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**Information System for Real Estate Agencies in North of Portugal**

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## **Abstract**

The main objective of this work is to study the importance of the Information System in real estate agencies, both short-term, long-term rentals, sales, purchases, and their clients. We realize that an Information System is not only people but also processes, data, hardware, and software. Using the services of a real estate agency brings many advantages - both from the point of view of homeowners and tenants. However, it is important to remember that cooperation with an agent also involves certain obligations. The main task of a real estate agency is to help you rent, sell, buy or simply announce your property, which they offer to both parties in the transaction. This is because the services of realtors can be used by both flat owners and tenants who are looking for accommodation. Consequently, it is a wilful activity. The Information System is divided into individual chapters such as the Decision Support System, which is an organized collection of people, procedures, databases, and devices that support problem-specific decision making. The work of Real Estate Agencies is based on Business Intelligence, as it requires methods and programs to collect and structure a big amount of data. It also requires the use of a Management Information System, Executive Information System, Transaction Processing System, and Security, as it contains a lot of sensitive information. The hypothesis of this work assumes that the Information System for real estate agencies in the north of Portugal is not sufficiently developed and will still need many more years to gain the confidence of the public of this service in this region. The methods utilised for this dissertation is a combination of questionnaires In addition, the data for this paper began to be collected individually, in November 2021. Moreover, some data to give a better picture are presented in tables and charts. All the information and data necessary for the study were appropriately archived. To present the data, the most common methods used were to divide the responses into percentages and proportions with reference to the population of the northern part of Portugal.

**Keywords:** Information System, Information Technology, Real Estate, Modern Technology, Digital Transformation.

## Resumo

O principal objetivo deste documento é estudar a importância dos Sistema de Informação nas agências imobiliárias, tanto a curto prazo, quanto a longo prazo, vendas, compras, e clientes. Compreendemos que um Sistema de Informação não é apenas pessoas, mas também processos, dados, hardware e software. A utilização dos serviços de uma agência imobiliária traz muitas vantagens - tanto do ponto de vista dos proprietários como dos inquilinos. Contudo, é importante lembrar que a cooperação com um agente também envolve certas obrigações. A principal tarefa de uma agência imobiliária é ajudá-lo a alugar, vender, comprar ou simplesmente anunciar o seu imóvel, o que eles oferecem a ambas as partes na transação. Isto porque os serviços dos agentes imobiliários podem ser utilizados tanto por proprietários de apartamentos como por inquilinos que procuram alojamento. Consequentemente, trata-se de uma atividade intencional. O sistema de informação está dividido em capítulos individuais, tais como o Sistema de Apoio à Decisão, que é uma coleção organizada de pessoas, procedimentos, bases de dados, e dispositivos que apoiam a tomada de decisões específicas de problemas. O trabalho das Agências Imobiliárias baseia-se na Business Intelligence, uma vez que requer métodos e programas para recolher e estruturar uma grande quantidade de dados. Requer também a utilização de um Sistema de Informação de Gestão, um Sistema de Informação Executiva e um Sistema de Processamento de Transações e Segurança, uma vez que contém muita informação sensível. A hipótese deste trabalho pressupõe que o Sistema de Informação para agências imobiliárias no norte de Portugal não está suficientemente desenvolvido e ainda vai precisar de muitos mais anos para ganhar a confiança do público deste serviço nesta região. Os métodos utilizados para esta dissertação são uma combinação de questionários. Além disso, os dados para este trabalho começaram a ser recolhidos individualmente, em Novembro de 2021. Além disso, alguns dados para dar uma melhor imagem são apresentados em tabelas e gráficos. Todas as informações e dados necessários para o estudo foram devidamente arquivados. Para apresentar os dados, os métodos mais comuns utilizados foram a divisão das respostas em percentagens e proporções com referência à população da parte norte de Portugal.

### Palavras-chave:

Sistema de Informação, Tecnologia da informação, Imobiliário, Tecnologia Moderna, Transformação Digital

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## Introduction

Today, innovation is the keyword for organising social and economic life. More and more companies are developing innovation strategies. Without a doubt, managing real estate agencies is not easy at all. Heads of companies have many responsibilities that in corporations would normally be split between several people. How do they find their way through the chaos of acquiring new leads, trying to keep cash flowing, and managing tasks effectively? New technologies that support entrepreneurs come to the rescue. How new technologies can be useful for company bosses, as well as other busy employees. This document presents the collected results of a survey conducted on 21 real estate agencies in the north of Portugal. In order to better understand the activities of these agencies, larger and smaller companies were considered. To encourage participation in this questionnaire, the researcher went to the premises of these agencies individually. Of the 25 companies taken into account, it was possible to obtain responses from 21 companies, which still gives an understanding of the operating system from an IT perspective.

The main objective of this work is to study the importance of Information Systems in real estate agencies, both in the short and long term, sales, purchases, and their customers. This study is important because the real estate sector is constantly evolving and demand at this market will continue to grow. It is also inevitable that information systems will offer more and more diverse and modern solutions to the market. In today's world, success is made possible by the use of modern technologies. Without them, it is inevitable that the development of a particular development will come to a halt.

The restrictions imposed in order to combat the COVID-19 pandemic have placed many businesses in a challenging situation overnight. In Portugal, in line with the strategy of limiting human contact as much as possible, it was decided to close most service establishments that require direct contact between people or the gathering of natives in a common area. In turn, the closure of schools and kindergartens at the beginning of spring meant that some workers with young children had to take personal care of them. For those who stayed at work, remote access was recommended, which had previously been standard in a few companies, and never on this scale. Colloquially speaking, it was thanks to the pandemic that many employees switched to remote working, with the resulting increased interest in, and development of, new information systems and new technologies. The spread of teleworking is mainly influenced by technological progress: better access to broadband Internet, relatively low prices of electronic equipment, and the abundance of tools for organising remote work. Among the most important are electronic messengers. They allow a faster exchange of ideas than e-mail, the creation of public and private groups (ex. Slack), as well as voice and visual communication (ex. Skype or Facebook Messenger). There are also tools that allow online video conferencing without having to install software on your computer (ex. Appear, Zoom). Just by sending a link, you can invite your guests to a virtual room - an invaluable solution when working in a larger team. When asked how their



employees most often communicate with each other, all the agencies surveyed said they constantly use regular mobile networks such as Vodafone, NOS and WTF.

Questionnaires were used during the study. Thanks to this survey, it was possible to obtain an overall assessment of the acute state of information systems in estate agencies in the north of Portugal.

# 1. Framework

This paper is referring to many recent scientific papers, books, articles and dissertations, which are related directly to the information system and information technology area. There are so many resources in this area that it is impossible to count them, which brings a good signal for future research. Just when we type in Google the title Information System, the program gives us 11790000000 results in 0.68 seconds (Google - IS, n.d.). When we type in Google “Agências Imobiliárias em Portugal”, which from Portuguese translation means Real Estate Agencies in Portugal we can get 4350000 results in 0.52 seconds (Google - Agências Imobiliárias PT, n.d.). Being aware that the subject matter covered in this study is constantly expanding when searching for materials, the university library was also consulted, although 90% of the bibliography used in this study was taken from online sources. Furthermore, with this study we are not able to determine until when it will last and how long we are able to study it. Given that information systems as well as real estate agencies are constantly evolving markets, there will certainly be an opportunity and a need for a similar study in this area in the future.

General information relating to the subject of information systems, or new technology systems, can be found everywhere, not only in the local, but also in the global sphere. Therefore, we can categorise it as ubiquitous knowledge. In the case of real estate agencies, however, as the title says, the scope has been narrowed down to the northern part of Portugal, so the author has had to research this environment on his own, as the subject of information systems in the real estate agency sphere in this part of the country has not yet been written about, or perhaps has not been published by anyone before (Brancheau & Wetherbe, 1987).

As the real estate market is constantly growing and the number of such companies is really high, this shows that there are more and more customers. Considering the town of Bragança, in the upper part of the country, which officially has a population of around 35,000 people, the survey found that there are more than 23 real estate agencies actively operating in such a small town. In addition, more than once it was possible to hear from student groups or immigrants and even the local community that the real estate sector is faltering in terms of IT. Hence, the decision to undertake this study and find out what the current situation is in this sector (Rainer & Prince, 2001). As everyone needs a roof over their head, real estate tends to be of interest to every adult to a greater or lesser extent. Therefore, it is likely that this type of research will find its audience (Teixeira, 2009).

## 1.1. The importance of an Information System and Information Technology

The author of six books and a Ph.D. in Computer Science from Columbia University Vladimir Zwass in his publication briefly explains that the information system is “an integrated set of components for collecting, storing, and processing data and for providing information, knowledge,

and digital products. Business firms and other organisations rely on information systems to carry out and manage their operations, interact with their customers and suppliers, and compete in the marketplace'' (Zwass, 1992, p 1). Information systems are used to run interorganizational supply chains and electronic markets. We can read it in a brief summary from the scientific website (britannica.com, 2022).

Margaret, Watson, Richard; Cavan and Bruce (1999) in their group work *Managing the three levels of change* add that corporations use information systems to manage human resources, process financial accounts, and to reach potential customers through online promotions. Quite often we can see that corporations are more often built entirely around information systems. As an example, we can cite the hyper-corporation Amazon. This company is continually investing in its development and in the electronic mall. Another good example is the hyper corporation Google. There is probably not a person in the world who is not aware of this company, so it is omnipresent. People from all over the world most often use Google's browser to search for any kind of information, in turn this corporation derives its profit from advertising. Governments are implementing information systems to provide services to citizens in a cost-effective manner (Stair & Reynolds, 2017). Goods such as digital goods should not be overlooked. These include e-books, video products as well as software. Citizens rely on information systems, usually internet-based, for much of their personal lives: socializing, studying, shopping, banking and entertainment (O'Hara, Watson, & Cavan, 1999).

Information System and Information Technology are vital to the management and operation of every company and organization. ''The information systems that society has become so dependent on are typically distributed network systems that consist of components of varying quality that have been integrated to provide services for the end-user'' we can read in the scientific paper (Westmark, 2004, p 6). Even the most intelligent IT system cannot make decisions for people in difficult business situations. However, new technology solutions, being information management tools, are necessary to make the decision as rationalized as possible and to make it in the shortest possible time (Lyytinen, 1987). In the past, the computer was a luxury, today it is an everyday necessity or even a relic. Few of us have a traditional desktop computer at home or at work anymore. Usually, we use modern equipment with an LCD screen or laptops, which we take home with us and everywhere else. The computer is our tool for work, entertainment, and self-development. Nowadays a computer connected to the Internet is a must.

Due to the continuous development of the market economy, increased competitiveness, increasing needs, and also customer requirements, it becomes necessary to manage the company more efficiently. Thus, in order to support this activity, the use of all kinds of information systems technology is becoming more and more common. An information system is a subset of an information system, related to the computer processing of data. The basic functions include collecting, processing, storing, and presenting the information. The development of functional and

structural properties of the system, resulting from the evolution of technical means, methods, and user needs, was the reason for the creation of an integrated information management system. It makes it possible to implement the components of the system in stages. We are talking about a modular structure, for which there is a demand in basically every company or organization, serving individual departments of the enterprise (Executive Support System, 2012). The essence of implementing information technology in manufacturing companies is to support management processes, which is understood as a sequential and multi-stage decision-making process. This is supported by the overall functionality of the systems, enabling the improvement of information and material flow between individual departments, optimal use of resources, and increase in management efficiency.

Information technology has become a vital and integral part of every business plan, among giant corporations. Such sectors maintain databases and mainframe systems for small enterprises that own a single computer information technology plays a role. The reasons for using computer technology in business are management information systems, customer relationship management, communication, inventory, and data management. In the case of communications for many enterprises email is the principal means of communication between employees, suppliers, and customers. Moreover, it was one of the first common ways to communicate at the beginning of internet usage by the population.

### **1.1.1. Characteristics of Real Estate Agencies**

A real estate agency is a company that mediates real estate transactions and its employees are referred to as realtors. Their business is to mediate in the sale, purchase, rental and exchange of real estate. Many agencies also provide additional services such as credit mediation or rental management. The real estate business therefore requires a high level of leadership, education, perseverance and patience from agents, as it is quite a volatile business sector. However, there are several advantages to opening a real estate agency, and it can also be a highly profitable industry.

In the north of Portugal, there are real estate agencies that function independently and also real estate agencies that base their business on franchising. On the one hand, choosing a franchise to open an estate agency can bring great advantages in terms of know-how, partnerships and recognition, as there are several estate agencies in Portugal, in the franchise system, with a high brand reputation and where you can have a greater opportunity to penetrate the market. On the other hand, the person who manages the office in question has less flexibility in setting up and managing the business, as he or she will have to meet certain standard franchise standards. Which also means higher costs such as entry franchise, royalties and a common marketing fund. On the other hand, in the north of Portugal there are many real estate offices that operate independently. What this translates into is that the owner has complete freedom of decision in the

business. However, this model may require more significance. If a new investor is setting up a new company in this market, it is essential at the beginning to do your research and develop a complete business plan that explains the whole business idea and predicts financial viability, as well as a communication and marketing plan. From the very beginning, it is necessary to decide whether the company wants to invest in the traditional real estate market or in the luxury real estate market, which is growing in some areas of Portugal. If you manage an estate agency, it is essential that you have a licence for this type of activity. If you are active as a real estate agent, individually or collectively, it is essential to be in good commercial standing; to have public liability insurance or a financial guarantee or an equivalent instrument that can replace it. Thus, it is a series of a huge number of documents, permits, licenses and articles with which every functioning office is obliged to familiarize itself and keep up to date. This would not be possible without the use of smartphones, computers and, of course, access to the web.

## **1.2. The meaning and the purpose of Information System**

The challenge for managers responsible for the development of IT systems as well as new technologies in a given company is to maintain coherence with the business strategy. Building an effective business organization also means implementing flexible business processes and IT solutions supporting them. Without this flexibility, market success will be increasingly difficult. Moreover, IT solutions should not be treated as specialized tools that only serve to improve the efficiency of an organization's operation (Gorry & Scott Morton, 1971). They are also a company's weapon in building a competitive advantage, which allows it to differentiate offered products and services from the competition, providing it with greater flexibility and supporting the business in solving specific problems. Therefore, today's integrated management support systems, the issues of which are worth getting to know, are of great importance (Gregor, 2006).

The goal for the system information creation and the specific requirements it needs to satisfy. The purpose includes a statement identifying who the information system is for and what it needs to achieve. On logical grounds, there is no compelling reason to argue that development in most cases will need to conduct research in order to define what the actual purpose of the proposed system may be. Such research may include interviewing management on the requirements of the system or surveying potential users of the system (Al-Mamary, Shamsuddin, & Aziati, 2014). Such research may also involve the creation of the problem definition and searching for the solution by the chosen specific team. The purpose for the system information creation and the specific requirements it needs to satisfy. The purpose includes a statement identifying who the information system is for and what it needs to achieve. On logical grounds, there is no compelling reason to argue that development in most cases will need to conduct research in order to define what the actual purpose of the proposed system may be. Such research may include interviewing management on the requirements of the system or surveying potential users of the system.

Research like that may also involve the creation of the problem definition and searching for the solution by the chosen specific team.

There are many advantages of implementing an information system in a company. For example, it facilitates the collection of data or information necessary for the operation of a given process or activity. Another advantage is the improvement of the analysis of the collected data and information. Another task of information systems is the possibility of transforming an unstructured process into a routine transaction or facilitating the introduction of changes to the sequence of the process. A huge benefit is that it enables quick and easy access to the collected documentation of a given agency. Today, even using the basic version of Office Excel, by pressing Ctrl and F simultaneously, we can search for keywords. There is no need to search for documents concerning a given transaction in the office, and what usually comes with it, is a huge amount of lost time. Among the agencies surveyed, 90.48% agreed that they had managed to observe a significant increase in the productivity of their employees with the introduction of newer IT systems. The remainder of the respondents did not know the answer to this question. Nowadays, more and more demands are being placed on employees. All companies agreed that with the use of Information System, the staff increased their capabilities. Modern technologies are proving to be a great help at work. When used appropriately, companies can be significantly improved in every department and almost any kind of work.

### **1.2.1. The types of IS**

Many systems are currently offered by various manufacturers. Entrepreneurs can choose to purchase ready-made or custom-made software. This gives the possibility to individually determine the scope of computerization of the enterprise. Integrated management systems are only a part of IT systems that can be used in an enterprise. Works related to the technical preparation of production may also be supported from the IT side. Production systems may consist of engineering, transaction, management information, and decision support modules. However, the final structure depends mainly on the needs of a particular production system (Flakiewicz, 2002).

A significant number of companies use six different IT systems, each of which has functions that support the management of a specific business unit. As an example of this study, all real estate companies have a huge range of data requirements. So, the main task of the IT systems is to help each individual department. With such a huge store of collected data and messages of various types, it is necessary to manage and organize it properly in order to keep it in order, which certainly contributes a lot to the employees of a given unit in achieving key objectives. If the data collected by an IT system and new technology are relevant and accurate, a company can use them to streamline tasks, detect inefficiencies and improve customer service. Successful companies typically use six different systems to ensure that every aspect of the organization's data is properly managed and used to improve decision-making and problem-solving. Tasks like these can allow an

agency to maintain a competitive edge, find growth opportunities, and maintain a thorough audit trail of financial and transactional data for compliance purposes (Christiansen, 2022).

### **1.2.2. TPS (Transaction Processing Systems)**

Tools used to process different types of transactions and operations, such as banking information systems, booking systems, and billing or invoicing systems, are called transaction systems. They have been developed, among other things, to automate financial operations. The definition of a transaction system is very simple, while in practice, the description of this activity is a bit more elaborate. We can say TPS that it is a registration of many automatic economic events and their recording according to strictly defined rules.

By reading a book by Philip A. Bernstein and Eric Newcomer we can get to know that today's transaction systems are characterized by great diversity, both at the level of architecture and functionality. Nevertheless, certain elements and concepts are common to them and function in virtually every production transaction system (Bernstein & Newcomer, 2009). One of the basic features of transactional systems is the possibility of parallel use of shared data resources by multiple users. This requirement implies the need to use appropriate access control mechanisms, allowing to maintain data integrity despite application errors or system failures. One of the elements allowing the manipulation of shared resources is to have a well-defined processing unit - a transaction.

The simplest example of using TPS by Real Estate Agencies in the North of Portugal is the POS system because payment can be done by card, Apple Pay, or by the most popular nowadays MBWay Application. A big advantage is that people taking part in the exchange are not obligated to use physical money, especially during the pandemic period. Moreover, it is way easier to register and invoice any kind of transaction. This type of system ensures high reliability for its users thanks to the backups it generates and the performance of the programs used. It is definitely a great convenience, as well as a safeguard for customers, as each transaction is documented with a receipt or invoice (Kemme, Pedone, Alonso, Schiper, & Wiesmann, 2003).

### **1.2.3. MIS (Management Information Systems)**

Business managers are looking for answers to basic questions about how to make a profit in the current market and what can be done to increase the efficiency of their business. Running a profitable business is not possible without proper data circulation and communication. Most informed entrepreneurs in the market, and in this case real estate agencies in the north of Portugal, understand the importance of management information. This integral part of running a business is now increasingly popular.

We often hear the saying: "money rules the world". There would be nothing strange in this if it were not for the fact that every employee working in a company has a superior and it is from him that he receives business orders. The final orders come from the people who directly manage the company: the board of directors, shareholders, and owners. It is worth considering what the word "management" means because the literature provides many definitions of this word. The most popular one indicates a set of activities (including planning, decision-making, organizing, leading, i.e. directing people, setting goals, controlling) directed at the organization's resources (human, financial, material, and information) and performed with the aim of achieving the organization's goals effectively and quickly. The decisions made by managers are to direct the company to achieve the highest possible profits. Proper management of an enterprise requires knowledge, experience, and above all, timely management information. Therefore, many companies decide to create a management information system. A management information system is an integrated system of people and applications providing information to support management and decisions. It differs from traditional systems and supports the internal control of the organization. A management information system is created primarily based on the information needs of the recipients, the specifics of a given enterprise, and the type of IT systems used by the company. More and more often ready-made models for managing information in a company, based on various systems, appear on the market. Most often such solutions are expensive and require the support of external entities in the case of modification or extension of reporting needs. Start-up companies usually cannot afford such solutions. It is then a very good idea to create your own system, but it is necessary to assess the possibility of its implementation. Before deciding to implement a management information system, we should pay attention to the costs we will have to incur for it, the assumed return on invested capital, and the information needs of our business. Until now, one of the best solutions was to launch a data warehouse. In this case, however, the biggest barrier is usually the company's technological resources and lack of properly qualified staff, which makes this activity also expensive. The first stages of work on implementing a data warehouse are usually very time-consuming, but in return, we get much more analytical possibilities. Refreshing reports created using this solution will be much simpler and faster ( Imhoff, Galemme, & Geiger, 2003).

Management Information System is an integrated scheme that supports the management with relevant information to run the business efficiently and effectively. Moreover, the core goal is to make raw data into useful information that helps in managerial decision-making. According to Paul Alpar and Aditya N. Saharia, we can distinguish seven functions of a Management Information System. The first function is data capturing, which is the function of gathering information from various sources, which includes being in touch with the customer, arranging the stores, e-commerce, updating sites, mobile shopping, etc. The output of one or more systems like sales, finance, and market analysis operations from digital and social media (Alpar & Saharia, 2009). The second function is data storage. Simply, all data thus collected is stored in a database or in data files. That information usually is stored in various storage media, like hard drives, and DVDs. and recently the most common - cloud-based applications store data on virtual servers. The survey also



asked "Do you store data in physical file on the shelf at the office? ", to which more than half of the companies surveyed (52.38%) answered in the affirmative. In addition to archiving data in physical folders in the office, we can also add more modern solutions that agencies use. 61.90 per cent use data storage devices, such as a desktop computer, laptop or other hard drive. 28.57% of businesses surveyed use cloud options and 9.52% use the rather popular Google Drive. Another essential function of the management Information systems is data processing. Converting raw data into meaningful information is what experts call data processing. This is an important function of MIS as information is the core necessity for achieving competitive advantage. The next function is data and information distribution. What is a competitive advantage distribution of the right data to the right person at the right time is termed information distribution? The information could be in the form of a report, image, message file form, video, or audio. To facilitate comparison, information is presented in the form of charts or tables, or graphs with the help of modern arithmetic, statistics, or simulation. MIS can predict business using historical data as a base. Another important function is forecasting or planning. Reports are generated based only on the enterprise's needs. These reports help management plan in advance. This enables each functional department to work efficiently. The final function of the Management Information System is Control, which helps in monitoring and tracking the operations against organizational plans, the deviation between operations and the organizational plan is analyzed for exercising control.

We can also create our management reporting system using easier-to-use programs (ex. Excel). In this solution we also encounter barriers. Revenue data generally contains a large number of records, which is a definite impediment to producing a report using a spreadsheet.

A well-designed management information system should provide information about the situation within the company, including reports that enable comparison of data over time, ensure maximum usability and functionality for users, and ensure that the benefits outweigh the costs of maintaining the system, which in the current situation related to inflation matters even more because we do not know until when the current market situation will persist.

#### **1.2.4. DSS (Decision Support Systems)**

The need to make decisions has accompanied managerial issues since the very beginning of the history of managing a company or an organization. For years, in the absence of other technical possibilities, decisions were made mainly on the basis of intuition and experience in a given field. The development of IT techniques and their actual application in organizations has only relatively recently made it possible to support the decision-making process on the basis of various data collected by IT systems used in operational activities. This situation opened up the possibility of developing a new field called managerial decision support, which in short is called business intelligence. Initially, this support concerned mainly long-term strategic decisions, over time it has evolved to include medium-term tactical decisions, and more recently it is increasingly helpful in

day-to-day operational activities (Burstein & Holsapple, 2008). This evolution is related to the time required to collect, process, and present the collected information in an appropriate form, as well as, to a large extent, to the growing awareness of the needs on the part of managers and the intensifying market competition (Rud, 2009).

From a collective and rather short work by Rączka, Kowalski, and Gąsiorek, we can read that a decision support system can be defined as a set of applications for collecting, processing, and delivering information to the end-user in order to facilitate accurate decision-making. Regardless of whether a given set of applications can be classified as a decision support system or not, it can be said that a classic solution of this class is built from the following logical components: data warehouse, data prediction system, reporting, data analysis, and data visualization (Rączka, Kowalski, & Gąsiorek, 2007).

It is worth noting here that any decision support system should not be perceived in purely technical terms or as a tool dedicated to providing template reports. The final user of the system - the analyst or manager - is an integral part of the information process, and the success of the management decision support system depends on his or her preparation, involvement, and understanding of the information provided. For the same reason, it is good to see this class of systems as an interactive tool for studying trends, behaviors, or events. Such an approach emphasizes the role of the graphical user interface, combining the presentation of reports with visualization and dynamic analytical examination of the available data.

Decision support systems are a new but rapidly growing field of software for companies competing in the increasingly demanding markets of today's world. Not so long ago these systems were rare, but now they are becoming increasingly popular, and in the near future they will probably become an indispensable tool in the everyday work of real estate agencies. Considering the amount of data, numbers, type of information collected, personal data of a given client, as well as the company's strategic plan, it is necessary to secure and divide the data better and better in order not to hinder the workflow. The success of the company largely depends on the quality and involvement of the managerial staff but equipping this group of employees with appropriate support equipment significantly influences the time spent on handling the decision-making process and its accuracy. An additional important effect of introducing a decision support system is a simplification of control over the company's operations and ensuring process coherence, which is provided by a coherent and easy-to-use application for employees, or a platform or a chat through which designated employees or members of the organization can communicate. All these features make the investment connected with creating a system of this class return quickly, both in a measurable financial form and in an unquantifiable increase in the understanding of the current situation and potential of a given organization.

### **1.2.5. EIS (Executive Information Systems)**

The Management Support System is software that enables users to transform company data into quick and, above all, easily accessible reports. An example of this is the monthly report of each real estate agency. So, each company has its representatives and agents, and each of these groups has its manager. Is it with the help of EIS that reports on sales, rentals, settlements, and other activities are possible in such a quick and easy way? Current statistics show that the most common tool for collecting data and information is the free and easy-to-use Google Platform. Through this amazing software, any part of an organization or a company can make a Google Document, Sheet, or Slides starting from scratch or using a ready template. With Google Forms, it is possible to prepare a quiz, form, or any kind of questionnaire. The big advantage is that the Platform is User-Friendly, without any doubt, either the oldest worker in the company will not be afraid of new technology to use Google Products. Simply from any kind of product provided by Google, anyone with one click can export all collected data in a PDF File and it is a perfect example of usage of the Executive Information System. Moreover, a typical EIS consists of a base of information, an analytic processor, a user interface, a set of tools for eventual maintenance, and an extensive database.

From the article of Błażej Charzyński for scroll.morele.net, we can read that backing up files on memory sticks is a thing of the past, as the era of virtual drives with Google Drive at the forefront has arrived. No special application is required to use this service. All you need is a Google account and to choose the right package. Google Drive is a set of services whose central function is to store files on a virtual medium. It was created in 2012 as part of the expansion of Google's international business. The number of its users was one billion in 2021. It is the most popular network drive in the world. And for good reason - in addition to its standard functionality, it has a large number of additional services developed to enable online document co-creation (Charzyński, 2021).

The Google Drive suite of services is not limited to the functionality of Office programs. It also allows you to store photos and automatically back up the files you choose, which can be a perfect surface for Real Estate Agencies, especially when it is needed to store files that contain the information photos, plans of the buildings, lands, or apartments. Google Drive stores photos in two ways. The first is by simply transferring files to an online storage device (Jones & McLeod, 1986). An alternative and much more convenient option is to use the Google Photos service, which uses the storage you purchase or are entitled to within Google Drive. This is a specially designed application for storing and categorizing photos, using SI (artificial intelligence) capabilities. "In the fourth quarter of 2021, the most popular vendor in the cloud infrastructure services market, Amazon Web Services (AWS), controlled 33 percent of the entire market. Microsoft Azure takes second place with a 22 percent market share, followed by Google Cloud with a nine percent market share. Together, these three cloud vendors account for 64 percent of total spending in the fourth

quarter of 2021. Organizations use cloud services from these vendors for machine learning, data analytics, cloud-native development, application migration, and other services'' (Vailshery L. , 2022, p 1). However, this is the date among the whole Globe, however in Europe Google is the first choice with the final results of 92.33% search engine Market Share in Europe for April 2022 (Statcounter Global Status. Engine Market Share in Europe for April 2022, 2022).

92.33%

Search Engines	Percentage Market Share
<b>Search Engine Market Share in Europe - April 2022</b>	
Google	92.33%
bing	3.43%
YANDEX	1.8%
3 more rows	

**Figure 1.** Search Engines Market Share Europe April 2022.

Source: <https://gs.statcounter.com/search-engine-market-share/all/europe> access from 08.08.2022.

### 1.2.6. BI (Business Intelligence)

Business Intelligence is a collection of practices, activities, and technologies that transform data into useful business information. The essence of BI is based on huge amounts of information, which do not have any value on their own. However, put together, with the use of appropriate mechanisms and presentation techniques, they constitute an excellent material for analysis and predictions in the context of creating a competitive advantage for the company. BI systems have evolved from Management Information Systems, such as management information systems and decision support systems. Furthermore, BI encompasses such areas and technologies as statistics, econometrics, operational research, artificial intelligence, databases, business reporting, analytics, data mining, or benchmarking. Equivalent names may be business intelligence, and business analytics. But these names are often misleading and do not reflect the overall description of the term. Whereas Business Intelligence is a broad category of applications, services, and technologies for gathering, storing, analyzing, and accessing data for decision-making, Decision Support System applications tend to be more purpose-built for supporting specific decisions. Digital transformation is about integrating different technologies such as analytics, cloud computing, the Internet, and artificial intelligence into the various business processes within an organization. These bring about a fundamental change in the way the business operates as well as the way they deliver value to its customers. Technology advancement provides many exciting opportunities for companies to improve their business processes and increase their business

competitiveness. Our Information Systems graduates are equipped with both the business and IT skills to better align technology to meet the business needs.

### **1.3. The components of IS**

We can say that an information system is a combination of software and hardware, adding to this the telecommunication networks that people build to collect, create and disseminate useful data. It defines the flow of information within the system. This is done to facilitate the provision of relevant data, and information to the user, in order to collect these data, process them and possibly transmit them to other users of this system.

We can distinguish 5 components of an information system. The first is hardware, the physical equipment used to input and process information. The structure of the hardware depends on the type and size of a given company. It consists of input and output devices, operating systems, processors, and multimedia devices. It also includes computer peripherals such as a mouse, keyboard, speaker, and the mouse. Considering the amount of accumulated documentation and all kinds of contracts, probably in every real estate office, an indispensable device is a printer, in order, for example, to print a given contract and, after signing, to scan a given document with a scanner. Another component of IS is the computer software, and by extension: the application programs are used to control and also coordinate the hardware components. Its task is to analyze and process the collected information. There is a division of software into 3 types, such as system software, application software, and procedures. The third component of IS is databases. These are basically raw facts and figures that are disorganized and then processed to generate information. Software is used to organize and make information available to the user, managing physical storage media and virtual resources. Just as computer hardware cannot function without software, software needs data for processing. From the website [geeksforgeeks.org](http://geeksforgeeks.org) we can see that data is managed using a database management system. Database software is used to efficiently access the data needed and to manage knowledge bases. The fourth component of IS is the network. In other words, these are network resources that refer to telecommunication networks such as intranets, extranets, and the Internet. This definitely facilitates the flow of data within a company, thanks to which employees, and in this case, estate agency agents, are able to save a lot of valuable time. The work of a real estate agent is very different from the classic full-time job. Flexibility and availability require exemplary time management. Furthermore, networks consist of both physical devices, such as network cards, routers, hubs, cables, and software, such as operating systems, web servers, data servers, and application servers. Furthermore, telecommunication networks consist of computers, communication processors, and other devices connected to each other by communication media and controlled by software. The fifth and final component of information systems is human resources. We are aware that real estate professionals must be verbal, reliable, communicative, and operative. People are the end-users of an information system, end-users use the information produced for their own purposes, and the main purpose of an information system is

to benefit the end-user. People are also responsible for the development and operation of information systems. These include systems analysts, computer operators, programmers, other information systems clerks, and management technicians (Horsburgh, Tarboton, Maidment, & Zaslavsky, 2011).

### **1.3.1. Strategic aspects and elements of the IS environment**

According to the literature, there is a complex relationship between information system assimilation paths, like management control or Enterprise Resource Planning. From the scientific paper of Chapman from 2009 we can read that the mentioned approaches are fundamentally bound up with organizational processes of accounting. Their goal is to organize and track any kind of records (Chapman, 2009). Information system is a multi-level structure that allows the user to transform through models and many procedures, considering output and input kind of data. The computerisation of information systems is an increasingly common way of increasing the efficiency of a management system because, despite the initial expenditure on training, software and implementation, an information system makes it possible to formalize the organizational structure, to increase the span of management, to automate tasks, to provide immediately the information requested, and to facilitate group work in enterprises with multiple departments. In the book of Kisielnicki and Sroka from 2005 we can read that according to management theory, an information system is a set of material means, financial means, algorithms and people, ensuring the efficient management of an enterprise (Kisielnicki & Sroka, 2005). However, in information economics, an information system is defined as a complex of interrelated information processes and an information system is a specific socio-economic system that is always co-created by resources and information in addition to information processes. Information is as important today as the tangible or intangible resources of enterprises. Entities that not only possess information, but also make skilful use of it and achieve an advantage in the competitive market. The value of an information system determines the value of information. The more benefits resulting from the use of information, the higher the value of this system. The value of an information system can be the net income derived from the optimal use of the system.

Jabnoun and Sahraoui (2004) describe transactional systems in a very rich way. They are based on complete, comparable and reliable data, which they process using simple models based on four basic operations. Their application requires computers with large storage capacities for data storage, problem-oriented software, a database management system and programming languages for processing economic data. They can be used for data recording and simple data analysis. The research paper goes on to say that, the management information system uses data that is not always complete and comparable, which it processes using equation-based and input-output models. It is necessary to use computers that allow conversational mode of operation and languages that allow data retrieval. They are used for advanced searching and linking of stored data (Jabnoun & Sahraoui, 2004).

### **1.3.2. The importance of IT and IS in Real Estate Agencies**

The development of information and communication technology is generating technological progress in virtually all areas of life. Our homes are becoming increasingly computerized. Household appliances are based on new technologies, from TV sets, washing machines, fridges, and irons to devices controlling lighting, heating, and monitoring. The Internet has made a huge contribution to the development of civilization. It is a source of knowledge on every subject and has become a powerful tool for communication between people.

Modern technologies in the real estate market are emerging in the wake of the technological revolution, while also being a necessary response to changing consumer needs and demands. Real estate agencies and developers need to constantly evolve and innovate in order to stand out and gain new customers. PropTech technologies are becoming the driving force behind business development in real estate, as we can read in Guttman and Jonathan (2015). Modern real estate technology, or PropTech, is used by property developers, real estate agents, consultancies, appraisers, construction companies, online platforms and property owners, among others. Also playing a strategic role in shaping the PropTech market are providers of off-the-shelf products and solutions, developers of specialized web and mobile applications, who can generally be referred to as technology companies, and investors who financially support the development and implementation of innovative concepts. PropTech is considered to be a complex phenomenon, involving many aspects of the real estate market, and comprehensive. All the technological solutions introduced are applicable to the entire process related to a property - from its design, conception, construction, investment analysis, sales, rental or brokerage transactions, to the operation, control and management of the property. PropTech's pioneering tools and services are being developed to support real estate professionals operating at every stage of a building's existence, to make them more efficient, more effective, to raise the level of service they provide, and simply to replace them in some of their duties. Modern technology does not completely eliminate the work of the real estate agent, but adapts his role to the new situation. The agency employee ceases to be a link between two parties and becomes an expert, a consultant. The estate agent - a provider of ready-made, comprehensive products with minimal formalities and a clear specification of payments. Customer orientation is becoming a priority mission. However, in order to be able to fully provide advisory services, technological solutions are needed, such as remote contact with the client through the use of various platforms and applications (Guttman & Jonathan, 2015).

Due to its fundamentally stable position, the real estate market is not as open and does not adapt innovative solutions as quickly as other sectors of the economy, such as the financial market. Nevertheless, the revolution has also arrived here. To a large extent, this is due to the growing expectations of a generation brought up in a computerized world, intuitively using modern electronic solutions, accustomed to universal access to products that are easy to use and

transparent in terms of payment. The ubiquitous digitalisation, as well as the systematic introduction of technological products providing solutions for construction, urban planning and property management, are not without their significance. Meeting the expectations of today's and tomorrow's customers and optimally adapting the product to their specific needs will be key not only to maintaining a position in the market, but above all to continuing to exist in a fiercely competitive industry. More and more entrepreneurs are realizing that the future of their business depends on the systematic and reliable implementation of modern technologies.

### **1.3.3. Description and analysis of information exchange processes in real estate agencies**

Communication in a company should not be ignored. It is very important that information flows correctly. It is one of the components of a company's success. Therefore, supervisors and employees should care that effective communication is a daily occurrence at the estate agency. It is communication that is one of the paths to success. It is about making sure that the flow of information within the company is correct. If this is not the case, employees show less commitment to their work, are not motivated, chaos reigns and no one actually knows what they are supposed to do or what is going on (Jhansi, 2022).

How do you find out if your company's communication is effective? To start with, it is certainly worth looking at what the channels of communication are, who communicates to whom and why. Most often, employees communicate with their supervisor and vice versa, employees with other employees, supervisors with their superiors. In real estate agencies it is very common for employees to communicate with a third party, the intermediary and of course the client.

Customers are the lifeblood of any business. All business owners must know that without them they cannot prosper in the market. Well, customer contact is a very important element that must be taken care of at every stage of running a business. Today's websites offer us many opportunities to communicate with customers. We can also easily influence web user interactions that will have a positive impact on the business. A well-developed customer relationship is all about growing your business.

### **1.3.4. Information System for Real Estate Agencies**

Real estate agencies are entities that deal in real estate transactions, including the purchase, sale, and rental of buildings, flats, commercial premises, storage or office space, land and other properties. People called agents or brokers work in so-called real estate offices. In the past, this profession was regulated by separate legislation, which meant that you had to pass an examination in order to obtain a license to practice the profession. Today, to become an agent, you do not need to pass a special exam. However, brokers are still required to have insurance and to comply with a



code of ethics. Therefore, an agent must act in accordance with the best interests of both parties in a real estate transaction and the law. He or she must also constantly improve their professional qualifications and perform all activities with special care (The CE Shop Team, 2019).

You can visit a real estate agency, whether you have a property for sale or rent, or are looking for an ideal place to live or locate your business. Property owners may count on an agent to prepare a suitable offer for sale or lease together with photographic documentation and to post it on industry websites. He or she can also help with the valuation so that it is in line with the current market situation and so that both parties - the clients and the real estate agency - benefit from the activity. As a rule, agents take care of showing potential buyers or tenants around and answering their questions. At the final stage of cooperation, an appropriate contract is drawn up to secure the interests of both parties. An agent assists people looking for the right property in a slightly different way. In this case, the client should specify his/her expectations regarding the location and parameters of the property, and the agent will search for and present him/her with the most interesting offers in accordance with the assumed criteria and budget. Then an agent will also take care of the correctness of the purchase or rental agreement.

It may seem like a pleasant and well-paid job, yes, it is, but most people in this industry have to deal with a huge responsibility. That is why the base in such a work environment is a well-managed information management system to follow the workflow and not lose any important documentation. In fact, in the case of this profession, it is difficult to talk about clear advantages and disadvantages, because what for one person is an advantage, for another may be a disadvantage. Everything depends on individual character traits, predispositions, and preferences. One of the advantages is the lack of monotony and routine. Each case is different and you constantly have to learn something new. Therefore, it is a good job for people who like new challenges and treat them as a good test of their skills. On the other hand, someone who prefers a predictable and structured job where all responsibilities are predetermined - may be less satisfied. In such a job, it is compulsory to be flexible, as the workers have to fulfill their time for after work hours of the clients. In order to organize all reunions, scheduled meetings, visits, etc. the most common way to contact each other is a regular network.

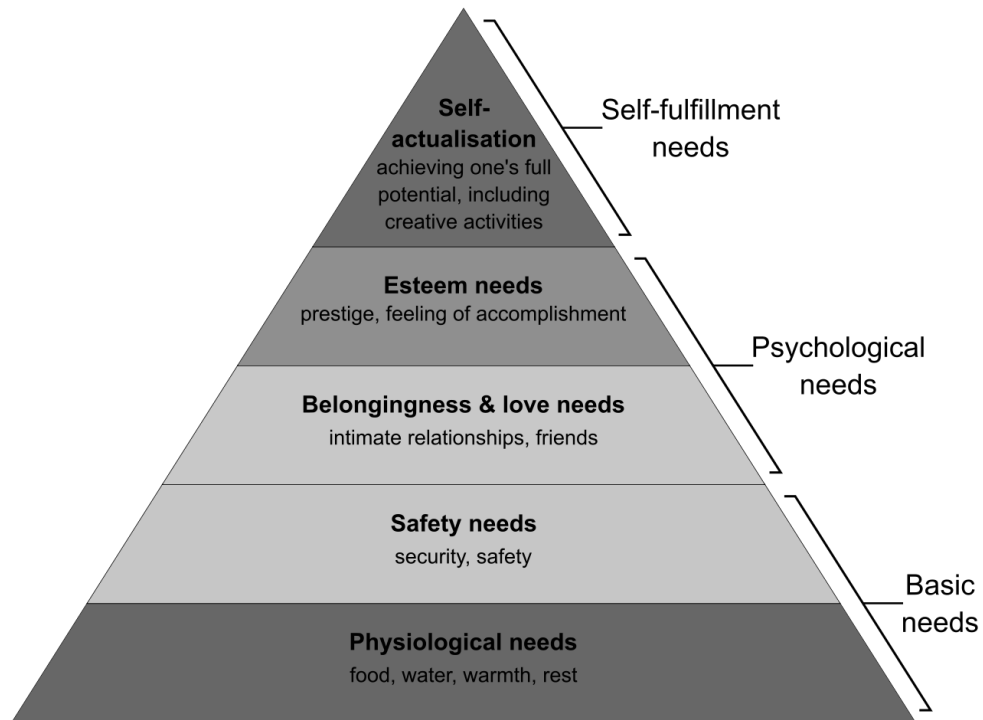
## **2. Research Methodology**

### **2.1. Objective of the study and Research Hypotheses**

The aim of the study is to gain an understanding of the importance of Information Systems and Information Technology. The research is done based on an example of the activity of real estate agencies in the north of Portugal and comparing them to each other, with the point of view of the clients and their knowledge about Information systems and Information Technology. The hypothesis of this work assumes that the Information System for real estate agencies in the north of Portugal is not sufficiently developed and will still need many more years to gain the confidence of the public of this service in this region. The aim of the study is to gain an understanding of the importance of Information Systems and Information Technology. The research was carried out on the example of real estate agencies in the north of Portugal.

The hypothesis of this thesis is that the information system for estate agencies in the north of Portugal is underdeveloped and will need many more years to gain public confidence in this service in the region. It is well known that accommodation is a primary good. As it is a primary need, it proves that the real estate agencies will always have many clients requesting their services. The natives of the North of Portugal were always and will always be in need of accommodation, that is why it is important to proceed with more and more innovative alternatives, using information systems and information technology modern supplies.

No one can imagine life without a roof over their head. Home gives us a sense of security. The need for security is, in Abraham Maslow's terms, one of the primary human needs. This theory is based on the fact that every subject needs to experience a sense of security in order to fulfill other needs. Within the so-called pyramid of human needs (Maslow, A theory of human motivation. Psychological Review, 1943). The security needs developed by Maslow were assigned to the group of basic needs, just above our primary needs such as physiological needs. The fulfillment of the need for security is of great importance for the satisfaction of the next higher needs. By 'needs' we mean the feeling of lacking something that is essential for life and the development of the individual (Maslow, Motivation and personality, 1954).



**Figure 2.** Maslow's pyramid with five levels.

Source: <https://www.simplypsychology.org/maslow.html> (access from 04.09.2022).

Security is at the bottom of the pyramid and therefore forms its foundations. Society has always needed shelter, and it will continue to do so for generations to come. For this reason, the property market will never stop growing. By comparison, if we buy the latest car, straight from the showroom, that car will start to lose value over time. The opposite is true for real estate. In spite of passing trends, in most cases, with the passing of time houses, flats, properties gain in value. Investing in real estate is one of the popular strategies to safely invest capital. At a time when inflation is rising all the time, this way seems to be one of the most profitable. However, in order for the investment to yield the expected return, it is necessary to know what to invest in and how to do it effectively. This is where real estate agencies come to the rescue.

The impact of modern technology on human life has, in principle, been a constant element in the development of civilization. We are talking about many years when innovative technologies become an accelerator of change. Technology and electronics are often associated with over-consumption, ever-increasing electronic waste and negative environmental impacts. Today, however, we see that technological advances are also contributing to a more sustainable, resource-efficient society of the future. The benefits of technology, enjoyed by an increasing number of the world's population, would not be possible without sustainability. Nevertheless, we are also witnessing how environmental pollution and the continued use of our planet's limited resources are increasing with technological progress. The more technologically advanced our society becomes, the faster development progresses, driving the constant consumer demand for ever newer technology - we want the latest mobile phones, laptops, tablets, watches, cameras,

toys and so on. Consumption drives further development and vice versa.

## **2.2. Methodology. Description of Data Collection and Data Analysis**

The methods utilised for this dissertation is a combination of questionnaires gathered through the physical papers and delivering them one by one and storing them in Google products sheets. In addition, the researcher went to each office in person to also conduct a short community interview, ensuring that the materials taken for the thesis would be read in an animated manner, and also greatly exemplifying scientific assistance in the writing of the document. In addition, the data for this paper began to be collected individually, in November 2021. Moreover, some data to give a better picture are presented in tables and charts. All the information and data necessary for the study were appropriately archived. To present the data, the most common methods used were to divide the responses into percentages and proportions with reference to the population of the northern part of Portugal.

This work is focused on the field of new technologies, information systems and their reflection in the real estate sector in the north of Portugal. The problem posed in the paper concerns the question of whether real estate agencies make sufficient use of modern information systems. The paper examines companies in detail. Field work was conducted from November 2021 to October 2022. The document is done by data mining, by collecting a lot of well-organized and stored data. The area of the information system is really wide and it reaches basically everything, basically every single structure, area, destination. Information systems store vast and massive amounts of information. This greatly simplifies the process of finding data, at a faster pace without wasting time. Business Information System facilitates the decision-making process and simplifies the process of providing the required information, thus helping to make better decisions immediately. For a well-executed report, a correctly executed in-depth analysis of the data and information collected is essential. The hypothesis of this documents states that a properly constructed Information System can contribute enormously and can accelerate activities in real estate agencies. It is presumed that the surveyed real estate agencies do not use the full potential and possibilities of modern information systems. No problems were likely to be encountered during the work, apart from the fact that just one company refused to collaborate.

According to the official information from [www.infoempresas.jn.pt](http://www.infoempresas.jn.pt) in Porto district officially there are 12806, however we consider 500, because most of the enterprises are officially registered, however not all of them have the same activity. Many people create companies in order to purchase and sell houses, and thanks to the fact of having own company, they can save a lot in case of taxes. Sample Size is equal 21, as this number of agencies collaborated in the research. In Porto district, the biggest companies, which were taken into consideration are: Era, ReMax, Decisões e Soluções, UNU and Century 21. Porto is a huge city, so there the accommodation service is in quite good position, as the market is growing all the time. Important to mention that

those big companies, are working in entire Portugal, not just in Porto, but in any other cities.

Confidence Level ( $\alpha$ ) = 95%

Sample Size ( $n$ ) = 21

Proportion Percentage ( $p$ ) = 5

Population Size ( $N$ ) = 500

Margin of Error:  $\pm 9.133\%$

The Margin of Error (MOE) is calculated according to the formula:

$$\text{MOE} = z * \sqrt{p * (1 - p) / \sqrt{(N - 1) * n / (N - n)}}$$

Where:  $z = 1.96$  for a confidence level ( $\alpha$ ) of 95%,  $p$  = proportion (expressed as a decimal),  $N$  = population size,  $n$  = sample size.

$$z = 1.96, p = 0.05, N = 500, n = 21$$

$$\text{MOE} = 1.96 * \sqrt{0.05 * (1 - 0.05) / \sqrt{(500 - 1) * 21 / (500 - 21)}}$$

$$\text{MOE} = 0.427 / 4.677 * 100 = 9.133\%$$

The margin of error (with finite population correction) is  $\pm 9.133\%$ .

Mirandela was one of the cities, which was taken into consideration during the reserch. From the research we can conduct that the agencies from there: Riskivector LDA, Casas Comigo, Mirandelense and Predial Habil are cooperating quite a lot with students, thanks to the school of IPB which placed there one of their big departments.

Confidence Level ( $\alpha$ ) = 95%

Sample Size ( $n$ ) = 21

Proportion Percentage ( $p$ ) = 4

Population Size ( $N$ ) = 25

Margin of Error:  $\pm 3.422\%$

$$z = 1.96, p = 0.04, N = 25, n = 21$$

$$\text{MOE} = 1.96 * \sqrt{0.04 * (1 - 0.04) / \sqrt{(25 - 1) * 21 / (25 - 21)}}$$

$$\text{MOE} = 0.384 / 11.225 * 100 = 3.422\%$$

The margin of error (with finite population correction) is  $\pm 3.422\%$

As the thesis paper is presented in Polytechnic Institute of Bragança it was need to take into consideration also that district. We can count around 30 agencies, and most of them are quite successful with their activity. From Bragança the companies, which were willing to collaborate are Ultimo Pilar, Reis & Pimentel, Predial Rua Nova, Predial Rua Direita, Visão geral, Multiconfiança and others.

Confidence Level (a) = 95%

Sample Size (n) = 21

Proportion Percentage (p) = 12

Population Size (N) = 30

Margin of Error:  $\pm 7.743\%$

$z = 1.96$ ,  $p = 0.12$ ,  $N = 30$ ,  $n = 21$

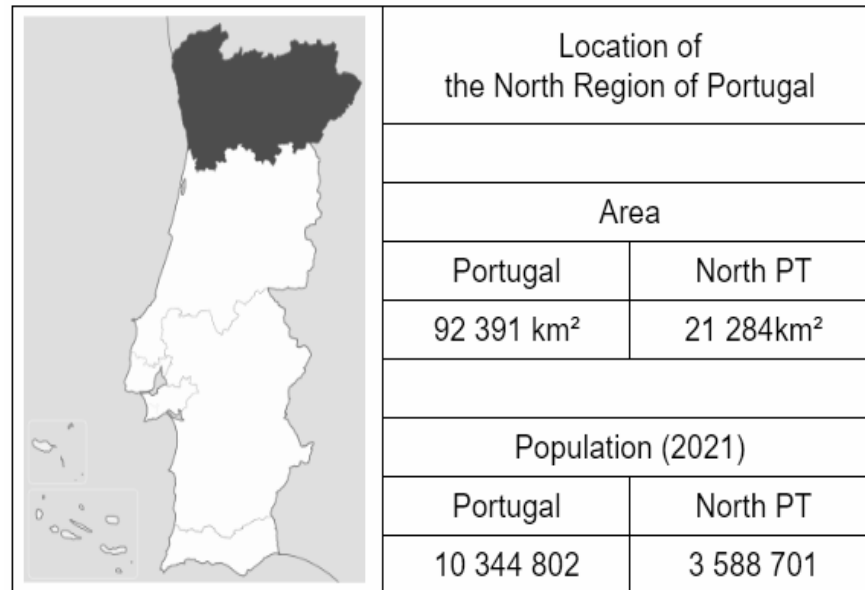
$$\text{MOE} = 1.96 * \sqrt{0.12 * (1 - 0.12) / \sqrt{(30 - 1) * 21 / (30 - 21)}}$$

$$\text{MOE} = 0.637 / 8.226 * 100 = 7.743\%$$

The margin of error (with finite population correction) is  $\pm 7.743\%$

### 2.3. Population vs. Sample and Case Study of Real Estate Agencies in North of Portugal

Speaking of the north of Portugal, we can mention cities such as Porto, Vila Nova de Gaia, Braga, Gondomar, Rio Tinto, Póvoa de Varzim, Matosinhos, Maia, Guimarães, Vila do Conde, Vila Real, Mirandela, or Bragança. As a matter of comparison, Lisbon, which is the country's capital, has twice the population of the city of Porto.



**Figure 3.** North Region of Portugal.

Source: Adapted from <https://www.citypopulation.de/en/portugal/cities/> (access from 04.09.2022).

From the table, we can deduce that the northern region of Portugal is home to roughly 35% of the country's population. The Northern Region has an official 54 cities, 27 of which are in the Área Metropolitana do Porto sub-region, followed by the Tâmega e Sousa sub-region with seven cities, the Douro sub-region with five cities, the Terras de Trás-os-Montes and Ave sub-regions with four cities, the Cávado sub-region with three cities and the Alto Minho and Alto Tâmega sub-regions with two cities.

### População residente: total e por grandes grupos etários (%)

Qual a percentagem de jovens, idosos ou pessoas em idade activa?  
Indivíduo - Proporção - %

Anos	Grandes grupos etários			
	Total	0-14	15-64	65 ou mais
2013	100,0	14,7	65,7	19,6
2014	100,0	14,5	65,5	20,1
2015	100,0	14,2	65,3	20,5
2016	100,0	14,1	65,0	20,9
2017	100,0	13,9	64,8	21,3
2018	100,0	13,8	64,6	21,7
2019	100,0	13,6	64,4	22,0
2020	⊥ Pre 100,0	⊥ Pre 13,2	⊥ Pre 64,0	⊥ Pre 22,7
2021	Pre 100,0	Pre 12,9	Pre 63,6	Pre 23,5

População residente: total e por grandes grupos etários (%)  
Fontes de Dados: INE - Estimativas Anuais da População Residente  
Fonte: PORDATA  
Última actualização: 2022-08-22

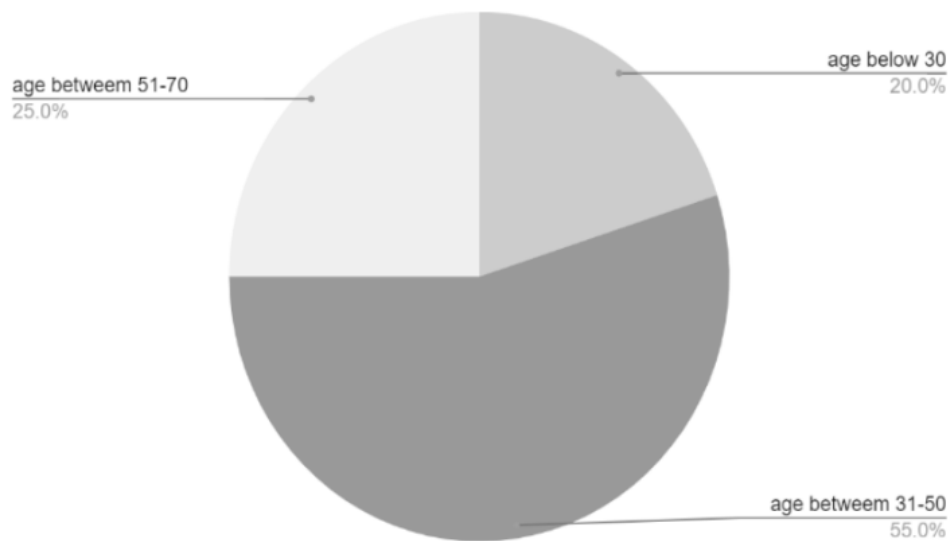
**Figure 4.** Population in Portugal (Source: Pordata).

Source: <https://www.pordata.pt/db/portugal/ambiente+de+consulta/tabela> (access from 04.09.2022).

The northern region of the country includes 3 cities with more than 100,000 inhabitants; 3 cities have between 50,000 and 100,000 inhabitants; 17 cities have between 20,000 and 50,000 inhabitants; 17 cities have between 10,000 and 20,000 inhabitants; and 14 cities have less than 10,000 inhabitants (Portugal, Ambiente, 2022).

Last year's figures, i.e. 2021, state that children up to the age of 14 made up 12.90 per cent of the population and those over 65 years of age 23.50 per cent. The largest age group in the country, at 63.60%, is between 15 and 64 years of age.





**Figure 5.** The biggest age group of respondent agencies.

Source: Author's own elaboration.

This diagram shows that the largest customer group among the companies surveyed is between 31 and 50 years of age. As many as 55% of the agencies surveyed identified this age group as the largest. The next largest group, mentioned by as many as 25% of the companies surveyed, is between 51 and 70 years of age. Only 20% of the companies surveyed indicated an age group below the age of 30. The north of Portugal brings together many groups of people. They are not only Portuguese, but also expatriates, which includes many temporary visits and a big tourist movement. Working people, and recently Portugal has been welcoming more and more students. Thanks to a thriving academic education system, the northern market is definitely gaining more young people. Having interviewed real estate agencies, it appears that a large proportion of rented accommodation is occupied by university students, but real estate agencies in most cases sign all agreements with the parents of these students, or if the parent is not physically able to attend, then the companies in a large number of cases ask for an additional endorsement from an authorized person to avoid unwanted problems. Of course, printing documents on a massive scale is still the order of the day, because what's on paper is on paper. And there will be those who say that the solid armored cabinets that can still be found in offices, for example, are the best place to store confidential information (Martinez-Mesa, Gonzalez-Chica, Duquia, Bonamigo, & Bastos, 2016).

In the survey conducted for this document, offices were asked whether the information system had helped to speed up internal communication, to which 42.86% of respondents answered in the affirmative. It then asked whether the information system was adequate enough to keep pace with the dynamic business environment, resulting in 14.29% of respondents answering in the affirmative. One of the questions posed in the survey referred to the technology for managing all the company's relationships and interactions with customers. The response was that only 19.05% of

the companies surveyed had developed this type of management. 28.57% of the companies surveyed provide online services to the customer and only 23.81% agree with the statement that the information system creates extensive opportunities for market promotion within the company.

A further question posed in the survey was that modern information systems contribute to the detection of inaccuracies, as well as showing erroneous results in calculations. Of these, less than a fifth of the companies surveyed, only 19.05%, answered in the affirmative. It appears that, despite this high capacity for calculation, the companies in the north of Portugal that we deal with prefer to check all calculations manually or with a calculator. It is fair to say that on most of the desks in the real estate offices we visited, a classic simple calculator caught our eye (Hasselbring, 2000).

### 3. Presentation and Analysis of Results

#### 3.1. Sample Profile

To give a tidy picture of the companies that took part in this study, 42.86% of the agencies surveyed are local businesses, while 57.14% of the agencies surveyed base their business on franchising and therefore have to follow the patterns set by the central departments of that company. When we talk about franchise companies in this survey, we are not only referring to Portuguese companies, but also to the larger international companies that we see operating in other European countries.

**Table 1.** Number of employees in surveyed companies.

How many workers does the company have?	
No salaried workers	4.76%
1-5	57.14%
6-10	28.57%
11-15	4.76%
15-20	0.00%
20 and more	4.76%

Source: Author's own elaboration.

The first inquiry asked to the estate agencies in the questionnaire was about the number of employees. This was an important question to investigate, as it gave us an outline of which surveyed companies in the north of Portugal we were dealing with. As we can see in Table 2, 57.14% of the companies work with a system of 1-5 employees, which means that the most common type of the enterprise in this area in our region is the micro company.

**Table 2.** Medium age of workers in surveyed agencies.

30 years old and less	14.29%
31-40 years old	23.81%
41-50 years old	52.38%
51-60 years old	9.52%
61-70 years old	0.00%

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70 years old and more

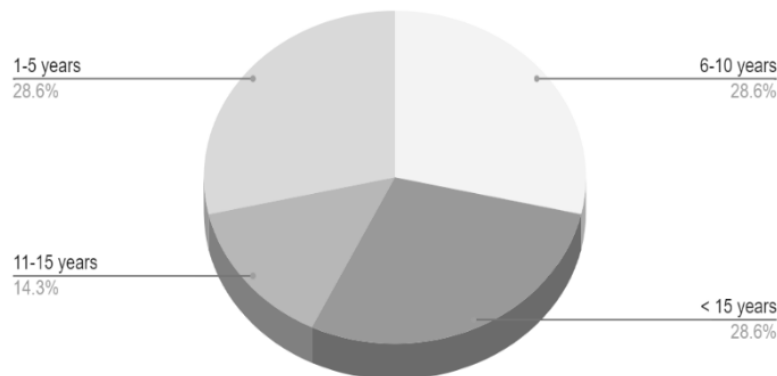
0.00%

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Source: Author's own elaboration.

Another question asked during the survey concerned the average age of those employed. The table shows that more than half (52.38%) of the employees are between 41 and 50 years of age. The next largest group (23.81%) is made up of employees between the ages of 31 and 40. The third group (14.29%) is made up of younger workers with an age of 30 years or less. The smallest average age group (9.52%) according to our surveyed companies is between 51 and 60 years of age.

According to our surveyed entrepreneurs, the most important qualities that every estate agency should be guided by are mutual respect, conservatism, mutual support, orderliness and development. All agencies responded unanimously that a particularly important part of success is good management, procedures and a close-knit team.



**Figure 6.** IS among the companies surveyed.

How long has the company been using IS?

Source: Author's own elaboration.

The results of the survey show how differently companies function in the market. 28.6% of the companies surveyed confirmed that they have been using information systems in their company for approximately 1 to 5 years, 6 to 10 years and more than 15 years. On the other hand, 14.3% of the surveyed offices said that they have been using IT systems for between 11 and 15 years.

The development of modern technology opens up many opportunities and underpins the complex systems that drive the economy in key sectors such as energy, finance, transport or healthcare. Many business models rely on innovation, technological development and the smooth functioning of information systems. Interrupting these, or failing to access already known resources, would undoubtedly negatively affect human lives and lead to billions of dollars in take-offs.

Smartphones, tablets, social media and cloud computing have created many opportunities for companies to grow, but at the same time they have become a cause of increased information

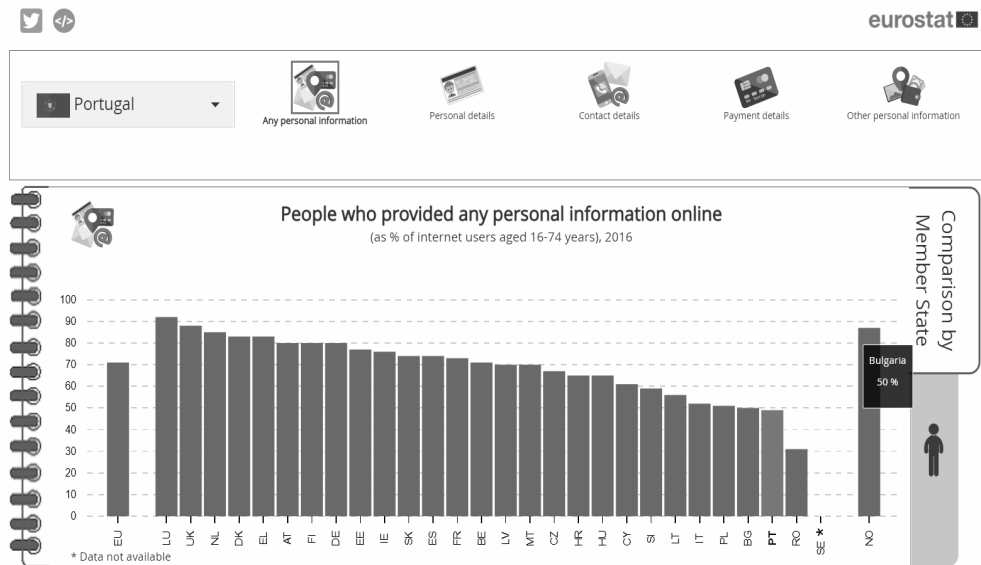
security risks. Companies are insufficiently concerned with procedures to protect data, thus exposing themselves to data leakage. Only 40 percent of companies ensure data protection by using encryption techniques. Thus, even the best information protection procedures will be worthless if they are not properly implemented. In particular, it is worth paying a lot of attention to raising employee awareness of information security, as the human factor is most often the weakest link in security systems. Increased pressure on profit growth, cost reduction and rapid technology development mean that information security is still a much-neglected area of business operations. The level of IT risk is constantly increasing. It is no secret that there is a lack of knowledge of information security among the older generation and ignorance of ever newer information systems.



**Figure 7.** Population in PT 2016 providing any personal information online.

Source: <https://ec.europa.eu/eurostat/cache/infographs/ict/bloc-3a.html> (access from 04.09.2022).

Following the information from the official European statistics page, we can conclude that many activities request the users to share some kind of personal sensitive data, like for example credit card details for the online shopping purposes or ID card details in case of booking a trip or a stay in any hotel. “Among people in the EU who have used the internet in the year prior to the 2016 survey, 71 % had provided some kind of personal information online. The most common types were contact details (61 % of internet users), followed by personal details such as name, date of birth or identity card number (52 %) and payment details, such as credit/debit card or bank account number (40 %). Just over one fifth (22 %) had provided other personal information such as photos, their location, or information related to their health, employment or income” (ec.europa.eu, 2022). In case of Portuguese population, the biggest group (67.00%) which did not mind to share personal information online were younger people between 16 and 24 years old, second group (49%) was the population between 16 and 74 years old) and the third group (31%) were older people from 65 until 74 years old.



**Figure 8.** People who provided any personal information online in Portugal in 2016.

Source: <https://ec.europa.eu/eurostat/cache/infographs/ict/bloc-3a.html> (access from 04.09.2022).

Eurostat comments “A number of different actions can be undertaken by internet users, separately or together, to control access to personal information on the internet. Almost half of all internet users (46 %) in the EU did not allow the use of personal information for advertising purposes and 40 % limited the access to their profile or content on social networking sites. Other ways to limit the access to personal information online are for example to change the browser’s settings to prevent or limit the amount of cookies on the computer/device or to use anti-tracking software. More than one third of internet users (35 %) in the EU had changed their browser settings to prevent or limit the number of cookies stored on their computer, while 17 % used anti-tracking software” (ec.europa.eu, 2022). From the figure we can see that Portugal is one of the last countries, what can mean that this country is the least trusted and prefers not to provide sensitive data via web browsers or applications.

### 3.2. The market of Real Estate Agencies in the North of Portugal - current situation and situation during the pandemic COVID-19.

The pandemic has negatively affected several sectors, both globally and in Portugal. Although the property market suffered a slight slowdown, it recovered quickly and remained buoyant and stable, and there was even an increase in property investment and development during this period, according to Ricardo Cruz, Country Manager of UrHome Portugal, via Magazine Imobiliário (2021). From this site we can also read that the official sources report that throughout 2020, demand for real estate had a decline as a result of the pandemic, while 2021 saw a gradual recovery of the market, and the year ended with very positive results, not only thanks to the opening of markets and countries, but also through high demand for real estate. This was also confirmed by the

companies we surveyed. Surprisingly, despite the crisis in the global market, it was during the pandemic that the local real estate agencies had the highest profits. To the agencies' surprise, clients were not afraid to manoeuvre properties (Mercado Imobiliário: Tendências e situação atual, 2021).

Thanks to Pandemic, a significant number of real estate agencies in the north of Portugal have decided to use virtual reality in their work, allowing clients to feel as if they were in the place the company is presenting. With up-to-date and modern equipment, an employee is able to take really good shots and reflect with detail the reality of the property being presented.

During the survey, companies were asked how the head office is connected to its branches, other employees. In response, 47.62% of the offices surveyed said that they communicate with other branches via IT systems, 23.81% indicated an older way of transmitting information, via documents, while 38.10% indicated that they use these two options simultaneously. 2 companies surveyed were unable to answer this question.

From the dialogue with the offices visited by the researcher, it was possible to learn that nowadays investments can be more dispersed and staggered, as investing on the coast or in urban areas is very different from investing inland or in low-density areas. During the pandemic, according to our own study, it can be deduced that smaller and poorer regions resulted in high turnover of various types of real estate. Year after year, Portugal remains at the top of the list of the world's most attractive travel destinations because of the quality of life it provides, the low cost of living, the security and, of course, the amazing weather conditions. But these are not the only reasons - low lending rates mean that many foreign investors are attracted to Portugal, with the southern part of our country, the beautiful Algarve, being a good example. Officially welcomed and also visible are the concentrations of many British who are increasingly keen to invest in the south part of Portugal. The Algarve has numerous arguments to attract international investment and foreigners with greater purchasing power and higher qualifications to visit, work and live in Portugal. The requalification of public space in the centres of the main cities, as well as in certain low-density areas, can enable tourism and real estate products to be offered with greater differentiation, positioning them in more profitable market segments.

In the case of the rental market during the SARS pandemic, Portugal was very much the choice of people of many nationalities. Portugal has become an ideal place to work online. So, people who worked remotely were keen to choose our country for this, suggesting the low cost of living compared to other European countries. Also, as a result of the pandemic, teleworking has turned our homes into home offices and made it possible to spend more time in holiday homes. Certainly, in the future, working arrangements will be negotiated between the company and the employee, giving more freedom to choose where to live.

During the pandemic, customer access was very limited. It was through the use of new technology

that business did not have to stand still. The real estate market is not as open and adaptive to innovation as other sectors of the economy, such as the financial market. according to most of the agencies interviewed, but the revolution has also arrived here, in part thanks to the pandemic.

By actually using the information gained from technological products, intermediaries are able to provide useful and fruitful advice and support to clients at every stage of the investment purchase process. And nothing is as good advertising as a satisfied customer. With accurate and complete data on the market, potential buyers or tenants, and the right programmes to analyze them, agencies can make much more predictive and informed decisions.

The uncertainty we are living in and the shadow of the crisis hanging over the Portuguese economy puts the future of the property market in question. However, the trajectory of this sector is expected to remain positive. Moreover, Portugal has never been talked about as much as it is now and therefore citizens should not rather underestimate the potential of the Portuguese market. Today we live with uncertainty. The war in Ukraine, rising energy and building material costs, reduced purchasing power for Portuguese families, high inflation and rising interest rates. Low returns on financial investments should maintain the level of investment in real estate as a safe and profitable alternative. Domestic demand in the housing market, the medium-high segment, by moving to neighbourhoods bordering Lisbon and Porto, should remain active.

### **3.3. Security for Information Systems**

Moreover, "An information system is secure if its user can rely on it and the installed software performs according to its specifications. We can say that a system is secure if, for example, it can always be expected to. We can say that a system is secure if, for example, it can always be expected that the data permanently will not be distorted and will not be read by an unauthorised person - we trust the system to store and protect data" (Garfinkel & Spafford, 1997, p 23). The development of information technologies has caused that both in private life and in business or statutory activities of companies and organizations an incomparably greater amount of information and data is processed in a given period of time than a dozen or so years ago. The role of information both in the context of its confidentiality as well as its availability and integrity has always been very important. The increased amount of information, development of computerization, facilitating access to data, streamlining the processes of transmitting or retrieving large amounts of data in small units of time, development of information storage technologies, and many other factors have contributed to the growing interest in information security management systems. This approach allows organizations to adequately prepare for disruptions related to lack of availability and integrity or loss of confidentiality of data and many other factors ( Thuraisingham, 2007).

Referring to the title of this thesis, in the field of real estate enterprises we can say about the protection of resources such as computer hardware, network infrastructure, printouts, and strategic data. backups. Further resources may include, among others, software versions, personal data of



employees, partners, associates, and, more importantly, customers. Each contract is based on an official state document such as an ID card or passport. It is important that this type of data does not fall into the wrong hands. Among our surveyed companies, only 33.33% care about this type of security measure. To ensure that sensitive documents and data do not fall into the wrong hands, it is worthwhile for each company's equipment to be properly checked after completion of its work, as they can get into the wrong hands.

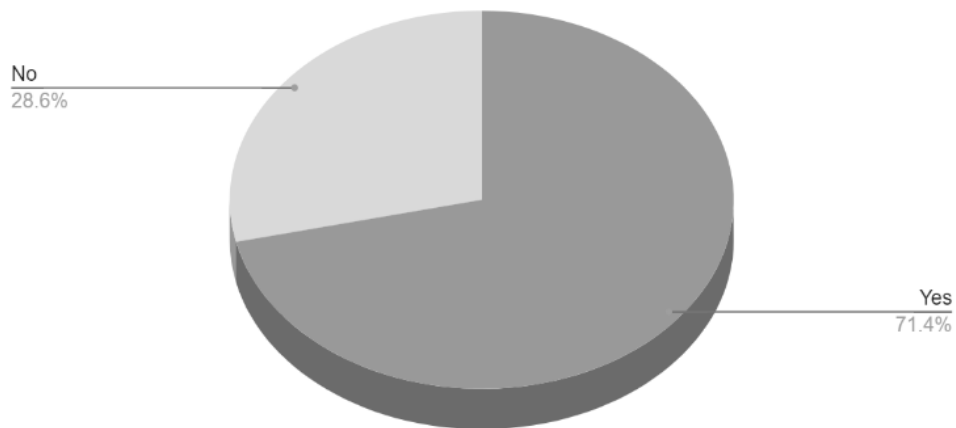
The paper *Recent Advances in Multimedia Information System Security* clearly explains and explains, based on examples, the current risks associated with the flow of information. "In multimedia communication, security issues, which are generated from the transmitted information's sensitivities, should be considered. For example, the information may be related to military forbiddance, commercial secret, or personal privacy. Only some authorized users can access this kind of information, and any action aiming to make the information released is regarded as an attack. With respect to the complexity of the information system, there are various threats" (Lian, Kanellopoulos, & Ruffo, 2009, p 3).

Considering the amount of personal data collected by real estate agencies, as well as other companies, one cannot ignore such great danger as the possibility of a hacking attack. We are increasingly hearing about the occurrence of this type of event. Even at the beginning of the current year, 2022, a similar problem occurred in Portugal. Vodafone Group Plc is a British multinational telecommunications company. Disputing the number of security backups Vodafone has, apparently, this company was the target of a "terrorist and criminal act" on 7th February this year. Vodafone Portugal CEO Mário Vaz confirmed at a press conference scheduled a few hours after the company admitted that the disruptions to the Vodafone network had been caused by a "deliberate and malicious cyber-attack aimed at causing damage". Moreover, Vodafone's CEO said that the "unprecedented cyber-attack" resulted in "the intentional destruction of several core elements of our networks, including the redundant systems that we have prepared to activate in a failure situation". The malicious action was carried out in a surgical manner, denoting an intention to cause damage of great depth and expression we can read from the article of Edgar Caetano and Manuel Pestana Machado (Observador, 2022). Even though such cyber attacks are still common in today's world, according to the questionnaire, no one of the companies proceed with any kind of cyber-security courses. We can distinguish some examples of attacks such as masquerading, eavesdropping, replaying, tampering, hijacking, exploiting, Denial of Service, phishing, and spear-phishing. To be more specific, we can also mention spam, scam, spim, spit, blog spam, and search spam (Caetano & Machado, 2022).

Biometric authentication solutions create a data-generated model that represents a person. With this model and biometric information, security systems can authenticate access to applications and other network resources. Biometric authentication is fast becoming a popular component of strategy in more and more enterprises. Usernames and passwords were the primary means of

security for decades, but no longer. Numerous high-profile security breaches at large financial and business institutions have led to millions of username and password combinations being stolen and put up for sale on the dark web. If we combine this with the tendency for passwords to be repeated for multiple accounts, the scale of the vulnerability becomes more obvious. Biometric authentication systems are less vulnerable to this vulnerability because the user's biometric data is unique. It is very difficult for an attacker to fraudulently replicate a person's fingerprint or facial recognition scan when taken by robust solutions with strong like/spoof detection, while it only takes a moment to authenticate the correct user. For this reason, biometrics is considered more convenient than passwords and more secure. According to Gartner, "biometric authentication cannot and does not depend on the secrecy of biometric traits, but instead relies on the difficulty of impersonating a live person presenting a trait to a capturing device. This last point is not widely known, leading to some common misunderstandings, reinforced by the limited detection of presentation attacks in consumer devices and publicity about successful attacks on Apple Touch ID, Samsung swipe sensors, Android facial recognition, and the like. "This should be reassuring news for those who are skeptical about the long-term viability of biometric authentication, " we can get to know from the Analyst Report (Gartner, 2021, p 2). Talking about security, from the questionnaire we can summarize that 71.43% of questionnaire agencies have an anti-virus software up-to-date, where less than half of these (47.62%) have the software updates automatically updated. Moreover, just 28.57% of the companies settled security policies for downloading and installing any kind of new software. What is surprising, is that just 14.29% of the questionnaire real estate agencies use the virtual private network for remote access. The most common, and at the same time most secure, security measure is to create a complex password, like for example the password should have at least 8 characters and should be changed every 90 days. Surprisingly, only 14.29% of respondents answered in the affirmative. Of the agencies surveyed, only 4.76% applied a need-to-know policy, 14.29% have a person responsible within the company for registering new users and removing leavers properly, however all companies follow the rule that no one of the staff is able to install additional software or application without authorization. 28.57% of the interviewed companies follow the rule that employees only have access to the data necessary for their work, which in some point seems safer. The survey also asked "Did your agency put in place a procedure for setting strong passwords to protect key elements of the system? ", of which 61.90 per cent of respondents said yes and the remaining 38.10 per cent said no. Currently, the most popular biometric techniques can be divided into groups such as fingerprint recognition systems, hand geometry, voice tone, an iris image, and unique blood vessel pattern of the hand and also facial geometry. At present, biometric security for a private smartphone or laptop works much more smoothly than text-based or digital passwords, in particular, because they are too complex. In the case of particularly sensitive company data or the importance of specific rooms to which access should be restricted, the best method is to use multiple biometric technologies, additionally supported by passwords. Nowadays, since we have such improved technology, in practically every smartwatch this type of function is very popular. Just to give an idea, we can see on the website [countrypointsearch.com](http://countrypointsearch.com) that already in 2018 more than one billion smartphones was produced with

fingerprint sensors. Nowadays, FaceID is more common, as it does not require basically any effort from the user. Questions such as “The servers are equipped with UPS (uninterruptible power supply)”, “The enterprise uses Biometric authentication (ex. Face ID, Touch ID)” or “Employees need to follow some extra policy for security in case they use devices for work out of the office” no one of the companies replied affirmatively. 9.52% confirmed that in their company Internet surfing on company devices is controlled and that their business partners, vendors and other third parties associated with the company also have an appropriate security policy (Sharma, 2018).



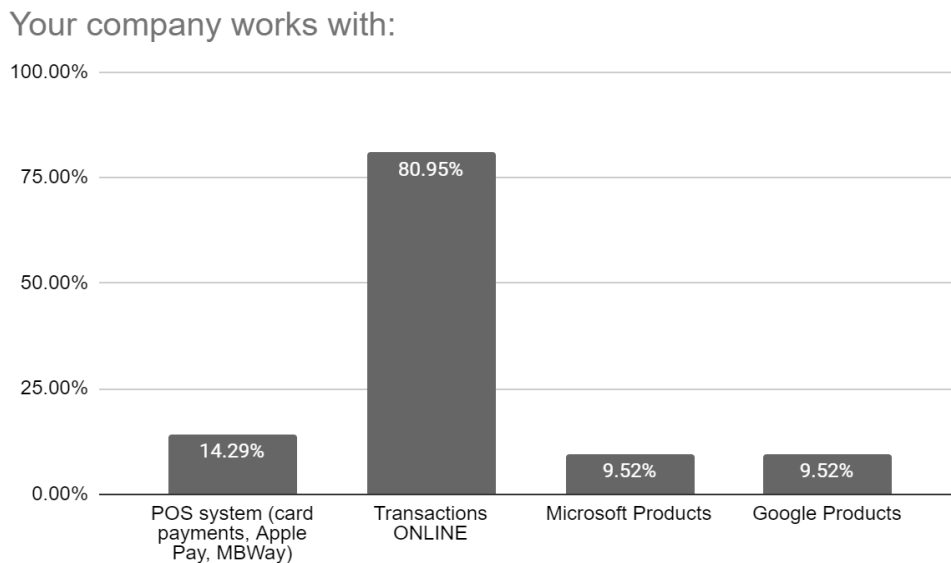
**Figure 9.** Antivirus system in surveyed companies.

Source :Author's own elaboration.

Antivirus programmes include a package that protects the computer from possible threats. They most often include two modules - a scanner and a monitor. The scanner is concerned with monitoring files on request or every specified, set period of time. Its purpose is to examine the contents of the disk. The monitor, on the other hand, checks the files concerned continuously and automatically. It monitors the computer's current activities. The antivirus application analyzes the information and assesses whether there is something to pay attention to or whether there are any threats, dangers. When choosing a computer protection programme, it is worth noting whether it has the ability to update new viruses. Most of the available applications of this type have such a function. If a computer does not have an anti-virus application installed, and there is an urgent need to verify a disk or file - so-called on-line scanners can be used. To use an online scanner, a web browser must be used. Of those surveyed, 71.40% of companies have already installed anti-virus software as a security measure, while the remaining 28.60% do not. It should be borne in mind that real estate agencies base their activities on many different types of contracts, agreements and documents, which should be well guarded. Without anti-virus protection, we cannot be sure that data will not be accessed by an unauthorized person. Anti-virus software helps prevent data loss and identity theft. Antivirus also detects some spyware. It is nevertheless worthwhile to additionally install a special spyware detection application on your computer.

### 3.3.1. Supplies used to store data

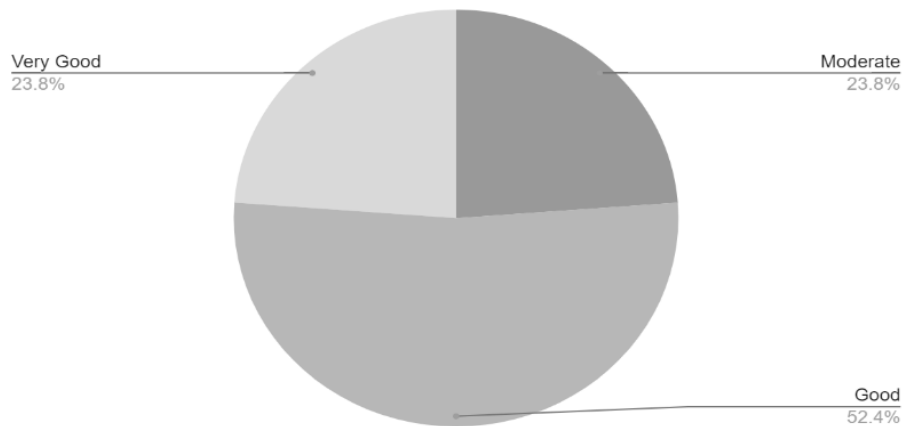
The Internet is an integral part of life for a large number of people, companies and institutions. It makes it possible not only to communicate quickly and access information easily, but also to simplify activities that used to involve greater effort. One example of simplifying life via the Internet is ONLINE transfers. Newer and newer solutions for the online payment sector are being developed and existing ones are being improved. The choice of payment methods via the web is very large and the means of making transactions themselves are common and frequently used.



**Figure 10.** Tools used in the enterprise.

Source: Author's own elaboration.

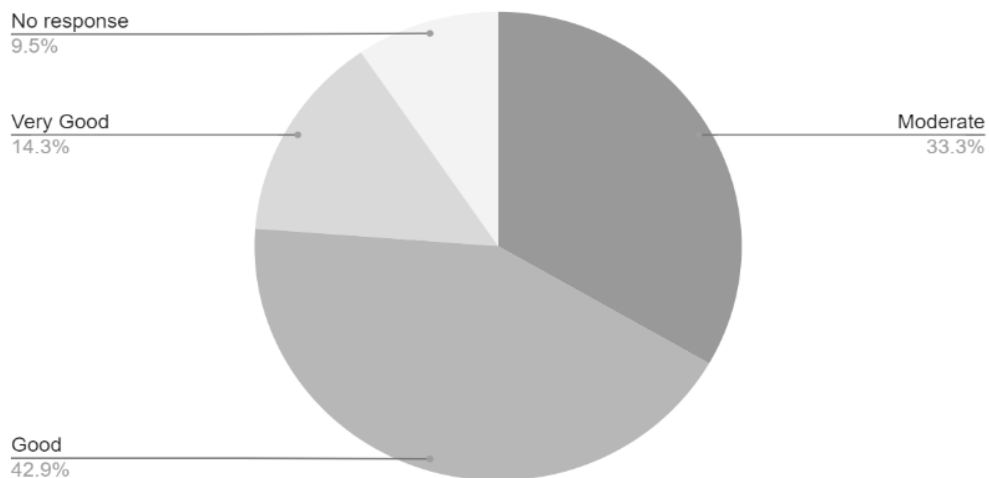
The survey asked businesses about ONLINE payments. As many as 80.95% of the real estate agencies surveyed use this facility. In contrast, only 14.29% of the companies surveyed gave their customers the option of using a POS system, which includes the classic card payment, Contactless, ApplePay or the currently very popular MBWay app. In addition, 9.52% of companies admitted that they use Microsoft products and the same 9.52% of companies reach for Google products.



**Figure 11.** IS support with Invoice System. Does IS help the company in the invoice system?

Source: Author's own elaboration.

A further part of the questionnaire showed that 19.00% of the surveyed agencies agreed that the information system has a very good effect on the company's accounting, 57.10% agreed that IS has a good effect on the company's accounting system and 23.80% assessed that IS has a moderating effect. Certainly, online payments save a lot of time in invoicing and embracing receipts, and another big plus is the structuring of data in the accounting system.



**Figure 12.** IS support with Payroll System. Does IS help the company in the payroll system?

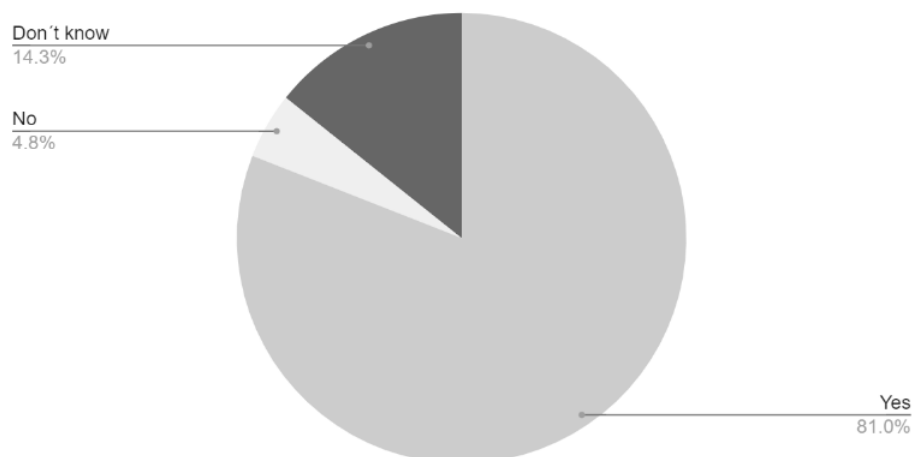
Source: Author's own elaboration.

In a further question regarding employee payment systems, the offices surveyed responded that the information system at 14.30% of the IS companies surveyed helps very well, at 42.90% of the IS companies it helps well, and 33.30% of the companies referred to it moderately. Nevertheless, during the individual visit to the real estate agencies, it was admitted during the interview that the payment document is most often printed at the end of the month and signed individually by each employee. Therefore, the use of modern and dedicated platforms was excluded here.

### 3.3.2. Platforms used for communication

Surely everyone will agree that communication is essential for business success. Thanks to the recent article Communication is key in the workplace from 2022 we can conclude a few reasons to work on the communication skills in the company. The advantages coming out of that are such as better engagement of workers, improved productivity, which in the state can bring many benefits to any kind of project at the office. “Longer-term, keeping employees for many years can add strength to the company and impact the bottom line. Many jobs require years of experience before an employee has sufficient expertise to drive innovation, solve critical problems, and lead others. How an employee feels toward the company, based on how they feel they are treated and valued as individuals, impacts how loyal they will be” (Cooks-Campbell, 2022, p 2).

Another advantage of improving the communication skills in the enterprise is better collaboration and greater motivation for any kind of settled goals. Surely, such improvements always demand a lot of work and time, but in the end surely will bring brilliant and positive effects. Such changes will certainly make a fruitful contribution to improving relations with potential clients in the future (Rauv, 2021).



**Figure 13.** Arrival of IS in the agency improved an easy access to data for the customers

Source :Author's own elaboration.

The vast majority of the agencies surveyed, 81.00%, agreed that the introduction of information systems in the company had contributed to easier access to data for customers. 14.30% of respondents answered that it had not, while 4.8% did not know the answer to this question.

**Table 3.** How do the enterprises advertise their activity?

How do you advertise your enterprise?	
Social Media	66.67%
Website	52.38%
Application	9.52%
Fliers	47.62%
Television	9.52%
Radio	23.81%
Others	42.86%

Source: Author's own elaboration.

The results of the survey show that the most popular method of advertising, or publicizing the agency, is social media (66.67%), the second most popular option is the agency's own website (52.38%) and the third option is flyers (47.62%). Then, as many as 42.86% of the companies surveyed chose their own option, where they had the option to write it in themselves. As a result of the questionnaire, it was found out that the surveyed bureaux advertise their business through good placement in the city, campaigns in supermarkets, displaying their stands at various local events and festivals, as well as gaining many clients through referrals from previous clients. In contrast, radio (23.81%) and television (9.52%) are used by a significant minority. Apps (9.52%) are the least successful when it comes to advertising with our respondents.

The app that the surveyed companies use most often is Whatsapp (71.43%), the next platform that estate agency employees use quite often is Messenger (19.05%), and the third app is Skype (9.52%). Surprisingly, none of the companies surveyed use the Slack platform, which is so common and easily accessible in today's market. What would the real estate market have looked like during the coronavirus epidemic if not for the benefits of new technologies, including the Internet? These days, it's hard to imagine doing anything without an internet connection. Many real estate agencies have found it very difficult to function. Fortunately, smart tools have come to the rescue, enabling us to work from home, contact clients remotely and sign contracts online. However, this is just the tip of the iceberg when it comes to real estate technology. Referring to the question regarding the connection to the company's Inern network, 61.90% of respondents selected Fiber optic, 9.52% Cable connection, 4.76% ADSL connection. As many as 23.81% of the office employees of these companies did not know which connection, they were using.

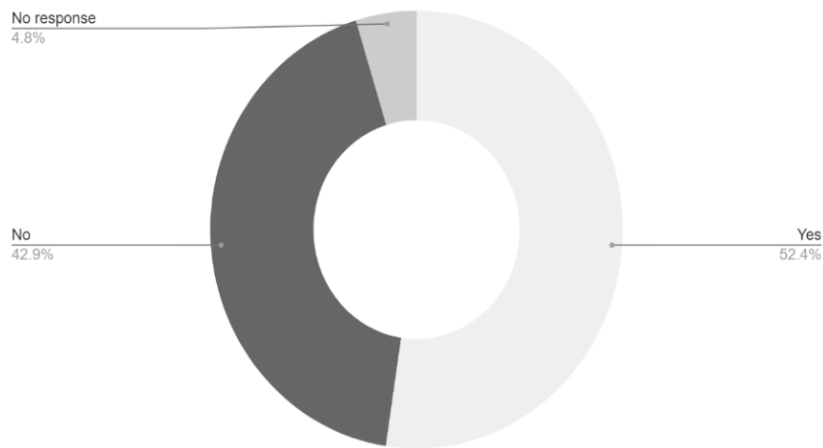
### **3.3.3. Data storing, documentation, and registration**

The storage of data, especially confidential data, is a very important aspect of any business.

Ensuring their security is often crucial to the day-to-day running of the business, and a possible leak could determine its very existence. It is one thing to have hacking attacks and another to have inadequate storage and lack of proper security. Modern software, advanced security and archiving methods greatly simplify the storage, processing and sharing of confidential data. They reduce the possibility of their loss through user error, failure or theft. Well, most data and information passing through businesses can be described as confidential. Business emails, employee contracts, private employee data, customer data, invoices and receipts. All of this contains information that is unlikely to get out of the company and into the wrong hands. The loss of such data in one way or another can have very serious consequences.

Threw the result of the questionnaire, we can conclude that every agency which we took into consideration is using Microsoft Windows. This may be due to habit, ease of accessibility. Windows is a universal system and owes its success, in addition to its functionality and intuitiveness, to the visual appeal of the interface itself. If you have a good computer, working with Windows 10 is pure pleasure. Moreover, just a few companies mentioned that they use Android System, which explains that just a few agencies use their companies' phones for other activities than just phone calls and exchanging messages. Most agencies prefer the traditional way and proceed with their work from the traditional computers. Windows operating systems have been with us for 35 years. The first 'windows' from Microsoft hit the market on exactly 20 November 1985. At the time, it was not yet a full-fledged, separate operating system, but a graphical overlay on the earlier, text-based MS-DOS system. It was originally to be developed under the name 'Interface Manager' and was Microsoft's response to the growing popularity of the graphical interfaces used on Apple's Macintosh computers. The frontend, and later the full-fledged systems, became increasingly popular after a while and eventually dominated the personal computer market. The operating system is the essential software that manages the processes on a desktop, laptop, tablet or smartphone. It is the underlying software platform that allows the installation and use of other programmes and applications such as web browsers, video players, office tools, graphics and video games. Operating systems are essential for the user to use the device at all. They are constantly evolving, being updated and improved to keep up with the latest technologies used in computer components. Currently, the most popular operating systems include Windows 10, Mac OS X and Linux.





**Figure 14.** Internal procedures in surveyed companies. Does the agency follow internal procedures that sets out how to deal with a data privacy breach and defines how to notify the customer?

Source: Author's own elaboration.

We can see from the figure that slightly more than half, 52.40%, of the agencies surveyed have an action plan in place, which sets out how they will deal with data privacy breaches and defines a possible way of notifying the client. Slightly fewer agencies, 42.90%, do not have such a plan prepared. In contrast, 4.80% of companies did not know the answer to this question.

Of the estate agencies surveyed, only 33.33% are proactive in enterprise resource planning. We are talking about software that helps the company integrate and manage different functional areas. In addition, 23.81% of the offices that took part in this survey reported that they have a person responsible for maintaining and registering and installing the relevant software on all devices. Furthermore, 19.05% of the agencies surveyed have a person responsible for replacing consumable products such as toner in printers, ink cartridges and the like.

## Conclusion, Limitations and Future Research Lines

The purpose of this study was to verify how Information Systems in real estate agencies in the north of Portugal present themselves. In the theoretical part of the work, the most important definitions related to the title of the work and related topics were discussed. To perform the work, the researcher used a questionnaire survey and an interview, approaching each of the surveyed companies very individually, in order to obtain the most precise results and effects of the study. Most of the companies were very willing to cooperate, noting that they were in favour of scientific research.

In summary, the luxury type of real estate is definitely more popular in the capital and also in the south of the country in Algarve, where many investors from abroad, mainly British, are investing. In the north of the country, on the other hand, which was the aim of this study, it confirms after interviews with various companies that the main clients are local Portuguese people and students. For the time being, northern real estate agencies do not make extensive use of the concept of modern information systems. In 2022, having won the war against pandemics, we have far greater access to the use of apps, platforms and websites, which would certainly bring positive results to the work. The hypothesis of this work assumes that the Information System for real estate agencies in the north of Portugal is not sufficiently developed and will still need many more years to gain the confidence of the public of this service in this region and the researcher proves this hypothesis.

For the time being, real estate agencies in the north of Portugal are content with their way of doing business and do not feel the need for additional training towards a more innovative direction, at least for the next few years. For the time being, this does not change the number of clients, but over time clients will demand that this sector be more ONLINE, as can be seen, for example, in the larger corporations in the major metropolitan areas.

We are aware that real estate agencies close sales, rentals, purchases and the like, in any case the respective act with the client must be based on any and all official paper, on the basis of identity documents. These are data that must be particularly protected to prevent them from falling into the wrong hands. We can learn from the document that not all companies that participated in the survey take care of such essential activities as system security. Only 74.43% of the companies surveyed currently have an antivirus programme installed, which still does not guarantee one hundred percent security. In 2022, if companies have not already done so, they should definitely switch from the common and outdated form of filing and archiving physical documents, for their own safety, the safety of their customers and to at least save their valuable time at work.

In today's world, the most popular form of customer outreach is none other than social media. Of the agencies surveyed, only 66.67% decided to use this type of modern solution. In contrast,

52.38% of the companies surveyed regularly use their own website. Proof of the old-fashioned habits of the surveyed companies, as many as 47.62% still promote their activities via posters and flyers. In 2022, we do not need a large financial outlay to promote our activities. A variety of applications are available to help us, thanks to an ever-evolving information system as well as new technology.

Como a indústria imobiliária está a desenvolver-se rapidamente, não pode deixar de incluir sistemas de informação cada vez mais modernos e actualizados. Por exemplo, dentro de cinco anos, resta saber se as agências imobiliárias no norte de Portugal estarão finalmente convencidas e confiarão na nova tecnologia. Certamente que este estudo produziu algumas conclusões interessantes, especialmente porque este tipo de documento ainda não foi escrito ou publicado.

Given the expanding property market and the unlimited room for modern information systems, and modern new technologies, it would certainly be useful to consider another study of this kind in the near future, due to the fact that the limits of this field of knowledge are unknown.

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## Appendix

Questionário para as Agências Imobiliárias  
Kinga Kępka-Abellonio (a45192)  
Mestrado em Gestão das Organizações



Boa tarde,

Sou aluna do último ano do Mestrado em Gestão das Organizações e estou a desenvolver um projeto de investigação no âmbito do Sistema de Informação com o tema "Sistema de Informação para Agências Imobiliárias no Norte de Portugal".

Peço a vossa colaboração respondendo ao questionário que segue. As questões colocadas são de resposta rápida e o preenchimento do questionário não deverá demorar mais de 7 minutos. Este estudo, meramente académico, será confidencial, anónimo e após a colheita de dados os questionários serão destruídos.

**Desde já, obrigada pelo seu apoio e colaboração!**

Cordiais Cumprimentos,  
Kinga Kępka-Abellonio (a45192)  
Mestrado em Gestão das Organizações

A informação que forneceu será utilizada apenas para fins académicos.  
Podemos assegurar a total confidencialidade da sua informação e a sua segurança.





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**Caracterização da empresa**

1. Número de trabalhadores da empresa
  - Sem assalariados
  - 1-5
  - 6-10
  - 11-15
  - 15-20
  - 20 <
  
2. Idade média dos membros da sua equipa:
  - > 30
  - 31-40
  - 41-50
  - 51-60
  - 61-70
  - 71 <
  
3. Indique como é o ambiente na sua equipa (pode escolher mais do que um):
  - respeitoso
  - competitivo
  - cooperativa
  - conservador
  - de apoio
  - desafiante
  - aberto
  - ordenado
  - de desenvolvimento
  - tenso
  
4. Os factores mais importantes que influenciam a atmosfera são (pode escolher mais do que um)
  - Gestão
  - Procedimentos
  - Indústria
  - Pessoas
  - Departamento de Recursos Humanos
  - Superiores masculinos
  - Supervisores femininos
  - Departamento de saúde e segurança
  - Departamento financeiro
  - Sistema de Informação
  - Novas tecnologias
  - Eu Próprio

A informação que forneceu será utilizada apenas para fins académicos.  
Podemos assegurar a total confidencialidade da sua informação e a sua segurança.

5. Em termos de percentagem, indique a idade média dos seus clientes

- >30 - %
- 31-50 - %
- 51-70 - %
- 71< - %

6. Por favor diga-nos há quanto tempo é que a sua empresa utiliza o Sistema de Informação?

- Menos de 1 anos
- 1-5 anos
- 6-10 anos
- 11-15 anos
- Mais de 15 anos

**Sistemas de Informação**

7. Por favor diga-nos como é que a sede está ligada às suas sucursais?

- Através de Sistemas de Informação
- Através de papéis e documentos
- Ambos

8. Através de que plataforma comunica normalmente com outros empregados:

- Rede regular (Vodafone, NOS, WTF)
- WhatsApp
- Facebook, Messenger
- Slack
- Viber
- Skype
- Outros: \_\_\_\_\_

9. Qual (ou quais) das afirmações descreve a realidade da sua empresa?

- O Sistema de Informação acelera a comunicação interna
- Sistema de Informação é suficientemente adequado para acompanhar o dinâmico ambiente empresarial
- A sua empresa tem o Planeamento de Recursos Empresariais (um software que ajuda as empresas a integrar e a gerir as diferentes áreas funcionais)
- A sua empresa estruturou a Gestão de Relacionamento com Clientes (uma tecnologia para gerir todas as relações e interações da sua empresa com os clientes e clientes potenciais)
- A sua agência segue alguma gestão da cadeia de fornecimento (a gestão do fluxo de bens e serviços, entre empresas e locais, e inclui o movimento e o armazenamento)
- O Sistema de Informação ajuda a sua empresa a livrar-se de erros ou problemas (ex. cálculos)
- Os funcionários estão mais motivados após a utilização dos Sistemas de Informação?
- A empresa fornece serviço online ao cliente
- O Sistema de Informação cria uma vasta gama de promoção no mercado na sua empresa

A informação que forneceu será utilizada apenas para fins académicos.  
Podemos assegurar a total confidencialidade da sua informação e a sua segurança.

- Existe alguém responsável pela manutenção e registo do software instalado em todas as máquinas
- Existe alguém responsável pela reposição de consumíveis: toner, tinteiros

**10.** Como se torna a velocidade de trabalho do pessoal após a utilização do Sistema de Informação?

- Aumenta
- Diminui

**11.** A sua empresa trabalha com:

- Sistema POS (pagamentos com cartão, Apple Pay, MBWay)
- Transacções ONLINE
- Produtos Microsoft
- Produtos Google?

**12.** Como é que armazenam normalmente os dados:

- Googe Drive
- Cloud
- Dispositivos informáticos
- Arquivado num ficheiro físico numa prateleira do escritório (em pastas)

**13.** É verdade que, após a chegada do Sistema de Informação, este proporciona um acesso fácil à informação para os clientes?

- Sim
- Não
- Não sei

**14.** Por favor classifique as seguintes actividades relacionadas com o trabalho da sua empresa, quanto é que beneficiaram ao utilizar o Sistema de Informação?

Conseguir novos clientes

1 = Muito Mau	2 = Mau	3 = Moderado	4 = Bom	5 = Muito Bom
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Sistema de pagamentos

1 = Muito Mau	2 = Mau	3 = Moderado	4 = Bom	5 = Muito Bom
---------------	---------	--------------	---------	---------------

Sistema de facturação

1 = Muito Mau	2 = Mau	3 = Moderado	4 = Bom	5 = Muito Bom
---------------	---------	--------------	---------	---------------

Sistema de contabilidade

1 = Muito Mau	2 = Mau	3 = Moderado	4 = Bom	5 = Muito Bom
---------------	---------	--------------	---------	---------------

Trabalho do departamento Recursos Humanos

A informação que forneceu será utilizada apenas para fins académicos.  
Podemos assegurar a total confidencialidade da sua informação e a sua segurança.

1 = Muito Mau	2 = Mau	3 = Moderado	4 = Bom	5 = Muito Bom
---------------	---------	--------------	---------	---------------

**15. Como anuncia a sua empresa?**

- Social Media
- Site Web
- Aplicação
- Panfletos, Folhetos
- Televisão
- Rádio
- Outros: \_\_\_\_\_

**TI e Segurança**

**16. Qual (ou quais) das afirmações descreve a realidade da sua organização relativamente à segurança?**

- Todos os computadores têm anti-virus funcionais e atualizados
- As actualizações do software de segurança são automaticamente actualizadas
- A empresa tem políticas de segurança para descarregar e instalar novo software
- Utiliza "virtual private network" para o acesso remoto
- Existem políticas de segurança de passwords (por exemplo: mínimo 8 caracteres e alterada a cada 90 dias)
- Os empregados participaram num curso sobre cyber-segurança e receberam formação em políticas de segurança e proteção de dados?
- A empresa aplicou uma política de divulgação
- Existe alguém responsável pelo registo de novos utilizadores e remoção dos que saem de forma adequada
- Os colaboradores só têm acesso aos dados necessários para o seu trabalho
- O pessoal instala software ou aplicação adicional sem uma autorização
- Existe alguém responsável pela gestão dos acessos a dados, pastas e permissões
- Os servidores estão equipados com UPS (uninterruptible power supply)
- A empresa utiliza autenticação biométrica (ex. Identificação facial ou táctil)
- A navegação na Internet em dispositivos da empresa é controlada
- Os empregados precisam de seguir alguma política extra de segurança no case de utilizarem dispositivos para o trabalho fora do escritório
- Os parceiros comerciais, vendedores e outros terceiros associados à empresa também têm uma política de segurança adequada

**17. Qual a ligação à Internet que a sua empresa utiliza normalmente?**

- Cabo
- ADSL
- Satélite
- Fibra ótica
- Mobile (cell phone and smartphone providers offer voice plans with Internet access)
- Não sei

A informação que forneceu será utilizada apenas para fins académicos.  
Podemos assegurar a total confidencialidade da sua informação e a sua segurança.

18. Apaga regularmente informações desnecessárias - trituração de documentos antigos (utilizando um triturador), destruição física de discos rígidos, purga de dispositivos móveis, puxar e destruir memória e cartões SIM de smartphones e outros dispositivos de que pretende livrar-se ou vender?
- Sim  
 Não
19. Criou procedimentos internos, ou de preferência um plano, que estabeleça como lidará com uma violação da privacidade de dados e que também defina como notificará o cliente??
- Sim  
 Não
20. Pôs em prática um procedimento para estabelecer senhas fortes para proteger elementos chave do sistema?
- Sim  
 Não
21. Qual o sistema operativo que utiliza:
- Microsoft Windows  
 macOS  
 Linux  
 Android  
 Ubuntu  
 Unix  
 iOS  
 Outros: \_\_\_\_\_
22. Já instalou ferramentas anti-vírus e anti-spyware?
- Sim  
 Não  
 Outros: \_\_\_\_\_

#### Backup

23. Marcar as que correspondem à sua empresa
- Existe uma política de backup de dados implementada  
 A sua empresa tem um processo de recuperação de desastres  
 A sua empresa tem um trabalhador específico que é responsável pelos backups  
 A agência utiliza uma empresa externa para proteger os dados  
 Verificam se as cópias de segurança funcionam correctamente  
 As suas cópias de segurança de dados são guardadas de forma segura tanto localmente como fora do local  
 As cópias de segurança na sua empresa correspondem a 100% dos dados de armazenamento

A informação que forneceu será utilizada apenas para fins académicos.  
Podemos assegurar a total confidencialidade da sua informação e a sua segurança.

**24. No caso do Armazenamento de Informação, tem algum plano de recuperação?**

- Sim  
(Em caso afirmativo) qual deles utiliza:
- Segurança do servidor (monitorização 24/7, firewalls, resposta a ameaças, etc.)
  - Segurança física (controlos de acesso ao edifício, câmaras de segurança, etc.)
  - Pessoal de apoio (técnicos no local a qualquer momento para resolver qualquer problema)
  - Sistemas de backup
  - Redundância à distância (backups espelhados para servidores em outros locais)
- Não

**25. Prosseguem com os backups do sistema**

- Diariamente
- Uma vez por semana
- Mensal
- Outro período: \_\_\_\_\_

**26. Utiliza um serviço de correio electrónico?**

- Sim  
(Em caso afirmativo) que serviço de correio electrónico utiliza:
- Gmail
  - Outlook
  - ProtonMail
  - iCloud Mail
  - Yahoo
  - Hotmail
  - Outros: \_\_\_\_\_
- Não