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Mapping Information systems' maturity in the Portuguese Hospitality Industry

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

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MAPPING INFORMATION SYSTEMS' MATURITY IN THE PORTUGUESE HOSPITALITY INDUSTRY

by

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ABSTRACT

Hospitality is a highly competitive market that struggles to improve its performance. Today, the use of technology is a critical factor for more efficient performance. For this reason, hotels are increasingly willing to adopt information systems to optimize the performance of their operations. The purpose of this study is to evaluate the information systems' maturity levels of Portuguese independent hotels and small hotel chains, to map them regarding hotels' characteristics and identify patterns among those maturity levels.

The literature indicates that hotels are becoming more willing to adopt information systems to optimize their operations, but it is always dependent on the decision-makers. The NEC (Network Exploitation Capability) Model (Piccoli et al., 2011) was employed to evaluate Portuguese hotels' information systems adoption. Quantitative and qualitative techniques were employed to perform this research. Six hoteliers, from the 77 hotel companies surveyed, were also interviewed, wich represented almost 10% of hotels. The results revealed that some hotel characteristics influence the information systems' maturity level, which, in average, has a value of 2.7 out of 5. Nevertheless, hoteliers, on average, give a self-classification of 3.51.

Besides measuring hotels' information systems' maturity, the study goes deeper. It explores the type of systems used by hoteliers, their main drivers and the limitations to invest in technology or in factors that do not only influence their information system's maturity. Additionally, this study shows how hoteliers see the technology on their day to day operations and staff qualification investment. Finally, this srudy corroborates the positive impact of technology on promoting business maturity, which consequently boosts hotels' performance and competitiveness.

KEYWORDS

Hotel Information Systems; Information systems' maturity; Network Exploitation Capability; Hotel Software; Hotels' performance and competitiveness

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LIST OF ABBREVIATIONS AND ACRONYMS

ADR – Average Daily Rate
B2C – Business-to-business
B2C – Business-to-consumer
BE – Booking Engine
CM – Channel Manager
CRM – Customer Relationship Management
CRS – Central Reservation System
GDS – Global Distribution System
GM – General Manager
HIS – Hotel Information Systems
HR – Human Resources
IS – Information System
ISM – Information System's Maturity
IT – Information Technology
NEC – Network Exploitation Capability
NIT – New Information Technologies
OCC – Occupancy
OTAs – Online Travel Agents
PMS – Property Management System
POS – Point of Sale
RevPAR – Revenue per available room night
RM – Revenue Management
RMS – Revenue Management System
ROI – Return on Investment
RS – Rate Shopper
SEO – Search engine optimization
SME – Small and medium enterprises
TAs – Travel Agents
TO – Tour Operator

1. INTRODUCTION

This introduction will provide the context of this study, with the problem definition, research questions, objectives of the study, and a brief structure.

1.1. PROBLEM DEFINITION AND BACKGROUND

Technology impacts everyone, all businesses and companies, and our experiences as individuals and as consumers (Ham et al., 2005; Lam et al., 2007). Companies today cannot perform well without resorting to technology. Hotels are not an exception. Due to the tourism context, hotels operate in a genuinely competitive market, and technology is acting as a driver for efficiency in processes and innovation (Cobos et al., 2016). Hospitality companies take opportunities from technologies, but this can be improved with a strategy (Piccoli et al., 2011). It is only then that hotels must execute their strategy and go for restructuring (Andal-Ancion et al., 2003).

A new ecosystem is urging as a fruit of the digital transformation, creating a new way of interacting in business, establishing more connections with customers, or creating more marketing content (Ribeiro & Florentino, 2016).

The hotel sector presents problems of efficiency and performance. To increase efficiency, improve productivity, and support decision-making, organizations, in general, have been increasing their investments in Information Technology (IT) gradually (Sun & Lu, 2014). Despite many people interrogating themselves about IT's benefits in organizations, IT has started to gain recognition for the improvements in operational efficiency and strategic positioning (Chen & Liu, 2019).

As seen in Figure 1, the Portuguese hotel panorama is marked by small national chains and independent hotels, with a weight of 58.8% (1,196 hotels) on the hotel sector in 2019, according to the data published by Deloitte (Galhardas et al., 2019). This type of hotel has less propensity to adopt technology and use it daily to optimize their tasks and better manage their businesses (Barros et al., 2011). The scope of this research will be independent hotels as these units and small local chains up to 6 hotels, with no affiliation to international brands. In 2019, independent and small hotel chains represented not 58.8% but 80% (1,709 hotels) of the hotel sector in Portugal (Galhardas et al., 2019; INE, 2020).

Portuguese independent hoteliers are in a stage of technology immaturity, characterized by few systems and processes (Barros et al., 2011). Immature organizations can profit from IT, but it is more challenging to make it regularly. Nevertheless, when a hotel moves to the next stage of maturity, it can achieve a performance improvement (Piccoli et al., 2011).

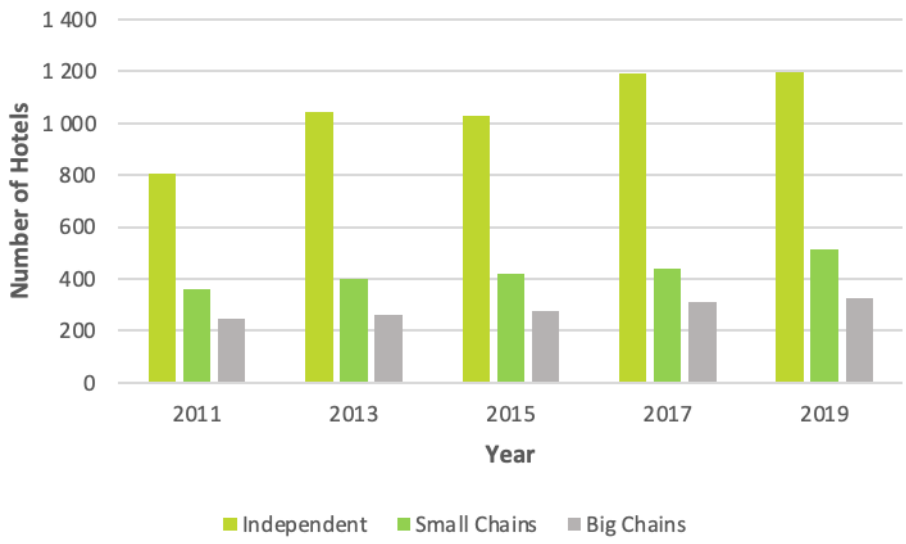

Figure 1 – Distribution of type of hotels in Portugal from 2011 to 2019 (Source: INE, 2020)

Since independent and small hotel chains do not follow the strict guidelines of international big hotel chains, the first goal of this study is to find out where are the independent hotels mapped in terms of technology maturity. For that, it will be used the five stages of the Network Exploitation Capability (NEC) model (Piccoli et al., 2011). This mapping is constructed based on the hotel's availability for technology, its usage, the analysis carried on with technology, the improvements achieved from its use, and the investment in the employees' qualification (Piccoli et al., 2011). This study's second goal is to understand if Portuguese independent hoteliers have the correct perception of their organization's information systems' maturity level.

1.2. Specific Objectives

As was previously stated, globally and in Portugal, independent and branded hotels face a problem of efficiency and performance. It is essential to understand independent Portuguese hotels' position in technology maturity to overcome their underperformance (Barros et al., 2011). Hence, this thesis aims to achieve several objectives:

1. Find out if it is possible to classify Portuguese independent and small chains hotels in terms of information systems' maturity according to the NEC Model.
2. Map where independent Portuguese hotels are regarding the level/stage of Information systems' maturity.
3. Identify patterns among hotels with the same maturity level.
4. Understand if and why hotels self-classify them incongruously with their maturity level.

1.3. METHODOLOGY

According to the NEC model, the primary purpose of this study is to find where the independent Portuguese hotels are mapped in terms of technological maturity. The aim of the study is to analyze the technologies available to these hotels and their use of it. The literature shows that different types of hotels have different technology engagement levels, and several factors influence decision-making at the moment of investing in technology. The authors of the NEC model mentioned that, back in 2011, there were no hotels located on the fifth stage of maturity, and only a few were located on the fourth stage (Piccoli et al., 2011). Technology adoption in Hospitality is seen as complex and relies on many factors (Ahmet & Murat, 2014; T. Kim et al., 2008) and has many drivers and limitations (Davern & Kauffman, 2000).

Thus, these are the research questions and the respective hypothesis:

1. Where are independent Portuguese hotels located in terms of NEC's maturity stages?
    - H1: Portuguese independent hotels are, on average, located in the third stage of maturity.
2. Is there any direct relation between the category of the hotel, the dimension of the company, the profile of the decision-maker, and the maturity level?
    - H2: There is a direct relationship between these factors.
3. What are the systems used by Portuguese independent hotels, and what is the level of integration among systems?
    - H3: All hotels have a Property Management System (PMS), but only a few have more recent innovative systems, as well as integration between the different systems.
4. Do hoteliers have invested in employees' qualifications? Do they intend to invest more next year?
    - H4: Only a few hotels plan to invest in employees' qualifications.
5. What are the drivers and limitations for hotels to invest in technology?
    - H5: The main driver for hotels to adopt technology is the standardization of processes and centralization of information, while the main limitation is the cost of the information systems and the budget allocated for them.

This study used primary quantitative and qualitative data to achieve the research's goals. The obtained electronic surveys covered 152 hotels. Surveys were directed to independent and small hotel chains in Portugal (up to 6 hotels), representing 80% of the national hospitality sector (Galhardas et al., 2019). Surveys were complemented with in-depth online interviews with six hotel companies. The interviews allowed a better analysis of how hotels use technology in their day-to-day, its impact on performance, limitations, and technology maturity.

1.4. STRUCTURE

This thesis is organized as followed:

Chapter 1 - Introduction – This part consists of a brief overview of the problem definition, research questions, the specific objectives set to be achieved with this study, and the respective methodology.

Chapter 2 - Literature Review – The literature review is divided into six topics. The two first topics contextualize the tourism and Hospitality scenario globally and in Portugal, followed by the distinction between independent and branded hotels. On the fourth and fifth topics, the role of information systems in business and, more specifically, information systems in Hospitality, respectively, are presented. Here, it is possible to understand the existing information systems for hotels, their function, the impact of these systems, and the factors pondering their adoption. Lastly, the 6th topic is divided into the presentation of information systems' maturity, diving deeper into its classification, and finishing with other considerations about the topic.

Chapter 3 – Methodology – The methodology will set out how the research was directed, considering the processes and techniques for data collection and analysis and the population studied.

Chapter 4 – Results Discussions – This chapter presents the study and analysis conducted on the data collected. Results were tested to understand if they validated the hypotheses.

Chapter 5 – Conclusion – Here, results were explored, and if they have contributed to the hotel industry, more specifically to our independent Portuguese hotels to be more efficient and performative. Moreover, limitations were faced, and recommendations were indicated for future researches following this investigation.

2. LITERATURE REVIEW

2.1. TOURISM AND HOSPITALITY CONTEXT GLOBALLY

Tourism is a vital industry in the global economy, and it has been growing worldwide. Traveling is becoming essential not only to economic development and business growth but also socially. Tourism enables us to meet other cultures, share ours, and bond with people as family and friends (Raju, 2018). In 2017, the world registered a total of 1,323 million international tourist arrivals from other countries. In 2018, there were a total of 184,299 registered hotels globally - a growth of 8.38% in 10 years (Statista, 2008).

In 1990, Heeple et al. defined the concept of *Hospitality* as the host providing tangible and intangible factors to a guest, creating the relation of a provider and a receiver (Hepple et al., 1990). According to King, C., there are two kinds of Hospitality, private and commercial. This thesis focuses only on commercial Hospitality, a company that aims to make profits provides food and beverages, lodging, and even entertainment for people in exchange for money. Hotels, resorts & spas, rental housing, and royal court renting are examples of this kind of commercial Hospitality (King, 1995).

Hotel operations run 24 hours a day, seven days per week, which requires continuous upkeep from planning, direction, and control (Lai, 2013; Longart, 2020). Financial resources and their allocation, macroeconomic factors, and diversification are the most significant influencers in hotel decision-making regarding investment (Graeme & Ross, 2006). In the past, Phillips, P. stated that tourism was facing a problem of productivity and efficiency. More recently, this idea was still confirmed (Barros, 2006; Phillips, 1999). A company operating with less efficiency will fail to keep enough market share. Tourism companies are not different (Barros et al., 2011). Another problem in Hospitality is a reactive attitude instead of proactive management (Piccoli et al., 2011).

When we compare Hospitality to other economic industries in terms of technology, hotels tend to stay a couple of years behind the average. The hotels' general financial success might explain this gap over the past years, making them not feel the need for technology to grow their revenues. Such a situation will change this year with the pandemic. Hospitality and Tourism were hardly affected by the COVID-19 pandemic (Tom & Thanh, 2020). Hoteliers found themselves forced to evaluate all their operating costs again and consequently raise their efficiency with fewer resources (Fabbro, 2020). Even after the pandemic, guests will be more demanding regarding safety and cleaning measures within the hotels, requiring them to adapt to a "new normal" (Mogelonsky, 2020). Hotels should focus the business on the post-COVID scenario. There is a need to predict the crisis consequences such as bankruptcy, massive layoffs, extreme cost reduction, and suspension of contracts with providers (Mauguin, 2020). Thus, one more reason for hotels to make use of technology to improve decision-making.

2.2. TOURISM AND HOSPITALITY CONTEXT IN PORTUGAL

Portugal shows exciting numbers in the Tourism and Hospitality industry with EUR 3.7 billion in revenues registered in 2017. Hotels are an important sector of this industry as they accounted for 71.5% (39.8 million) of 55.7 million overnight stays - both on hotels and similar accommodations units (INE, 2018).

In 2019, the impact of Tourism on the Gross Domestic Product (GDP) was 8.6%, while in 2009 it was 2.39%, and in 1999, 2.37%. This value indicates that tourism grew more during the last ten years than ever, resulting in a considerable increment in individual travelers (PORDATA, 2020). The Portuguese Touristic industry beneficiated from a growing number of tourists from emergent economies like Brazil, India, or China. The increase in tourists resulted in the increment of the number of hotels across the country, which, seemingly, made the hotel room supply increase (Barros, 2006).

Thus, Tourism is one of our economy's sustaining pillars as it creates many jobs and wealth. Plus, it stimulates financially weaker and underpopulated areas such as Alentejo, Beira Interior, or the Islands (Barros, 2006). Lisbon is the capital city of western Europe with the 4th highest occupancy rate and the 8th highest RevPAR (Revenue Per Available Room), leading to the diagnosis of the ADR (Average Daily Rate) not high compared to other European capitals. (Galhardas et al., 2019).

The Government in Portugal assumes robust control over the measures and aids given to tourism and Hospitality companies. This aid is also related to the significant dependency on the EU funds injected into the industry (Ramos et al., 2000). This dependency may explain the Portuguese Tourism lack of a clear strategy and its much-needed differentiation and positioning in the market. Moreover, Portuguese tourism relies very much on environmental changes (Ramos et al., 2000). While in Europe, the most significant risks are possible terrorist attacks or political tensions, in Portugal is the competitive market growth and the shortage of qualified labor force (Galhardas et al., 2019).

Unlike other European countries, Portuguese tourism panorama is dominated by national hotel groups. Among the 500 Top Portuguese enterprises, only five are hotel companies (Barros et al., 2011).

Since 2011, the number of hotels in Portugal increased by 43.6%, and the number of independent hotels increased by 32.5%. The weight of independent hotels in the Portuguese Hospitality context increased until 2017, achieving 61.4% in that year. Since then, international chains started to build more hotels and acquiring independent units, and in 2019, only 58.8% of Portuguese hotels were considered independent (Eiras Antunes et al., 2017, 2018; Galhardas et al., 2019; Sousa Marrão et al., 2011, 2012, 2013, 2014, 2015).

Portugal follows the global panorama, with a relative lack of efficiency in the Portuguese hotel industry, leaving a large space for improvements in terms of technological efficiency and productivity to be more competitive (Barros, 2006).

2.3. INDEPENDENT HOTELS VS. CHAINS

There are two main types of hotels in the hotel industry: independent and branded/international ones. Recently, independent hotels earned strength due to evolving products and new technologies available in the sector. The independent hotels have a good weight in the industry and continue holding due to their presence in market niches regarding location, service, or tailored product (Langlois, 2003).

In terms of structure and organization, it can be simpler for independent hotels with a more straightforward structure and less complicated processes than branded chains (Anastassopoulos et al., 2009; Yang & Mao, 2017). Nevertheless, even in small properties, there are many roles inside the hotel (Kasavana, 2016).

Factors for innovation success differ between branded chains and independent hotels. Branded chains rely on four factors: market attractiveness, new service development process management, market responsiveness, and empowerment. Independent hotels depend on seven factors: market attractiveness, empowerment, training of employees, behavior-based evaluation, effective marketing communication, marketing synergy, and employee commitment (Ottenbacher et al., 2006).

These two hotel types can be differentiated because independent hotels usually have a small ownership structure and are not connected to any brand, which causes a deficit in resources and often induces a poor performance, as is proposed by the "resource constraint theory" (O'Neill & Carlbäck, 2011; Yang & Mao, 2017). Accordingly, with the constraint theory, there have been identified some inconsistencies between independent and branded hotel performance (Yang & Mao, 2017).

Usually, branded hotels have better performance and have more willingness to innovate, which leads to them taking less advantage than what independent hotels take from the branded chains (Orfila-Sintes et al., 2005; Yang & Mao, 2017). When independent hotels are in proximity to branded hotels, they can indirectly increase their performance, making it consensual the value that a brand brings for a hotel (Yang & Mao, 2017).

The adoption of technology is also different in independent units than lower-class properties with high-class properties, better equipment, and more qualified staff to use these technologies (Yang & Mao, 2017). Independent hotels can be examples of innovation and technology, and chains can have difficulty in technology performance (Piccoli et al., 2011). Hence, both independent and branded hotels' advantages and disadvantages have been identified to implement technology (Yang & Mao, 2017).

2.4. WHAT ARE INFORMATION SYSTEMS, AND WHAT IS THEIR ROLE IN BUSINESS?

Information technology and information systems are taking a relevant role in businesses. IT has capabilities to change traditional businesses, such as Tourism but these capabilities are often not materialized (Andal-Ancion et al., 2003).

Zwass, V. has defined the information systems as "an integrated set of components for collecting, storing, and processing data and providing information, knowledge, and digital products" (Zwass, 2017). Information Systems can only achieve their full potential when they correspond to the needs of management's information. The management information systems aim to give necessary information for planning, organizing, managing staff, and controlling operations. It also provides information for monitoring progress to achieve business goals, track performance, recognize patterns, support decision making, and analyze alternatives for strategic, tactical, and operational decisions (Kasavana, 2016).

Even though challenging to analyze, most companies have a database that is a collection of data about useful information, namely guests' data (Kasavana, 2016). "Knowledge is Power," and this knowledge is sustained by information technologies that allow hotels to know their guests better and satisfy their needs better (Olsen & Connolly, 2000).

Every business wants to have a competitive advantage, and sometimes this idea is associated with IT and new technologies. Thus, many decision-makers opt to invest in IT for fear of being behind the competition, a vision that leads to not leveraging the IT's potential value inside that organization among employees (Chen & Liu, 2019; Weill, 1992).

Despite IT's benefits for organizations, IT has started to be recognized for the improvements in operational efficiency and strategic positioning. While studies concluded a relationship between IT investment and organizational changes, others did not, so we cannot generalize since many other factors influence IT's impact on the organization, making it a complicated relationship (Chen & Liu, 2019; Mitra, 2005).

Some authors consider technology a driver for efficiency in processes and innovation (Cobos et al., 2016). To increase efficiency, improve productivity, and support decision-making, organizations, in general, have been increasing their investments in IT gradually. Productivity can be measured by the tasks made during a specific period of workflow or data processing. The increase in profitability is harder to measure but consists of the fact that an application outweighed cost (Kasavana, 2016).

The adoption of these kinds of systems resulted not only in a reduction of the costs, but also in the increment of revenues, and so, more outstanding products but also in the improvement of customer service and operations (Siguaw et al., 2000; Tarcan & Varol, 2009). Besides, the potential to acquire new business is not only based on acquiring new

customers but also on generating new revenues from existing customers, such as upselling (Davern & Kauffman, 2000; Kimes, 2008; Law et al., 2013).

The main barriers for technology adoption can be the lack of technology strategy or lack of information about those new IT services, and essentially it is the cost of IT (Cobanoglu et al., 2006). Understanding the IT cost is the software license and the education on staff, support, and maintenance, and depending on the technology, new hardware equipment compatible with the new solution (Chen & Liu, 2019).

When it comes to the technology to be used, after its implementation, the user can put some barriers such as the level of skills or knowledge, which is a limit of the value of IT investments (Davern & Kauffman, 2000). Sometimes, both decision-makers and the users of the systems are not the same people. If there is more acceptance from the users, it will minimize the resistance and maximize IT's effective utilization (T. Kim et al., 2008; Yang & Mao, 2017). Therefore, user satisfaction is super important, affecting, directly and indirectly, the company's performance while using the solution. If there is system acceptance, the employee will be more performative and effective operationally (Chen & Liu, 2019). Once the implementation of a new system is done, training is required for the employees who will use that technology, allowing them to perform faster and more comfortably in a unique solution that is more familiar to them (Moyeenudin et al., 2018).

Digital transformation in Hospitality has started to happen, and it can be defined as the outcome of different digital innovations, according to Alrawadieh et al. It seems to be inevitable for hotels despite all financial charges, from hardware and software to training the staff to use the technologies (Alrawadieh et al., 2020). Lam et al. defend that digital transformation is necessary and not an option (Lam et al., 2007). Several authors defend digital transformation as essential for companies to achieve their goals, improve the service quality, reduce costs, create knowledge, and maximize revenues (Alfirevic & Stemberger, 2015; Camilleri, 2018). This process either led to creating a new way of interaction in business, establishing more connections with customers, or creating more marketing content (Ribeiro & Florentino, 2016).

2.5. INFORMATION SYSTEMS IN HOSPITALITY

2.5.1. Hotel Information Systems: which are they, and what is their purpose?

Hotel Information Systems (HIS) could be placed in four categories (Ham et al., 2005; Lam et al., 2007):

1. Front office systems.
2. Back office systems.

3. Restaurant banquet management.
4. Guest-related interface.

These HIS categories can be seen in the multiple systems used in the various departments, such as the automation of the sales office processes, like data gathering, analysis, answering group requests, or account management. According to the HIS literature, these are the systems hoteliers can take advantage of to improve their day-to-day operations:

- Accounting Applications: it is a back-office software that can be integrated with the modules of the PMS such as accounts receivable and payable, inventory and payroll accounting, financial reporting (Kasavana, 2016).
- Booking Engine (BE): it is a tool recommended for the hotels to have toward getting direct reservations on their website, application for mobile reservations, and social media channels. Booking engines can be designed according to the hotel's website. To have the reservations processed requires a connection with the channel manager or the PMS (Cantoni et al., 2011). A significant part of hotels privileges bookings by direct channels such as a hotel's website, ensuring the best rates of loyalty advantages for customers who book there (O'Connor & Murphy, 2004).

- Channel Manager (CM): This system allows the hotels to send availability and prices to online channels automatically, exposing their inventory in a more significant spectrum of channels and OTAs. It also helps to manage the channel and pricing conflict (Civak et al., 2018).

- Chatbots: this technology is a computer application that operates as a virtual assistant dialoguing in the users' natural language (Lasek & Jessa, 2013; Venkatesh, 2000), reducing sales and support service and so, its costs, allowing customers to know more about the hotel's rooms and their rates and making direct bookings (Putri et al., 2019).

- Customer Relationship Management (CRM): this is a system for dealing with the history and actual individual needs of guests, their contacts, and interests for the sales and marketing team to access and sell additional hospitality products or services according to those interests (Kasavana, 2016). It is vital to have a CRM for the guest's family and friends to become guests (Murphy et al., 2016). According to Piccoli, G., CRM works better for the hotel brand level with loyalty programs (Piccoli et al., 2003).

- Electronic locking system (ELS) - This electronic key locking system is networked with the PMS. The necessary code generated will also be deleted, and a front desk person can code the room key for the next guest's arrival (Moyeenudin et al., 2018).

- Energy Management System (EMS): a typical function that shuts down the operation of equipment those are not in use for a period and automatically manages room temperature, air movements in public spaces and guest rooms (Kasavana, 2016).

- Global Distribution Systems (GDS): allow the distribution of hotel reservations online worldwide, and Internet Distribution Systems (IDS), which are oriented for consumer reservations, working as self-service (Kasavana, 2016).

- Human Resources systems are instruments for staff scheduling, performance metrics, employees' data, compensations, among others (Buckley et al., 2001).

- Interactive communications system: aims to facilitate the meetings and the events in the hotel and ensure the phone device for the guests' room to communicate with the reception or room service when necessary (Examiner & Dinh, 2009).

- Online Reputation Management (ORM): Online reputation consists of impressions, either positive or negative, that people get from the companies. In this case, the people's experiences in the hotel. From the reviews, hoteliers can take a self-evaluation and improve their experience to be more efficiently successful. This kind of system can aggregate guests' impressions from various websites and OTAs to position the public image (Civak et al., 2018). Hotels that do not share content on their online channels are at a disadvantage. Almost all hotels have booking.com and TripAdvisor, but only a few with reviews (Leite & Azevedo, 2017).

- Property Management System (PMS): it helps to virtually manage the guests' stay at the property, with several front-office and back-office functions, namely: allowing management of all rooms, monitoring availability, evaluate the stages of reservations, attribute rooms to guests, monitoring cleanliness and housekeeping, facilitate the check-ins, facilitate the guests' payment (Kasavana, 2016). As probably the most essential and central system in a hotel, it has many interfaces with other systems such as Point of Sale, Revenue Management System, Channel Managers, Global Distribution Systems, and other systems. A PMS, according to Moyeenudin, H., "a set of automated software modules that can support a variety of activities in the front office" namely: reservations module, rooms, guest accounting, and general. Moreover, it has small modules for back-office and audits (Moyeenudin et al., 2018).

- Point of Sale (POS): It aims to monitor service area transactions like restaurants, spa, bars, and other selling points. It can track all revenue centers at a hotel (Kasavana, 2016).

- Rate Shopper: it can be used independently or incorporated in a Revenue Management System (RMS), providing a monitorization of competitors' prices from various channels in a centralized platform, the parity between the online channels where the hotel is selling the inventory. To take advantage of a rate shopper, it should include an RMS and benchmarking integration to feed the pricing recommendations (*Top 15 features to look for in a rate shopper*, 2018).

- Revenue Management System (RMS) also helps with pricing strategies, evaluates indicators, chooses policies in day-to-day operations, predicts upcoming demand, tracks competitors' rates, and analyzes group bookings. RMS systems also provide decision-making information to other departments like marketing, sales, or even HR (Alrawadieh et al., 2020; Y. Kim et al., 2005). The cost of an RMS is indeed the most significant barrier to the adoption of this technology. The replacement of Revenue Managers by sophisticated RMS has been discussed. Due to this kind of system's cost and the complexity of this profession, it will be something distant in time to happen (Alrawadieh et al., 2020).

2.5.2. The Impact of Hotel Information Systems and its adoption

To be more competitive against the new and traditional players, the lodging industry relies on technology in various operations. Moreover, technology in Tourism has brought more sophistication to the operations (Alrawadieh et al., 2020; Sigala, 2018). Hospitality companies take opportunities from technology, but they can be enhanced with a strategy (Piccoli et al., 2011). IT is not only seen as mere tools but also as a strategic asset for the Hospitality industry. These systems operate 365 days for 24 hours. (Lam et al., 2007).

The competitive advantage can be product differentiation, improving customer service, reducing operating costs, or the ability to approach specific market segments (Kasavana, 2016). To improve performance and strategic competitiveness on a long-term basis, IT is an important instrument that helps hotels achieve it (Kim et al., 2008).

By the end of the last century, many companies were investing in New Information Technologies (NIT), namely, in websites, mobile communications, and software. Some of those technologies enabled a decrease in the number of intermediaries. In the case of hotels, Tour Operators (TO) (Andal-Ancion et al., 2003). These kinds of technologies are assigned to managers with multiple responsibilities, so they are not technically specialized and may lack formal training. Typically, a manager has a basic knowledge of how systems operate, only selecting the systems that better fit their needs instead of the organization's (Kasavana, 2016). This situation happens mainly in small independent hotels where the structure is simpler (Piccoli et al., 2011).

While data usage has increased in the hotel sector, it is important to highlight that some hotels used spreadsheets to track historical data, elaborate forecasts, or set their pricing, changing that information with other hoteliers about their performance (Alrawadieh et al., 2020). Data management is a way of improving quality and performance once it can help recognize employees' knowledge (Moyeenudin et al., 2018). These systems transform data into facts and useful information, which is nowadays an asset for a hotel, once it increases knowledge about their guests, services, performance, finance, and operations (Kasavana, 2016).

Existing technologies surpass the number that a hotel could implement. However, no system alone can help manage all areas of a hotel, so there are systems net to interface with other systems to solve this limitation (Andal-Ancion et al., 2003; Kasavana, 2016). Like in other sectors, in hospitality, the interface between systems is of foremost importance to create automation (Piccoli et al., 2011). Interfaces with PMS and other systems are essential because they allow access to data and information collected by the PMS in various systems as well as to create automated processes. However, these interfaces represent risks such as losing data, compromising some capabilities, and making systems slower. To overcome these risks, hotel managers have to feel confident, resort to contracts, make communication clear, perform comparisons, and create contingencies (Kasavana, 2016).

IT adoption is more driven by cost reduction and optimization of the operation than by customer service improvement (Doran et al., 2002). While the Hospitality industry is not technology-driven, technology adoption seems complicated (Law et al., 2013). Implementing technologies is related to factors like the hotel's size or affiliation to a hotel chain, which tends to have more technology available. Moreover, it is also associated with the decision maker's profile: "age, education level, and job tenure." When the decision-makers are younger, with a higher education level or a shorter job tenure, the decision tends to favor technology adoption (Ahmet & Murat, 2014). The embracing of technology is also related to personal innovativeness from the staff, organization innovativeness, and the user's acceptance of the information system. Both personal innovativeness and organizational innovativeness influence each other (Kim et al., 2008).

Despite not having empirical support for this argument, O'Connor & Murphy (2004) defend that managers are less willing to adopt technology than their employees. Since HIS are perceived as more valuable by employees who perform daily tasks that can be optimized, it is hard to make decision-makers understand these systems' usefulness. HIS acceptance will be increased with the systems' higher user-friendliness (Huh et al., 2009). It is also believed that technology is becoming more user-friendly and data-driven, making it more sophisticated (Alrawadieh et al., 2020; Karadjov & Farahmand, 2007).

The quality aspects are understood differently by distinct system users (Sim et al., 2006). A key to the success of HIS might be user-oriented support. Essentially, during the early stage of technology implementation, it is crucial to receive training from the vendors to perform better and increase users' motivation to use IT (Lam et al., 2007).

In 2003, a few authors wrote that businesses should take into consideration ten drivers for the adoption of technology, falling into three categories: "inherent characteristics of products and services", "interactions between a company and its customers," and "interactions between a company and its partners and competitors" (Andal-Ancion et al., 2003). These drivers are:

1. "Electronic deliverability": hotel customers can have information, compare prices, and book reservations online.
2. "Information density": companies increased the amount of information they have available online.
3. "Customizability": NIT can offer products with individual needs to customers.
4. "Aggregation effects": it can facilitate the upselling and cross-selling of products and services.
5. "Search Costs": NIT has brought more transparency in transactions, allowing the price feature comparison production.
6. "Real-time interface": allows dealing with data and information changes automatically.
7. "Contracting risk": the idea of the product purchased online can be different from reality.
8. "Network effects": In some cases, the utility of a service increases as many people are using that service. In the case of a hotel, it can be the example of the status that staying in a well know and luxury hotel concedes to a guest.
9. "Standardization benefits": NIT allows synchronizing processes and standardization, mentioning the importance of integrated systems.
10. "Missing competencies": facilitates alliances and partnerships between companies to help others in the case of some missing competency from the initial provider (Andal-Ancion et al., 2003).

More sophisticated customers tend to influence the IT adoption positively (Law et al., 2013). Self-service technology can produce service independence through technological interfaces. This trend is more realistic in upscale hotels (Brown & Dev, 2000). However, this technology addresses issues such as the possibility of service failure or questioning the quality of the customer service with the lack of interpersonal contact, technology anxiety (depending on the culture), and elimination of social experience (Doran et al., 2002). During the past years, the guestroom experience changed a lot, and so hotels wanted to introduce more technology in the rooms, seeking to provide them more comfort and entertainment options (Ana et al., 2016; Margarido, 2015).

The concept of "Hotel of the Future" is connected to customization, resorting to customer preferences, and advanced technology (Doyle, 2014). Guests imagine this kind of hotel as related to new technologies, reducing costs and increasing efficiency, as well as the ability to "personalize the customer experience and improve service" (Margarido, 2015; Talwar, 2020).

2.6. INFORMATION SYSTEMS' MATURITY (ISM) IN HOSPITALITY

2.6.1. What is Information systems' maturity?

The importance of understanding the potential of technology is known (Davern & Kauffman, 2000). IT has gained a position of competitive advantage in this genuinely competitive business environment. It is a vast amount of information to be processed and communicated for internal and external channels (Lam et al., 2007). In Hospitality, technology became a prime element to support service delivery (Olsen & Connolly, 2000).

Tapia has defined *maturity* as the sophistication level within a particular field (Alfirevic & Stemberger, 2015; Tapia et al., 2014). Popovic, A. presented *information systems' maturity* as the "growth and development of IT infrastructure and functioning" (Alfirevic & Stemberger, 2015; Popovič et al., 2009). Maturity is not just about the technology adopted by a hotel but also about its being directed. This concept often implies a level of sophistication level significantly achieved. The "Capability Maturity Model" aims to improve the results of technology processes (Alfirevic & Stemberger, 2015). This maturity frequently involves transformations of crucial business operations and affects products, processes, structures, or management practices (Matt et al., 2015).

Misunderstanding technology leads to underperformance due to a lack of knowledge about IT and three crucial functions: demand generation, multi-channel distribution, and revenue optimization. In the opinion of the same authors of the NEC Model, these areas should be something in which hotels shall invest to reduce the underperformance. If this is made in a synergy between the three different areas, it brings more results. They also recognize that they do not invest more due to a lack of resources (Piccoli et al., 2011).

2.6.2. How is ISM measured, and how can it be classified?

Piccoli et al. (2011) have developed the Network Exploitation Capability model based on three components: generality, detail, and usability. This model is composed of five stages and so four transition phases. If the hotel comes to a new stage, there will be a performance improvement, and the hotel will build more processes and systems. One stage is the basis for the next one (Piccoli et al., 2011).

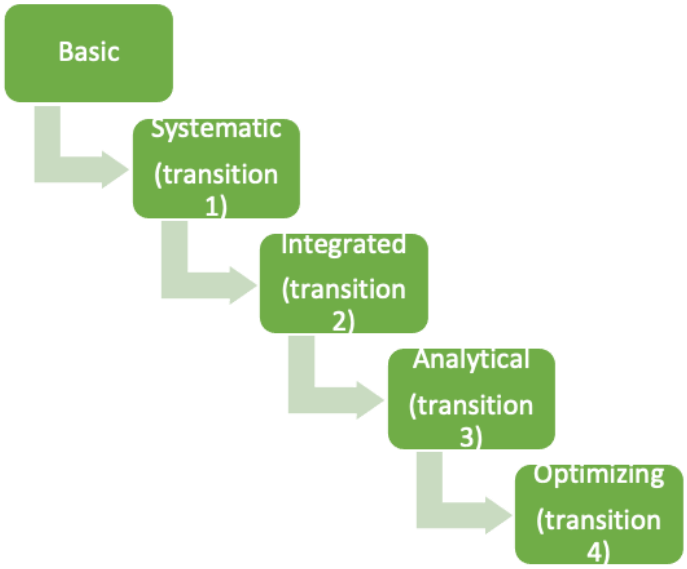

Figure 2 – NEC Maturity Levels and its transitions

The NEC Model's authors concluded that in 2011 most of the hospitality firms found themselves at the first or second stage. Most of them have only one employee with NIT skills. A few companies were in Stage 3, with more operational behavior, especially hotel chains. There are no firms in Stage 4 with a more disciplined mindset for analytics to effective operations. Hence, also, there were not 5th stage properties fulfilling these requirements (Piccoli et al., 2011):

1. Have defined the organizational roles and structured departments.
2. Continuous improvement on their BI introducing new analysis.
3. Present information in an integrated way across the organization.
4. Performing under an R&D mindset and with an active role in industry research and solutions.

Stage	Defining Attribute	Description	Macro-Behaviors
Basic	Durability	Taking advantage of utilization individually	Only a few or none organized practices. The decisions are left to the idea of one individual.
Systematic	Organization	Organized operational practices	There are frequently organized performed practices.
Integrated	Synchronization	Synchronize operational practices	The principal business operation sectors (demand generation, electronic distribution, and revenue optimization) synchronize their activities.
Analytical	Logic	Structured logical practices	The Analytical work exceeds independent report practices from daily operations.
Optimized	Continuation	Continual development	The capacity to compound, rearrange systems and assets while the organization and markets change from the technological perspective.

Table 1 - Five Stages Model of ISM, their Attributes, Description, and Macro-Behaviors

Different authors have presented a model of ISM with three stages, based on several factors to measure the ISM: data storage, IT literacy, reliability, integrity, security, availability, networking, level of support to management, access to the information within the hotel, software renewal cycle, hardware renewal cycle, access to hotel information from the outside. It is possible to observe a link between ISM and non-financial performance, namely guest relationships and business processes (Matook & Ihme, 2006). The measurement of performance also includes intangible aspects. Hospitality performance has two dimensions: guest relations and process quality (Alfirevic & Stemberger, 2015).

General Information systems' maturity Levels (Matook & Ihme, 2006)	
Level I	Information Systems operate as a partner in the technology department to automate the procession of data.
Level II	Information Systems operate as a business partner, centered on support business functions, and integrate them.
Level III	Information Systems operate as a partner for the business strategy, seen as a competitive advantage.

Table 2 - General ISM Levels, according to Matook & Ihme

Performance must be evaluated regarding processes levels and outcomes. That outcome needs to consider many external factors which impact the organization and its performance (Piccoli et al., 2011).

Having some staff inside the organization with skills and capabilities for network exploitation is not enough to be an example of NEC maturity. Instead, the example is measured by if the organization (hotel) can respond to new technologies regarding emerging distribution and marketing capabilities (Piccoli et al., 2011).

Immature organizations are characterized by having few systems and processes. If not registered, documented, and centralized, those processes and technologies' skills will get lost. For immature organizations, the goal is to increase the technology level, more investment, more consistent performance (Piccoli et al., 2011). According to the NEC Model, companies in the fourth and fifth stages must have systems fully integrated. Besides, analytical capabilities to improve their processes and learnings improve their performance and optimization (António & Serra, 2015; Piccoli et al., 2011).

3. METHODOLOGY

3.1. RESEARCH DESIGN

Primary data were used for the purpose of the study and split into two distinct categories, qualitative and quantitative. Quantitative data were descriptive in the form of survey data. It was also initially planned to make a structured observation. However, due to the COVID-19 pandemic in the current year and the mandatory social distance, this last method was substituted by direct qualitative research in the form of in-depth interviews.

3.2. QUANTITATIVE RESEARCH - SURVEY

The research employed the sample size technique to estimate the sample size that would represent the population (Gaciu & Keller, 2019). Considering the population of 1,606 hotels contemplated independent and small chains for the research by the end of 2019, a confidence level of 95%, and a margin error of 10%, at least 90 hotels were required to be represented on surveys. There was the possibility to have a valid answer with a company managing between one hotel and seven hotels.

$$Sample\ Size = \frac{\frac{z^2 * p(1-p)}{e^2}}{1 + \frac{z^2 * p(1-p)}{e^2 * N}}$$

Equation 1 – Sample Size

For this equation, *N* is the population size, where N=1,606, *e* is the margin of error in decimal form, where *e*=0.1 and *z* is the z-score, "*the number of standard deviations a given proportion is away from the mean*", where *z*=1.96 (SurveyMonkey, n.d.), *p* represents the sample proportion. Once the pilot was not representative enough for the investigation, *p* was considered 50%, "which is conservative and gives the largest sample size", where *p*=0.5 (Statistical Services, 2020).

Surveys were distributed among Portuguese hoteliers, ideally, with profiles of influence in the decision-making, such as the hotel directors, director of sales, or operations department (INE, 2020). Although the survey was distributed in Portuguese, the English version is attached and available in Appendix I.

Starting with a brief context of the study, the survey was divided into three separate parts. The first with demographic property characteristics and discovering questions, the second part with questions focused on identifying patterns and features from management among various hotels, and the last part focused on answering directly to the classification of information maturity levels (Mairinger & Pinho, 2019; Margarido, 2015; Nasoz, 2011).

The survey was conducted through the platform *Jotform.* The data collected were treated in excel, through dynamic tables, conductive to get the necessary metrics to answer the research questions. Several channels were used to accomplish the needed answers, such as direct messaging to hoteliers via LinkedIn, e-mail, and WhatsApp using the network in the field. Every answer was collected anonymously. After running a pilot with five hoteliers, the survey was approved to ensure the clearness of the questions and that it was adjusted to the reality of Portuguese Hospitality. These pilots were eliminated from the valid answers.

As previously mentioned, the investigation aimed to map the hotel companies in terms of information systems' maturity according to the NEC Model (Piccoli et al., 2011). Furthermore, to relate that classification with their self-classification, finding incongruities over or under the hotel company's actual position. Besides, another goal was to link the level of maturity with several patterns: company's dimension, hotel's category, the region where the company has hotel(s), presence on international brand/chains on their competitive set, the decision-maker profile for technology, the systems implemented in the hotel and technology investments, and the investment on staff qualification.

Figure 3 describes the process of how the analysis of the survey was made. One of the initial questions is the self-classification of the NEC maturity stages. Then, the respondent needs to go through a five-question process to find which is their maturity stage, understanding if they fill the requirement of each stage. If the respondent selects "Yes," then he/she has the possibility to be evaluated on filling the following requirement. Once the respondent says "No" to some question, he/she stays on the previous stage. To accomplish the fifth stage, he/she needs to say "Yes" to every requirement. After this process is completed, the analysis of the incongruity and patterns takes place.

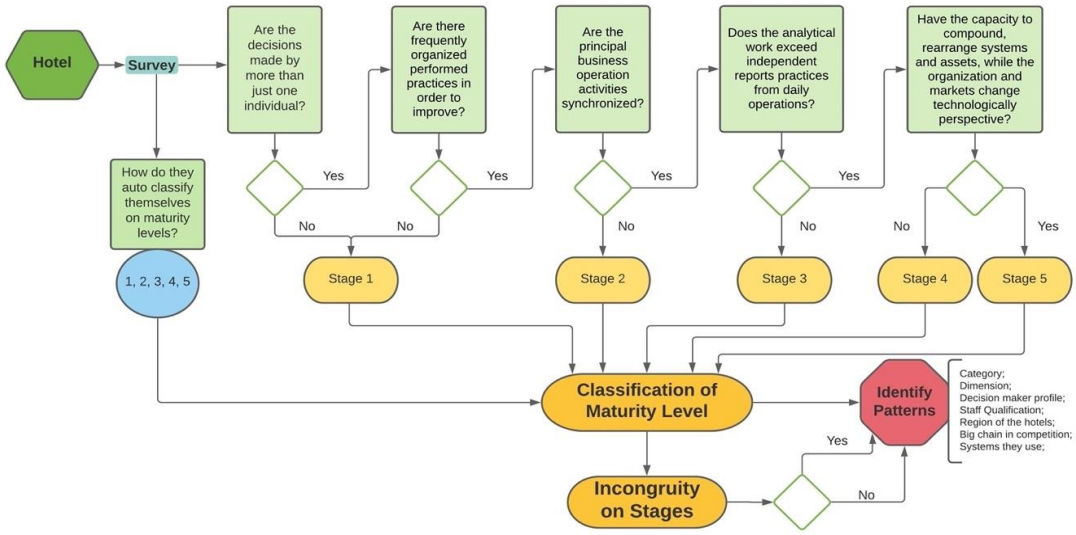

Figure 3 – Data Analysis Diagram

The survey was available to collect answers, from 20th October to 20th November. The first week was used to run the five pilots, who have provided feedback to the survey, resulting in small adaptations in the structure. Those five answers were removed from the valid ones. After closing the survey, 86 responses were registered, representing a total of 195 hotels. The first step was to clean the answers from chains with more than seven hotels and responses from the same hotel company, and the first five responses as pilots, which led to close the survey with a total of 77 valid answers, equivalent to 152 hotels with a total average of 134 rooms per hotel company. As the collected responses represented 152 hotels instead of the 90 initially planned, the margin of error became inferior to 8%, keeping the population size and the confidence level constant.

3.3. QUALITATIVE RESEARCH – IN-DEPTH INTERVIEWS

After the surveys and its macro analysis, the investigation has dug deeper into the results under online interviews in order to understand better the drivers and the limitations for the hotels to be more technologically mature and if they acknowledge the importance of this concept, and what is the use they make of technology.

The interviews were made with a few close-ended questions and open-ended questions, following the interview guideline previously prepared to meet the study objectives and explore better the survey analysis. These interviews were conducted via Zoom and recorded for documenting this step of the research. Questions for the interview can be found in Appendix II.

4. RESULTS AND DISCUSSION

This chapter is destined for the analysis and discussion of results, both the surveys and the interviews.

4.1. QUANTITATIVE RESEARCH – SURVEY ANALYSIS

Table 3 shows all of the respondents are independent units, while only one respondent represented a company owning six hotels. It is impossible to identify a direct continuous relationship between the number of hotels per company and its rooms.

Hotels per company	Average number of rooms per hotel company	Sum of hotels
1	81	60
2	167	54
3	331	24
4	254	8
6	600	6
Total	**134**	**152**

Table 3 – Dimension of the companies represented in the survey

Out of the 77 answers, 26 of the respondents are hotel General Managers, 16 revenue or e-commerce managers, and 18 are salespeople, whether managers or assistants. The rest 17 assume different positions, from reservations to operations, from social media managers or human resources to the company owners.

The most vital variable to analyze within the survey was the maturity level and then related to the other variables that can influence or influence the maturity level. As explained in the previous chapter, five questions (Part III of the survey) intended to map the hotel's ISM directly. If the hotel had answered negatively to question 24., it was immediately classified as the first maturity stage. If they had answered positively, they could proceed with the following question, corresponding to the next stage. In the end, if the hotel had answered positively to all the questions, it could get the classification as the fifth stage, and if not, it was between the first and the fourth stage.

Many hotel companies find themselves in the first or third maturity stage, as seen in figure 4. The fifth stage also has a vast preponderance. However, not as previous stages, which leads to conclude, on average, hotels in Portugal are located between the second and third stage of maturity, with a classification of approximately 2.73 from one to five, meaning between the systematic and the integrated phase. All the five levels are presented here, with the minimum as the first stage and the maximum as the fifth stage, and a median located on the third stage. The respondents were asked to self-classify them in terms of what they think their ISM level would be. Hence, it is possible to observe a significant part of hotels (86%) position themselves as on the third or fourth stage of maturity. If this would

represent the reality, then the average level of ISM of Portuguese hotels would be 3.51, between the integrated and the analytical phase.

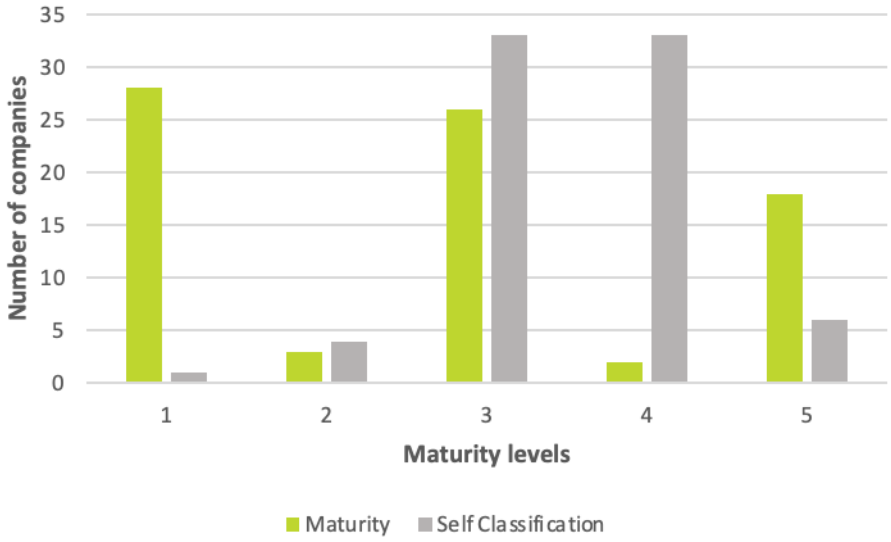

Figure 4 – Relationship between NEC Maturity Classification and Self-Classification

It is also possible to observe that while 28 out of the 77 hotel companies were classified as the first maturity stage, only one company has self-classified itself as on the first stage, leading to the conclusion that this incongruity might mean either hotels are unaware of what ISM means, or they are feeling more optimistic.

The incongruity is not just between the classification according to the survey and their self-classification. However, besides, hotels are incongruent with their classification according to the NEC Model employed in this investigation. For example, one hotel answers positively to the fifth question but negatively to the fourth question. This would stop the hotel on the third stage while it is fulfilling the requirements besides its level.

Table 4 is divided firstly on the left by "Appropriateness" or "Incongruity", regarding the classification according to NEC Model. Accordingly, almost two-thirds of the respondents with incongruity among the answers meet the classification levels. Thus, the question "is this NEC Model applicable to the investigation context?" or "Is the metric well evaluated for each stage?"

Classification according to NEC	Count of hotels
Appropriateness	**27**
Appropriateness with Self-Classification	3
No Incongruity	3
Incongruity with Self-Classification	24
Over Classification	9
Under Classification	15
Incongruity	**50**
Appropriateness with Self-Classification	13
No Incongruity	13
Incongruity with Self-Classification	37
Over Classification	36
Under Classification	1
Total	**77**

Table 4 – Classification according to NEC and incongruities on the classification

Furthermore, only 16 out of the 77 hotel companies have classified themselves in the same stage as they are, according to the research, while the others have classified them above their stage. More than 58% of the respondents think they are in (at least) one stage above what they are – over-classification. Less than 21% were more pessimistic, positioning themselves below what they are – under-classification.

When it comes to relating the ISM with other variables, we studied in the first place the relation to the hotels' characteristics, such as the Region where the company owns hotels, their dimension (measured by the number of rooms), the category of each hotel, and if these hotels have big hotel brands on their competition, who might influence their structure or performance.

The regions of Portugal presented in Portuguese and are represented in table 5 by NUTS II *(Nomenclatura das Unidades Territoriais para Fins Estatísticos)*: Norte[i], Centro[ii], Lisboa[iii], Alentejo[iv], Algarve[v], Região Autónoma da Madeira[vi] e Região Autónoma dos Açores[vii]. Geographical regions do not equally distribute the hotels represented in the study. However, observing the numbers compared to the region's weight in the national context, there is a better distribution. The maturity levels in Algarve and Norte are quite well distributed and representing the pattern of the survey. The opposite happens with Centro and Madeira, with a significant predominance of first-stage maturity hotels. On the other hand, Lisboa and Alentejo, which count with almost 59% of their hotels located on the third stage of maturity. Lastly, looking at the Azores that despite having four hotels, only two companies are represented; thus, it is not sufficient to make conclusions.

Level of maturity	Alentejo	Algarve	Centro	Lisboa	Norte	RA Açores	RA Madeira	Total
1	3	2	10	7	16	1	9	48
2		2			2		1	5
3	6	6	4	20	10		5	51
4					6		2	8
5	1	8	5	7	15	3	1	40
Total	**10**	**18**	**19**	**34**	**49**	**4**	**18**	**152**

Table 5 – Level of Maturity by Geographic Region

Table 6 relates the maturity level with the companies' average size (number of hotels) and the hotel's average size (number of rooms). It is non-viable to conclude any relation between maturity and the companies' size since there is no pattern. In terms of the number of rooms, it is shown a sightly growing tendency in hotels' size on the highest maturity levels. Even so, it is not conclusive enough to establish a relationship between these two variables.

Level of Maturity	Sum of Hotels	Sum of Rooms	Average of Hotels per company	Average of Rooms
1	48	3490	1,5	77
2	5	350	1,3	70
3	51	4459	1,4	87
4	8	998	4,0	125
5	40	3818	1,7	95
Total	**152**	**13115**	**2,0**	**86**

Table 6 – Level of Maturity by company's dimension

Compared to the hotel companies' dimension, it is non-viable to identify any relationship between the level of maturity and the category of hotels, since hotels with different maturity levels are equally distributed by different categories, especially the traditional ones, from 3 to 5 stars. Thus, it is attainable to conclude, by figure 5, that there is no relation between the level of maturity and the hotel category.

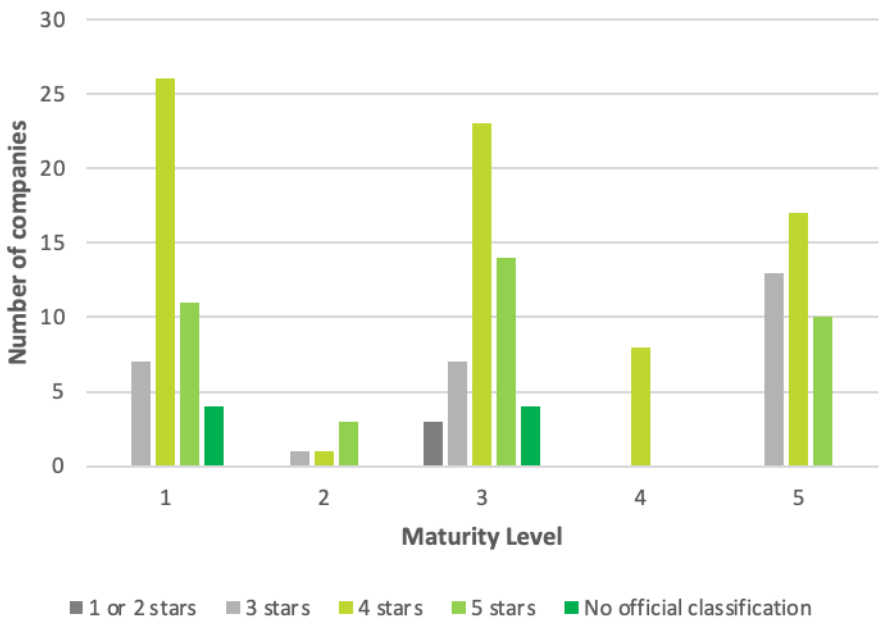

Figure 5 – Relation with Maturity Level with Hotel Category

Unlike the two previously studied variables, in figure 6, it is possible to identify a relationship between the maturity level and a big hotel brand's presence in the competition. Almost all hotels (94%) do not have big brands as competitors are located in the first three stages of maturity. A similar situation happens with hotels with this kind of competition, although they are not direct competitors, speaking of 82% of hotels. On the other hand, within hotels with a big brand as their direct competitors (59%), 37% are in the fifth stage. When making the previous (but reverse) analysis, 70% of hotels that count with big brands on their direct competition are in the last three stages.

Additionally, while 54% of hotels in the first level face big brands on direct competition, this weight is 83% for the fifth stage. Therefore, a relationship between the level of maturity and big brands' presence in the competition is noticed. The factor of these competitors might explain this tend to be international big chains which are, as seen in the literature, more mature and digitalized, without familiar management and so, the independent units and small hotel chains which compete with these international chains also tend to follow the competition and adopt more technology improve their management to be more competitive as well.

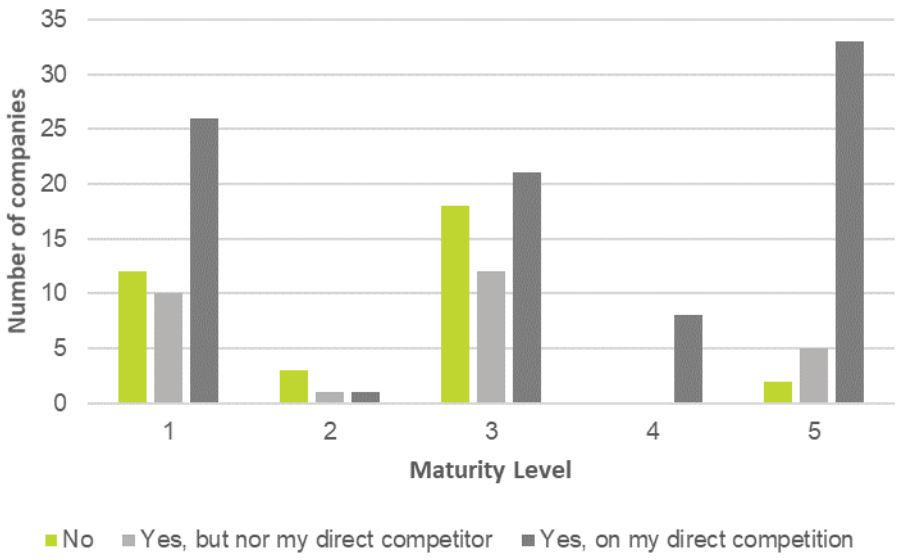

Figure 6 – Relation with Maturity Level and the presence of international competition

Another matter mentioned in the literature as relevant to influence the ISM of a hotel is the decision maker's profile for technology. This person needs to see value in information systems and then decide whether to buy them or not. The study has investigated three different variables related to the decision-maker profile: his/her background, his/her age, and his/her position in the hotel company.

Table 7 shows the potential relationship between the maturity level (on the left) and hotels' distribution regarding their decision-maker background. In general, the decision-makers have their background either in Hospitality (45%) or in Business (31%). There is no clear relation considering the academic backgrounds. However, it appears only between the first (basic) and third (integrated) stages of maturity some decision-makers have a background apart from Hospitality or have no academic background. These two make 16% of the hotel companies. Also, in general, no immense prevalence is registered of IT/Systems' background to be the people who decide to buy an information system, around six times less than Hospitality. Hence, there might be a relation between these two variables, but it is not very evident to take a conclusion.

Decision-maker Profile	Count of hotels
Level 1	**28**
Business	9
Hospitality	8
IT/Systems	2
None	6
Other	3
Level 2	**3**
Hospitality	3
Level 3	**26**
Business	9
Hospitality	13
IT/Systems	1
None	2
Other	1
Level 4	**2**
Business	1
IT/Systems	1
Level 5	**18**
Business	5
Hospitality	11
IT/Systems	2
Total	**77**

Table 7 – Level of Maturity and the decision-maker's background

Out of the 77 answers, 50 mentioned the decision-maker has between 31 and 50 years old. The extremes, between 18 and 30 years old as younger decision-makers and more than 61 years old, the amount of answers is very similar. What is not that similar is that out of the five answers corresponding to the older (more than 61 years old) decision-makers, only one turned to be a company in the fifth level of maturity, while three companies in the first maturity level. When looking at the two younger ranges of ages, between 18 and 30 years and between 31 and 40 years old, seven companies in total are seen, either in the first stage of maturity and the fifth stage of maturity. Lastly, compared to the two middle ranges, between 41 and 50 years and 51 and 60, it was not found any clear pattern. Consequently, looking into figure 7, it is feasible to say that there is a sightly relation between the maturity level and the decision-maker's age when speaking to younger or older people. However, it was not possible to establish a relationship with the middle ranges.

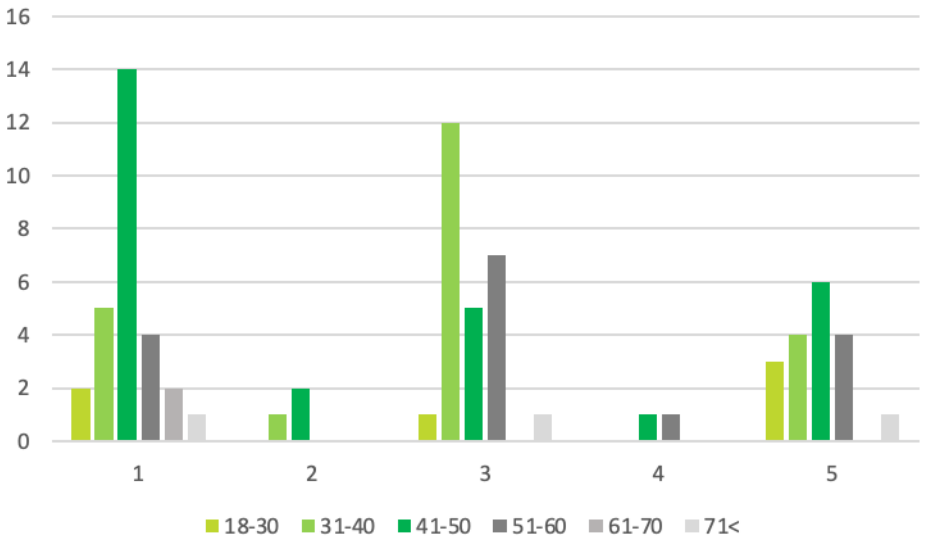

Figure 7 - Level of Maturity and the Decision-maker's age

Looking into table 8 below, it is unfeasible to design a relation between the position/role of the decision-maker in the company and the maturity level attributed to that company. Most of the decision-makers are CEOs, General Managers, or Company Owners, with a significant proportional weight on the number of classifications on each level. Hence, it is unfeasible to see a relation between these variables, as seen with the other variables about the decision-maker profile.

Position of the decision-maker	Count of hotels
Level 1	**28**
CEO	3
Company Owner	5
General Manager	11
IT Manager	2
Manager Assistant	1
Other	5
Revenue Manager/e-Commerce	1
Level 2	**3**
CEO	1
General Manager	2
Level 3	**26**
CEO	5
Company Owner	4
General Manager	8
IT Manager	1
Revenue Manager/e-Commerce	4
Sales Manager	4
Level 4	**2**
CEO	1
IT Manager	1
Level 5	**18**
CEO	3
Company Owner	3
General Manager	8
IT Manager	2
Other	1
Sales Manager	1
Total	**77**

Table 8 – Level of Maturity and the Decision-maker's role in the company

Apart from the hotel's characteristics or its decision-maker, the NEC Model also suggests that the maturity level is connected to the systems available in the hotel and staff qualification who use these technologies to perform their tasks. In the graph below, represented by figure 8, the average number of systems available in hotels and the integrations with the PMS and the CM, known as collection and distribution points of information for other systems, as seen in the literature. According to the survey results, there is a moderate tendency for hotels in higher maturity stages to possess more information systems and more integration between those systems, making sense from synchronizing information, which is a measure of maturity.

On average, a fifth-stage hotel has 30% more systems than a first-stage hotel and 19% more than a third-stage hotel. Making the same analysis on the PMS integrations, the numbers become 35% and 17%, respectively, and also, 35% and 23% on the CM integrations. Of course, there is still the need to understand the breaking tendency with stages two and four of maturity, which might be explained by the small number of hotels that assumed those classifications. So, there is not enough data to make a precise analysis assuming these

second-stage (systematic) hotels and fourth-stage (analytical) hotels are outliers. Hence, it is attainable the relation between the number of systems available for a hotel and its integration and maturity level.

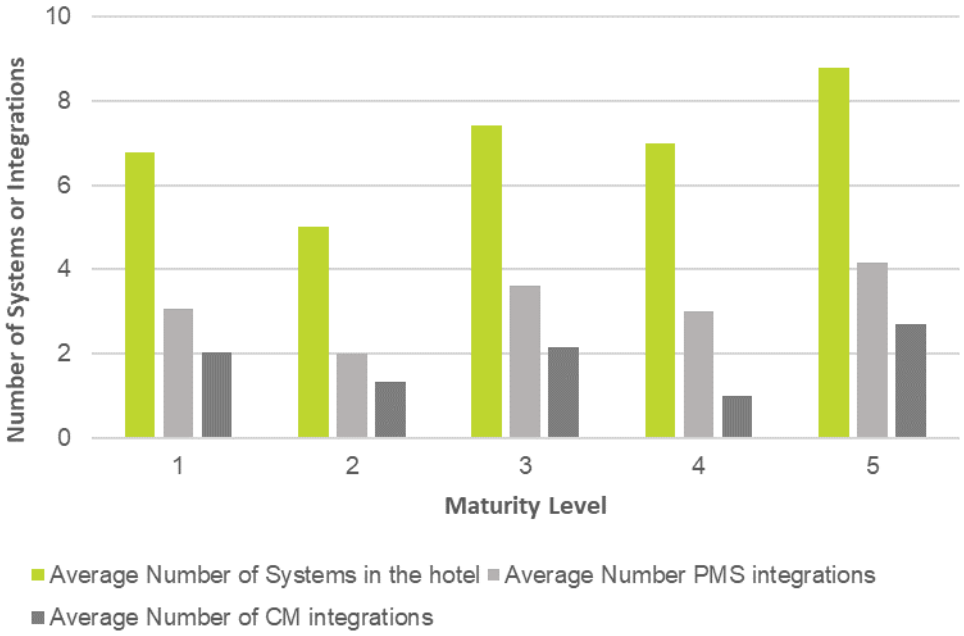

Figure 8 – Relation with Maturity Level and information systems in the hotel and its integrations

In more detail, this assumption can be explained by the fact of unequal distribution between different levels, seen in table 9. Out of the 28 hotel companies in the first level of maturity, 17 of them have equals or less than seven systems (61%), while out of the 18 companies on the fifth level, 12 have eight or more systems (67%).

No. of IS in the Hotel	1	2	3	4	5	Total of hotels
3	2				1	3
4	3		4			7
5	8	3	1		1	13
6	1		3	1	3	8
7	3		8		1	12
8	3		3	1	4	11
9	2		2			4
10	3		2		2	7
11	3		1		3	7
12			1		1	2
13			1			1
14					2	2
Total	**28**	**3**	**26**	**2**	**18**	**77**

Table 9 – Level of Maturity and the number of systems in the hotel

More than analyzing the number of systems, it is crucial to understand the position of the hoteliers regarding the latest technology considered for this study: Chatbots for hotel's websites, CRM, and ORM, against the PMS, the central and one of the oldest kind of information systems for hotels. As evident in figure 9 below, every hotel company that answered the study has a PMS. It is the central system, and every hotel shows the need to have one, regardless of the maturity level, hotel category, or dimension.

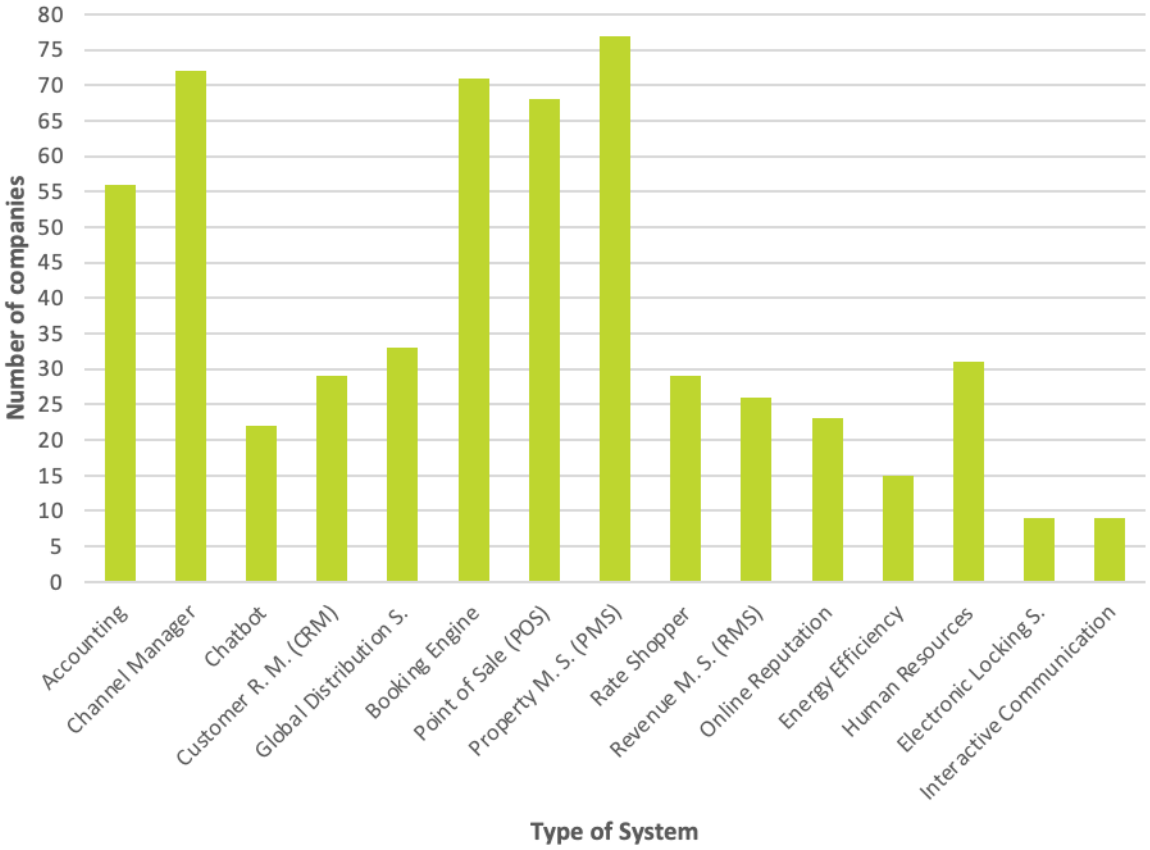

Figure 9 - Count of which information systems are available in the hotels

On the other hand, on average, only one-third possess the latest technology. Among these three, CRM is the most favorite, with 38% using it. However, less than 30% have a Chatbot or a system for ORM. There is a clear growing tendency: as the level of maturity grows, the presence of the latest technology grows too. The ratio of the latest technology presented in the first-stage hotels is approximately 0.68 out of 3 technologies per hotel company with this classification, 1.0 for third-stage companies, and 1.5 for fifth-stage companies. The key differential is located on the chatbot, as the CRM or ORM systems, hotels are equally distributed among the maturity levels.

More than evaluating what hotels have today, the study went onto their intentions to adopt more information systems next year. Table 10 shows that more than 54% intend to decrease their current investment in technology. Out of those 42 companies, only one expresses to acquire four new technologies, which can signal that some hotels are changing their suppliers for more affordable ones. Nevertheless, 23% suggests investing up to 10% more in technology by the next year and 19% to invest up to 25% more. Only one company intends to invest up to 50% more in two new technologies and one company more than 100%. Five new technologies suggest a restructure of this hotel company's information systems.

Plan to invest more and in how many systems	**1**	**2**	**3**	**4**	**5**	**Total of hotels**
Up to 10% more	**6**		**10**	**1**	**1**	**18**
1	2		3			5
2	1		4	1	1	7
3	3		1			4
none			2			2
Up to 25% more	**5**	**1**	**3**	**1**	**5**	**15**
1			1		1	2
2			1	1	2	4
3	3				1	4
4		1	1		1	3
5	1					1
none	1					1
Up to 50% more					**1**	**1**
2					1	1
More than 100%			**1**			**1**
5			1			1
Intend to invest less	**17**	**2**	**12**		**11**	**42**
4	1					1
none	16	2	12		11	41
Total	**28**	**3**	**26**	**2**	**18**	**77**

Table 10 – Level of Maturity and intentions to invest in information systems

The amount desired to invest is aligned with the number of new technologies hotels want to invest in, in general. Even some companies do not intend to hire new technologies instead of improving the ones they have. A small number of hotels is available to increase their budget for technology. However, due to the actual Hospitality context, with the crisis originated by the COVID-19 pandemic, hotels are decreasing investments in many fields, not just technological tools.

The intention to buy technology is not explicitly related to the maturity level of hotels. The same weight of hotels in the first (basic) and fifth (optimized) stages of maturity intend to buy less technology. In fact, there is a slight tendency for more mature hotels to increase investment in technology. However, if these hotels already possess several, they might have arrived at a point of decelerating the investments made on information systems.

With table 11 below, it is evident that these latest technologies will be a priority for investment. This year, 71% of hotel companies without a Chatbot, 62% without a CRM, and 70% without an ORM. Next year, according to the hoteliers' investment plans, these numbers will be respectively: 56%, 48%, and 56%. This means approximately 20% more hotel companies plan to invest in at least one of these three mentioned technologies.

	Has already the technology	Plan to invest	Total next year
Chatbot			
No	55	12	43
Yes	22		34
CRM			
No	48	12	36
Yes	29	1	41
ORM			
No	54	11	43
Yes	23		34

Table 11 - Investment in the latest technology

This analysis is more exciting and relevant for the study when comparing these results to the maturity level. Out of the 36 new technologies expected to be adopted, only 28% correspond to the hotels with the two highest maturity stages while 44% to hotels with the two lowest maturity levels, as seen in table 12. This can be explained concern the fact that more mature hotels already have these technologies and do not need to invest as much as less mature hotels. However, it can also mean there is no direct relation between the level of maturity and the intention to acquire newer information systems.

Level of Maturity	Sum of new latest technologies
Level 1	**13**
1	4
2	6
3	3
Level 2	**3**
3	3
Level 3	**10**
1	5
2	2
3	3
Level 4	**3**
1	1
2	2
Level 5	**7**
1	3
2	4
Total	**36**

Table 12 - Number of hotels per maturity level that invested in the latest technologies

Like with any other investment, also technology has its drivers to be made and its limitations. Hotels were asked to point out their three main drivers to invest in technology and limitations to raise this kind of investment (and the main reason among those three). The following table 13 shows the drivers per maturity level. Understandably, the second and fourth levels show fewer drivers and limitations due to the small number of hotels with this classification.

Main Driver for hiring technology by the level of maturity	Count of hotels
Level 1	**28**
Increase revenue/profits	12
Centralize information, processes, and areas of activity	2
Manage distribution more efficiently	3
Provide a better experience to guests	1
Reduction of time on daily tasks	1
Re-invent us and be closer to the digital transformation	1
Having more information for better decision-making	5
Having a competitive advantage	3
Level 2	**3**
Increase revenue/profits	2
Re-invent us and be closer to the digital transformation	1
Level 3	**26**
Increase revenue/profits	11
Centralize information, processes, and areas of activity	1
Manage distribution more efficiently	1
Reduction of time on daily tasks	8
Re-invent us and be closer to the digital transformation	1
Having more information for better decision-making	3
Having a competitive advantage	1
Level 4	**2**
Increase revenue/profits	1
Re-invent us and be closer to the digital transformation	1
Level 5	**18**
Increase revenue/profits	5
Centralize information, processes, and areas of activity	1
Provide a better experience to guests	3
Reduction of time on daily tasks	5
Re-invent us and be closer to the digital transformation	1
Having more information for better decision-making	3
Total	**77**

Table 13 - Main Drivers for hiring technology by the maturity level

It is evident the main driver for hotels to invest in technology is "increase revenue/profits", in every maturity level, with a total of 40% choosing this as their main driver out of the eight given options. However, only 29 hotel companies have Rate Shopper and 26 with a Revenue Management System (RMS), respectively 38% and 34%, which are the information systems directly related to revenue optimization, which might be incongruent with the hoteliers' answers. As the second option, with less than half of the choices, there is a "reduction of time on daily tasks" inherent to almost every information system.

On the other hand, the less chosen drivers were centralizing information, processes, and areas of activities and having a competitive advantage. It is interesting to verify that the choices are not related to the maturity levels as the main choices are coherent among every stage. The only significant difference registered is that hotels with the highest maturity give more importance to providing a better experience to their guests, yet not significant enough to establish a relationship with the maturity level and the drivers for technology investment.

As the main limitation for investment in technology, in every level of maturity, the respondents' most chosen reason was "do not have the budget for more systems", as seen in table 14. Almost 68% pointed this as their main limitation to acquire more technology, showing that hoteliers do not see much ROI on information systems. This can be compared to the insecurity of having information accessed by third parties, in this case, technology vendors, with less than 4% of respondents pointing this as an issue, which shows that hotels trust their vendors to save and manage their data.

Main Limitation for hiring technology by the level of maturity	Count of hotels
Level 1	**28**
Do not know the potential of other systems	2
Do not have the budget for more systems	21
Do not have qualified staff to use these technologies	2
Do not see value in the systems we know	2
It seems too complex for our structure	1
Level 2	**3**
Do not have the budget for more systems	3
Level 3	**26**
Do not want our information to be accessed by third parties (technology vendors)	2
Do not want to use more tools	3
Do not have the budget for more systems	17
Do not see value in the systems we know	2
It seems too complex for our structure	2
Level 4	**2**
Do not know the potential of other systems	2
Level 5	**18**
Do not want our information to be accessed by third parties (technology vendors)	1
Do not want to use more tools	4
Do not have the budget for more systems	11
Do not see value in the systems we know	1
It seems too complex for our structure	1
Total	**77**

Table 14 - Main limitations for hiring technology by the maturity level

Unlike the drivers, a small pattern can be identified between different maturity levels for investment limitations. Firstly, only first-stage hotels selected not having qualified staff to use technological tools as a limitation. Secondly, the budget limitation is decreasing proportionally as hotels show more maturity and the limitation of not seen value or potential in information systems, meaning more mature hotels believe in ROI of this

technology. Lastly, contrasting with the need to feel their information safe, the more mature a hotel seems to be, the bigger is their concern with the data.

Lastly, the variables connected with the staff's qualification and training in the use of technologies are mentioned. On the left of table 15, it is seen how frequently hotels invested last year on the staff qualification or if what staff received was only provided by the technology vendors. Below each option, there is the intention for the following year. At least one training was received during last year in 35% of the companies, provided by the hotel employers themselves. According to the intentions expressed, this number will grow to 42% next year. On the other hand, 10% of the companies have not provided training to their staff, which will also grow to 14%. Once again, this can be explained to buy the investment retreats caused by the pandemic. Moreover, it is interesting to see that only less than half of the companies (39%) plan to change their strategy from the last to next year.

Staff Qualification	**1**	**2**	**3**	**4**	**5**	**Total of hotels**
Provided by technology vendors	**15**	**2**	**16**	**1**	**8**	**42**
Provided by technology vendors	9	1	9		7	26
No			3			3
Yes, between 1 and 3 times	6	1	3	1	1	12
Yes, more than 3 times			1			1
No	**4**	**1**	**2**	**1**		**8**
Provided by technology vendors		1				1
No	4		2	1		7
Yes, between 1 and 3 times	**5**		**5**		**9**	**19**
Provided by technology vendors	2		1		4	7
Yes, between 1 and 3 times	2		4		5	11
Yes, more than 3 times	1					1
Yes, more than 3 times	**4**		**3**		**1**	**8**
Provided by technology vendors	1				1	2
No			1			1
Yes, between 1 and 3 times	1		1			2
Yes, more than 3 times	2		1			3
Total	**28**	**3**	**26**	**2**	**18**	**77**

Table 15 – Investment in Staff Qualification

Diving deeper into this analysis by maturity levels, it is verified that half of the companies who have not provided training to their staff last year belong to level one, while none to level five. Besides, more than 55% of the fifth-stage companies invested in their staff qualification at least once last year, while only 32% on the first stage of maturity have done it. On the other hand, results show that more mature companies are proposing a reduction in the staff qualification, 33% of the fifth stage companies plan to invest in the staff qualification. In comparison, this number is 38% for the third stage companies and 43% for the first stage. Thus, there is no clear relationship between investment variables on staff qualification and maturity level since the past pattern becomes the opposite for future intentions.

Finally, it is crucial to look at the role of technology providers in this variable. About 54% of the companies have seen their staff receiving only the technology vendors' training. Of those, 62% intend to keep with the same strategy, contributing to 47% of companies that expect to have their staff only receiving training by the technology vendors. This means more than half of people who resort to technology tools have been educated by technology providers, who play a more strategic role in hotel companies, as seen.

4.2. Qualitative Research – Interviews Analysis

A total of six interviews were made, with the sales or revenue manager from six different hotel companies, shown in the table 16. Two classified as the first (basic) maturity level, two classified as the third (integrated) maturity level, and two classified as the fifth (optimized) maturity level. This distribution allows the top, intermediary, and bottom levels of maturity to be represented within these interviews. The hotel companies are labeled as type. So, the region has leisure hotels from the archipelagos and city/business hotels from the two big Portuguese cities, as shown in the table below. All the companies are predominantly 4-star properties. Companies from levels two and four were not called to the interviews since they are intermediary levels, and according to the survey, they represent only 6.5% of our sample.

	Maturity Level					
	1		3		5	
Region	RA. Madeira	Lisboa Norte (Porto)	RA. Madeira	Lisboa	RA. Azores	Norte (Porto)
Hotel Type	Leisure Business	Leisure Business	Leisure	Leisure	Leisure Business	Leisure Business
No. Hotels	2	2	3	4	3	3
Profile	Sales Manager	Sales Director	Revenue Manager	Revenue Manager	Revenue Manager	Director of Sales & Revenue
No. Systems	7	10	13	8	11	10

Table 16 - Interviews made, organized by the maturity level and hotel characteristics

The initial 20 questions were then transformed into 18 questions because understanding as two questions were repetitive.

1. **Name, Region, Hotel, #rooms, #hotels**

In level 1, both interviewed companies now have two hotels. The goal is to assess whether there is a noticeable difference in these two sales managers' responses from a company in the islands to a company with a presence in the country's largest cities. According to the survey results, the region is a factor of maturity differentiation, particularly in Madeira, with more hotels with less ISM, unlike Lisbon.

As interviews of maturity level, three were made to the person responsible for revenue management in the organization. These two small hotel chains are in Lisbon and Madeira Island.

Regarding level 5, interviews were conducted with two companies, both with three hotels. One of them in the Norte/Porto region, interviewing with the sales and revenue director, and another on the Açores island was interviewed with the revenue manager.

2. **What tasks/responsibilities are inherent to you in your organization?**

Responsibilities are associated with the respondent's profile. In the sales managers' case, the answers obtained were similar, being responsible for an integrated marketing and sales strategy, managing all the hotels' business areas: accommodation, meetings, and events.

According to level 3 companies' revenue managers, they analyze information, distribute new prices, check budgets, and design marketing strategies. They define the effort to be made per segments and channels relevant to the business.

At level 5, the northern chain group's sales director, with all the reservations, marketing, sales, and revenue interconnected, defines an occupancy budget and average price and respective strategies to be put into practice. He is also responsible for hiring all the tools necessary for these departments' proper functioning, including software. On the island company, the revenue manager has primary responsibilities: hiring online channels, creating packages and rates, and applying discounts to maximize revenue. She is also the person in the company who builds revenue reporting and manages the distribution. Thus, it does not assume a board position as the previous person.

3. **Which information systems does your hotel have?**

One of the companies in the first stage has 11 systems focused on revenue management and distribution regarding information systems. The other company is more focused on the maintenance and operations side, with seven systems.

In the third stage group, the smaller company has eight information systems, while the largest company has 13. In this matter, the conclusion is that the company from Lisboa is less well equipped than the Madeira company, which has more software to enhance the customer experience.

The most mature, in terms of information systems equipment, companies are equated with 10 and 11 systems. So it is not possible to identify a pattern against a company in the Islands versus the Norte region.

4. **Which system do you use the most (minimum once a week)?**

Since the systems available are different, the use of them is naturally different. Regardless of the hotel, these people mainly turn to CM and PMS. In cases where this tool is available, so are ORM and RMS/RS. At level 1, only one hotel did not have any of the tools mentioned here, apart from PMS. The higher the company's maturity level, the more often the systems were used, and a higher spectrum of use.

5. **How do these systems help you to perform tasks?**

In general, opinions are shared in terms of time saved, more generous and faster access to information, centralization of information and processes, and it will also be the fact that it is agility for the excellent decision-making at the right time. For Sara Freire, one of the interviewees, information systems are "*a great help, whether in time savings and human resources. What I used to do in hours, now I do it in minutes, and time is money*."

6. **Do you have systems integrated? If so, which ones? Which integration features do you use?**

The most common integration, and corroborating the survey results, is PMS and CM, either with CRM, BE. They allow several interactions in terms of inventory management, and change of tariffs, marketing actions according to GDPR, management of new and current reservations.

The interviewees claim that these integrations allow managing the operation more effectively in real-time, with information centralization. Besides, the advantages of saving time for these professionals and reducing error margins are identified and all automated tasks.

7. **Out of the systems you use, which ones were chosen by you?**

The influence on the information systems' decision varies between 25% and 100% in the answers' total, depending not on the company's characteristics but the respondent's profile. These data have to do with decision-making power and the use of each system itself.

8. **In your opinion, would you need more information systems in your activity? What about your company? Please state why.**

The hotel with fewer tools, including without a CM, considers having one necessary to manage the distribution better. For hotel companies that already have these systems, they do not consider more systems necessary. Instead, greater centralization and adjustments of

the systems, to be more efficient in their use. In general, different needs are few and have to do with the particularities of the businesses.

9. **Out of the systems you use, have you been trained to use them correctly?**

All interviewees stated that technology vendors trained them. However, some opinions show that training could be improved and deepened, either more actively or via customer support.

10. **Usually, systems, especially software, are going in changes over time. How does your company keep track of these updates? Are there regular developments on the solutions?**

All interviewees guarantee that they are aware of new solutions in the market and maintain constant communication with current technology partners to update themselves on new developments and updates. The significant differentiation is and visible according to companies' maturity, in which companies these new solutions are effectively updated.

11. **Has your company provided free technology training during the last year, in addition to that provided by the suppliers of information systems? If so, give examples.**

All the companies also have provided training to their employees in various areas depending on their tasks.

12. **Before being in touch with this investigation, have you ever heard of the concept of information systems' maturity? What did you know about this?**

These answers allowed the identification of clear evidence according to the level of maturity of the company. None of the level 1 interviewees knew the concept of information system maturity. At level 3, they have superficially heard about it, and at level 5, they have had contact with this concept previously, whether in a professional or academic context.

13. **If you answered the survey, indicate which rating you gave to your company's information systems' maturity level and why you chose that classification.**

Knowing that the companies were of levels 1, 3, and 5, the self-classifications obtained were 3 to 5, respectively 3 and 4, then 3 and 5, and finally 3 and 4. All respondents maintained their self-classification. Companies that have ranked themselves above the NEC Model classification are linked with the fact that they have been on a positive evolution path in recent years, linked to a comparison at a regional or national level, and thus position themselves above that average. On the other hand, the level 5 companies that have self-classified them below have to do with the need for greater efficiency in the use of existing

systems and with the international comparison with large European and American chains, which also compete with these national hotels.

14. In your opinion, why urge limitations to arise to be at the next level of maturity? Do you think your organization can easily overcome these limitations?

As was evident in the literature review and confirmed by the surveys, the limitations, especially at levels 1 and 3, comprehend essentially with budget issues, i.e., systems' cost. Not a specific system, but the package required for hotel activity and the interfaces between those systems. It was also indicated as a limitation that there is still a path of stimulus to employees to resort to technology to optimize their tasks, so it is necessary to wage on their training.

Another limitation pointed out is whether it is justified to use an additional tool to perform small tasks. Rudi Azevedo states, "*the financial limitation is seen in these companies as a difficulty to make the Boards, or the decision-maker, to understand the added value of these systems and what will be the ROI because a technological tool in a hotel budget is a small percentage*."

15. In your organization, what are the various organized practices often implemented to improve performance?

All companies point out regular meetings with their boards for presentations of results and strategy definition, based on customer and employee feedback and hotel performance.

From levels 3 and 5, there is a benchmarking strategy. Employees' training is always pointed out as a critical indicator in this improvement, with the technological training aspect.

Finally, one of the companies (level 5) states that improving the tools' performance is not done the monitorization because "*it is already a given that is giving feedback and is necessary for our good performance*," says Rudi Azevedo.

16. How are the demand generation, electronic distribution, and revenue optimization sectors synchronized in your organization?

Levels 1 and 3 were unable to indicate the demand generation's synchronization strategies, electronic distribution, and revenue optimization. At level 5, the answers were more concrete, with the strategies to be thought from top to the operation with several actions thought to see how the guest goes through a flow, directly related to the direct booking by the website. This will enhance customer loyalty, provide a greater possibility of experiences, and optimizes our revenue with the reduction of distribution costs.

17. What types of integrated analysis are made complementary to individual reports?

As was expected, level 1 and level 3 companies do not elaborate integrated analysis. The analyses are all done individually by various people or departments. Nevertheless, they have their source of data, the PMS being the central starting point for all. The remaining companies try to do everything in an integrated way, "*from the budget to the daily routine of analysis so that there is the integration of knowledge and everyone can work on the same thing, by the same data source*," says Tiago Oliveira.

18. How is your organization responding to technological changes in the market?

Finally, more as an opinion question, answers are very similar inside the same levels. There is still work to do on changing the mindsets in shift seeing technology as a cost to an investment, which begins slowly to be made at the lowest maturity companies.

For the more mature companies, they are very active in the search for new solutions. They have most of the software available as in large national hotel chains, in various departments. However, they point out a limitation in the improvement of these solutions and the transition costs.

5. CONCLUSIONS

5.1. SUMMARY OF RESULTS

As seen by the survey's collected answers, many variables present a cause-effect relationship with the maturity stage. These variables might be the decision-makers' profile, having a big brand on their competitive set, or information systems portfolio, opposite to companies' dimension (in the number of hotel units or rooms), or investment in staff qualification.

The respondent's profile undoubtedly influences the answers when comparing the tasks affiliated to his/her role and the technology used to do so. Different people have different needs for task optimization and then different technology needs and thus, influence the decision-making for technology differently. Most of the interviewees were not the final decision-maker, leading to understanding the spectrum of their influence to decide which systems they use.

As seen in surveys and interviews, higher maturity stages present a higher average of HIS and its integrations. Besides, these hotels use their IS more frequently and more functionalities to take more benefit from it. The primary need for hoteliers seems to be the optimization in using their existing systems and improve their efficiency, and in some cases, their integrations, instead of acquiring more systems. However, the main limitations are the budget limitations and the lack of capacity to see and take value from these solutions as companies, not individual users. In training, the results indicate that technology vendors assume a vital role in this task. Furthermore, hotel companies are, in general, investing in their employees' training and qualification.

Self-classification is discrepant from reality due to several factors but shows evidence of a connection with the kind of hotels respondents use for benchmarking.

Considering the ISM itself, this research was, for some hoteliers (interviews indicate 50%), the first contact with this concept. For the ones who knew, they belong to companies placed in the higher maturity levels. Concerning the differentiation between maturity levels, some advanced strategies, like the upselling mentioned in the literature (Davern & Kauffman, 2000), are seen in the higher levels and the integrated analysis. Lastly, this conducts to conclude that not all organizations have the capability to respond to technological changes. All organizations state they are aware of new systems but cannot implement those in their companies.

5.2. TESTED HYPOTHESIS

Based on quantitative research through surveys, the research hypotheses can be confirmed or rejected.

H1: There is a confirmation when addressing the first research question and its hypothesis. On average, independent Portuguese hotels are located on the third maturity stage – integrated, with operational synchronization practices - of the NEC Model, with a classification of 2.73 between one to five.

H2: The maturity level seems to be related to some hotel variables, but not all of them, as the hypothesis suggested. It was not possible to conclude the relationship between the maturity level and the hotel companies' size, measured in the number of hotels, despite identifying a possible relationship in the number of rooms per hotel. A close situation comes up once more in the hotel category, not being attainable to identify a relationship with the maturity level once more. Lastly, with the decision-makers' profile, no pattern can be designed with the position the decision-maker assumes in the company. However, the decision-maker's background is not relevant, but it matters if he/she has one. This means owning a superior education degree might impact the level of maturity and the decision-maker's age, with the younger generations taking hotels for more mature levels. Consequently, the hypothesis is considered rejected, acknowledging, as mentioned in the literature, the profile of the decision-maker impacts the information systems' maturity.

H3: With the third hypothesis, there is a need to divide it into two parts. The first is confirmed, knowing every hotel has a PMS, being the hotel's central system. Also, there is a cause-effect relationship with the maturity level and the number of systems available, and their integrations. As the second part of this hypothesis, only 16 of the companies (21%) possess one of the three latest technologies considered for this research. The number of integrations between different systems is not significantly different since hotels with more information systems will have more integrations. Since the difference is proportional, the H3 is confirmed, except for the integrations between different systems.

H4: Despite having almost a tie, the fourth hypothesis can be confirmed, with 42% of the hotel companies planning to invest in their employees' qualifications next year, a situation that can be explained by the pandemic of COVID-19, which affected Hospitality tremendously. Only about one-third (35%) of the hotel companies have done this during the last years.

H5: Similarly to the H3, H5 needs to be divided into two parts. This initial hypothesis is far from the actual main driver for investment in technology, which intends to be "increase revenue/profits". Simultaneously, the centralization of information, processes, and areas of activities was the least chosen reason, along with having a competitive advantage. On the other hand, the hypothesis was proven to be the main limitation identified by previous studies - not having more budget allocated for more information systems (Cobanoglu et al., 2006).

This study made it possible to validate, based on the NEC model, the positive impact of technology in promoting business maturity and, consequently, in hotels' performance and competitiveness.

5.3. RESEARCH IMPLICATIONS

The present study allows a better understanding of how independent hotels in Portugal are placed in terms of information systems' maturity, including comparing hotels of different characteristics. Portuguese independent hotels can now see what is missing to improve their maturity. Their performance and competitiveness pointed out the industry's problem where technology is the answer to this problem. The present thesis has corroborated this theory while accomplishing its specific goals.

Generally speaking, there is still a long work to do in this matter to change the mindset of hoteliers, especially decision-makers, to see technology rather as an investment instead of a cost. Hence, if Portuguese independent and small hotel chains decide to go after the NEC''s recommendation (Piccoli et al., 2011), corroborated by these research's results, they will invest in information systems, integrate the different systems available, ensure qualification for their staff to use these tools, and optimize their performance and operations. Therefore, a take less reactive attitude and instead, a more proactive attitude towards management.

5.4. LIMITATIONS

Like other studies, this one also faces its limitations. First, as the research center is information systems for hotels, it was hard to find literature on individual systems. Either because they are not very popular or very recent, or simply do not exist. As an example, online check-in and check-out precluded the research of these systems. This leads to a second limitation: how a study about technology becomes obsolete very quickly, according to Bilgihan, A., Cobanoglu C., and Miller, B. So, the study might not be applicable in long-term research (Bilgihan et al., 2007).

There is a need to remind the study to focus on technology, which is a constant change, leading to the NEC Model (Piccoli et al., 2011), perhaps to need revision or even misfit the current Portuguese context. Incongruities of 65% are registered, and very few answers were collected for levels two and four of maturity.

Furthermore, it is challenging to investigate many questions to evaluate each stage's detail due to the respondents' limited availability. Lastly, it is essential to refer to the challenge of gathering the initial number of interviews planned. The plan was to interview different profiles besides the sales/revenue professionals, who proved to be harder to reach.

5.5. FUTURE RESEARCH

As per future research, the suggestion is to segment the research more, focusing on newer information systems instead of the entire pool of the existing systems.

On the other hand, scrutinize the incongruities registered: what hoteliers think and know about information systems' maturity to clarify why there are so many discrepancies between the classification and their self-classification. Moreover, the accuracy of classification can be studied regarding the decision-maker's profile or even the respondent. It would be possible to see which kind of profiles are more aware of the information systems' maturity concept, as it was started with the interviews for the present research.

Overall, it would be especially interesting to use machine learning capable of predicting the hotel's maturity level, given the hotel's characteristics, decision-maker profile, and the portfolio of information systems in the hotel from a more significant data set of hotels. This would allow setting deeper the patterns of information systems in various types of hotels. Thus, hotels could benchmark better and compare themselves to their competition. Plus, technology vendors could target their clients better and quickly identify the gap in order to improve their performance.

Once this investigation is applied in other countries or regions, there is the need to adapt to the hotel context, namely the weight of independent hotels and hotel types.

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7. APPENDICES

7.1. APPENDIX I - SURVEY QUESTIONS

Introduction to the survey

This survey is done in the context of an investigation presented as a requirement to obtain the Master's degree in Information Management. Its availability for the research "Mapping of Information systems' maturity in the Portuguese hotel industry." This survey takes approximately 5 to 7 minutes to complete. All responses will be collected anonymously.

Part I – General Information

1. Respondent's position:
    - Reservations Manager
    - Sales Assistant
    - Revenue Manager/e-Commerce
    - Operations Director
    - Sales Manager
    - General Manager
    - CEO
    - CFO
    - Company Owner
    - IT Manager
    - Other
2. Position of the technology decision-maker
    - Reservations Manager
    - Sales Assistant
    - Revenue Manager/e-Commerce
    - Operations Director
    - Sales Manager
    - General Manager
    - CEO
    - CFO
    - Company Owner
    - IT Manager
    - Other
3. Decision-maker background
    - Business
    - Hospitality
    - IT/Systems
    - None
    - Other

4. Decision-making age (years)
    - 18-30
    - 31-40
    - 41-50
    - 51-60
    - 61-70
    - >71
5. Hotel Name/Hotel organization name _____
6. Numbers of hotel units managed by the organization_____
7. Total number of rooms/accommodations managed by the organization_____
8. Mark in which category types the organization has hotel units:
    - 1 or 2 stars
    - 3 stars
    - 4 stars
    - 5 stars
    - Aparthotel
    - No official rating
9. Mark the regions (NUTS II) where the organization has hotel units
    - North
    - Center
    - Lisbon
    - Alentejo
    - Algarve
    - RA Madeira
    - RA Azores
10. Do you have any major hotel brands represented in your competition?
    - Yes, in my direct competition
    - Yes, even though he's not my direct competitor.
    - No

Part II – Information Systems in the Hotel

11. The maturity of information systems can be defined as the "growth and development of IT infrastructure and its operation". Please rate on a scale of 1 to 5 what you think is your level of maturity of your information systems.
    1___ 2___ 3___ 4___ 5___

12. Please point out the systems you use in your hotel company
    - Accounting applications

- Channel Manager
- Chatbots on the Website
- Customer Relationship Management (CRM)
- Online Reputation Management
- Global Distribution System (GDS)
- Booking engine
- Points of Sale (POS)
- Property Management System (PMS)
- Rate Shopper
- Revenue Management System (RMS)
- Electronic locking system
- Interactive communications system
- Energy Management System
- Human Resources System
- Others:_____

13. Compared to the last three years, in the next 12 months, does your organization plan to invest more in information systems?
    - No. We intend to invest less
    - Up to 10% more
    - Up to 25% more
    - Up to 50% more
    - More than 100%

14. If your answer to the previous question (13.) was that you would invest more, indicate which systems you intend to implement.
    - Accounting applications
    - Channel Manager
    - Chatbots on the Website
    - Customer Relationship Management (CRM)
    - Online Reputation Management
    - Global Distribution System (GDS)
    - Booking engine
    - Points of Sale (POS)
    - Property Management System (PMS)
    - Rate Shopper
    - Revenue Management System (RMS)
    - Electronic locking system
    - Interactive communications system
    - Energy Management System
    - Human Resources System
    - Other: _____

15. Of the systems you have, which ones are integrated with your PMS?
    - Accounting application
    - Channel Manager
    - Chatbot on the Website

- Customer Relationship Management (CRM)
- Global Distribution System (GDS)
- Booking engine
- Points of Sale (POS)
- Revenue Management System (RMS)
- Electronic locking system
- Interactive communications system
- Human Resources System
- Others: _____

16. Of the systems you have, which ones are integrated with your Channel Manager?
    - Chatbots on the website
    - Customer Relationship Management (CRM)
    - Global Distribution System (GDS)
    - Booking engine
    - Points of Sale (POS)
    - Property Management System (PMS)
    - Revenue Management System (RMS)
    - Outros: _____

17. In the next 12 months, does your hotel organization plan to integrate more information systems, whether current or future hiring?
    - Yes, as early as next year.
    - Yes, between 1 and 3 years.
    - We haven't made the decision yet.
    - No.

18. Has your hotel organization invested in the qualification of employees in technological skills in the last three years?
    - Yes, more than 3 times in that period.
    - Yes, between 1 and 3 times in that period.
    - Only the training given by the technology suppliers themselves.
    - No.

19. Does your hotel organization intend to invest in employees' qualification in technological skills in the next 12 months?
    - Yes, more than three times in that period.
    - Yes, between 1 and 3 times in that period.
    - Only the training given by the technology suppliers themselves.
    - No.

20. What are the main reasons for your organization to hire a new information system? Please select the three main reasons.
    - Reduced time spent on daily tasks
    - Have a competitive advantage over the competition
    - Centralize information, processes, and areas of activity
    - Increase Sales/Revenue and/or Profitability

- Provide a better experience for our guests
- Manage distribution more effectively
- Have more information for better decision making
- Reinventing ourselves and being closer to digital transformation

21. What is the main reason for your company to hire a new information system? Please select one reason.
    - Reduced time spent on daily tasks
    - Have a competitive advantage over the competition
    - Centralize information, processes, and areas of activity
    - Increase Sales/Revenue and/or Profitability
    - Provide a better experience for our guests
    - Manage distribution more effectively
    - Have more information for better decision making
    - Reinventing ourselves and being closer to digital transformation

22. What are the main limitations for your organization to hire more information systems? Please select the three best reasons.
    - We see no value in other systems we know
    - We don't know the potential of other systems
    - They seem too complex for our structure
    - We don't have a budget for more systems
    - We don't want to use more tools
    - We don't have qualified and qualified personnel to use the tools
    - We do not want our information to be accessed by third parties (system providers)

23. What is the main limitation for your organization to hire more information systems? Please select only one reason.
    - We see no value in other systems we know
    - We don't know the potential of other systems
    - They seem too complex for our structure
    - We don't have a budget for more systems
    - We don't want to use more tools
    - We don't have qualified and qualified personnel to use the tools
    - We do not want our information to be accessed by third parties (system providers)

Part III - Maturity of Information Systems

24. In your organization, are operational decisions made only by a single decision-taker?
    - Yes
    - No

25. Are there frequently organized performed practices in order to improve?
    - Yes
    - No

26. Are the principal business operation activities synchronized?
    - Yes
    - No

27. Does the analytical work exceed independent report practices from daily operations?
    - Yes
    - No

28. Have the capacity to compound, rearrange systems and assets while the organization and markets change from the technological perspective?
    - Yes
    - No

If you would like to receive the results of this study later, you can provide your email address: _____

7.2. APPENDIX II - INTERVIEW SCRIPT

Introduction to the interview

This online interview will be conducted in the context of research to complement the completion of the Master's degree in Information Management by NOVA IMS. The research's theme is the mapping of the maturity of hotel information systems in Portugal. Answers will be collected exclusively for the present study and anonymously in the results of the study. The interview has 19 questions and has a duration of about 30 minutes. Right now, I want to thank you for the time available.

Do you authorize the recording of the interview?

1. Name, Region, Hotel, #rooms, #hotels
2. What tasks/responsibilities are inherent to you in your organization?
3. Which information systems does your hotel have?
4. Out of these, which ones do you use regularly and for what (minimum once a month)?
5. Which system do you use the most (minimum once a week)?
6. How do these systems help you to perform tasks?
7. Do you have systems integrated? If so, which ones?
8. If you answered the previous question in the affirmative, which integration features do you use?
9. Out of the systems you use, which ones were chosen by you?

10. In your opinion, would you need more information systems in your activity? What about your company? Please state why.
11. Out of the systems you use, have you been trained to use them correctly?
12. Usually, systems, especially software, are going in changes over time. How does your company keep track of these updates? Are there regular developments on the solutions?
13. Has your company provided free training during the last year, at the technological level, in addition to that provided by the suppliers of information systems? If so, give examples.
14. Before being in touch with this investigation, have you ever heard of the concept of information systems' maturity? What did you know about this?
15. If you answered the survey, indicate which rating you gave to your company's information systems' maturity level and why you chose that classification.
16. In your opinion, why urge limitations to arise to be at the next level of maturity? Do you think your organization can easily overcome these limitations?
17. In your organization, what are the various organized practices often implemented to improve performance?
18. How are the demand generation, electronic distribution, and revenue optimization sectors synchronized in your organization?
19. What types of integrated analysis are made, complementary to individual reports?
20. How is your organization responding to technological changes in the market?

[i] Norte: this region is located in the North of Portugal. It is more traditional, having Porto (the second biggest city in the country) as its economic driver. Tourism is essentially leisure and with many small hotels and rural hotels.

[ii] Centro: Centro (translated from Center) is a vaster territory. It gathers more districts, making it more diverse from leisure cities to small municipalities driven by small regional corporations. Tourism is significantly associated with thermal waters and religious tourism in Fátima. The average length-of-stay in Centro is 1.7 nights, the smallest in Portugal, as well as occupancy rates (Galhardas et al., 2019).

iii Lisboa: Translated from Lisbon, this is the capital of Portugal and the biggest city. It is a very dynamic city, with a broad spectrum of hotel types: big international brands, small Portuguese hotel chains or independent, and many guesthouses or hostels. Lisbon is the region with more accommodation units, the highest occupancy rate, and average daily rate

(ADR) in the country, competing directly with other central European capitals (Galhardas et al., 2019).

iv Alentejo: Alentejo is the most rural area in Portugal. It is significantly associated with big homesteads and small familiar accommodations, segmented for leisure travelers with very seasonal tourism.

v Algarve: Like Alentejo, Algarve has the most seasonal tourism. Located in the very south of Portugal, it is famous for its sun and beach, which attracts very diverse leisure travelers. Aparthotels with one or two stars until super-luxury resorts make Algarve diverse, one of the favorite beach destinations in Europe, especially among Germans and British. Algarve is hugely economically dependent on tourism.

vi Região Autónoma da Madeira: Madeira is one of the Portuguese archipelagos located south of the Continent. Sunny, tropical, typical. Madeira is famous for its landscapes and festivities. With the average highest size of hotels, Madeira has an average high occupancy rate, and its tourists stay on average longer, 5.1 days (Galhardas et al., 2019). Similar to Algarve, Madeira relies a lot on tourism to be economically sustainable.

vii Região Autónoma dos Açores: Translated for English as "Azores", has a more recent growth than Madeira, with the lowest occupancy rates, the average length of stay, and ADR (Galhardas et al., 2019).