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**How can the application of Intelligent Systems and Machine Learning help prevent Tax Evasion**

Christian Dahlkvist Mendonça

Master in Management

Supervisor:

PhD, Rui Alexandre Henriques Gonçalves, Invited Assistant Professor

Iscte – Instituto Universitário de Lisboa

September, 2024

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**BUSINESS
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Department of Marketing, Strategy and Operations

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**Acknowledgements**

"A dream written down becomes a goal. A goal broken into steps becomes a plan. A plan backed by action becomes reality." (Greg Reid)

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<div align="right">To all, thank you.</div>

# Resumo

Atualmente, as empresas operam em uma economia aberta e global, sendo cada vez mais comum a concorrência fiscal entre Estados como um fator para atrair investimento. No mundo atual, que está em constante evolução, a importância de investir em sistemas inteligentes para combater a evasão fiscal por parte das empresas não pode ser esquecida. Os sistemas fiscais modernos que suportam ferramentas digitais, como, por exemplo, a análise avançada de dados e a aprendizagem automática, podem simplificar o trabalho da administração tributária. Dessa forma, é importante referir que a implementação de Sistemas Inteligentes e Machine Learning traz mais benefícios do que obstáculos, tanto para as empresas quanto para a Autoridade Fiscal. A área fiscal é uma área com um vasto potencial de execução desses sistemas. Nesta investigação, foi feita uma análise do contributo que a implementação de Sistemas Inteligentes e Machine Learning tem em ajudar a evitar a evasão fiscal. Após a investigação e análise realizada, concluiu-se, através de um modelo qualitativo, mais especificamente entrevistas semiestruturadas, que os indivíduos entrevistados concordam com o sucesso e vantagens dessas novas tecnologias. Além de diminuir o tempo de resposta e análise de informação detalhada, essas ferramentas detalham a informação analítica e financeira de uma empresa, facilitando a leitura para auditores ou investidores. No entanto, apesar de haver entendimento entre os entrevistados sobre os benefícios, também houve espaço para identificar os desafios que esses Sistemas Inteligentes e Machine Learning enfrentam, como a necessidade de um forte investimento em cibersegurança para proteger os dados dos clientes e de treinamento adequado para que os profissionais lidem com esses sistemas.

**Palavras-chave:** Sistemas Inteligentes, SAF-T, Taxação Tributária, Evasão Fiscal, Planeamento Tributário, Autoridade Tributária, Base de Dados.

Códigos JEL: E62, H26, H3, K36, M41, O23

# Abstract

Currently, companies operate in an open and global economy, where Tax competition between States is becoming increasingly common as a factor to attract investment. In today's constantly evolving world, the importance of investing in intelligent systems to combat tax evasion by companies cannot be overlooked. Modern tax systems that support digital tools, such as advanced data analysis and machine learning, can simplify the work of tax administration. In this regard, it is important to note that the implementation of Intelligent Systems and Machine Learning brings more benefits than obstacles, both for companies and for the Tax Authority. The tax area has vast potential for the application of these systems. In this investigation, an analysis was conducted on the contribution that the implementation of Intelligent Systems and Machine Learning has in helping to prevent tax evasion. After the investigation and analysis, it was concluded, through a qualitative model, specifically semi-structured interviews, that the individuals interviewed agree on the success and advantages of these new technologies. In addition to reducing response time and the analysis of detailed information, these tools provide detailed analytical and financial information about a company, facilitating the review process for auditors or investors. However, despite the agreement among the interviewees about the benefits, there was also room to identify challenges that these Intelligent Systems and Machine Learning address, such as the need for strong investment in cybersecurity to protect customer data and for adequate training to enable professionals to work with these systems.

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# Acronyms glossary

DL - Decree Law

EU - European Union

ERP - Enterprise resource planning

GDCSTC - The General Directorate of Customs and Special Taxes on Consumption

GDISC - General Directorate of IT and Support for Tax Services and Customs

GDT - The General Directorate of Taxes

IRS - Personal Income Tax

IS - Intelligent Systems

ICT – Information and Communication Technologies

IT - Information Technology

LTU - Large Taxpayer Unit

SAF-T (PT) - Standard Audit File for Tax purposes, Portuguese version

TA - Tax Authority

# 1. Chapter – Introduction

## 1.1 Initial Framing

This dissertation, developed within the scope of the Master´s in Management, aims to develop an analysis of the Portuguese Tax System and how can the introduction of new digital forms in the work system, help the government entity, Tax and Customs Authority (TA), analyze more data in less time with the simple goal/so that it can identify tax evasion/fraud cases.

## 1.2 Study Objective

In today's constantly rapidly evolving world, the importance of investing in intelligent systems as a way to combat tax evasion by companies is more crucial than ever. This problem continues to be a day-to-day challenge for governments all around the world.

As we see, every year technology evolves faster than we can keep pace. With this continuous evolution, the traditional methods of tax collection struggle to keep up with the businesses that evolve and find more and more sophisticated ways to discover, identify and use the breaches in the tax system in their favor. Per (Alm & McClelland, 2018; OECD, 2020) The rapid pace of technological advancement continuously challenges traditional tax collection methods, enabling businesses to exploit loopholes in the system, resulting in substantial revenue losses for governments. This problem represents significant revenue losses for governments worldwide every year, revenue that could be applied to other departments for example, other investments that could help the country and the people move forward, evolve, and gain competitive advantage. Therefore, governments need and are recognizing the power that technology can offer in their favor.

By investing in digital tools and Intelligent Systems, governments can increase their efficiency in their capabilities to monitor, analyze and detect cases where Fraud/Evasion is happening so that they can minimize it effectively protecting essential revenue cash flows necessary for funding and developing important infrastructure and public services. These factors are also known as factors of competitive advantage which companies should strive for. (Deros, Yusof & Salleh 2006.)

The increase in digitalization offers governments from different countries opportunities to increase their effective tools so that they can confront tax evasion head-to-head.

Intelligent systems, together with innovative data analysis and machine learning algorithms, have the ability to quickly and correctly analyze big amounts of financial data. These systems, if well implemented have a variety of abilities such as, they can identify patterns, anomalies, and potential tax inconsistencies that can go unnoticed. Per Globerman (1999) dealing and investing in technological change is a key driver of productivity growth. This naturally helps the authorities to be more practical in dealing with rule-breaking and make sure companies follow the tax rules correctly so that they can mitigate the risks as soon as possible, therefore gaining time dealing with these kinds of problems.

Also, from a social point of view, investing capital into digital methods to fight tax evasion not only helps collect more revenue but also makes the tax system fairer for everyone, it promotes equity and fairness. (Peng, Heim, and Mallick, 2014) Ensuring that everyone contributes their share based on their ability to pay, not only reduces income inequality but also provides the necessary resources for public services and infrastructure.

By minimizing the opportunities for tax evasion, the authorities make sure that the financial environment and economy of the country can grow and develop based on trust and confidence in the tax system, strengthening the social differences between citizens and the government increasing their transparency and trust from companies and the public.

Ultimately, embracing digitalization in tax administration is not just a necessity but a strategic way for governments seeking to safeguard their revenue foundation and confirm the integrity of their tax systems in the digital age.

**1.3 Objective of Thesis**

With the development of this thesis, it is intended to deepen and analyze the concepts related to "Tax Evasion", and the inspection power of the Tax Authority and Customs (TA) using theoretical cases of these operations, clarifying and inform the readers.

1. We intend to explain concepts related to 'Intelligent Systems and Machine Learning', explaining the domains that this subject includes, demonstrative cases of this field to clarify the readers. To illustrate the readers, the main objectives will be Explanation of concepts related to

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Tax Evasion.

2. Explanation of concepts related to Intelligent Systems and Machine Learning.

Additionally, the goal is to give a clear conclusion that connects objective (1) with objective (2), illustrating how using "Intelligent Systems and Machine Learning" can help prevent tax evasion. The thesis also seeks to make sure everyone, especially young people, understands the concepts of tax crimes and unethical behavior. This helps them be cautious and prevent these problems in the future. It is hoped that the investigation may prove useful, to help in the discussion of a very present, constant and worldwide theme.

## 1.4 Proposal Structure

This dissertation is structured into five chapters. The first chapter explains the introduction to the work that was developed, justifying the importance of the theme in this context.

The second chapter refers to the investigation, study and review of the literature on the subject, addressing certain topics, namely abusive tax planning, fraud and tax evasion as well as measures to combat it, Intelligent Systems and the inspection power of the TA.

Subsequently, the third chapter will analyze the research and methodology approach that was used for this study, more specifically the method used in the paper in order to understand what its main elements are, as well as the contributions that it brings to the study. The fourth chapter will discuss and analyze the results that were gathered after carefully using the chosen approach.

Finally, the last chapter, fifth chapter describes the conclusions drawn from the study, followed by an analysis of the key results and the limitations of the developed system. It then discusses the main practical implications for management and proposes different considerations for future research.

## 2. Chapter - Literature Review/ Theoretical framework

### 2.1 Concepts: brief analysis

Paying taxes is the duty of all citizens (Kirchler et al., 2008). No government can announce a tax system and then rely on taxpayers' sense of duty to remit what is owed. Some dutiful people will undoubtedly pay what they owe, but many others will not. (Joel Slemrod, 2007).

The taxpayer's attitude towards a tax system is influenced by several aspects. Human beings tend to act in accordance with society, trying, therefore, to find ways of paying the lowest tax possible Devos (2014). As history has taught us and from what we can read from, there are times of economic crisis, lack of credit and international bailouts. In this way, there tend to be two opposing contexts.

On the one hand, the State ("support institution that regulates and has sovereignty over a defined territory and population") needs to generate more Tax gains, which naturally translates into an increase in taxes. On the other hand, taxpayers, when facing this insecurity in the country, resulting from economic crises, lack of credit, etc., have the objective of reducing or easing their tax burden on their occupations and their dividends to satisfy their needs. By this logic, the Tax pressure that taxpayers face is successively greater, being more intense in a climate of financial instability, as previously mentioned.

According to Wilkins (2019), this insecurity and concern on the part of taxpayers/companies leads to decisions being made with the aim of reducing the tax burden, legally or illegally, one of the objects of study of this thesis. As already mentioned, in order to reduce the tax burden, taxpayers often explore illicit means, which are simply a result of tax planning.

It is therefore important to first mention the distinction, dimension and differences, often forgotten, between Fraud, Avoidance and Tax Evasion when we talk specifically about Tax Evasion.

### 2.2 Tax Evasion

Tax evasion refers to the illegal attempt by individuals or businesses to avoid paying their taxes. This illegal practice is done by companies/individuals through the use of omission or false information in income declarations, insertion of inaccurate elements, illegitimate use of benefits

tax, alteration of tax documents relating to sales transactions or provision of services and failure to issue invoices or equivalent documents so that they can reduce tax liabilities. Tax evasion involves exploiting legal loopholes to achieve a more advantageous tax outcome. Even though there may not be a direct violation of the law, individuals or entities engage in finding a way around various legal and tax regulations.

As per Casalta Nabais (2004), taxation typically relies on the income disclosed by taxpayers, meaning it is based on their declarations. The use of indirect methods to determine the tax base occurs only when direct proof and quantification based on accounting are not achievable. In such cases, taxation is fundamentally based on normal income.

In his analysis, Feinstein (1991) brings attention to some of the most relevant problems of tax evasion, highlighting that beyond the loss of state revenue, it also undermines the incentive for taxpayers to be Taxed responsible. When taxpayers witness others evading taxes successfully, it can create a sense of injustice among those who diligently meet their tax obligations.

This feeling of injustice, that taxes may not be used fairly is addressed by Pommerehne and Hannemann (1996), who write that the way taxpayers see their taxes being applied to goods and services public, is a determining factor not only in the progression to evasion but also from a taxpayer's point of view a way to see if the country has regressed or progressed.

## 2.3 Tax Avoidance

Within this same area, the term Tax Avoidance is often used in association with Tax Evasion, however, it is important to understand that they have two different meanings when it comes to their definition.

While Tax Evasion is the use of illegal instruments to not pay or pay less taxes, Tax Elision is the use of legal instruments to pay the smallest amount of taxes possible, in a way that allows the taxpayer to bear a minimum tax burden, taking advantage of loopholes in the law without violating the national legal system. 'The normative hypothesis is not met, the tax obligation does not arise, but the economic result is achieved. There exists a legal provision that enables the taxpayer to achieve comparable outcomes, without being taxed or being taxed more favorably.' (Dr. João Nuno Calvão da Silva).

According to Paulo Dá Mesquita (1997), it is crucial to differentiate between two types of Tax Avoidance scenarios, both of which are recognized within the legal framework. The first involves practices where a company seeks incentives and benefits in the law to plan its taxation more efficiently.

The second type involves legal but unconventional actions taken in the 'shadow of the law,' which the law itself does not yet anticipate. When considering this in terms of company management, it becomes evident why this can be a competitive advantage in the market. By reducing the tax burden, companies can increase revenues and dividends, therefore increasing their competitive position.

Sá Gomes (2000) gives us a comparison between tax avoidance and tax evasion. In the first case, the reality appears from transactions that emerge outside the law – "extra legem", that is, that were not predicted, and therefore cannot be considered illegal. They are called tax avoidance in Saxon doctrine and encompass what, in French doctrine, is called "Tax skill or Tax agility". Where illegal acts – "contra legem" cover situations of fraudulent means and parallel economy, such as falsification or destruction of accounting documents, misappropriation of hold back taxes, non-payment of taxes and abuse of trust and is mentioned in Saxon doctrine as tax evasion.

**2.4 Tax Fraud**

As we analyzed previously, nowadays, one of the most serious problems in the tax system is tax evasion and fraud. This last term with regards to tax crimes, consists of the most common practice.

Tax Fraud stands out from the other terms, in the way that a crime is committed when taxpayers carry out acts or legal agreements taking into account, on the one hand, evading the payment of taxes or the acquisition of incentives tax, using illicit instruments.

Although tax evasion and tax fraud are often used as the same, they differ in some key aspects. Both are significant illegal acts, but tax fraud normally comes with penalties that are worse than simple Tax Evasion. Tax Fraud involves the deliberate falsification of tax documents, leading to felony charges. In contrast, tax evasion occurs when someone uses illegal processes to avoid paying taxes, such as by not filing tax returns or failing to pay taxes owed.

According to Antunes (2005: p. 14), tax fraud exists when […] taxpayers declare income or profit lower than the real through the omission in mandatory declarations of your real tax situation or resorting to various expedients, such as simulated deals, falsification of documents, false tax accounting, issuing and using false invoices and appropriation of taxes withheld and owed by third parties.

As defined in articles 103 and 104 of the RGIT (General Regime of Tax Offenses). Some examples are, in the condition of business or professional income, "omission to declare taxable income (…); concealment of facts, income or values that must be declared; non-delivery of withheld tax or paid VAT (which may give rise to the tax crime of breach of trust, article 105 of the RGIT (General Regime of Tax Offenses); false classification of facts or transactions subject to tax; falsification or falsification of accounting, namely: failure to record transactions; accounting of fictitious operations or operations unrelated to the activity carried out (…); non-existence, concealment or destruction of accounting" (Pereira, 2018, p. 554).

## 2.5 Reasons why Tax Fraud is committed

In 1953, Donald Cressey came up with a study, The Fraud Triangle Theory. This model identified three major components that were used to qualify the existence of fraud, understanding the reasons that would lead individuals from organizations, individually or together, to commit fraud. There are a lot of factors that can lead to this crime, which can vary from debts, personal problems, or relationships between employee and employer. Per Donald Cressey the three components that simultaneously lead to acts related to fraud were:

Incentives/Pressure – The pressure associated with the financial needs that the individual may have, the urge of a rapid necessity for financial liquidity (health problems, existence of debts, game habits: excessive alcohol consumption, drugs or other substances), or when an individual tries to live above his possibilities related to material ostentation (cars, clothes, etc.). This pressure results from an uncontrollable need to obtain money or goods of a material nature with value, in order to solve problems or increase financial/asset availability. Four common conditions that can lead to cheating under financial pressure include financial instability, external pressures, personal financial needs, and the pressure to meet financial targets.

Opportunity – Normally associated with systems fragilities from organizational control, from an individual or an entity, the possibility of committing fraud without being caught. There are several weaknesses that can lead an individual to commit fraud, such as the absence or ineffectiveness of controls, lack of audit mechanisms, ability of managers to derogate from controls, lack of access to information or lack of anti-fraud communication, impunity for the practice of fraudulent acts, cultural/organizational context conducive to the practice of fraud, external/internal collaboration – collusion. Opportunity is the most controllable component of the process, since this is the aspect that internal control focuses on.

Attitude/Rationalization – It is normally through reasons that the individual seeks to justify fraud, the capacity of rationalization and interpretation of the various data that they have of the reality that surrounds us. Rationalization is part of the fraud triangle is the most difficult to measure (Skousen et al., 2009).

There are a lot of diverse associated aspects, such as: the fact that the fraudulent action leaves no personal victims; the example set by others who carried out similar practices; existence of social debates associated with the gaps of isolation and feelings of impunity; and news released about more serious cases that had no consequences in terms of probability.

Figure 1: The Fraud Triangle Theory Cressey (1953)
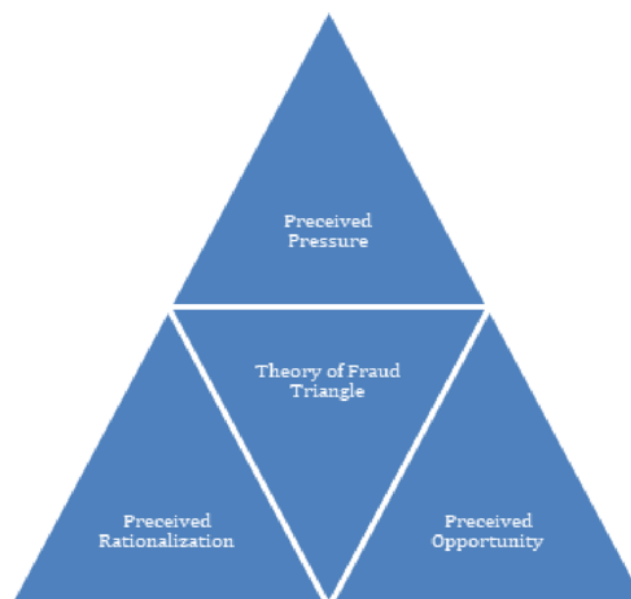


Source: Cressey, Donald R. (1953)

## 2.6 Customs and Tax Authority

The department in charge of managing tax information and part of the Finance ministry in Portugal is known as the Tax and Customs Authority, often abbreviated as TA.

It was established by decree law no 118/2011 on December 15, following the merger of three entities.

- The General Directorate of Customs and Special Taxes on Consumption (GDCSTC),
- The General Directorate of Taxes (GDT), and
- The General Directorate of IT and Support for Tax Services and Customs (GDISC).

This merger marked the beginning of a new era in public administration reform. The Tax and Customs Authority (TA) operates as a self-governing administrative body under the State, as outlined in article 1, paragraph 1 of DL no. 118/2011. Its primary objective includes tax and customs administration, as well as oversight of the European Union's external border and the national customs territory.

These responsibilities vary from Tax and Economic to Social protection purposes, aligning with governmental policies and European Union regulations, as specified in article 2, paragraph 2 of DL no. 118/2011. This Tax, Economic and Social responsibilities are showed in the following points:

- TA is responsible for managing and collecting income, property, and consumption taxes, customs duties, and other taxes it oversees. It also gathers revenues from the State and public entities governed by public law.

- TA ensures the processing and collection of income, property, and consumption taxes, customs duties, and other taxes that are tasked with managing. It also gathers and manages revenues from the State or public entities under legal public law regulations.

- TA conducts inspections for taxes and customs, enforces regulations for goods entering the EU territory, and monitors the movement of goods within the national borders. This includes preventing and addressing tax and customs fraud, evasion, and illegal trading activities.

- TA is responsible for creating and maintaining the infrastructure, tools, and IT systems required to fulfil its responsibilities. It also offers assistance, guidance, and high-quality services to taxpayers.

- TA conducts and encourages technical and scientific research in taxation to enhance legal and administrative measures. It also focuses on continually training its workforce and provides support to the Government in shaping tax and customs policies.
- TA helps inform taxpayers and business entities about their tax and customs responsibilities and assists them in meeting these obligations.
- TA works with relevant authorities to develop and enforce measures against money laundering and terrorist financing. It also ensures the availability of all the information regarding the identification of individuals who own or control legal entities and collective interests.

These topics help ensure the importance that this department has, dealing with national Tax matters. Despite efforts in Tax or Civic Education, these tools are crucial in combating Tax Fraud and Evasion. By using the correct tools, the TA is designed to collect taxes, as it is required by law, which are very important for achieving common goals. More importantly, they act to inspire citizens and companies to obey the law, preventing crimes and encourage a precise evaluation and payment of taxes.

In this way, when citizens see that the tax system is working, effective and fair, with a strong implementation of a system in place, they are much more likely to trust the system and by their own choice follow with their tax duties. This creates a culture of obedience, where following the law becomes the usual, leading eventually to a fairer distribution of the tax burden and a stronger sense of civic responsibility.

We can say that within the range of their responsibilities, it is also in charge of proposing and observe the life cycle of information systems, being a key supervisor in a more and more digital world and being an agent for its cooperation with the authority that is responsible for the detection and control of evasion and tax fraud and customs.

## 2.7 Complexity and Characterization of the Tax System

**Complexity**

According to Alm (1996), it is an important concern in public economics to try and transform a complex tax system into one that is/craft a tax system that is designed appropriately. This system should have a mix of different desirable taxation attributes like for example: income and

revenue generation, ensuring fairness (equity), trying to promote efficiency, and maintaining simplicity.

Such a system is usually viewed as balancing the various desirable at-tributes of taxation: taxes must be raised (revenue-yield) in a way that treats individuals fairly (equity), that minimizes interference in economic decisions (efficiency), and that does not impose undue costs on taxpayers or tax administrators (simplicity) per James Alm (Vol 49 no. 1 (March 1996) pp. 117-33).

**Characterization**

As we all know the state serves as a governmental authority responsible for various aspects in political, executive, judicial, defensive, supervision and promoting integrity in the society. It operates and it has different needs through different sectors such as primary, secondary, public and private. It is in the public domain that the government has to have financial activities that support and secure the public demands (Martinez, 2003, page 3).

The government, through financial activity, obtains the expenses derived from satisfaction of collective needs and the collection of revenue to cover these expenses (Pereira, 2018, page 139).

It is in this context that we understand the needs for taxation, with the main aim of obtaining revenue for the Government.

According to Pereira (2018) "The term "tax system" traditionally refers to the collection of taxes within a specific area primarily focusing the legal framework, such as tax legislation." (Pereira, 2018, page 67).

**2.8 Portuguese Tax System**

Following Smith (1776), the primary goals of taxation are efficiency, simplicity, equity and minimizing tax compliance costs. These ideas, as stated, should form the foundation of an ideal tax system. (Pereira, 2018) additionally explains the importance of these ideas, putting effort on the importance of "justice" to ensure equality in taxation, eliminating discretion in tax assessment, and simplifying taxpayers' responsibilities increasing revenue while minimizing costs.

On the other hand, as stated by Oliver & Bartley (2015) the existence of some complexity is necessary so that the balance between the tax principles can be achieved so that

a stable tax system can be achieved. Portugal is recognized as a leader in tax complexity and bureaucracy (Borrego, 2014).

Over the past decade, the Portuguese Tax System has undergone multiple reforms. These reforms were mainly in the way that the Portuguese department, the Tax authority, handled its operation method. These reforms were most significant after the 3 international packages to Portugal, when the consortium of the European Commission, the European Central Bank and the International Monetary Fund, commonly named as "Troika" entered Portugal, in 2011. There were several aggressive policies that were incorporated with the single purpose of increasing the tax revenue and decreasing the public expenses, so that it would be possible not only to decrease the yearly deficit in public accounts, but also the excessive debt of the Portuguese State.

One of the most significant implementations was the introduction of the e-invoice, this implementation led to a substantial increase in the power of observation, analysis and oversight on the part of the Tax Authority (TA) on commercial entities and consumers. The e-invoice system consists of the registration and communication, by the taxpayers themselves, of a specific set of operations, in order to enhance the TA control.

With this system, the TA now has an understandable database across various sectors, allowing it to control the numbers of invoices issued, creating tax incentives, and automatically filling deductions for IRS collection purposes.

**2.9 Strategic Plan 2023-2025, Tax Authority**
A Strategic Plan is important for a Tax Authority to manage taxes effectively and adapt to changes in the economy, technology, and society. In this way, the strategic plan is presented. The Plan seeks to strategically frame AT's operations in the three-year period 2023-2025, aiming to ensure the coherence and articulation of annual plans, and the consequent continuous assessment of its performance. Per (Hill & Jones, 2008:145) Clear procedures represent a  first and necessary step to achieving the desired goals of the organization.

As everybody knows the world moves more towards digital systems, where new technologies change the way finances are operated, it's crucial for the Tax Authority to be flexible and prepared to these changes. The elaboration of a Strategic Plan helps a country address these challenges by improving tax compliance, fighting tax evasion, and increasing

transparency. It also focuses on building public trust by modernizing services, improving taxpayer support, and ensuring taxes are applied fairly and efficiently. According to Alavi and Leidner (2001) it is the application of knowledge not knowledge itself which can provide competitive advantage to companies meaning that knowledge needs to be applied and integrated to company processes and includes organisational culture and identity, routines, policies, systems and many other

Per Cailler (2016:303) Objectives represent the starting point and direction for any work, as each organization has its own objectives that it works to achieve. With clear goals and measurable targets, the Tax Authority can improve revenue collection, manage resources better, and respond quickly to new trends and risks in the financial system. There must be some objectives that help an organization implement their strategies. Based on the analysis, the following strategic priorities were identified:

- Boost voluntary tax compliance by making it easier for people to follow the rules and increasing efforts to control tax evasion and fraud.
- Build trust and transparency by acting in a clear, predictable, and respectful way, while encouraging cooperation and proactive behavior.
- Encourage digital transformation by improving services through innovation and increasing the use of technology and smart data management.

Since this research focuses on the digital transformation and innovation that the Tax Authority (TA) is prioritizing for the coming years, based on their results, the TA's specific strategies are:

- Build trust in digitalization: By ensuring data security and protection, the Tax Authority will focus on a strategy of innovation driven by digital transformation. A key part of this strategy's success is guaranteeing strong cybersecurity and data protection.
- Innovate services: The Tax Authority will continue to improve its services using available tools to promote digitalization, while making sure data security and protection are not compromised.
- Increase the use of technology and smart data management: The Tax Authority will integrate technology into all work processes, especially in data management, to enhance compliance and improve efficiency.

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**2.10 Intelligent Systems**

It is difficult to define an exact criteria that can be used to distinguish an Intelligent System from another type of computer system. The main difficulty in trying to put a definition in such a criterion result from the lack of an adequate definition of intelligence. We can define Intelligent Systems as being a ("system with a set of characteristics, including learning and the capacity for discovery, adaptation, resistance to errors and failures, and the capacity for explanation.") (Luís Miguel Botelho, 2015).

We can all agree that innovation is a mandatory step if you want to reach efficiency and improve your results either if it is in private companies or state management. Therefore, the combination of advanced technologies and their integration into physical and digital systems is becoming, more and more, an important demand in organizational models/companies' management. This necessity rises from the need for companies and authorities to adapt and to keep up with the constant change in technological development, ensuring their survival and profitability within their operational processes.

The economy and society of the state are often reflected in the country's tax structure. The technologies, infrastructures and capabilities of tax authorities have demonstrated, with the evolution of a country, to be characterized by being triple-use technologies that aim to establish digital platforms and institutions suited to the way a country operates. In this way, best practices for allocating resources must be outlined, mainly to the government, but also to private industry and end users.

To encourage companies to adhere to tax system regulations, it is undeniable that an appropriate specialized analytical system and unique Intelligent Systems application must be developed that can benefit companies and consumers and at the same time respect the conditions imposed by the Tax Authority. (Sérgio Figueiredo, 2021).

According to authors Russell and Norvig (2020), modern Intelligent Systems naturally has its problems and restrictions. This evolution allows us to accumulate large amounts of data, including unreliable and unstable data, learn from practical examples (learning evolution), identify objects and events and make predictions about situations that may arise. The AI that exists and is available today is incapable of fully understanding and clarifying its analytical predictions in the real world.

## 2.11 Importance of Intelligent Systems

With the generalization of information and communication technologies (ICT) and their worldwide compatibility, the State is faced with a set of opportunities and challenges. For the State to be prepared and take advantage of technology, it must be flexible and have human skills in the area of technology and information.

As financial and commercial transactions, involving goods and services, continue to grow, it becomes increasingly important for the State to exercise control over economic and financial operations for taxation purposes and revenue collection. This necessitates that the State possesses competent and adaptable institutions.

According to Schrettenbrunnner (2020) innovation of technology needs to be taken seriously within an organization as the competitiveness will highly depend on Intelligent Systems. To achieve this, training and upskilling Public Administration employees is essential.

Due to the rapid development of technological advancement, it is very important that these employees are well-prepared to maximize the benefits that new technologies have. To process the data and gather the information from these systems, analysts and managers are critical (Sharma et al., 2014). The focus should be on enhancing efficiency and developing the ability to adapt to constantly evolving work environments.

We are entering a new era where it is anticipated that commercial and financial operations will be entirely supported by electronic documents, regularly submitted to official entities. This shift will allow for greater control by regulatory entities. Accounting information will be transmitted to these entities, enabling more effective monitoring of economic and financial activities within the national market. Building a strong relationship between the Tax Authority and citizens is crucial, especially given that tax collection is generally unpopular.

A closer and more positive relationship between the institution and the public is aimed at increasing trust and encouraging a culture of voluntarily fulfilling tax obligations, rather than simply viewing them as mandatory. This awareness is reinforced by digitalization and automation, which serve as the driving force behind the enhancement of business value and organizational performance (Anand et al., 2013; Wamba-Taguimdje et al., 2020).

## 2.12 SAF-T (PT): definition

The digital transformation of tax administrations has most of all adapted how tax authorities manage and supervise financial operations. This shift has introduced advanced systems that enhance the efficiency and accuracy of tax-related processes, enabling greater control over compliance, reducing administrative burdens, and improving transparency between taxpayers and authorities. In Portugal the TA has already taken some steps at all of the following five levels:

- e-Filing: mandatory or optional electronic submission forms (for example, Electronic Declarations).
- e-Accounting: periodic submission of accounting, invoicing and other relevant data in a standard electronic format (namely, e-Invoice).
- e-Matching: crossing information based on information from third parties, and from the taxpayers themselves, increasing the control of value chains (such as Alerts and deviations).
- e-Audit: inspections carried out based on electronic records (namely via the file SAF-T).
- Assessment: automatic completion and settlement of declarations based on available information, of which the Automatic IRS is an example.

As mentioned previously, the Portuguese Tax System (TA) has made some revolutionary measures, the introduction of the e-invoices, which led to an increase in the power of analysis and oversight of data on companies. When analyzing the theme of this thesis and the objectives that have been addressed through the research that has been and are still being carried out, we can state that Portugal, more specifically, the Portuguese Tax Authority, introduced support programs for companies that facilitate the organization and availability of all the information necessary for regularization by regulatory authorities and to structure their decision on tax crimes. Therefore, there was another big step taken through digitalization, the launch of a program, the Standard Audit File for Tax Purposes (SAF-T).

This program, firstly introduced in 2007, in XML format is a standard file that basically consolidates all pertinent tax documentation for a company. Portugal was the first country globally to implement the use of the tax audit file, as noted by Podik, Shtuler, and Gerasymchuk (2019) and Magalhães (2019).

As per Ordinance No. 321-A/2007 dated March 26, the Portuguese Government, under the Minister of State and Finance, mandated that "IRC taxpayers engaged primarily in commercial, industrial, or agricultural activities and utilizing IT resources for accounting must generate a file containing data from their invoicing and accounting systems, adhering to the specified data structure, upon request by inspection services within their jurisdiction, starting from 2008."

Basically, these files are subsequently exported and submitted to the Tax Authority. These files contain the identification of the company, customers and suppliers, as well as the identification of products and services. All tax-relevant sales documents, receipts issued to customers, transport and verification documents are included. They are utilized for monthly invoicing reporting to the Portuguese Tax Authority. While these files may contain surplus information, there is a dedication to preserving only essential data as mandated.
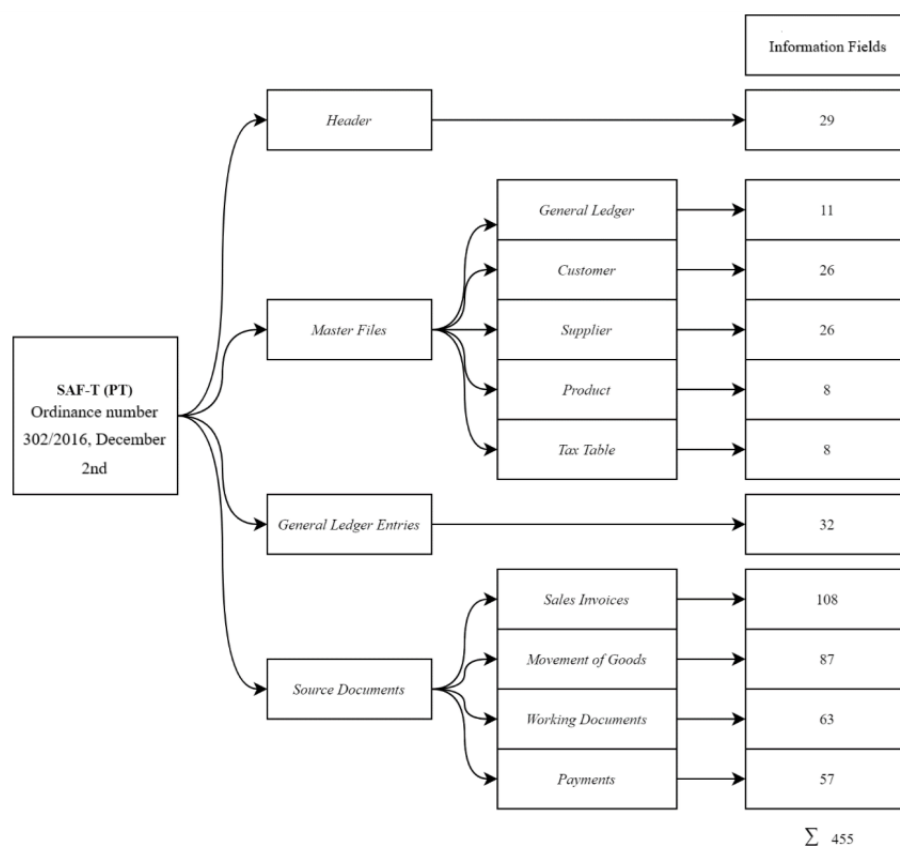
Since January 1, 2008, it has become a must for all "IRC Passive entities whose primary activity involves commercial, industrial, or agricultural operations and who manage their accounting with computerized systems" to produce "a file containing the information from their invoicing and accounting systems according to a specified structure." The mandatory implementation of the audit file, SAF-T, has proven to be an effective tool for inspection services, well organized procedures and lowering compliance costs. However, it was necessary to modify the file to put it in order with the new Accounting Standardization System (SNC) and to validate the invoicing software.

Furthermore, as seen in the next illustration, the SAF-T program is basically divided in 2 major areas, the header, which contains all the major information about the company and the master files, which include five tables, such as:

- General Ledger: It contains information about the accounts used and theirs opening balances.
- Customer Files: It contains information of the clients.
- Supplier: Covers information about suppliers.
- Product/Services Files: It contains information about the products/ sold services.
- Tax Table File: It comprises information about the tax, description of the regime and information about the rate applied.
- General Ledger Entries: Includes information on accounting movements related to the file export period.

● Source Commercial Documents: Contains information about commercial documents issued by the company, invoices, credit notes, debit notes, receipts, etc.

Figure 2: Description of the SAF-T Accounting data structure

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| | Information Fields |
|---|---|
| Header | 29 |
| General Ledger | 11 |
| Customer | 26 |
| Supplier | 26 |
| Product | 8 |
| Tax Table | 8 |
| General Ledger Entries | 32 |
| Sales Invoices | 108 |
| Movement of Goods | 87 |
| Working Documents | 63 |
| Payments | 57 |
| Σ | 455 |

SAF-T (PT) Ordinance number 302/2016, December 2nd — Master Files — Source Documents

Source: (Own elaboration), OCDE, 2005

# 3. Chapter – Methodology

## 3.1 Problematic

These days, "the best way to be more efficient and productive in making and testing knowledge (and producing new results) is through scientific and technological research… it appears as well as the most efficient instrument known today to transform a reality" (Fortin, 2003, p. 122).

In a society that is mostly Tech driven, we follow the development of the digital world naturally, where platforms and data transmission means of different kinds are used as a way to combat tax fraud/evasion. As seen within this investigation we pretend to understand, in a qualitative approach, which opinions do the agents that deal with the software have regarding it and the implications of its use in the legal regime of the SAF-T (PT) Accounting in the Portuguese Tax context.

## 3.2 Starting question and Investigation objectives

With the primary goal, it is tended to understand the impact of the Intelligent Systems in the relationship between the Portuguese companies and the Tax Authority. In this context, the following specific objectives were outlined.

1. Analyze the purpose of the implementation of the SAF-T (PT) Accounting following the legal and tax laws in Portugal.
2. Understand the view of the different agents interviewed that are primarily in contact with this software, Certified Accountants (clients), and Tax Inspectors (Tax Authority).
3. Identify the importance and the use of Intelligent Systems and Machine Learning applied to companies' management to help prevent Tax Evasion.

## 3.3 Investigation Design

To do this Thesis, and with the Research Question in mind, the type of methodology used in this paper is inserted in a qualitative research model, also in balance with the title of the thesis, "How can Intelligent Systems and Machine Learning applied to company's management help prevent Tax Evasion".

To do a qualitative search, there are 3 important steps: the first one relates with the drawing of the research, the second one refers to the data collection and the final one with the

analyses of all the data. These steps form the way to do a qualitative analysis. All the steps are important, the first one, the goal is to identify the theme and the objective of the study so that it will be crystal clear to the audience what this paper is all about.

There should be a research question so that we begin identifying the reasons for that study and why we are analyzing it. Bogdan and Biklen (1994) defend that there are some important factors when starting a research topic. In the first place, it's important that we are practical when choosing the topic, so that we can count on delivering it in the correct deadlines with correct information from trustworthy sources.

From the early stages of the research, by finding authors that will serve as a basis for various theoretical points of view and therefore for the investigation, in the literature review, the first thing to do is to gather all these materials and start thinking how to correlate their opinions.

From these references, this entire theoretical framework is used to construct the texts, with data such as the name of the author/s, the title, edition, references, etc. For research to be scientifically well founded, the selected population that is representing the conditions that are being under investigation must trustfully reflect the remaining elements of the wider population.

Additionally, other factors are essential for scientific credibility to the paper, such as the research design (whether experimental or based on the field), the definition and range of the research problem, the formulation of assumptions or hypotheses, the selection of data collection tools, and the theoretical frameworks used to interpret the results" (Fontanella, Ricas, and Turato, 2008, p.18).

In qualitative research it should be verified if the investigation does in fact measure what the researcher set out to measure, if his methodological processes are in fact trustworthy and if his results are compatible. (Ollaik and Ziller, 2012, p.231)

In this context, I started from the research and analysis of my study objective where I identified the subjects of investigation with the goal of learning their opinion and their point of view from different angles so that I could compile all their data and present a well written conclusion.

This research had the goal of gathering and describing opinions on how Intelligent Systems and Machine Learning influence the tools used by professionals that have a direct

contact with the SAF-T (PT) Accountant program such as Certified Accountants and Tax Auditors from the Tax Authority. The aim was to document and analyze this information without having an effect on it, focusing purely on observing and analyzing the data. As Yin (2015, p. 77) suggests, the researcher should "ask good questions, listen carefully, stay flexible, understand the topics being studied, and remain unbiased."

**3.4 Investigating Subjects**

The subjects of Investigation that were selected for this research were mainly divided in two areas, Certified Accountants and the Tax Auditors from the Tax Authority as I found that these are the agents that have the direct contact with the SAF-T and SAF-T (PT) Accounting program.

In total there were six different responses, where four responses were from Individuals belonging to the Certified Accountants, and two from Tax Auditors, with the goal of having a different understanding from the financial branch, the audit branch and finally the tax branch with different organizational structures. Some that worked as an intermediary between the Tax authority and financial institutions, and the others as an intermediary between clients and the Tax authority.

There were challenges in getting some of the interviewers to participate in this study, especially Tax Authority inspectors, due to the professional confidentiality they must have and due to the fact that they worked in a government entity. However, my goal was to gather general information and opinions without requiring their disclosure or any sensitive information related to their professional activities.

Furthermore, the qualitative method was the method used in this investigation to get a clear and understanding of the thesis topic. In this way, by getting data from a different variety of perspectives, I was able to know and compare different viewpoints, supported by case studies, books, financial reports, and other relevant sources.

Figure 3: Demographic and Professional Overview of Interview Participants

| Individual | Age (Years) | Formation | Profession/Function |
|---|---|---|---|
| Individual 1 | 39 | Master | Certified Accountant |
| Individual 2 | 42 | Master | Certified Accountant |
| Individual 3 | 45 | Bachelor | Certified Accountant |
| Individual 4 | 53 | Doctor | Certified Accountant |
| Individual 5 | 48 | Master | Tax Auditor, Tax Authority |
| Individual 6 | 51 | Doctor | Tax Auditor, Tax Authority |

Source: (Own elaboration)

## 3.5 Informative collecting instruments and procedures

At first, I thought I would base this Research study on surveys done to a target audience that would reveal their opinions, accuracy and new angles on this topic. However, after consideration, this method would not be sufficient to clarify important questions due to the complexity of the topic.

Therefore, since the use of surveys was no longer possible, I opted for another way, open interviews, which were completely confidential, (the id of the interviewed). Using this method, I was able to understand and to analyze their answers and correlate their answers, having a better understanding of the topic, so that I would be able to conclude with important marks with the goal of clarifying the audience as best as possible. There were 12 questions that were introduced in 5 different topics, these topics would vary from the "Role of Intelligent Systems", "Impact on Business Management", "Technology and Software", "Training and Opinion", and "Portuguese Context".

## 3.6 Informative processing and analysis

The questions were arranged with the categories and objectives that guided the development of the questions.

As said before, there were 12 questions that were divided in 5 different topics, these topics would vary from the "Role of Intelligent Systems", "Impact on Business Management", "Technology and Software", "Training and Opinion", and "Portuguese Context" so that it would not only be easier to the interviewees but also to the general public to understand the flow of the interview. The analysis of the responses will be shown later. Table 2 presents the analytical framework that was developed.

Figure 4: Research Objectives, Questions, and Techniques

| Objective | Search Questions | Used Techniques |
|---|---|---|
| **Role of Intelligent Systems** | 1. What is the role of the SAF-T and SAF-T Accounting programs as instruments of new technologies in combating tax evasion? | Qualitative analysis through the analysis of contents of interviews |
| Role of Intelligent Systems | 2. Does the SAF-T safeguard the rights and guarantees of the agents in contact with this file, or does its use violate fundamental rights? | Qualitative analysis through the analysis of contents of interviews |
| Role of Intelligent Systems | 3. What is the perception of the agents (in this case, agents in your area) regarding the SAF-T? What are the benefits and/or drawbacks? | Qualitative analysis through the analysis of contents of interviews |

| | | |
|---|---|---|
| **Impact on Business Management** | 1. How can the correct use of the SAF-T (PT) Accounting file benefit a company's financial management? | Qualitative analysis through the analysis of contents of interviews |
| Impact on Business Management | 2. How can the SAF-T (PT) file help improve the accuracy of internal and external audits? | Qualitative analysis through the analysis of contents of interviews |
| **Technology and Software** | 1. Is our current accounting system fully prepared and up to date to generate the SAF-T (PT) file according to the requirements, or are there still several gaps? | Qualitative analysis through the analysis of contents of interviews |
| Technology and Software | 2. How can we ensure data security, particularly for clients, in the process of generating and submitting the SAF-T (PT) file? | Qualitative analysis through the analysis of contents of interviews |
| Technology and Software | 3. In your opinion, what are the main concerns regarding data privacy and confidentiality related to the use of SAF-T files? | Qualitative analysis through the analysis of contents of interviews |
| **Training and Opinion** | 1. What type of training does the accounting team need to effectively handle the SAF-T? | Qualitative analysis through the analysis of contents of interviews |

| | | |
|---|---|---|
| Training and Opinion | 2. Do you agree that there should be more tax inspections to combat fraud and tax evasion? What changes would you propose? | Qualitative analysis through the analysis of contents of interviews |
| **Portuguese Context** | 1. How does the adoption of SAF-T files help mitigate risks related to corruption within companies? | Qualitative analysis through the analysis of contents of interviews |
| Portuguese Context | 2. In your opinion, is Portugal still behind in terms of digitizing the tax/banking system compared to other European countries? What changes would you propose? | Qualitative analysis through the analysis of contents of interviews |

Source: (Own elaboration)

**4. Chapter - Results and Discussion**

As mentioned above, when doing the analyses of this research study, it was at first based on a literature review and then, based on a neutral analysis of the responses provided by the interviewees during the semi-structured interview.

Therefore, all the results of this study will be presented by answering the questions that were proposed in the following methodology: (1) divide it into five topics, referring to the five topics in which the questions are inserted.

For example, the first topic that is going to be analyzed are the questions related to the "Role of Intelligent Systems". (1) What is the role of the SAF-T and SAF-T Accounting programs as instruments of new technologies in combating tax evasion? (2) Does the SAF-T safeguard the rights and guarantees of the agents in contact with this file, or does its use violate fundamental rights? (3) What is the perception of the agents (in this case, agents in your area) regarding the SAF-T? What are the benefits and/or drawbacks?

Then the goal is to interpret all the key takeaways and results from the interpretation of the questions given by each group of interviewers (Accounting, Auditor) and correlate them supported by quotes from the interviewees to prevent bias and ensure the results are more reliable and aligned with their perspectives.

As mentioned previously, the interviewees names/companies are going to be confidential to protect and respect them. Interviewees are going to be represented by "Individual" followed by the respective ordinal number order they were interviewed.

**4.1 Role of Intelligent Systems**

**Q1** - What is the role of the SAF-T and SAF-T Accounting programs as instruments of new technologies in combating tax evasion?

The first question is aimed to understand the role that these programs have in preventing the commitment of crimes so that individuals that don't have a background in this area have a better understanding of the subject that is being studied in this study. Furthermore, the answers will provide a clear understanding from the interviewees point of view, what is the main goal of using this kind of programs and if they are in fact successfully implemented.

After carefully analysing all answers, Individual "1" refers that there are key factors to take in account when studying this programs such as, first the "data standardization that immediately facilitates communication between companies and TA", the information goes back and forward in a much easier and faster way, secondly the efficiency of the processes, this program facilitates the automates tax accounting processes, there is less need for manual intervention and therefore a decrease in human errors, a decrease in administrative tasks and operation costs.

Individual "3" and "4" also referred that this transparency between the Tax Authority and the companies lead to "facilitation of the Authority oversight, identifying cases of Tax Evasion/Fraud quicker, in fact, the use of this software's speeds up the tax audit process greatly by enhancing the role of the tax auditor when analyzing companies information, such as, company accounts, this inspection allows them to direct their inspection to most critical points of entity".

This correlates with what Smith (1776) says previously, "the primary goals of taxation are efficiency, simplicity…", naturally the use of this new systems by the Tax Authority creates a path to new forms of analyze data more efficiently. This is beneficial as it transmits less time inspecting special cases, collecting and preparing different inspection acts.

Furthermore, Individual "2" ads that "with the new technologies, companies can integrate different intelligent information systems, having an increase in the quality of the software's that are used, the ERP, for example, which can lead to the process of information more fluid, this standardization of results allows that the companies can utilize more advanced tools like Machine Learning, which allows the analysis and decision making in less time". This is important information not only for the shareholders, sharing the "health" of the company but also with its stakeholders.

**Q2** - Does the SAF-T safeguard the rights and guarantees of the agents in contact with this file, or does its use violate fundamental rights?

The second question is aimed with the goal of understanding if this program assures the security of the confidentiality of the data from the companies that is treated by the SAF-T programs or if the personal information is violated in any way. It is important to understand this to know if this protection ensures that the use of data does not overreach or infringe upon fundamental

rights such as privacy, confidentiality, and due process. Safeguarding these rights builds trust between businesses, individuals, and tax authorities, therefore ensuring that while tax compliance is enforced, personal and professional freedoms are not compromised.

Individual "3" explains that "There should be a higher level of data encryption in some data or at least concealment, especially in the data related to the clients and suppliers, because it's a fundamental secret of the company". It is very sensitive information that the SAF-T Accounting deals with, the individuals that have access to this program and work in the Tax Authority can have privileged knowledge of information, they are entrusted with sensitive and confidential data.

This data includes financial statements, business strategies, and trade secrets, such as: which client buys the most, the amount of products that were bought and sold or even which are their profit margins, which, if misused or leaked, could harm the companies involved and undermine fair competition. Individual "3" concludes with an example "Imagine an entity that buys and sells shares, that operates in the share market. With this file, the SAF-T Accounting, if all is accounted in the correct accounting movements, any individual working with this file would have access to what the company was buying and selling and what would be its earnings in each transaction, which is very privileged information".

Individual "6" adds that "this stands as a possible major problem and a dilemma of the society, not only in an ethical but also in a legal and economic way". There is always a chance of being hacked when dealing with sensitive data that is uploaded to the network or even as the information is easily accessed. If you have credentials it can lead to a potential for conflict between personal gain, for example, insider trading, bribery, and their duty to uphold the law and protect taxpayer confidentiality.

This correlates with (Martinez, 2003, page 3), "…the state serves as a governmental authority responsible for various aspects in … defensive, supervision and promoting integrity in the society", it is important that the state guarantees the privacy of its citizens/companies as it is a right of everyone that is a citizen or block the attempts of public details being hacked as not only it ensures the human/companies dignity, but also the safety and self-determination.

Furthermore, abusing this privileged information can corrode public trust in the Tax Authority and can have significant consequences for both the economy and society. Maintaining ethical standards is essential to ensuring that tax authorities act impartially and that

businesses can operate in a system where their private information is protected. Failure to do so could lead to corruption, unfair advantages, and damage to the integrity of the entire tax system.

**Q3** - What is the perception of the agents (in this case, agents in your area) regarding the SAF-T Accounting? What are the benefits and/or drawbacks?

Following the last two questions, this question was asked with the purpose of understanding the personal views that the different interviewees had on the use of the SAF-T Accounting programs and their contribute/drawbacks to the companies and to the Tax Authority.

The opinions of all Individuals were very consensual and similar to the topics that were discussed in the previous answer. From an Accounting perspective, Individual "1" and "3" states that there are a lot of benefits.

These benefits relate to per (Luís Miguel Botelho, 2015), "…define Intelligent Systems as being a … system with a set of characteristics… capacity for discovery … and the capacity for explanation." because, with this program, it is possible to incorporate all the accounting information in a matter of seconds, in a day it is possible to compile information regarding 4 to 5 years of data from companies' statements which naturally translates to lower context costs.

From a Tax Authority perspective, it is beneficial, as we learned. It allows a higher control and detection of Tax Evasion/Fraud happening, two companies that send their VAT statements can then be traced, and their data crossed to identify and interpret its results, which naturally helps the Authority.

Therefore, to conclude, as a major benefit, you have the reduction of time consuming when treating this information or dealing with companies with a high turnover. As common drawbacks, the individuals interviewed opinion related to the importance of the security related to all the data that this program treats. It is imperative that there has to be a high level of cybersecurity as this data will all be concentrated in a database. Not only this but it was also mentioned that there are a lot of small companies that don't have the capacity to invest in this kind of software's, they currently use obsolete software's in their accounting, however this can be seen as a result of the evolution of the market.

In order to keep up with the competition, there has to be investment in this area, a constant digital evolution, seen not as an expense but rather as an investment, from a management point of view.

## 4.2    Role of Intelligent Systems

**Q1** - How can the correct use of the SAF-T (PT) file benefit a company's financial management?

The following question has the purpose of understanding how effectively the use of the SAF-T (PT) Accounting program can increase a company's financial organization and reporting precision and improve financial management practices within the business based on the interviewee's opinion.  Individual "6" carefully explained the benefits of incorporating this program, the SAF-T (PT) Accounting, into its business management. "The correct use of these programs or any Intelligent System so long as it is secured and the data is all encrypted can greatly increase a company's financial management by offering a clear, organized, and standardized method of recording and reporting financial data.

Not only ensures that all transactions are documented but also facilitates the way of dealing with all the tax laws by reducing the risk of financial disparities". As seen in the discussion of the above questions, its easy to understand that with this system, SAF-T (PT) Accounting, companies can use this organization to track their financial performance, be better prepared for external audits and try to minimize the likelihood of doing Tax Evasion/Fraud. Individual "1" ads that the possibility to track the financial performance of a company align with the treatment of this data and obtain its financial/economic indicators, Key performance indicators, allows an evaluation of the company and plan the future development/growth of the company. Besides the rapid access to information, the decrease in human error is also a very important factor when considering the time that was spent inserting all the information regarding balance sheets and income statements.

As said Chen, J. (2022). Engineering, 12, Article May., "Effectively using intelligent systems, like automated financial software and data analytics, is essential to improving a company's financial health." As seen, these systems implemented in companies help businesses analyze financial data in less time and real-time, making it simpler to manages their cash flow, predict future directions, and quicky identify any problems. Smart tech clarifies a lot of things,

such as, financial tasks. Reduces human mistakes, and saves time on standard work, which enables businesses to focus their attention on more strategic planning and growth. By using technology, such as Intelligent Systems, to manage finances more efficiently, companies can boost profits, make better decisions and stay competitive in the market.

**Q2** - How can the SAF-T (PT) file help improve the accuracy of internal and external audits?

The aim of this question is to examine how the SAF-T (PT) file can increase the precision and efficiency of both internal and external audits. It seeks to understand how systematized, detailed financial data can make the audit process easier to understand, to follow and easier to identify discrepancies and ensure compliance with the regulatory standards that the Tax Authority implements. Individual "4" refers that "the improvement and investment in these Intelligent Systems, for example, SAF-T (PT) Accounting, reduces human mistakes and detects fraudulent intrusion to decrease human intervention".

From a Tax Authority perspective, the use of the SAF-T (PT) file can greatly enhance the accuracy of both internal and external audits by providing a standardized, automated system that simplifies the audit process. The SAF-T file captures comprehensive financial data, including sales, purchases, inventory, and accounting records, in a uniform format. This ensures that tax authorities have access to detailed, structured information, reducing the likelihood of errors or omissions.

Since all the data is in a consistent format, it allows for more efficient cross-referencing and analysis, making it easier to identify discrepancies or irregularities that may indicate tax fraud or non-compliance. Additionally, the automated nature of the SAF-T system minimizes manual handling of data, which reduces the chances of human error and ensures the data being audited is accurate and reliable.

Individual "6" gives his opinion by stating that "I have been involved in internal auditing for 20 years, and during this time, I have witnessed significant changes in the competency expectations for internal auditors. Two decades ago, internal auditors were expected to have broad knowledge and skills, with the idea that a well-trained auditor could handle any type of audit. Today, much more specialized skills are required, and in this organization, for example, the internal audit function has been divided into different teams, each focusing on specific areas of expertise within their respective responsibilities."

Moreover, the SAF-T file strengthens the integrity of external audits by ensuring that companies are providing complete and transparent financial information. Tax authorities can use the data within SAF-T files to verify that the tax declarations made by businesses are correct and consistent with their financial records. This system streamlines the audit process by giving auditors direct access to detailed, organized financial data, thus speeding up the review and enabling authorities to focus on identifying potential risks or areas of non-compliance. The availability of real-time data also facilitates more frequent and efficient audits, ultimately enhancing compliance and improving the overall effectiveness of tax enforcement.

This connects to what (Hassan 2022) said, "Intelligent Systems offer different potential benefits to the audit process in question, particularly in the fields of accuracy and efficiency". By automating tasks like data entry and analysis, Intelligent Systems can reduce errors and improve the speed of the auditing process. Additionally, these internal and external audits provide deeper insights and a better understanding of complex data sets, leading to more accurate and reliable audit reports.

## 4.3    Technology and Software

**Q1** - Is our current accounting system fully prepared and up to date to generate the SAF-T (PT) file according to the requirements, or are there still several gaps?

The aim of this question is not to evaluate if the current accounting system is completely up to date and capable of generating the SAF-T (PT) Accounting program in the same line with the regulatory requirements but also to seek and to identify any potential gaps or limitations that could impede compliance and affect the system's overall effectiveness.

There were some divided opinions related to this topic. Some Individuals who belonged to the accounting field revealed that there are some problems, mainly to medium and small companies who have limited resources. As seen before this is an investment, and it can occur that these companies don't have the monetary capacity/ability to invest in these programs.

Analyzing what authors Russel and Norgiv (2020) said "modern Intelligent Systems naturally has its problems and restrictions", it is possible to understand that it is naturally that there will always be problems when facing the implementation of a new software, the goal is

to evolve with its mistakes, try to mitigate them and learn from them. Its only by doing this that companies can learn how to avoid them and make progress to a healthier financial future.

These companies therefore still have big gaps when compared to big companies. Individual "4" refers that when creating the SAF-T Accounting file, the first thing to have in mind is that the companies need to have a very well done and organized accounting, due to the contranatural balances. "In the past there where contra natura balances that weren't properly explained, today the SAF-T Accounting file doesn't allow that".

There are still gaps in our accounting system especially in the financial statements or in the accounting taxonomies. Individual "4" proceeds to add "Our accounting system still needs to have a lot of evolution, for example, when we want to create a balance sheet, if we do it according to the taxonomies system, it stays limited to the its rules, it is not possible to decompose this information, this creates an obstacle because not all companies have the same size, don't sell the same products. When the file is produced, the information comes aggregated so the utility to analyze it gets lost, in a more analytical perspective".

**Q2** - How can we ensure data security, particularly for clients, in the process of generating and submitting the SAF-T (PT) file?

In this question the aim was to explore how the data is security ensured and what were the strategies for safeguarding all of the client data when the SAF-T Accounting is generated and submitted to the Tax Authority.  All individuals mentioned that in order to have a high level of security, there has to be a high level of investment into cryptography.

For example, data-level access control, this security measure is seen as crucial, not only dealing with this software but in general when dealing with Intelligent Systems, where precise policies determine who has access to specific data and what actions they are allowed to perform, thereby reducing data exposure. It serves as a strong safeguard against unauthorized access, preventing potential data leaks. Additionally, this approach plays a key role in ensuring compliance with data protection regulations.

As Individual "3" states "There has to be a high level of security when dealing with this sensitive information, there has to be an authentication and authorization of those who use it, especially a detailed record of all the activities related with the generation, access and sending of the SAF-T Accounting file, thus helping to identify if there is any access or activity that is not permitted/suspicious, but essentially the software security".

From a Tax Authority point of view there has to be a certainty if the programs are certified. Individuals "5" and "6" state that there are companies that don't use this software, rather use a similar version of it. "It's very important to regulate these companies and how they upload their data. There are cases where companies use a version that it's not approved/certified by the state authority.

Therefore, it's imperative that there are no differences when dealing with these cases, all must be equal so that it's easier to deal with them, companies should invest in this license and acquiring this program, in the case of securing the data, it's simple, one is approved by the Tax Authority, the other is not". They argue that companies that violate these rules can/should face heavy fines, highlighting the role of regulation in driving data security efforts.


**Q3** - In your opinion, what are the main concerns regarding data privacy and confidentiality related to the use of SAF-T files?

The aim of this question is to gather insights on the primary concerns surrounding data privacy and confidentiality when using SAF-T files. It seeks to understand the potential risks and challenges that organizations may face in protecting sensitive information during the handling and submission of these files. Almost all Individuals that deal with the submitting of this software claim that there are concerns regarding data privacy and mostly concerns regarding possible data breaches.

Individual "2" for example, states that "As I told before, the confidentiality of the data is not guaranteed, the names of customers, the names of suppliers and financial investments, a lot of information is available to third parties who have unavoidable access". Individual "4" defends that there is a lot of sensitive data this software operates on. "This is the type of information that, if exposed, could lead to significant harm or compromise, inside the companies or even to the society and to the Authority, this includes financial records or proprietary business data. Therefore, sensitive data must be protected with the highest security standards by ensuring the users privacy so that the clients can not only trust us but also the Tax Authority".

In this way, the biggest risk /concern that the Tax Authority should have is preventing possible attacks/cybercrimes and data breaches. Logically, if there would be a leak of information due to a data breach it could have major consequences, such as the reveal of sensitive and valuable information, leading to financial losses, reputational harm, and legal

repercussions. Individual "4" states that "Implementing robust data security protocols is essential to prevent such breaches and maintain the confidentiality and integrity of the data".

## 4.4    Training and Opinion

**Q1** - What type of training does the accounting team need to effectively handle the SAF-T Accounting?

The aim of this question is to identify the specific training requirements for the accounting team to efficiently manage and process the SAF-T files. It seeks to determine the skills and knowledge necessary to ensure accurate compliance with the technical and regulatory aspects of SAF-T handling.

The introduction of this software into the accounting system by the Portuguese Tax Authority represents an investment into the use of Intelligent Systems with the goal of increasing the efficiency and effectiveness when dealing with matters related to trying to simplify the process of submitting the financial and accounting data, from a client/accountant perspective and from a Tax Revisor perspective, simplifies the analyses of the important information.

Nevertheless, dealing with this kind of software involves learning and interpret the data that its inputted and outputted. In this way it is fundamental that there should be an investment in software/IT department or in specialized training so that if or when problems occur, the individuals dealing with this kind of software have the tools to face the problems/questions regarding this. This is explained as Individual "2" refers "One of the big problems related to this software is the computer skills to deal with the SAF-T file because this file needs computer investment to deal with technical problems. It's supported by (Gärtner, 2018) who refers, the importance that training has to be one of the main focus, in order to run the intelligent systems to its optimum potential.

To succeed, firstly it is fundamental that the professional knows how to work with the accounting software, and inside this software knows how to generate the SAF-T Accounting file, secondly the constant need for continued training in the team to effectively deal with this file. With the introduction of this new file, SAF-T Accounting, there will have to be training in the new updates of the functionality". Individual "4" ads that there should be an increase in the

training of new areas. "There should also be an introduction of training in new areas, such as security and data policy".

As Schrettenbrunnner (2020) says "innovation of technology needs to be taken seriously within an organization…" this highlights the necessity for investment not only in digital tools but also in human capital, all the stakeholders need to take this seriously, ensuring that human capabilities evolve alongside technological advancements.

There are problems when considering investment in Intelligent Systems, namely costs of these training courses. Individual "1" concludes by saying "either we have technological information from companies that give us support to enhance the data and this costs the analysis itself, or the internal teams have to have training in the information technology area, and this creates a problem when it comes to high investments that maybe small companies don't have the capacity to invest and this is a problem that has to be overcome. In addition, this creates another problem, with the automation of processes, we need people, in addition to training and computer skills, to also have skills in analyzing and interpreting data that is produced by this system".

**Q2** - Do you agree that there should be more tax inspections to combat fraud and tax evasion? What changes would you propose?

The aim of this question is to consider opinions on whether increasing the frequency of tax inspections would be effective in reducing fraud and tax evasion. It also seeks to collect possible suggestions for potential changes or improvements to improve the effectiveness of tax enforcement measures based on the experience of the Individuals from all their professional areas.

A system where there is a high possibility of tax inspections, prevents individuals and businesses are less likely to engage in fraudulent activities or evade taxes, they are more likely to adopt responsible accounting and financial practices which translates to better corporate management and financial transparency. Seen previously, "The efficiency of a tax system relies not only on the design of tax policies but also on the effectiveness of tax enforcement mechanisms, particularly inspections and audits." Slemrod, J. & Yitzhaki, S. (2002), it is logic to understand that when taxpayers believe there is a higher chance of being audited, they are less likely to engage in evasion.

Having a system where these practices are usual, helps create a fairer, more transparent, and more effective tax system. Citizens who see that the laws are being applied consistently and those who commit these illegalities are held accountable strengthen the public trust, they see it as legitimate. Individual "3" proceeds to state that "There should be more tax inspections, however it's difficult to control 100% of the tax system, every step and every company of the country".

Individual "3" proceeds to refer some changes that would make sense such as investment in education and specialization in this field, that was referred above "There should be an investment in the training and capacity of the inspectors that deal with this software, in big data or machine learning, recruit more specialists because the Tax Authority doesn't have the capacity or the man power to analyze every detail, its simple impossible right now. As soon as this investment is made, naturally there will be a higher control". As Whelan and Carcary (2011) defend "companies' performance is highly linked to employee competencies; knowledge, skills and abilities to carry out tasks".

Individual "5" contributes with key takeaways referring that there are still a lot of problems with this control from the Tax Authority that are key steps to improve the system. "We can see that the use of Intelligent Systems 100% facilitates the identification of cases of tax fraud/evasion. Not only it gives more information but it's also easier to cross data between companies, however there is a crucial aspect that is often forgotten.

The SAF-T Accounting file focuses on those who work on declarative accounting information, the problem is those who do not have declarative information to declare, the parallel economy. Therefore, there is a lot of combat missing from the TA, the Tax Authority is getting used to always controlling the same ones, those who are in the system, and not those who aren't". Individual "5" concludes by saying that this should be one of the main changes that should be made, "This would be one of the changes I would introduce, as the inspection process will be much more agile and efficient with the introduction of the SAF-T accounting file, there should be very specialized teams for this issue, the non-declarative accounting". This is therefore connected to Casalta Nabais (2004) previously statement, "…disclosed by taxpayers, meaning it is based on their declarations". If the taxpayers don't have anything to declare it is almost impossible to track the illegalities done by these citizens.

From a Tax Authority point of view, Individual "6" acknowledges that significant changes are necessary and supports the idea of increasing tax inspections. However, he points

out a problem with the justice system when it comes to handling cases identified as tax fraud or evasion, namely the time it takes to reach a verdict. "There are ongoing cases that have been in court for the last 5 years without any improvements, and I'm talking about cases where the Individuals/Companies are suspected of evading the tax system in amounts around 100.000 euros, which aren't very "significant amounts" compared to others, so you can imagine the length and duration it would take to reach a final verdict in cases that were around millions."

## 4.5    Portuguese Context

**Q1** - How does the adoption of SAF-T files help mitigate risks related to corruption within companies?

The aim of this question is to explore how implementing SAF-T files can reduce risks associated with corruption within companies by improving transparency and accountability. It seeks to understand how the standardized data provided by SAF-T files can deter corrupt practices and improve the inspection. By implementing this software into the company's structure, it's easier to understand and build accountability. Companies need to maintain detailed and accurate records of all the transactions made.

This obligation encourages a culture of accountability within the organization, as employees are aware that financial activities are being strictly recorded and can be audited at any time by the Tax Authority. This factor, aligned with the need for improvement in the company's internal accounting and financial systems, leads to the increase in internal controls and processes, therefore companies are better equipped to detect and prevent corrupt practices internally before they escalate and reach the TA domain.

However, there is still a possibility of existing cases of corruption since companies are only required to submit the SAF-T file annually, they have ample time throughout the year to engage in and conceal corrupt activities before the next reporting period.  Individual "4" explains this "Yes it helps mitigate the risks of corruption but there is still a chance of corruption. The submission of this file is yearly, so the companies have a high time interval to hide possible crimes."  This connects with what Joel Slemrod (2007) says "Some dutiful people will undoubtedly pay what they owe, but many others will not." There is always a possibility

of existing corruption in companies or by individual citizens, the goal of the Tax system is to utilize this innovation to mitigate the possibility of this cases.

The solution that Individual "4" proposes is to reduce the deadline of the SAF-T accounting program. "The solution that for me that would make sense, would be to split this file into quarterly, or monthly deliveries". Individual "4" adds that from a TA perspective, besides this decision there should be a set of financial indicators that would make the job easier. "It is necessary to prepare a set of KPIs and monitor these KPIs with the generation of the SAF-T file and compare them with the ones that were generated before, in this way the TA can identify if there is any sort of illegalities happening".

**Q2** - Do you believe Portugal is still behind other European countries in digitizing its tax and banking systems?

The question seeks to assess whether Portugal has kept its evolution when compared with other European countries in modernizing its tax and banking systems through digital technology. It also aims to explore the extent of Portugal's progress in adopting advanced digital solutions and processes.

Additionally, there is an interest in hearing possible suggestions for potential changes that could enhance the efficiency, transparency, and security of Portugal's financial infrastructure, bringing it in line with leading practices across Europe. After carefully analyzing the answers from the interviewees, it's possible to state that in fact, based on their opinions, Portugal is well advanced in the tax and banking industry. Individual "5" claims that Portugal was in fact, one of the pioneers in the implementation of the SAF-T file, inside the Europe community. "As you know, and if you google it, Portugal was one of the first countries to use the SAF-T software, and the most advance in my opinion. Spain, for example, has been trying to copy and implement our system."

Individual "1" ads that "Portugal has a significant advance compared to others, in terms of declarative obligations, invoicing obligations and digital delivery obligations, I would say we are in the top 3 in terms of control within the formal economy, however there is still a big problem related to the control of the parallel economy".

In this way, Portugal continues to face challenges in controlling the parallel economy due to a combination of factors, including mostly cultural attitudes towards informal transactions, economic pressures, and regulatory limitations. A significant segment of the

population still views cash-based, off-the-books transactions as a means to avoid high taxes or navigate economic uncertainty. Despite efforts to increase tax inspections and introduce digital reporting tools, the enforcement can be inconsistent, and the complexity of the tax system may unintentionally encourage non-compliance. Furthermore, the lack of common adoption of digital payment methods, particularly in rural areas, makes it easier for informal economic activities to persist without detection.

# 5. Chapter - Conclusion

## 5.1 Limitations and Future Investigation

This final chapter aims to present the conclusions of the study. One of the primary objectives was to research and analyze a wide range of knowledge and technical skills related to the topic. This investigation was supported by relevant literature and a scientific approach. In this context, the key findings and limitations of the study will be discussed, along with the practical implications of the developed system for the Tax System.

The research shows that Portugal has made good progress in digitizing its tax system and using technology like the SAF-T file, but there are still challenges to overcome. According to the people interviewed, the SAF-T and SAF-T Accounting programs have helped make tax processes smoother and fight tax evasion by improving transparency and efficiency. They allow easier data exchange between companies and the Tax Authority. However, the interviewees mentioned some key areas that need improvement, such as better data security and more frequent reporting to reduce the chances of corruption and fraud. They stressed that having digital tools is not enough, these tools must be used properly to achieve the intended results.

One of the biggest changes suggested was to increase how often SAF-T files are submitted. Right now, companies need to send these files only once a year, which gives them a large window to hide any illegal activities. Many interviewees think that submitting these files every three months or even monthly would reduce the risk of fraud. More frequent submissions would allow for closer monitoring, making it harder for companies to commit fraud without being noticed. They also suggested creating key performance indicators (KPIs) to monitor the data in these submissions, so the Tax Authority could quickly spot any issues and focus on them.

Another major concern was data privacy and confidentiality. SAF-T files contain very sensitive company information, such as details about clients, suppliers, and financial transactions. While these files help the Tax Authority keep better control, they also create risks if the data isn't protected well enough. Interviewees called for stronger data encryption, tighter access controls, and better rules to ensure that sensitive information is kept safe. If data protection is weak, it could lead to serious problems like data breaches, insider trading, or misuse of confidential business information, which would harm both the companies and the tax system's integrity.

The research results also pointed out some limits in Portugal's tax system, especially when it comes to controlling the informal, "off-the-books" economy. Even though digital tax reporting has improved, a large part of the economy still operates in the illegality. Cultural habits of transactions with cash, combined with economic pressures and complicated rules, have made this issue worse over the time. Interviewees said that the Tax Authority often focuses more on businesses that happen in the formal economy and not enough on those operating in the informal sector.

To be clear and specific and to answer the theme of the thesis, "How can the application of Intelligent Systems and Machine Learning help prevent Tax Evasion" the main goal of this study, there are key factors to take in account. The introduction of Intelligent Systems (such as, the SAF-T file) and Machine Learning as a tool in the workplace to identify illegal cases need to be seen as a 100% benefit to the tax system. Putting these tools in practice, the authority can detect:

- strange patterns in tax reports, like underreporting income or over-claiming deductions, predict who is more likely to evade taxes by looking at past behavior, which translates in more focus on the high-risk cases,
- real-life monitoring as IS can check financial transactions in real-time and detect any unusual activities, catching cases of tax evasion/fraud earlier,
- analyze the behaviour of taxpayers based on their financial habits and predict potential cases,
- crossing data, with the support from different sources, such as bank records or financial statements, tax authorities can get a complete view of a taxpayer's financial activities and
- better audits, helping authorities focusing on high-risk taxpayers, utilizing their time more effectively and effort by avoiding unnecessary audits on "legal" individuals.

After discussing all the data gathered in this study, it is important to mentioned that the research has some limitations when considering future research. Firstly, the number of individuals available for the interviews. There wasn't a lot of availability from the public, in this case, Accountants and Tax Revisors to want to participate in this study. It is important to mention that for further investigation there needs to be a higher number of interviewees so that the conclusions and the opinions discussed are wider and more ideas are taken into account.

Secondly, the variety of areas of specialization of the interviewees. There were only two areas that were taken in consideration (accounting and tax auditor area). It is important to mention that for further investigation there could be interesting if there was a wider range of specialization so that the data, opinions and different visions gathered would have a bigger impact to the discussion of the results.

To conclude, Portugal has made great efforts in using digital tax tools like the SAF-T file, but challenges still remain to overcome. A stronger data security, better efforts to combat the informal economy, need for training to everyone who deals with this software and a reformulation of the judicial system are seen as the major problems that exist and will continue so if nothing is done to invert it.

## 6. Chapter - References

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## LEGISLATION CONSULTED

Commercial Companies Code

Personal Income Tax Code

Value Added Tax Code

Decree-Law No. 47/77, of February 7

Decree-Law No. 8/2007 - Official Gazette No. 12/2007, Series I of January 17, 2007

Ordinance No. 321-A/2007, of March 26

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Law No. 139/2015, of September 7

Decree-Law No. 98/2019, of June 2