education. The three main pillars of the survey had to shed clarity into the use of mobile technologies, the extent of willingness for

[10] See Xiang et al. (2015). Smart Destinations: Foundations, analytics and applications, Journal of Destination Marketing & Management 4, 143-144.
[11] "Millenials", "Digital Generation" or "Generation Y" are individuals born between 1982 and 2002.

data sharing in the pursuit of personalised experiences and the particular smart technologies that tourists use or are willing to use for a premium experience.[12]

While looking into the results of the survey, data showed that, the so called "Digital Generation", would rather receive event and activity related information, proposals and offers, but not interact and share their experiences with the destination businesses or governmental institutions. This finding reveals that the mainstream concept of a considerably prone to interaction smart tourist is a myth. Thus, focusing on the development of interactive platforms for smart destinations might not be optimal. The second part of the questionnaire reveals that there exists a clear unwillingness from the members of the sample group to share sensitive personal data like specific expenses, social media profiles, real time location etc. in order to obtain a more personalised product or service. To conclude, the survey revealed that Spanish "Generation Y" tourists place high value on more "basic" technologies like public, free of charge Wi-Fi connection, intuitively structured and informative official destination web page and social media profiles, which provide them with a direct booking option and so forth. However, contrary to the belief of smart destination management entities, technologies like chatbots, gamification, virtual reality etc. are not considered value boosters for an exquisite experience.[13] These valuable insights of Femenia-Serra et al (2018). show deviations from the theoretical expectations of what a smart tourist destination should represent. However, it should be mentioned that the researchers' model has limitations concerning the examined sample group. One cannot extrapolate information regarding one nationality to all international tourists. Moreover, the perceptions and behaviour of visitors would inevitably have shown different results, had the purchasing power of the sample group been higher.

The subsequent paragraph is going to provide various examples of Smart Tourist Destinations from Spain, which include smart islands and smart cities. This would provide a broader understanding of the "smartness" concept.

Red.es, a public business entity of the Ministry of Economy and Business in Spain, is in charge of boosting digital economy and innovation by the implementation of ICTs. This entity obtains funding from the European Union for numerous projects with the economic assistance of the European Regional Development Fund (ERDF)[14]. During the "Ist Call for Intelligent Islands", integrated in the National Plan of Intelligent Cities (2015), three Spanish islands were selected to receive funding: Palma de Mallorca, Fuerteventura and El Hierro.[15] The focus of the foregoing paragraphs is going to lie on a

[12] See Femenia-Serra et al. (2018), Smart destinations and tech-savvy millennial tourists: hype versus reality. Tourism Review, (Forthcoming).
[13] See loc cit.
[14] The objective of the ERDF is to reinforce economic and social cohesion in the European Union and to amend the disparities between its regions.
[15] See www.red.es, ¿Quiénes somos? (official web page of the public business entity).

summary of the objectives of the two Canary Islands and serve as guidelines for possible "smart" alternatives for Tenerife.

To begin with, the general targets addressed by the "Ist Call for Intelligent Islands" encompass the areas of sustainability, accessibility and competitiveness. The main goal is to improve public services and goods by the implementation of Information and Communication Technologies. As a by-product, the possible negative impact on the territory, caused by its island status would be mitigated.

The official dossiers of both projects: "*Fuerteventura Open i-Sland*" and "*El Hierro en Red*" first describe the current state of technological development of the areas targeted for improvement, and then set the objectives of how to improve the already existing ICTs or incorporate new ones. Both islands need to implement technological solutions in three branches: intelligent government, sustainability and safety & emergency. Among all, the most distinctive lines of action would be highlighted.[16]

Fuerteventura plans on the implementation of a "*Smart Island*" platform which gathers input from all sources of information available: incorporating structured, unstructured data, data extracted from sensors, smart devices, using Internet of Things etc. Similar to the STI of Puerto de la Cruz, this platform aims to serve as a scorecard for the managing destination entities to improve tourists' experience and the living standards of the residents by providing instant information and at a lower cost for more intelligent decision-making. "*Smart Island*" would also have an interactive part for feedback and communication with visitors and residents. Further innovative initiative of "*Fuerteventura Open i-Sland*" is i-Light, which targets to reduce energy consumption and lower costs by the implementation of a remote management system for the public lighting.[17]

The project "*El Hierro en Red*", the other beneficiary from the "*Ist Call for Intelligent Islands*" funded by the ERDF, includes more sustainable ICT solutions oriented towards mobility and accessibility issues. One of the main lines of action is the optimisation of the transport network in order to be able to provide demand driven transportation services. On-board control is planned to be installed on the vehicles in order to obtain real time information regarding schedules and traffic. Furthermore, interactive platforms are going to provide passengers with updated transportation data by means of internet mobile devices. It is of essential importance to mention that the existing infrastructure of El Hierro is pioneer

[16] See www.red.es , Ciudades e Islas Inteligentes, "I Convocatoria de Islas Inteligentes" (2015).
[17] See "Fuerteventura Open i-Sland", Dossier Informativo, Convocatoria de Islas Inteligentes de la Agenda Digital para España (2015).

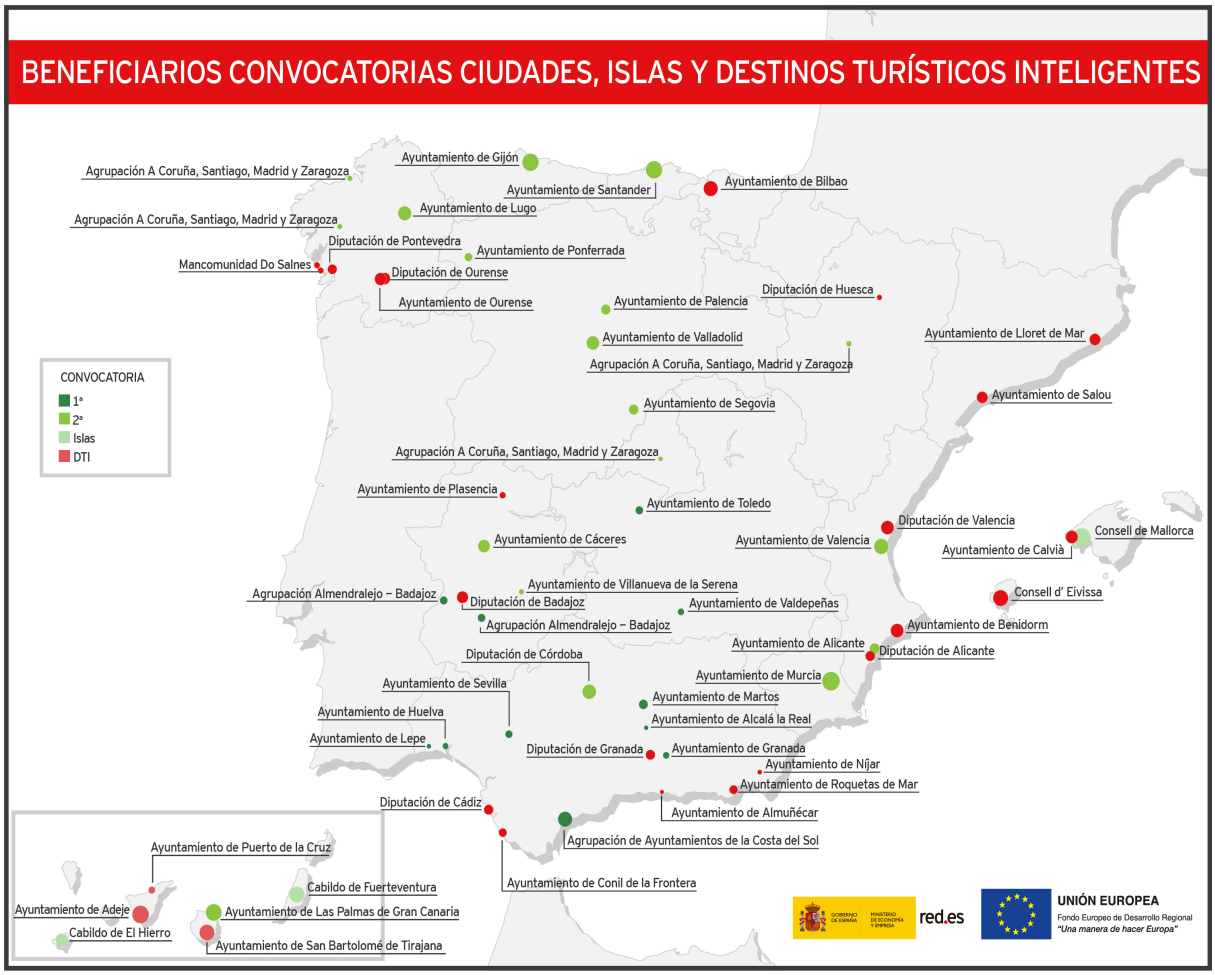
in offering a public Wi-Fi network. This fact is vital not only for all visitors, but also for the implementation and development of new innovative technologies.[18]

At the call for financial aid for "*Intelligent Tourist Destinations*" in 2018, 24 intelligent tourism projects were approved for a total amount of 68,3 million euros of investment. The general manager of Red.es explained that, together with the 109,5 million invested in the project of Intelligent Cities and Islands, and other related projects, the total sum invested in smart territories amounts to more than 200 million euros. The 24 approved projects include the autonomous communities of Andalucía, Aragón, Cataluña, Valencia Community, Extremadura, Galicia, Balearic Islands, Basque Country and the Canary Islands. The latter includes three municipalities, one of which is Puerto de la Cruz, obtaining 893.186,30 € out of the 12.646.796,85 € dedicated to the Canary Islands. Furthermore, the funding has to be utilized for specific initiatives. Some of the most important activities that need to be implemented are the application of Business Intelligence, Analytics, Big Data and Systems of Tourism Intelligence; the implementation of Wi-Fi access points, systems of intelligent public lighting, mobility, transportation, irrigation, energetic efficiency, waste, among others; the creation of tourist relevant content including virtual and augmented reality, etc.[19]

[18] See "El Hierro en Red", Dossier Informativo, Convocatoria de Islas Inteligentes de la Agenda Digital para España (2015).
[19] See Resolución de la convocatoria de ayudas "Destinos Turísticos Inteligentes", www.red.es (2018).

Finally, for purposes of clarity, Figure 1 depicts all beneficiaries according to the different calls over the years, and the type of territory.

Figure 1: Beneficiaries from the calls for intelligent cities, islands and tourist destination



Source: www.red.es

To conclude this section, the European Commission has launched an initiative called "*European Capital of Smart Tourism*". This year (2019), two cities were awarded with this title: Helsinki (Finland) and Lyon (France). Candidates compete in four categories and namely: accessibility, sustainability, digitalisation and cultural heritage & creativity. Accessibility entails not only physical boundaries that need to be overcome, but also language and technological boundaries notwithstanding age, cultural or ethnical background. Apart from the preservation of natural resources, sustainability encompasses involvement of the residents in tourism sector and reduction of seasonality. Digitalisation needs to be present in all tourism related aspects and has to serve as an aid for local businesses. Cultural heritage & creativity refers to the preservation of local traditions and encouragement of its development for the benefit of all stakeholders of tourism.

Apart from the official winners, four different cities were given awards for each of the above mentioned categories, one of which is Málaga for its accessibility. The other three are Ljubljana (Slovenia) for sustainability, Copenhagen (Denmark) for its digitalisation and Linz (Austria) for its cultural heritage & creativity.[20]

4.2 Artificial Intelligence: Big Data, Business Intelligence, Machine Learning

Although *Business Intelligence* might seem like a quite popular term, it results that determining an appropriate definition is not an easy task. There exist controversies among specialists in the area and for this reason, during last year's Gartner's Symposium in Australia several definitions were coined during a survey that took place among 150 experts. The definition with the highest percentage obtained (43%) was the following: "The use of information which allows organizations to manage, decide, measure and optimize the impact of efficiency and the financial results in the best possible way." [21] The main objective of BI is the use of data in order to obtain value. In the current situation, businesses need to adapt to the rapidly changing technological environment and look for new opportunities. Each day companies dispose of greater quantities of data of all kind: structured, unstructured, internal, external etc. and of less time to analyse it. This is one of the reasons why the concept of Big Data emerged a posteriori.

There exist two settings of BI: operational and informational. The operational setting is the ERP (Enterprise Resource Planning) system of any firm, which could be for example SAP, Microsoft Dynamics or any other ERP or even an Excel file. The ERP is usually connected to auxiliary systems like the CRM (Customer Relationship Management) system, distribution, customer web portal, manufacturing, finance etc. It represents an internal tool used on a daily basis to manage the operations of the firm.

If we compare the operational with the informational setting, several advantages and disadvantages could be pointed out. On the one hand, operational systems are robust and facilitate an agile data insertion. However, on the other hand, they lack cross analysis and furthermore, the presentation of data is not intuitive. Informational systems, like Microstrategy or Business Objects, represent a much more analytical setting, including graphs, KPIs, indicators etc., which have a visual, interesting and user friendly interface and facilitate the decision-making process.

The source of data of the operational systems is the internal information of the ERP, whereas the informational systems include both operational and external data. The purpose of the information of

[20] See www.smarttourismcapital.eu.
[21] See Gartner Symposium/ITxpo Australia 2017.

operations systems is the daily management of the company, while the informational systems assist in the process of analysis, decision-making and planning. In contrast to operational systems, where data storage involves numerous tables, informational systems consist of a data lake where all the information is stored.

In order to further clarify the concept of informational systems, a brief explanation of data warehousing will be provided. As previously mentioned, the source of information comes from internal and external settings. By means of a process called ETL (Extraction, Transformation and Loading) all the data is inserted into a data warehouse. The next stage is the reporting layer, where data is visualised. Some informational systems include a DataMart which gathers information for a specific department, usually which encompasses massive amounts of data.

Following, the terms of *Artificial Intelligence (AI)* and *Machine Learning (ML)* are going to be introduced in order to outline the methods that are implemented in the development of our STI.
As with BI, the same phenomenon happens with AI, and namely that experts find it difficult to unanimously stipulate a definition. According to Stanford University, AI is "the branch of science and engineering that is seeking to make machines intelligent, especially software systems".[22]

The notion of AI emerged in the 1950s, however during the last decade, with the rapid evolution of technology, there has been an exponential growth in the development and implementation of AI algorithms in numerous areas of life. The main reason behind that is the enormous amount of data that exists and needs to be processed in order businesses to be able to react accordingly to the growing expectations of their clients. Artificial Intelligence is used to decipher problems involving limitless time and memory. AI thereby boosts productivity, facilitates decision-making and aids to make the life of human beings easier.[23]

According to the publication of C. Martínez in 2018's e-book of Thinktur, dedicated to Artificial Intelligence, she states that the term "intelligence", when applied to a machine signifies the ability to replicate behaviour intrinsically related to human beings. Martínez outlines two types of behaviour. The first one is intelligent, which encompasses decision-making processes tackling with sophisticated data, resource planning, prediction making, process optimisation etc. The second type is related to the cognitive behaviour and involves image, voice and video recognition and even communication with humans.[24]

[22] See Thinktur, Inteligencia Artificial: desarrollos en turismo (2018).
[23] See Esposito A. et al. (2016). Some Notes on Computational and Theoretical Issues in Artificial Intelligence and Machine Learning, Springer International Publishing Switzerland.
[24] See Thinktur, Inteligencia Artificial: desarrollos en turismo (2018).

In order to further enhance the topic, F. Romero (2018) from Andalucía Lab describes that the core behind AI lies on two mainstreams: *deep learning*, which involves complex neural networks with great learning capacities, and *Natural Language Processing (NLP)*. These concepts are related to the previously mentioned intelligent and cognitive behaviour.[25]

Having already discussed some basic notions regarding AI, one might expect that those algorithms would also be applied to the tourism sector. Being tourism a multi-faceted, cross-cutting sector, AI finds a vast application in many of its branches. In a sector where each day becomes more and more vital to be able to understand the necessities, preferences, feelings and emotions of the clients, AI results an indispensable tool in order to satisfy the demanding clients from the generations Y and Z. Generation Z comprise the Post-Millennials who have been born with and feel comfortable with the internet and have a high interaction level on social media, blogs and other online platforms. These generations create large amounts of User Generated Content (UGC) which needs to be thoroughly analysed in order companies to be able to satisfy their needs.

There is a growing amount of *Machine Learning* algorithms that are used in tourism. ML stems from the field of AI and consequently also emerges in the 1950s. However, the beginning of the 1990s was when ML was identified as a separate field. The formal definition states that: "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E." In other words, computers are used to imitate human behaviour acquiring knowledge from data sources of different kind. Since machines do not dispose of the ability to think like people do, they need to be trained by algorithms.[26]

According to Portugal et al. (2018), the algorithms used by ML can be classified into 4 main types depending on the method of learning that they implement:

a) The *supervised* algorithms are previously administered with so called training data. They are expected to learn from the training data and implement that information on new real world data.
b) *Unsupervised* algorithms have the task to learn from real world data on their own, without the help of a training set.
c) The third type of algorithms, the *semi-supervised* ones, dispose of the help of a training set, however, this set has missing data. Nevertheless, they are expected to obtain knowledge from it.

[25] See Thinktur, Inteligencia Artificial: desarrollos en turismo (2018).
[26] See Portugal, I. et al. (2018). The use of machine learning algorithms in recommender systems: A systematic review, Expert Systems with applications 97, 205-227.

d) The last ML algorithms use *reinforcement learning approach* and are expected to learn from feedbacks provided by the environment or an external thinking organism.[27]

4.3 System of Tourism Intelligence (STI)

The Spanish state corporation Segittur, whose main goal is to narrow the gap between innovative technologies and tourism, is pioneer in inventing a System of Tourism Intelligence (STI). They give a simple explanation of how the system makes use of big data, applies business intelligence to it and obtains an outcome. The idea behind the creation of a STI is to serve as an intuitive technological tool for all stakeholders of tourism that helps local tourist destinations to improve their tourism experience. A STI represents an aid to tourism entities for better and more precise decision-making. Furthermore, it has to be individually moulded for the concrete needs of the destination based on its specific characteristics. Since we are living in an era where all individuals are constantly bombarded with information from a countless amount of sources, it becomes vital to make use of the relevant information and extract it in a rapid way in order to make an adequate and cost effective decision. The use of Information and Communication Technologies (ICTs) by a tourist destination signifies a competitive advantage over other destinations.[28] Segittur came to the conclusion that a STI needs to incorporate an abundant amount of detailed data base sources.

This new technological tool facilitates a fast track to relevant information through a deep search in big data and, by applying business intelligence, provides a synthesized, smooth and straightforward information extraction. Segittur outlines two basic utilities of a STI: a) as a multidimensional information analysis tool and b) as a scorecard of a new generation. Not only does it provide an analysis beyond the narrow business perspective, giving a vaster overview of a whole economic sector, but it also calculates a synthetic numerical indicator of the activity of the destination. So far, three tourist destinations have started enjoying the benefits of the STI and namely Badajoz-Elvas, Las Palmas de Gran Canaria and Palma de Mallorca. The system forms part of the broader project of Smart Tourism Destinations discussed in part 4.1. The focus is going to be placed on the STI of Badajoz-Elvas due to the fact that the other two are still in a basic level of development. After a brief outline of the core components of Badajoz-Elvas' STI, it is going to be compared and contrasted with the newly developed STI of Puerto de la Cruz.

[27] See Portugal, I. et al. (2018). The use of machine learning algorithms in recommender systems: A systematic review, Expert Systems with applications 97, 205-227.
[28] See García, S. (2016). El SIT. La puesta en marcha de un Sistema de Inteligencia Turística Local, SEGITTUR.

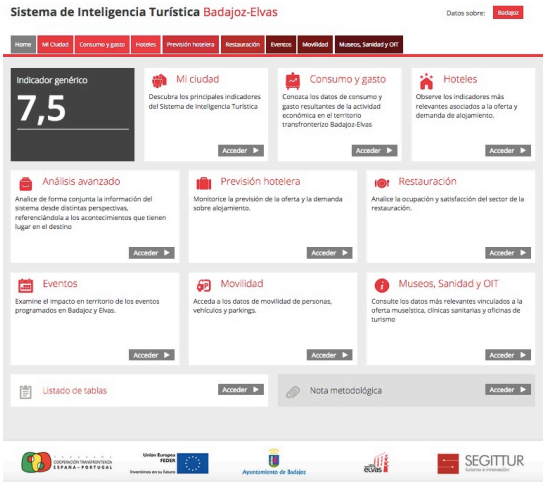
4.3.1 Badajoz-Elvas vs. Puerto de la Cruz

There are seven indicators that are integrated in the system, which encompass data regarding consumption and expenditure, hotel indicators, hotel forecast, restaurant services, events, mobility and museums, healthcare and International Tourism Organisations (ITOs). The STI pretends to analyse and convert data into instant knowledge, accessible to all agents of tourism. On one side, it helps the governing institutions to implement the correct policies at the correct time point at a reduced cost. On the other side, from the visitors' point of view, an improvement in governmental decision-making, leads to a better destination experience.

The STI developed by Segittur and applied to Badajoz-Elvas with the collaboration of Microsoft Power BI and NeuroMobile, aims to try to adapt the city to the citizen. The method consists in empowering the governing destination entities with a tool, able to extract real time knowledge from every data base source in order to boost intelligent decision-making. Power BI is a cloud based analytics and business intelligence platform, which uses prebuilt dashboards that extract data and convert it into insights. According to Gartner´s ranking from 2018, Microsoft and their business intelligence platform are among the world's leaders in this sector.[29] Therefore, the STI of Badajoz-Elvas is equipped with an intuitive interface, structured into easily identifiable quadrants (See Figure 2), so that no special training is needed to operate with it. Since the STI relates to two borderline cities (between Spain and Portugal), stakeholders of tourism find important to obtain information regarding the mobility between them. Hence, NeuroMobile has developed a system for positioning, monitoring and analysis incorporated in the STI, able to autonomously collect data from portable devices, sensors, beacons, ATMs and so forth. Consequently, according to NeuroMobile, invaluable insights have been revealed, one of which is the high importance of health tourism, which comes from Portugal. Further useful information reveals expenditure patterns of visitors by nationality, among others. [30]

[29] See Microsoft Power BI lidera el cuadrante mágico de Gartner 2018.
[30] See NeuroMobile aporta localización y análisis del Sistema de Inteligencia Turística (SIT) de Segittur en Badajoz-Elvas.

Figure 2: STI Badajoz-Elvas



Source: http://sitbadajozelvas.es/

Figure 3: STI Puerto de la Cruz

Source: http://vituin.iaas.ull.es/

The advantages of Badajoz-Elvas' STI are countless, nevertheless, even though the system has been launched in 2015, there is still place for improvement. From the seven indicators displayed in red colour on top of the website, the further one goes to the right, the lesser information will obtain.

If we examine the STI of Puerto de la Cruz, the first impact is created by the iconography of the web page (See Figure 3). Correctly selected images attract the attention rapidly and create a personal bond between the user and the message that a web page intends to convey. The structure of the system is built on two main pillars and namely tourism behaviour and the image of the destination, which is a differentiating point from the STI created by Segittur. This separate representation gives a clearer understanding of a tourist destination and facilitates knowledge extraction by the stakeholders of tourism. Furthermore, the colour scheme selection (blue) is chosen to express security and trust (See Appendix 2), a subconscious factor that influences decision-making. In order to obtain a broader view of Puerto de la Cruz's STI, Appendices 1, 3 and 4 show three different representations of information, which are visual, intuitive and in real time. Appendix 1 shows an example of a bar chart depicting tourist population distributed according to important tourist centres of Puerto de la Cruz and time periods. Appendix 3 pictures a Word Cloud from reviews on TripAdvisor regarding the restaurants in the area. The size of each word is related to the frequency of repetition by the users. Lastly, Appendix 4 represents visually the location of each restaurant and its name.

Section 5 of this MT is going to provide a detailed description of the methodology implemented in the creation of the STI of Puerto de la Cruz and the main KPIs.

5 METHODOLOGY

5.1 Definition and identification of Key Performance Indicators of tourist behaviour.

Since the aim of the project that we have been working on is to create a user friendly STI, which is comprised of key indicators for the businessmen in Puerto de la Cruz, it is essential to be able to distinguish between KPIs and mere metrics. First of all, a KPI has to be linked to a previously determined objective. Its task is to depict the measurement of the evolution with respect to this objective. A clarifying example would be for instance the occupancy level of a hotel on a specific day. It represents an important metric, however a KPI would provide much more value from a businessman's perspective, since it could, for instance, depict the evolution of the occupancy level with respect to an equivalent day last year or the day or month before. A Key Performance Indicator has to fulfil certain criteria in order to be implemented in any decision-making process. First of all, it has to be *actionable*. This means that in the process of defining and identifying KPIs, it is essential to bear in mind that if we are not able to perform any action in order to influence the indicator, then it is not useful for our analysis.

Imagine, for example, that we have the information regarding the number of reservations made by Chinese guests in our hotel. Nonetheless, our hotel does not have the capacity to activate the Chinese market. In this case, this number would be a metric and not a KPI since the information does not deliver any value to us. Secondly, a KPI has to be *relevant* for our decision-making process. If we had to establish prices on a corporate level for a hotel chain and we took into consideration solely the pricing strategy of a particular hotel, this would not be a relevant indicator since it would not be representative for the hotel chain. Furthermore, a KPI has to be *trustworthy*. In the case that we took a small sample size with significant deviations, this would lead to erroneous conclusions, due to the lack of data. Hence, this indicator would not be trustworthy. To conclude, if our KPI complies with the above mentioned criteria, however, the information is too complex to understand, then it also would not provide any value to the decision-making process. An important aspect is to stick to simplicity in order data to be *comprehensible* and easy to deal with.

5.2 Data mining

In order to create the System of Tourism Intelligence of Puerto de la Cruz, thorough data mining has been performed both for the image and the tourism behaviour of the destination. Sources of structured and unstructured data have been thoroughly researched in order to extract the relevant information that would serve to determine the index of business confidence. The first stage of the data mining process has been performed based on key indicators determined by academics of the ULL, specialised in the area of tourism and computer science. After determining eight (8) key indicators for each of the two areas of research, and an exhaustive data mining process, a demo version of the STI was elaborated by the informatics team. With the collaboration of the city councilwoman of Puerto de la Cruz, a meeting

with a sample of more than twenty businessmen/women was organized for the purpose of presenting our new system and obtaining their feedback. After the meeting, all participants were asked to determine whether the chosen indicators are useful for their decision-making processes.
On a consecutive meeting, the businessmen/women kindly collaborated by filling out questionnaires previously prepared by our team. After analysing the results, some variables were grouped together, others were added and some discarded as not important. An important general conclusion was deduced from the questionnaires. Entrepreneurs specified that for all indicators and variables, the time periods studied should be clustered into winter and summer, due to the seasonal nature of their demand. The results of the fieldwork helped fine-tune the analysis and adapt the STI to the needs of the entrepreneurs.

5.2.1 Visitors

"Visitors", is the first key indicator chosen for the analysis of tourism behaviour. It has been subdivided into six (6) variables: occupancy, average length of stay, tourist profile, tourist population, motives of tourists for the choice of accommodation and tourists lodged according to municipalities.

The next two variables are going to be explained in detail in order the main procedures and criteria of data selection to be clarified. The rest of the variables are going to be only briefly outlined since the methodology followed throughout the process is consistent.

Occupancy is subdivided into four parts: type, country of origin of the tourist, islands or municipalities and time periods. Using statistics provided by the Canary Institute of Statistics (ISTAC), three variables of occupancy were analysed: overnight stays, lodged travellers and travellers entered. The period from 2009 to 2017 has been studied to compare the evolution of overnight stays by country of origin of tourists. The minimum and maximum values of the data obtained from the island of Tenerife are contrasted to the same values of the micro-destination of Puerto de la Cruz. Data shows that the maximum amount of overnight stays reached during this period in Tenerife are made by tourists with country of origin Great Britain (14.484.159), while the minimum amount are made by visitors from Denmark (537.638). Puerto de la Cruz, on the other hand, obtains the highest number of overnight stays from Spanish residents (2.226.215), followed by Germans (2.077.123).

Average length of stay, is the second variable included in the indicator Visitors and is described by: time periods, place of residence and tourism entities (islands/municipalities). The same period from 2009 to 2017 was chosen from ISTAC's database for analysis. Statistics show that the shortest length of stay of tourists registered during that time span in Tenerife (4,28 days) is from Spanish residents, while Germans obtain the maximum number of 10,28 days. The same conclusions regarding the minimum length of stay can be derived for Puerto de la Cruz and namely that Spanish residents are the

ones who spend the least time (5,15 days). The highest value for Puerto de la Cruz comes from Belgians (13,19 days).

Tourist profile, is measured by place of residence, time periods, sex and age range. Information provided by the Canary Institute of Statistics is general for the archipelago and divides tourists into three age groups: 16-24 years, 25-44 years and older than 44 years. However, businessmen from Puerto de la Cruz indicated that, stemming from the age groups, a further more detailed segmentation of the market needs to be performed. Entrepreneurs demanded information on the MICE (Meetings, Incentives, Conventions and Exhibitions) and the LGTB (Lesbian, Gay, Transgender, Bisexual) segments. Furthermore, they found useful to obtain data whether tourists travelled alone (single segment), as a couple or with the whole family.

Tourist Population, is also depicted by time periods and tourism entities further subdividing into the following micro destinations: Puerto de la Cruz centre, Playa Jardín-Maritim, Conjunto Histórico, Taoro-La Paz and Martiánez. However, the survey showed that this variable does not need to be considered separately, but together as part of the variable *Tourist Profile.*

At first, the ***motives of tourists for the choice of accommodation*** were divided into four subcategories: main motive for the trip (leisure, business or bleisure-a mixture of leisure and business), type of accommodation, tourism entities and periods of time. Nevertheless, businessmen added a fifth category named travel type. Firstly, the transportation type had to be determined and namely whether tourists travelled by air, sea (cruises) or earth. In case of air transportation, it had to be stipulated whether tourists used direct flights, flights with stopovers, charter flights or low cost companies.

The last variable for the indicator "visitors" is ***tourists lodged according to municipalities***. The data taken into consideration is the type of accommodation, place of residence and time periods.

5.2.2 Hotel Indicators

The second key indicator of tourism behaviour is described by three main variables: revenue, census index and number of accommodation units offered.

Revenue is further divided into revenue type, tourist entity and periods of time. Businessmen from Puerto de la Cruz found all types of revenue (ADR, RevPAR and Total Revenue) valuable for their decision-making process.

The ***census index***, disposes of information regarding occupancy rate per accommodation unit and occupancy rate per room/apartment and according to the entrepreneurs does not need to be studied separately, but as part of the variable *Revenue*.

Accommodation units offered, is analysed by time periods and place of residence.

5.2.3 Consumption and expenditure Indicators

The third indicator comprises a great amount of statistical data obtained by the Canary Institute of Statistics. It contains ten (10) variables: average expenditure per tourist on the Canary Islands, daily average expenditure per tourist according to the booking lead time, inter-annual variation of tourist expenditure according to country of origin and islands, daily average expenditure per tourist according to channels of flight sales, average expenditure per tourist according to country of origin, average daily expenditure per tourist according to type of accommodation, average expenditure per tourist on the Canary Islands according to age, average daily expenditure per tourist according to intervals of overnight stays, average expenditure per tourist on the Canary Islands according to gender.

All ten variables were measured according to time periods, tourism entity and place of expenditure (country of origin or destination). Furthermore, the reservation channel or the flight sales channels were added to the corresponding variables, thus adding information regarding whether they were made via tour operators, OTAs, travel agencies or direct purchase.

Entrepreneurs indicated that it would be valuable for them to obtain a breakdown of the average tourist expenditure by: origin of the expenditure (home country or destination); market segment; accommodation; gastronomy and purchases.

5.2.4 Restaurant Business Indicators

The main variables comprising this indicator are as follows: number of reviews, mean score of restaurants in TripAdvisor according to zones, percentage of restaurants according to price interval and zones, classification of the restaurants according to parameter score that define the quality of a restaurant according to zones, classification of the restaurants according to percentage of scores (excellent, very good, average, poor, terrible) according to zones, percentage of restaurants per price interval according to zones.

5.2.5 Events & Museums

Local events were initially characterised by five different variables according to time period, type of the day (weekday or weekend), name and typology and according to municipality and importance. However, the questionnaires suggested that these variables should all be grouped and studied together. After a meeting with the city councilwoman of Puerto de la Cruz, the following information was decided to be included: events that are repeated annually like for instance: Mueca festival, Oktoberfest, Fiesta de San Juan, Tenerife Walking Festival etc. Furthermore, the future development of this indicator would include data regarding occupancy, ADR and RevPAR during these specific dates. This information is yet to be collected and provided with the kind collaboration of the management of the 58 hotels of the town and other stakeholders of tourism. Other relevant data would be provided by police reports regarding the flow of vehicles during the events. The impact of the event would also be measured by reports form public and private parking lots.

At this initial state of launching the STI, data regarding museums includes a list of all museums in the area and an interactive map where they can be easily identified. Further comments on the future development of this indicator are going to be revealed in section 5 of this MT.

5.2.6 Mobility Indicators

Our research team has included in the STI of Puerto de la Cruz a listing of the public and private parking lots, strategic bus stops and taxi stops including their full addresses and a map indicating their exact location.

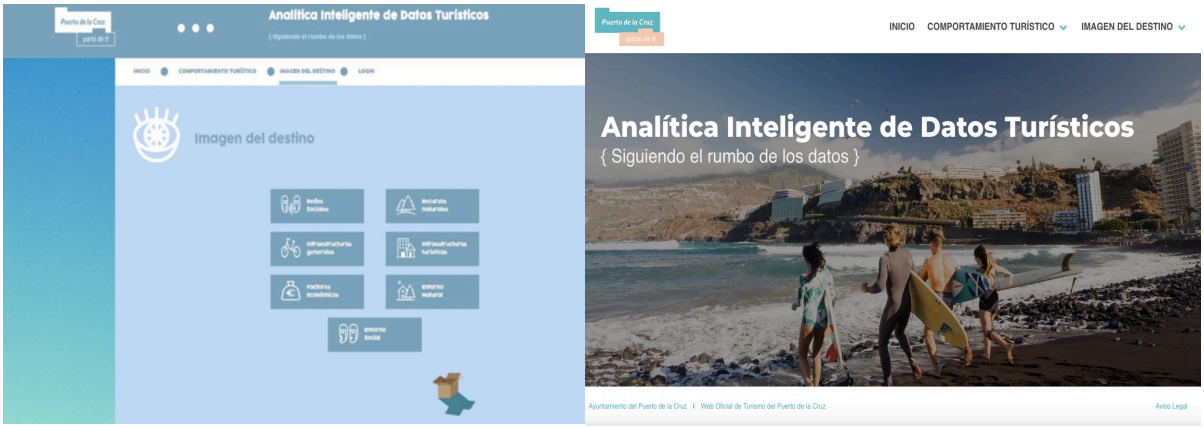
The variables describing mobility indicators were selected as follows: entrance of vehicles in parking lots per seasonal periods, according to the day of the week, the location of the parking lot and a ranking of most visited routes according to points of interest. These variables were all grouped in one and the information for the future development of the STI would be provided from police reports, public and private parking lots. Mobility indicators would as well be further discussed in section 5 in order to outline the future research lines.

5.2.7 Hospitals and International Tourism Organisations (ITOs)

Three main hospitals, one public and two private ones, were identified and listed including information regarding their addresses and a map of their exact position. The same refers to the two international tourism organisations, which additionally provide a contact telephone number and opening hours to the public.

Having concluded the process of data mining and the selection of the most relevant Key Performance Indicators, the STI serves as a framework, encompassing all the information in a user friendly manner. The system makes a clear distinction between the two basic lines of study: tourism behaviour and image, which further facilitates data extraction. The project of creation, improvement and implementation of the STI of Puerto de la Cruz is still in a development phase. However, since the start, in the beginning of 2018, there has been a significant progress, which can also be observed by a change in the interface (See Figure 4)

Figure 4: Old vs. new interface of the STI of Puerto de la Cruz



Source: http://vituin.iaas.ull.es/

Even though, up to this date, definite results cannot be derived by the STI, the system is intended to serve as an intuitive, analytical, visual tool able to extract, transfer and upload structured and unstructured data automatically, without the need of further interviews of the stakeholders of tourism. Real time relevant information is vital for adequate, cost effective smart decision-making and the implementation of artificial intelligence and machine-learning algorithms contribute to the system's efficiency. The following section is going to elaborate on the specific method implemented in the creation of the STI.

5.3 Analytic Hierarchy Process (AHP) Method

As discussed in part 4.3 of this MT, the distinctive feature of the STI designed for Puerto de la Cruz is the calculation of a business confidence indicator. In order to be able to extract the knowledge based on the experience of private and public stakeholders involved in the sphere of tourism, a common Multi-Criteria Decision-Making Method is used. The Analytic Hierarchy Process was considered most appropriate among other methods due to the following aspects of the matter at hand. Firstly, the formerly mentioned method is highly advantageous when dealing with situations where a large group of individuals is facing a complex problem, which has to be resolved based on personal judgements and opinions.[31] In the case of Puerto de la Cruz, our team collected data from a carefully selected group of stakeholders in tourism development including: the councillor for Tourism of Puerto de la Cruz, tourism professionals from the University of La Laguna, the managers of local tourism establishments such as distinctive hotels, restaurants, stores, attraction parks, etc.

Secondly, another pro of this technique is its effectiveness when some or all of the elements involved in the decision-making process are not easily quantifiable. While some of the components selected for

[31] See Velasquez and Hester (2013). An Analysis of the Multi-Criteria Decision-Making Methods; IJOR Vol. 10, No. 2, 56-66.

our research have numerical values, others are intangible and cannot fit into a scale. The data mining performed to determine the influence of tourism behaviour of Puerto de la Cruz on business confidence involved structured and unstructured data. Therefore, the use of AHP is justified.

Lastly, the AHP is applied in a situation where communication between the stakeholders of tourism is hindered by, for instance, difference in terminology, standpoint or field of specialization.[32] Due to the fact that our sample group consists of an amalgam of different tourism professionals, it is logical to deduct that impediments in communication would exist.

The Analytic Hierarchy Process serves as a framework for structuring a complex decision problem and makes use of mathematics and psychology to represent and quantify the multiple elements. The main goal is to determine an index of business confidence for Puerto de la Cruz. Thomas Saaty (1990), the developer of this method, outlines three different phases that need to be followed.
The first step is to structure the problem as a hierarchy. For this, it is fundamental to assure the completeness of the criteria.[33] During the research period of Puerto de la Cruz, our scientific team performed the selection of criteria in two stages. We began with determining criteria and sub-criteria based on data provided by tourism literature and the expert opinion of tourism professionals from the University of La Laguna. Consequently, a formal meeting took place with our sample group of local tourism agents where they were asked to answer a previously prepared questionnaire to determine whether the proposed criteria are the most relevant ones according to their experience. As a result, some of the criteria and sub-criteria were modified or eliminated and others were added. In order to easily comprehend how to determine the influence of tourism behaviour of Puerto de la Cruz on business confidence, a hierarchy tree was built, where elements could relate to any aspect of the decision problem, independently whether the input data was structured or unstructured.

The second step is to extract the knowledge and experience from tourism agents by asking them to methodically evaluate the criteria and sub-criteria according to the significance they give to each one of the alternatives. The stakeholders of tourism make use of Saaty's Fundamental Scale to evaluate the importance of each element on a pairwise comparison basis. An absolute numerical scale is used to assign values between 1 and 9 to the subjective judgements of the evaluators. These values correspond to the personal conviction of each professional whether the pair of alternatives are of equal, moderate, strong, very strong or extreme importance (See Table 1).

[32] See Saaty, T. (1990). How to make a decision: The Analytic Hierarchy Process; European Journal of Operational Research 48, 9-26.
[33] See loc. cit.

Table 1: The fundamental scale of absolute numbers of the AHP

Intensity of importance on an absolute scale	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance of one over another	Experience and judgement strongly favor one activity over another
5	Essential or strong importance	Experience and judgement strongly favor one activity over another
7	Very strong importance	An activity is strongly favored and its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values between the two adjacent judgements	When compromise is needed
Reciprocals	If activity *i* has one of the above numbers assigned to it when compared with activity *j*, then *j* has the reciprocal value when compared with *i*	
Rationals	Ratios arising from the scale	

Source: T. Saaty (1990).

To serve as an example, the question that has to be asked when comparing two criteria is: Which of the two alternatives *occupancy* and *average length of stay* is more important for the agents of tourism with respect to the criterion *visitors*. Once the more important alternative is identified, the less important one is assigned a reciprocal value. Expressed in mathematical terms, a pairwise comparison square matrix is obtained where, when row *i* equals column *j*, the relative importance is equal to 1, since the same alternative is compared to itself. Furthermore, the reciprocals principal for the alternatives $a_{ij} = a_{ji} = 1$ holds. Table 2 represents the pairwise comparison matrix with respect to the criterion visitors. The values provided are sample values to ease the illustration of the decision problem, due to the fact that data obtained from the real sample group is confidential.

Table 2: Pairwise comparison of alternatives with respect to the criteria visitors (sample values)

Pairwise Comparison	Occupancy	Average Length of Stay	Tourist Profile	Tourist Population	Motives for Choice of Accomodation	Tourists lodged according to municipalities
Occupancy	1,00	0,50	2,00	0,17	1,00	3,03
Average Length of Stay	2,00	1,00	0,25	0,33	2,00	1,00
Tourist Profile	0,50	4,00	1,00	0,50	3,03	0,14
Tourist Population	6,00	3,00	2,00	1,00	0,20	1,00
Motives for choice of accomodation	1,00	0,50	0,33	5,00	1,00	0,33
Tourists lodged according to municiplities	0,33	1,00	7,00	1,00	3,00	1,00
sum	**10,83**	**10,00**	**12,58**	**8,00**	**10,23**	**6,51**

Source: Prepared by the author, based on the AHP Method.

The third step is denominated synthesis. It consists in calculating each individual weight by dividing each alternative by its corresponding column sum. As a result of estimating the mean value (average) of all weights across each row, the local priorities of each variable are obtained. Likewise, in order to obtain the global priorities, it is necessary to multiply the local priorities of the sub-criteria by the local priority of their corresponding criterion (See Table 3). The full representation of the calculus of the local priorities for the eight main Key Performance Indicators (criteria) is depicted in Appendix 5.

Global priorities are essential in order to obtain the weight (importance) of each variable on the objective, in this case on tourism behaviour.

Table 3: Synthesis: Calculus of local and global priorities (weights)

							Local Priorities	Global Priorities
Occupancy	0,09	0,05	0,16	0,02	0,10	0,47	**0,15**	**0,006**
Average Length of Stay	0,18	0,10	0,02	0,04	0,20	0,15	**0,12**	**0,005**
Tourist Profile	0,05	0,40	0,08	0,06	0,30	0,02	**0,15**	**0,006**
Tourist Population	0,55	0,30	0,16	0,13	0,02	0,15	**0,22**	**0,009**
Motives for choice of accomodation	0,09	0,05	0,03	0,63	0,10	0,05	**0,16**	**0,006**
Tourists lodged according to municiplities	0,03	0,10	0,56	0,13	0,29	0,15	**0,21**	**0,009**
checksum	1,00	1,00	1,00	1,00	1,00	1,00	1,00	**0,041**

Source: Prepared by the author, based on the AHP Method.

Once we have finished extracting the knowledge of stakeholders of tourism, a normalisation of the data is needed. Therefore, the historical maximum and minimum values of each indicator need to be determined. The final step for obtaining the index of business confidence is by summing the products between the global weights and the normalised KPIs. The result is a number between 0 and 10 which constitutes the extent to which a tourist destination is attractive to entrepreneurs and investors.

6 CONCLUSIONS AND FUTURE RESEARCH AREAS

Information and Communication Technologies have become a significant part of modern society's life. The rapid development of technology has contributed to the appearance of more demanding tourists with high expectations. Travelling patterns have changed, thus alleviating seasonality issues, converting non-tourist regions, into desirable travel destinations due to the craving for different and unique experiences. The independence of travellers with the trip organisation has reduced the length of stay (LoS) and increased the frequency of the trips. These and many other factors indicate that a thorough understanding of tourism behaviour is essential for a destination to be competitive. Thus, the idea for the creation of a System of Tourism Intelligence, which would serve as a guideline to stakeholders of tourism to adapt the cities to the necessities of tourists and residents. The STI of Puerto de la Cruz is aimed to empower local businesses with information, beneficial for smart decision-making. Nevertheless, there exist limitations, which still have to be addressed in order the system to be fully efficient.

As mentioned in section 3 of this MT, there are several indicators, which would be further developed in order to enrich the database of the STI and convert it into a more complete and reliable technological source of tourism information. Moreover, the limitations of the System of Tourism Intelligence will be pointed out including proposals for improvements.

Firstly, the indicator *Events & Museums* is planned to include data regarding the expenditure of tourists during events not only for accommodation, but also the amount of money they spend on local businesses during each individual event. In this way, the impact of a particular event on small and medium sized businesses could be measured, compared and contrasted to the impact of another event, thus incentivizing investment. In their vast majority, entrepreneurs of Puerto de la Cruz are, by nature, risk averse. This statement is based on personal behavioural observations on businessmen and women during the various meetings and interviews performed in the process of creation of the STI. The more risk averse a stakeholder of tourism is, the less likely it would be for him/her to invest in a tourist destination, generate employment and contribute to improve the quality of tourism services. Hence, it appears the need for a technological tool with an intuitive interface, capable of extracting knowledge from big data in order to generate a business confidence indicator.

Furthermore, the plan is to expand the input dataset regarding entrance in museums according to seasonality, day of the week, country of residence and age group of the tourist.
A second indicator that our research team is planning to elaborate on, is *Hospitals and International Tourism Organisations.* It is considered of importance to stakeholders of tourism to have access to the number of tourists treated in either private or public hospitals according to seasonal patterns, country of origin and age group. The same applies to the entrance in International Tourism Organisations.

Mobility is another indicator of vital importance for the tourism ambience of a smart destination. How tourists travel from one place to another, the kind of transportation they use, the time it takes an individual to move between different points of interest (hotspots), entrance of vehicles in parking lots according to time spans, days of the week and geographic location. These are the main variables that need further investigation. On one hand, from the perspective of the city council, having this knowledge would enable the governing figures to alleviate problems like oversaturation of parking lots by expanding the existing ones or creating new parking locations. On the other hand, from the perspective of the owners of local businesses, mobility indicator variables would help them identify where tourist concentration and demand is higher. Therefore, entrepreneurs would supply their products and services at the right location and the right time, thus reducing costs, saving time and boosting efficiency.

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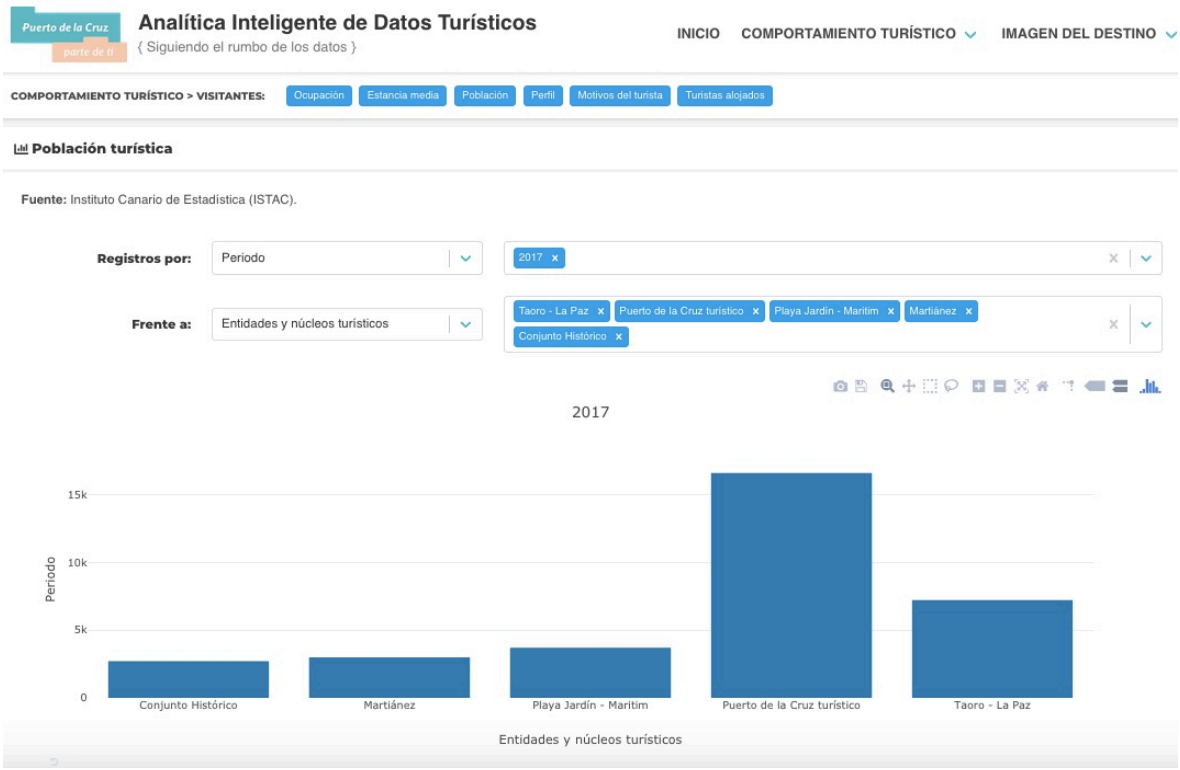
9 APPENDIX

Appendix 1: Example of graphic data representation of the STI of Puerto de la Cruz

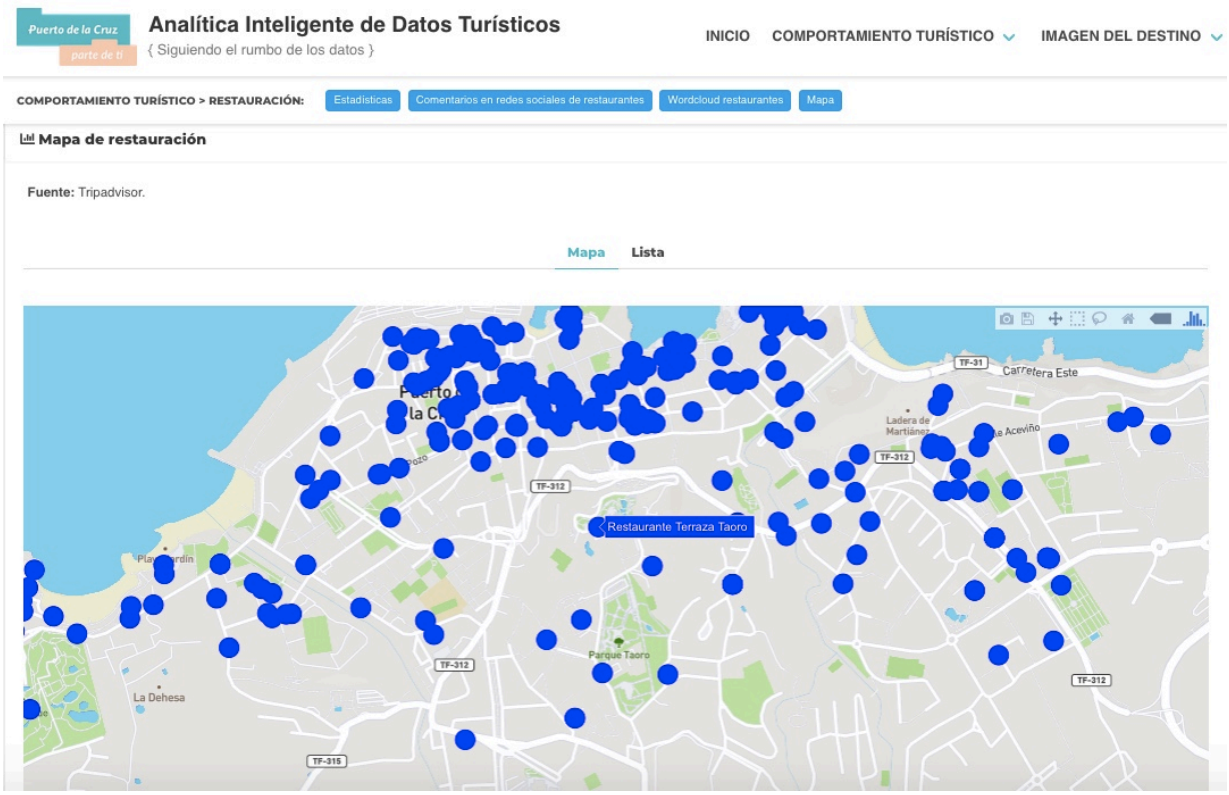


Source: http://vituin.iaas.ull.es/visitantes

Appendix 2: The meaning of the colour scheme

Source: www.websitebuilderexpert.com

Appendix 3: A map of the restaurants in Puerto de la Cruz



Source: http://vituin.iaas.ull.es/restauracion#restaurantes_tripadvisor_mapa

Appendix 4: Word Cloud from reviews of restaurants on TripAdvisor

Source: http://vituin.iaas.ull.es/restauracion#restaurantes_tripadvisor_mapa

Appendix 5: Calculus of the local priorities for the eight main Key Performance Indicators

AHP Method for selecting methods or technology that satisfy certain criteria.
IMPORTANCE OF CRITERIA

	Visitors	Consumption & Expenditure Ind.	Hotel Ind.	Restaurant Business Ind.	Mobility Ind.	Product Creation Ind.	Events	Museums Hospitals & ITO
Visitors	1,00	0,50	0,20	0,33	0,50	1,00	0,33	0,14
Consumption & Expenditure Ind.	2,00	1,00	0,25	0,50	3,00	2,00	0,20	1,00
Hotel Ind.	5,00	4,00	1,00	1,52	0,14	0,33	1,00	0,50
Restaurant Business Ind.	3,00	2,00	0,66	1,00	2,00	1,00	0,50	0,33
Mobility Ind.	2,00	0,33	7,00	0,50	1,00	2,00	1,00	0,33
Product Creation Ind.	1,00	0,50	3,00	1,00	0,50	1,00	0,20	1,00
Events	3,00	5,00	1,00	2,00	1,00	5,00	0,33	0,33
Museums, Hospitals & ITO	7,00	1,00	2,00	3,00	3,00	1,00	3,00	1,00
sum	24,00	14,33	15,11	9,85	11,15	13,33	6,57	4,64

									Local priorities
Visitors	0,04	0,03	0,01	0,03	0,04	0,08	0,05	0,03	**0,04**
Consumption & Expenditure Ind.	0,08	0,07	0,02	0,05	0,27	0,15	0,03	0,22	**0,11**
Hotel Ind.	0,21	0,28	0,07	0,15	0,01	0,03	0,15	0,11	**0,12**
Restaurant Business Ind.	0,13	0,14	0,04	0,10	0,18	0,08	0,08	0,07	**0,11**
Mobility Ind.	0,08	0,02	0,46	0,05	0,09	0,15	0,15	0,07	**0,14**
Product Creation Ind.	0,04	0,03	0,20	0,10	0,04	0,08	0,03	0,22	**0,08**
Events	0,13	0,35	0,07	0,20	0,09	0,38	0,05	0,07	**0,20**
Museums, Hospitals & ITO	0,29	0,07	0,13	0,30	0,27	0,08	0,46	0,22	**0,19**
checksum	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00

Source: Source: Prepared by the author, based on the AHP Method.