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Impact and Implementation of Artificial Intelligence in Human Resources Research and Selection Tools

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Masters in Business Administration

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To my parents and best friends for always believing in me and supporting me.

Resumo

No cenário em evolução dos processos de trabalho em transição de operações presenciais para operações remotas, a experiência digital está a passar por uma mudança transformadora. A Inteligência Artificial (IA) está a emergir como um interveniente fundamental em diversos domínios, obrigando todas as organizações e estruturas a adaptarem-se e a melhorarem o seu desempenho (Vardarlier & Zafer, 2020: 355). Além disso, espera-se que a integração de módulos avançados de IA, especialmente no âmbito dos recursos humanos, tenha um impacto positivo na vida dos colaboradores (Karaboga et al., 2020).

O objetivo principal deste estudo é avaliar o impacto da IA nos processos de recrutamento e seleção, tanto em ambientes corporativos como em agências de recrutamento. Além disso, procura avaliar as perspetivas futuras considerando as tecnologias baseadas em IA e as suas potenciais vantagens e desvantagens na indústria de Recursos Humanos (RH). Para atingir esses objetivos, foram estudados os temas pertinentes na revisão da literatura e realizados questionários distribuídos a 300 profissionais das áreas de RH e IA.

Os dados recolhidos revelaram que é indiscutível que a indústria de RH está a passar por uma transformação e rejuvenescimento impulsionado pelo advento da Indústria 4.0. A exploração e integração da IA são partes integrantes desta jornada transformadora. Num contexto mais amplo, ambos os domínios estão a convergir para enfrentar os desafios colocados pela inundação de dados. No entanto, é de salientar que a utilização da IA neste setor permanece numa fase inicial e todo o seu potencial ainda não foi concretizado.

Palavras-chave: Inteligência Artificial, Recursos Humanos, Recrutamento e Seleção

Classificação JEL:

J24 - Capital Humano; Habilidades; Escolha Ocupacional; Produtividade do Trabalho

O320 – Gestão da Inovação Tecnológica e I&D

Abstract

In the evolving landscape of work processes transitioning from in-person to remote operations, the digital experience is undergoing a transformative shift. Artificial Intelligence (AI) is emerging as a major player across diverse business domains, compelling all organizations to adapt and enhance their performance (Vardarliyer & Zafer, 2020: 355). Anticipating ongoing advancements and changes, AI is poised to assume an even more substantial role in everyday life processes. Furthermore, the integration of advanced AI modules, particularly within human resources, is expected to make a significant positive impact on the lives of employees (Karaboga et al., 2020).

The primary objective of this study is to evaluate the extent of modernization and the impact of AI on recruitment and selection processes within both corporate settings and recruitment agencies. Additionally, it seeks to understand future outlooks by considering AI-based technologies and their potential advantages and drawbacks within the Human Resources (HR) industry. To achieve these goals, the study examined pertinent topics in the literature review and conducted surveys distributed to 300 professionals in the fields of HR and AI.

The data collected revealed that it is indisputable that the HR industry is undergoing a transformation by the advent of Industry 4.0. The exploration and integration of AI are integral parts of this transformative journey. In a broader context, both areas are merging to address the challenges posed by data overload. However, it is noteworthy that the utilization of AI in this sector remains at an early stage, with full potential yet to be achieved or fully perceived.

Keywords: Artificial Intelligence, Human Resource, Recruitment and Selection

JEL Classification:

J24 - Human Capital; Skills; Occupational Choice; Labor Productivity

O320 – Management of Technological Innovation and R&D

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Index of Acronyms

AI – Artificial Intelligence

ATS – Applicant Tracking

CV – Curriculum Vitae

DL – Deep Learning

HR – Human Resources

HI – Human Intelligence

IS – Intelligent Systems

IT – Information technology

ML – Machine Learning

CHAPTER 1

Introduction

1.1. Context

Since the beginning of the 21st century, and especially in the last couple of years, the presence of Artificial Intelligence in everything around us is undeniable. All companies, activity sectors and new businesses seek to keep up with technological evolution and grow with it. The Human Resources area is no exception to the rule. In post-pandemic times, and after an increased need to transfer face-to-face activities to telework, the selection and recruitment of personnel, whether when carried out by the companies themselves or when carried out by outsourcing firms, necessarily underwent a change and adaptation in the methods.

For a long time, the recruitment and selection processes were relatively static, with recruiters having complete control over the entire procedure. The process didn't have as many steps or tests as it does now, with the chronological timeline being job opening, followed by a job ad, screen applicants, interviews, and negotiation with the selected one. In the early 2000's with the technological evolution, some changes started to occur and in the last decade there has been a complete transformation in the recruitment industry, with changes in the way candidates and recruiters think. The volatility of the workforce and the easy access to all sorts of information, have turned the tables around and candidates now have a stronger control over the hiring process. (Smith, 2021)

Recruitment and selection processes arise from a company's need and begin with the definition of hiring objectives, ending with the allocation of the candidate to the vacancy, after completing several selection phases (Holm & Haahr, 2019). When this procedure takes place digitally, the previously mentioned steps are maintained, but instead of face-to-face assessments and interviews, procedures are transferred and adapted with the help of technologies to work 100% remotely.

Besides this transfer from presential to remote processes, the whole digital experience is also changing, AI is starting to play a part in all areas of business, and all companies and structures must adapt if they intend to improve their performance. (Vardarlier & Zafer, 2020: 355). With its constant changes and developments, it is predicted that AI will have an even greater use in everyday life processes. The use of more advanced artificial intelligence modules, especially in human resources, will also make a significant contribution to employee life. (Karaboga et al., 2020)

1.2. Research Issue

If we contemplate the various moments that make up a recruitment process, we can easily come across several situations that can be improved in traditional recruitment: for example, CV triage, initial phone interviews, even personality tests. Hunkenschroer and Luetge (2022) explain that besides interviews, AI-powered skill tests, simulations, and neuroscience video games are used to assess further qualities, for example, applicants' risk attitude, planning, abilities, persistence, or motivation.

This project aims to understand how Artificial Intelligence works, its characteristics, advantages, impacts, failures, and limitations, thus understanding its applicability in recruitment and selection to combat failures or improve current processes. In the study carried out by Big Data Social (Pérez & Falótico, 2019, p. 108), it was possible to verify that “companies that use AI in their HR processes improve up to 300% the time of the recruitment process with a higher quality, compared to traditional recruitment methods”, thus confirming that the presence of AI in recruitment and selection processes can clearly improve the results of these processes.

Especially in the post-pandemic period, this study proves to be relevant. The changes in the market and in business life that the world has undergone have only accentuated its volatility (Bhowmik & Wang, 2020). s. More and more professions, even those that require a high level of specialization and years of education, are being threatened by automatization. (Kettler & Kehneryp, 2019) Forcibly, almost all sectors of activity had to adapt quickly to a new reality, one of them being recruitment and selection. Now, as this is one of the areas of human resources where a decision can have a critical impact on the organization (Sutherland & Jordaan, 2003), this analysis is also important from a perspective of highlighting the existing flaws in current processes and showing the impacts and consequences that a recruitment process carried out incorrectly can have. These failures and consequences can include situations such as constant staff turnover, loss of time and money, in more extreme situations and in some functions technical errors that can have immeasurable consequences for the reputation of a company.

1.3. Objective of the study and research questions

The main objective of this investigation is to explore the impact and the evolution of AI in recruitment and selection tools and how intelligent systems can impact the performance and decisions of recruiters and employees of an organization. In order to reach the main objective

some specific themes were defined to be approached by the two different groups of study, such as:

1. Artificial Intelligence and how intelligent systems can be applied to HR.
2. Study of current recruitment methods and recruiter's predisposition for the changes AI implies in the method of work.

There was also an attempt to understand up to what point both areas are coincidental in terms of results. This means, there was an attempt to realize if with the implementation of these systems and the supposed optimization of the process companies would get a higher number of correct hires/ selections of employees, thus increasing their stay in the company, correct development of tasks and fulfilment of responsibilities. To better understand the problematic in question two different surveys were distributed amongst AI experts and Recruiters/HR Generalists.

There are several questions, from the most general to the most specific, that become fundamental to guide the investigation, such as:

Question 1: How can artificial intelligence replace people in recruitment processes?

Question 2: What are the benefits of artificial intelligence to recruitment processes?

Question 3: What are the downsides of artificial intelligence regarding recruitment processes?

To be able to answer the previously mentioned questions, related with the theme of this dissertation, the investigation took a more deductive approach.

The first part of this study was based in research through qualitative document analysis (QDA). This was the chosen approach since this is a rather reflexive topic that demands an emergent flexibility. Emergent flexibility is closely related to the inductive nature of qualitative research. (Schreier, 2012) This theories and studies conducted by other authors contain resources that were not affected by the researcher preserving their real-life context and with no intent of manipulation of the research setting (Schreier, 2012).

The second part of this dissertation was focused on replicating previously done surveys on a new database of AI and HR experts in order to better identify the evolution on the topic and have a more concrete set of questions previously validated.

The areas chosen for analysis, especially that of Artificial Intelligence, are the target of constant transformations and innovations, so for this particular study the best way to approach the theme would be to carry out the work through a more exploratory vision and through a qualitative investigation. The interest of this project will be more the "research process than just the results or products that result from it" (Carmo & Ferreira, 2008). In this sort of data

research, it is tremendously important to verify the validity of the work present, so the data collected came from certified workers in both fields.

1.4. Global Structure

In order to reach the previously exposed goals, the thesis will be developed according to the following structure:

Part 1 – Introduction: This stage will comprise the justification/pertinence of the study, the objectives of the dissertation and the methodology approach used.

Part 2 – Literature Review: At this point there will be a focus on the theoretical content of the thesis. This portion will be divided into three sections: AI and SI, HR recruitment tools and a final part where the interconnection between both themes will be dissected. The concepts will be defined in a more general approach and having in mind several articles and books on the topic, mentioning some of the major theories and tools currently used.

Part 3 – Methodology: This section provides a detailed explanation of how data was gathered and analyzed. The methodology section includes the following components: Research Design, Data Collection, Sampling, Data Analysis and Validity and Reliability.

Part 4 - Analysis of Results: In this part the results of both surveys will be examined and explained having in mind the theories from Part 2. There will be an in-depth explanation of data and the final conclusions we can take from each study. Additionally, a comparison between the results of the previously done research from which the survey questions were adapted from will also be explored.

Part 5 – General Conclusions: This chapter is meant to answer the investigation questions described in Part 1. In this specific dissertation the results will be predominantly qualitative, so the conclusions of this work are not supposed to be generalized but to be analyzed under a critical perspective.

Literature Review

2.1. Intelligent Systems (IS)

Evolution has allowed for significant progress in all areas of science and computation. In the era of the industrial revolution mankind-built machines and tools were automated to fulfil tasks that before required human effort. Nowadays, in the digital age, computer-based tools are being created and developed to automate tasks that demand mental effort. (Molina, 2022) The exponential need for more intelligent tools gave rise to what we call intelligent systems (IS).

We can define an IS as any system that can investigate data, and reason with it through the examination of patterns and relationships to come up with the desired output. (Vorm, 2018) The main goal with the creation of this systems is to maximize the probability of success and minimize the probability of failure (Albus, 1994) and to provide a standardized methodological approach to solve important and fairly complex problems and obtain consistent and reliable results over time. (Rudas and Fondor, 2008) In sum, IS refer to a broader category of systems that use computational techniques to mimic or exhibit certain aspects of human intelligence. These systems may not necessarily fall under the category of AI, as they can be inspired by natural or biological intelligence as well. Intelligent Systems aim to solve complex problems by processing data and making informed decisions. (Hopgood, 2022)

Intelligent systems are used in various aspects of society, and their applications continue to grow as technology advances. Some key areas where intelligent systems are commonly used are: virtual assistants (Gurabeve & Lopes, 2020), search engines (Madhu, et. Al, 2011), autonomous vehicles (Long, et. Al, 2007), healthcare (Tavakoli, et. Al, 2020), amongst many others.

The development of these systems and the availability of very large, labelled training datasets have enabled a new generation of intelligent systems built on machine learning, which have given rise to the data-driven paradigm of deep learning on deep neural networks. (Vorm, 2018) This type of intelligent systems that have the deep neural networks to support self-learning are what we call Artificial Intelligence.

2.1.1. Artificial Intelligence (AI)

One of the great quests of humanity is to understand why and how we think, AI intends to explore further ahead into that concept, so its purpose doesn't exclusively rely on trying to comprehend intelligent entities, it also intends to create them. (Russel and Norvig, 2013) The official beginning of AI as a concept can be traced back to the Dartmouth Conference, that occurred in 1956, when John McCarthy came up with the term "artificial intelligence," to distinguish the field from cybernetics, which was a term created by Norbert Wiener to refer to his vision of autonomous (unmanned) systems. (Chen et. Al, 2022)

Since Artificial Intelligence can be applied to several areas of knowledge and is disseminated throughout life in society, there are numerous definitions for it. It is one of the most current fields in science and engineering. This area tries to bring to the world of digital computing the heuristics of biological systems (Costa, 2009). It comprises methods, tools and systems to solve problems that normally require the use of human intelligence (Costa, 2009).

Recruitment involves actions and activities taken by an organization in order to identify and attract individuals (...) who have the ability to help the organization realize its strategic objectives. (...) such activities should generate a set of desirable candidates; increase their interest in and attraction to the organization as an employer; and increase the likelihood that they will accept a job offer. (Breaugh (1992), as cited in Saks (2005) p.48).

Russel & Norvig (2013) define AI in two different dimensions that interact with each other: processes of thought and reasoning (thinking like a human, rationally) and behavior (acting like a human, rationally). In their manual they explored further into these two dimensions and split them in four categories. The first category focused on the concept of acting in a human way, through the Turing test approach. Oppy (2021) defines this test as a sort of game where there would be three elements: a person, a machine, and an interrogator. The interrogator would be separated from the other person and the machine, and it would have to determine which of the two is the person/machine. So, the computer would have to master the following skills: natural language processing, knowledge representation, automatized reasoning, and machine learning. (Russel & Norvig, 2013). The second category: thinking in a human way, as to do with the cognitive modeling strategy. If one intends to create a system that thinks like a human, it is first necessary to determine how the thought processing works (Russel & Norvig, 2013). The third and fourth category are linked with the rational spectrum, and they focus on the "laws of thought" that make a human being think rationally and the consequent rational action that

follows the thought (Russel & Norvig, 2013).

The previously mentioned definition of AI is leading experts to believe that we are now entering the stage of the fourth industrial revolution, where technology is destroying the borders between the digital, biological, and physical sphere. (Schwab, 2017)

AI comprises a taxonomy inside the concept. It can be split in three levels. AI is the widest term of the concept, and it concerns all the systems and algorithms that are able to solve complex problems usually done by humans. Machine learning (ML) is a subset of AI that can identify patterns in data and in the world and rules without being explicitly programmed on how to solve the problems that are posed. The third and more specific level is Deep Learning, that refers to the act of using deep neural networks with multiple layers to train algorithms. (Zaremba, 2020). Exploring deeper into what ML is it's pertinent that we take a look at Dunjko & Briegel (2017) definition: "Modern machine learning addresses a variety of learning scenarios, dealing with learning from data, e.g. supervised (data classification), and unsupervised (data clustering) learning, or from interaction, e.g. reinforcement learning"

Supervised data classification consists in learning by example, so, the algorithm needs data with answers to learn, from that already "solved" data it learns the rule/pattern to classify the rest of the data. Singh et al. (2016) defined supervised machine learning as the "construction of algorithms that are able to produce general patterns and hypotheses by using externally supplied instances to predict the fate of future instances."

On the other hand, unsupervised data classification helps figure out patterns without data or preexisting labels for the information. Clusters are a very good example for this sort of ML, where data is put into groups in a way to minimize the distance between the variables inside each cluster and maximize the distance between the group of clusters. (Djunko & Briegel, 2017). There are two major differences between unsupervised machine learning and supervised machine learning is that there is no training set for the former and hence, no obvious role for cross-validation, the second important difference is that although most clustering algorithms are phrased in terms of an optimality criterion there is typically no guarantee that the globally optimal solution has been obtained. (Gentleman, 2018)

Lastly, reinforcement learning is present, mainly, in the fields where robotics and AI come together. This sort of ML is done based on a logic of penalty and reward. A robot for example (the learner) is not told which actions to make, but instead discover which action yield most reward. Although it may seem similar to unsupervised ML, this sort of learning does not address the reinforcement learning problem of maximizing a reward signal. (Sutton, 2018)

Summing it up so far, AI incorporates human behavior and intelligence to machines or systems (Sarker, 2021), while ML is the method to learn from data or experience (Sarker, 2021). Deep Learning (DL) represents learning methods from data where the computation is done through multi-layer neural networks and processing (Sarker, 2021). In his article *Deep Learning: A Comprehensive Overview on Techniques, Taxonomy, Applications and Research Directions* (2021) Sarker argues that the term “Deep” in the deep learning methodology refers to the concept of multiple levels or stages through which data is processed for building a data-driven model. So, in this sense, it can be considered as one of the core technologies of AI, and almost as new level or dimension, termed “Smarter AI”.

Following up these three levels (AI, ML and DL), Huang & Rust (2018) developed a theory based in the applicability of AI to different levels and stages. Synthesizing from the literature of Human Intelligence (HI) and AI they distinguish four intelligences. They are mechanical, analytical, intuitive, and empathetic.

“The four intelligences may be both ordinal and parallel: They are ordinal because some HIs (e.g., intuitive and empathetic ones) are more difficult to be mimicked by AI and thus take longer to develop successful AI applications. They may be parallel because once AI has reached a certain intelligence level, all lower AIs can coexist to provide service. For convenience, we refer to the intelligences that take AI longer to emulate as “higher” levels of intelligence.” (Huang & Rust, 2018)

Mechanical Intelligence is related with basic adaptation and knowledge; analytical focus on systematic data-based learning and development; Intuitive Intelligence is learning based in comprehension and the “highest” level of intelligence is the empathetic one, that is learned based on experience.

The current exponential growth of data makes the use of traditional computer programming unfeasible, the advantage that AI brings is then that these mechanisms automatically adapt to the task requirements (Kaufman, 2018). Because of this Artificial Intelligence can also be defined as a spectrum of technology where “computers can think, do, interact and act in several areas as a real human being” (Rich, 1985; Cited by Dirican, 2015).

Looking back at Russel & Norvig (2013) concept of AI, and in a very simplistic definition they define it as the study of agents that receive perceptions from the environment and execute actions, each agent implements a function that maps the sequence of perceptions in actions. In their manual an agent is someone that thinks and acts in an environment and can improve its performance through learning. This study intends to demonstrate that AI, and subsequent intelligent systems created for the purpose of improving the recruiters work should not be seen as a full-on substitute to human labor but looked into as an integral part of strategy inside the organization. Although there are many more definitions out there for the concepts, here AI will be defined as the intelligence that machines and informatic systems, based in algorithms, have that make them reproduce tasks once thought to be exclusively possible to achieve through human intelligence, with the advantage of doing it in a faster and infallible way.

2.2. Human Resources: Research and Selection

Recruitment within an organization is the key element for Human Resource Management and is the main method to ensure the organization of work (Muscalu, 2015). This is the department inside Human Resources Management responsible for creating a mean for organizations to achieve the best results, through the most competent professionals.

There are several definitions for the concepts of recruitment in human resources. For Muscalu (2015) it can be defined as the process of researching, seeking, identifying, and attracting potential candidates with the ultimate purpose of finding the best individual for the job, for Opatha (2010) it is defined as the process of finding and attracting people duly qualified to apply for vacancies made available by the company. However, all definitions culminate in a single logic:

Recruitment involves actions and activities taken by an organization in order to identify and attract individuals (...) who have the ability to help the organization realize its strategic objectives. (...) such activities should generate a set of desirable candidates; increase their interest in and attraction to the organization as an employer; and increase the likelihood that they will accept a job offer. (Breaugh (1992), as cited in Saks (2005) p.48).

Within recruitment itself there are two dimensions, internal and external recruitment. The concepts definition is very self-explanatory. When we talk about internal recruitment, we are assuming that internal candidates have an advantage/ priority over the external ones, and are considered first (Taylor,2014). This sort of process brings a lot of benefits for the company: lower hiring costs, slower paced environments (Muscalu, 2015) and a better internal integration, due to the fact that the candidate is already aware of company dynamics. On the other side of the recruitment spectrum is the external process. It's based on the logic of hiring collaborators from the external market to raise the company's human capital. (Muscalu, 2015) But not only human capital is relevant as consequence for this type of recruitment but also the fact that it will modify the cultural organization of the enterprise (Bilhim, 2006) since it will allow the "entrance" of new ideas and approaches.

External recruitment is defined by Muscalu (2015) as the term itself indicates, by hiring workers in the external labor market, in order to increase human capital. suit the job. As previously mentioned, the main advantage of this type of recruitment is the introduction of new ideas, concepts, and methods in organizations, promoting positive changes in them. On the other hand, external recruitment also carries some potentially negative aspects like higher costs and demotivation of internal employees (Chiavenato, 2014).

In both cases, before the recruitment and selection process starts the recruiter/recruitment company should be correctly trained and picked out, since "the quality of a recruitment process produces a major impact on the candidates" (Chiavenato, 2014). After that first stage is completed, said person or team should be handled the job descriptions of the function. Bilhim (2006,p157) mentions that all data related with responsibilities and function analysis must be gathered in order to define the job, its purpose, characteristics and demands. Many times, when job descriptions fail to contain information like task descriptions, competences required, level of autonomy, amongst others, failure in the selection process occurs, due to "insufficient analysis of the function, its environment and information transmitted to the candidate" (Bilhim, 2006, p.157).

When it comes to the different media that is used to promote a job vacancy it will also depend on the type of recruitment. If the company is opting for an internal hire the announcement is made through service notes or the internal journal/newsletter (Bilhim, 2006, p.162). Inversely, if the candidate search is conducted externally the options vary: Media announcements, Headhunters, temporary work companies, client recommendations, partnerships with schools, and many other alternatives (Bilhim, 2006, p.162)

The selection phase consists of assessing the strengths and weaknesses of each candidate for the vacancy according to its characteristics and requirements, so that the selection can be as accurate as possible (Plumb, 2017). Initially, an analysis is done to the application letters and Curriculum Vitae (from now on addressed in this study as “CV”), this first trial usually eliminates many candidates (Bilhim, 2006, p.162).

The remaining candidates enter a second stage of the selection process. According to Stone, et al. (2013) this phase of the process subject candidates to various tests: psychological, cognitive, or in the style of an interview. This argument is also supported by the literature by Sánchez et al. (2019) which, in addition to the previously mentioned metrics, also discusses the possibility of a job simulation technique. So, selection techniques, according to Sánchez et al. (2019) can be classified in four different groups:

- 1) Selection Interviews: the most common tool, however the most subjective and doubtful out of all the techniques, many mistakes can happen, amongst them prejudice and behavioral predispositions. According to Bilhim (2006), to avoid the banality of the mistakes mentioned above, this interview needs to be meticulously prepared, with script where questions are structured in a certain way and formulated in the same terms for all candidates.
- 2) Work Simulation Techniques: these can work as group dynamics or individual tests. Rather than assessing one’s knowledge, these techniques try to grasp how the candidate would apply such knowledge when faced with a situation at work. The type of tests to apply will vary depending on the organization and the profile of the function (Bilhim, 2006).
- 3) Knowledge and Psychometric Tests: out of all the tests, these are the most accurate ones to assess a candidate’s future performance in the job as they have a broader statistical validity. There are three types of psychometric tests: intelligence, projective and skills test.
- 4) Personality Test: as the name indicates, this test is aimed to find out the main traits of a candidate’s personality and understand if they would be a good fit for the company’s environment and values. There are five major indicators this test tries to identify: the level of extroversion, state of conscience, emotional stability, affability and aperture to new experiences (Bilhim, 2006)

The end of this process, whether we are talking about internal recruitment or external recruitment, culminates in the selection of one or more candidates.

Although this can be a tardy process sometimes it is important to keep in mind that a company's recruitment strategy and selection constitute a powerful tool for the organization's success. According to Henry & Temtime (2010): Recruitment is the entry point for manpower in an organization and the path of that organization must start from there, so that it is possible ensure that the right profiles have been attracted. Some of these issues arise after being confronted with the work by Sousa et al., 2015 on the evolution of the recruitment and selection process.

2.3. Artificial Intelligence and its relationship with Human Resources

Concerns for labor shortages and the increasing importance of human capital, made recruitment more important than ever. Many organizations are already having trouble finding qualified employees. (Saks, 2008)

In his book: Strategic Human Resources Management, Bilhim (2006) dissects the entire procedure and decree laws for Public Placement job contests and recruitment process. Although the laws are directed towards a specific sector the main principles and guarantees to the contestants/candidates reflected in the article 5 of the Decree Law nº 204/98, of 11 July should be the general guiding principles of recruitment processes: equality of opportunities and conditions for all candidates, freedom of application, neutrality in the jury's composition (or in the case of a recruitment process, the recruiter), application of several methods and criteria to the evaluation. What typically happens in recruitment process is the selection interview is the most used technique and it can be used in the several stages of a process: as technical interview, as personal interview, as a performance evaluation interview, amongst others (Chiavenato, 2014, p.128). Even with its strong subjective and imprecise component, the personal interview is the one that affects the most the final decision and selection of a candidate (Chiavenato, 2014).

Therefore, the analysis of the interrelationship between the two fields: Human Resources and Artificial Intelligence, two very disparate areas, can be carried out through several points: financial issues, time savings, reduction of flaws inherent in current methods and/or their complementation, talent shortage (Eckhardt, 2009).

Recently, recruitment processes have felt an increased influence from the use of technology (Eckhardt, 2009), the computerization of these processes and the standardization of information on candidates eliminates the need for routine tasks such as searching for candidates, filing, and sorting curriculums, thus contributing to a shorter and more efficient verification by the recruiters of the collected information. (Lima, 2018). The internet is revolutionizing the whole concept of recruitment, and its value resides in how easy and immediate the whole process became, with potential candidates being able to interact with recruitment agencies or companies at any place and time, and vice versa. (Chiavenato, 2014)

Nowadays, most HR experts/ recruiters use ML to some extent (Kettler & Kehneryp, 2019). Karolina Rąb-Kettler and Bada Lehnervp in their article Recruitment in Times of Machine Learning (2019) mention several steps of the HR process where ML is already being implemented: job descriptions (some programs were implemented to help to create and post job descriptions that target specific groups), CVs screening (an Applicant tracking system – ATS – that is able to prescreen applications, identifying key words and place candidates in the right openings), scheduling interviews, first screens (the initial triage recruiters conduct can be replaced by a chatbot that will easily replace a human interviewer), amongst others. They argue that if fully implemented most, if not all, administrative recruitment tasks, could be fully automated.

Salim Akhtar Sheikh, Vineeta Tiwari and Sunita Bansal (2019) dived deeper into a generative model chatbot for Human Resource created using Deep Learning, this would cross even more boundaries than just erasing administrative tasks. In their article they explained that a Chatbot is an automated structure expected to begin a dialog with human customers or diverse Chatbots that gives through text. In their HR case the chatbots which were proposed were an Artificial Intelligence based Chatbot for major measurement profiling of contenders for the explicit task. The learning strategy utilized for the Chatbot in their study is assorted neural structure which includes deep learning techniques like recurrent neural network. The test results demonstrate that the most noteworthy, scored sentences are nearest to an inquiry. In future the model can be trained with increasing no. of hidden layers to make it more accurate and no. of iterations in model training will be taken 8000. (Akhtar et al., 2019).

Before diving further into the possible relation of AI with recruitment processes it is relevant to point out that the sort of interrelation this report intends to analyze isn't directly correlated to e-recruitment, it goes beyond the "simple" concept of using tools that come from information technology to help recruiters sort out information. As discussed by Brown & Abia (2020) there is diversity in understanding of electronic recruitment (e-recruitment) which results in confusion on the meaning and use of the term. "E-recruitment and selection, incorporated by companies, is defined as the selection and hiring of employees through the Internet, which makes it possible to recruit, contact, evaluate, select, and carry out remote interviews with candidates to cover a vacant position" (Sánchez et al., 2019) but with the help of AI these processes can be even greatly automated while being more objective and dealing with a higher number of candidates. (Sullivan, 2004). In this sense, the entire recruiting process will incorporate not only the tools but also an entire new experience given by the company. Sánchez et al. (2019) enumerates some of the new e-recruiting tendencies/ techniques used by companies like: corporate websites, employment portals, video curriculums and social networks.

When it comes to e-recruitment, Wozniak (2014) mentioned that in order to implement it correctly it will be necessary to segmentate the market to locate potential candidates, subsequently the company needs to get in touch and gather the necessary data for the selection process. With technology improving and moving forward at the speed of light the amount of data also grows, and with comes a new dimension in the subject entitled as Big Data. Sagioglu & Sinanc (2013) defined this term as "massive data sets having large, more varied, and complex structure with the difficulties of storing, analyzing and visualizing for further processes or results. (...) These useful information for companies or organizations with the help of gaining richer and deeper insights and getting an advantage over the competition."(p. 42). These changes and what can almost be addressed as a data revolution will demand from the companies and workers an incremented use of AI tools and IS to help them sort out the processes. The most commented development and change in recruitment, and a big responsible for this surge of information, is without a doubt social media, and its exponential use as a tool to bring job seekers and employers closer.(Taylor, 2014). According to Taylor (2016) although we can find many benefits in social media use there are several critical points that can be made in terms of equality, diversity, and an overall "deeply unsystematic way of vetting people" because of the online image they present.

When discussing the criteria for e-recruitment and the use of AI in HR departments, one must not forget one of the big struggles and challenges of the implementation of new or improved tools: people managing them. Eckhardt (2007) explored this very important dynamic in his case study “How to convince people who don’t like IT to use IT: A case study on e-recruiting”. The study's findings suggest that when investing in IT without concurrent organizational changes, there is a risk of significant decline in productivity. This potential decline comes from the fact that the positive impact of IT investments can be outweighed by adverse effects resulting from a misalignment between organizational practices and the implemented IT infrastructure.(Eckhardt, 2007)

In such a scenario, addressing obstacles to the adoption and utilization of IT may necessitate a combination of both IT-related and non-IT strategies. These barriers may manifest in the form of government regulations, inadequate management practices, or notably, resistance from users. One particular group of potential users known to exhibit significant reluctance towards adopting web-based systems is young individuals applying for non-academic apprenticeships, especially within the context of (e-)recruitment processes.(Eckhardt, 2007)

It is also important to highlight the fact that currently successful recruitment will only be truly achieved if the people recruited have values, attitudes and personalities that fit and coincide with the company's values (Muscalu, 2015). However, while the company's values may be aligned, there is no guarantee that the recruiters' values will be aligned at the time of the decision at least. The rational decision-making process is not always achievable. Ending up with the selection in the hands of the recruiter and his intuition, this requires that the company itself becomes dependent on the knowledge or experience of an employee (Gladwell, 2007) however, whether we like it or not, this knowledge is not always fully consolidated and issues how discrimination against particular groups in our society continues often unconsciously. (Taylor, 2014; Sánchez, 2019). But in the AI field ethical risks can also arise, all scientist and engineers that invest in this area are faced with ethical consideration on how they should act and what they should create. (Russel & Norvig, 2013). Some of this problems can be people are losing their jobs to automation, they can lose their sense of identity, AI can be used for undesirable purposes, and the use of these systems can result in a lack of accountability, amongst many others (Russel & Norvig, 2013)

Kettler and Kehneryp (2019) raise an important question when it comes to job loss: they believe HR professionals should not be afraid of being replaced by robots, quite the opposite, they should use technology in their favor. They argue that a humanistic insight and understanding are important together with the capacity to adjust to the dynamic reality. A real agility, lean management, is a combination of these two factors. This cannot be done by even most sophisticated robots and efficient software.

CHAPTER 3

Theoretical Approach

Having in mind the literature review from the previous chapters, and the many insights given by the different authors on artificial intelligence and its impact in recruitment and selection it was possible to come forth with 3 research questions, that will be furthered explained in this chapter.

In the context of recruitment, the evolution of technology has given rise to the exploration of how artificial intelligence and intelligent systems can reshape traditional recruitment processes. AI, aims to replicate certain aspects of human intelligence, allowing machines to process data, recognize patterns, and make informed decisions (Russel & Norvig, 2013). As organizations strive to optimize their recruitment strategies, the intersection of AI and recruitment has become a focal point for research and practice. (Eckhardt, 2009).

In the first part of the literature review, the AI subchapter delves into the realm of intelligent systems (IS) and artificial intelligence (AI), tracing their evolution and impact on various fields. The focus then shifts solely to AI, which is explored as a profound endeavor to understand and replicate human thinking processes. It seeks to translate human intelligence into computational systems, striving to replicate both thinking processes and human-like behavior. The distinctions between AI, machine learning (ML), and deep learning (DL) are elaborated, revealing their hierarchical relationship and mechanisms.

Supervised and unsupervised ML are introduced as fundamental components of AI, clarifying how they handle data patterns and classifications, with examples such as data clustering. Reinforcement learning's role in robotics and AI is outlined, highlighting its reward-based learning model. The "Smarter AI" concept is elucidated, suggesting an enhanced AI tier that signifies a deeper understanding of data. The text then advances to Huang & Rust's classification of AI into mechanical, analytical, intuitive, and empathetic intelligences. These categories exemplify AI's expanding capabilities, each with varying complexities to emulate human attributes. The passage underscores the exponential growth of data and AI's ability to adapt, thus presenting a flexible solution to complex tasks.

Lastly, the definition of AI as a technology spectrum is discussed, emphasizing its capacity to replicate tasks previously exclusive to human intellect, doing so with heightened speed and precision. While acknowledging AI's potential, the text underlines that it should be regarded as an integral part of organizational strategy rather than a complete replacement for human labor. This led to the first research question:

RQ 1: How can artificial intelligence replace people in recruitment processes?

On the other hand the chapter also discusses the integration of Artificial Intelligence into Human Resources (HR) processes. While not explicitly stated, the text hints at concerns related to this integration. These include worries about job displacement due to automation, biases in AI-driven decisions, ethical considerations regarding AI's impact on employment and identity, data privacy and security, the potential depersonalization of candidate interactions, questions about the reliability of AI-based decisions, the risk of amplifying biases present in training data, and the unintended consequences of relying solely on AI for recruitment. Despite these concerns, the text underscores the need for a balanced approach that leverages AI's capabilities while maintaining the human element and ethical considerations in the HR domain.

With both positive and negative aspects arising from the authors' work, two other logical research question rose:

**RQ 2: What are the benefits of artificial intelligence to recruitment processes? And
RQ 3: What are the downsides of artificial intelligence regarding recruitment processes?**

The convergence of Artificial Intelligence (AI) and Human Resources (HR) is revolutionizing the way organizations approach recruitment and selection processes. This integration offers a multitude of advantages that enhance efficiency, accuracy, and decision-making throughout the HR domain. AI is transforming the mundane administrative aspects of recruitment, such as resume screening and candidate communication, by automating these tasks. This frees up HR professionals to focus on strategic initiatives, like building strong employer brands and nurturing employee development. With AI's ability to process vast amounts of data quickly and efficiently, HR departments can analyze job descriptions, match candidate profiles, and make data-driven decisions. This contributes to better candidate selections, resulting in improved overall quality of hires. Moreover, AI introduces objectivity and minimizes biases in the selection process. Algorithms can evaluate candidates based on predefined criteria, reducing the impact of unconscious biases that can often influence human judgment. This leads to more fair and equitable hiring decisions, promoting diversity and inclusion within organizations.

Beyond data analysis, AI-powered chatbots are revolutionizing candidate interactions. They can provide instant responses to inquiries, streamline application processes, and even conduct initial interviews. This not only saves time for both candidates and HR professionals but also ensures a consistent and positive candidate experience throughout the recruitment journey.

However, as AI becomes more integrated into HR processes, ethical considerations come into play. The potential for job displacement and concerns about privacy and bias in AI-based decision-making need to be addressed. HR professionals need to strike a balance between leveraging AI's capabilities while retaining the human touch in recruitment, nurturing employee relationships, and upholding ethical standards.

CHAPTER 4

Methodology

This chapter aims to explore the methodology used for this thesis in order to answer the initially proposed questions about the impact of AI in HR recruitment and selection tools, the perception of both experts in the fields and possible advantages and disadvantages from its use. The methodology used consisted in the adapting questions from previously done surveys and interviews in other research work. This choice was taken having in mind the fact that it is better to use previously validated items/questions in past research whenever possible. (Story et al., 2019 & Tait et al., 2015)

The survey on HR professionals on the impact of AI in recruitment and selection, with the questions focusing on innovation and impacts. This study was conducted by a group of academic researchers and students, their work used the quantitative, descriptive research method (Jatoba et al., 2019) and was funded by National Funds through the Foundation for Science and technology under the project UID/GES/04752/2019. Another article by Ugur Karaboga and Pelin Vardarlier (2020) examining the use of Artificial intelligence in recruitment processes was used to ground this methodology and get the AI experts perception on the theme. In their research project they opted for a qualitative research model: interviews made with 22 employees from different companies, in this research project the questions were adapted to a survey model and the answers were based upon the general grouping answers created in their article, still allowing participants the chance to write their own answer. The decision to transform the inquire from interviews to questionnaires was based on the fact that surveys through questionnaires allow a better systematization of the contents, simplicity of analysis, fast data collection at a cheaper cost. (Carmo & Ferreira, 2008)

4.1. Methods – Survey Structure

Qualitative and quantitative research are usually looked into as antonyms, with the first being expressed in natural language, whereas the latter is expressed in numbers and in statistical models. (Gerring, 2017). There are a variety of ways in which qualitative and quantitative methods may be combined to improve the trustworthiness of survey and experiment findings. (Marsland et al., 2000) Like quantitative research, qualitative research can address causation and involves observation and interpretation of events. Instead of seeking to measure and count

the occurrence of a state or events, qualitative methods adopt a more complex and subjective path which end up preserving the complexities of human behaviour (Lakshman et al., 2000) For the case of this thesis, a mix of both was used.

Surveys remain the foundation of social science research but can be employed in almost any discipline and their main goal is to answer a good research question that is interesting for the broader target population (Story et al., 2019). Surveys have several advantages since they have external and internal validity, are efficient and flexible and may even have ethical advantages. (Mathers et al., 2007). In the particular case of this research the online method was the one chosen due to the minimal cost, fast transmission/ response times, access to large population and no interviewer biases. (Story et al., 2019).

According to Mathers et al. (2007) surveys can take up one of the following forms: cross-sectional survey, longitudinal survey and explanatory or correlational survey. The chosen surveys that both questionnaires for this thesis were adapted from can be considered a mix between a cross-sectional survey and explanatory one. The first because it was a survey that was carried out at a just one point in time, providing the researcher with a snapshot of what is happening in a group at that particular time. (Mathers et al., 2007) and correlational because the researcher was also trying to explore causal relationships between two or more variables. (Mathers et al., 2007).

Both questionnaires are composed by open and close ended questions. These two type of questions differ in many characteristics. (Reja et al., 2003) Close ended questions give the respondent a set of alternatives, while open-ended questions allow the participant to express their opinion (Reja et al., 2003). For the particular case of web surveys, it is easier to use close ended questions since they only require a single key/mouse press response and are less cognitively demanding (Desai & Reimers, 2018) In their research on the use of open and closed questions for Web-based measures Saoirse Desai and Stian Reimers (2018) found out that dropout increase when participants had to give open-ended responses. For this reason, most of the questionnaire answers had the close ended answer option and an extra line if they'd prefer to give a longer/ personal answer. Close ended questions can be dichotomous, multiple choice, Likert scale questions or rank order questions, in both research surveys they are multiple choice, with the candidates being offered multiple valid options.

4.2. Dissemination of the survey and sample

Surveys allow convenient and inexpensive research and can be disseminated via mail-out questionnaires, email questionnaires, telephone interviews, and personal interviews. (Jones et al., 2006). For the case of this research, two online surveys were created, as previously mentioned they were designed considering the literature review and using Google Forms resource, which, after validation by one of the supervisors of the present study, were shared through a link on LinkedIn and via email to several academics in the field of AI and recruiters/HR professionals.

A sample is a set of elements selected in some way from a population. (Schofield, 2006). In most cases the sample for one research may be the same as the population under investigation, however, most academics are more likely to find themselves in a situation where the potential participants the study are much more common and cannot all be practically included (Mathers et al., 2007). The first step in sampling is to define the population of interest clearly and accurately (Schofield, 2006). For this research study there were two different samples, one for the AI survey and another one for the HR one. Both were non-probabilistic samples; these types of samples are used in many research projects investigation. Non-probabilistic samples can be selected having as a basis intentional choice criterion systematically used with the purpose of determining the units of the population that are part of the sample. (Carmo & Ferreira, 2008)

4.2.1 AI Sample

The AI survey consisted of a sample of 150 individuals with over 18 years of age who had already exercised or currently exercise a role in the field of AI or develop functions that involve technology sciences and intelligent systems. Most were male (61.3%), aged 18-29 or 30-35 years (32.7%) and worked in IA or in an area related to IA (41.3%).

Table 4.1 – Sample characterization AI survey (N = 150)

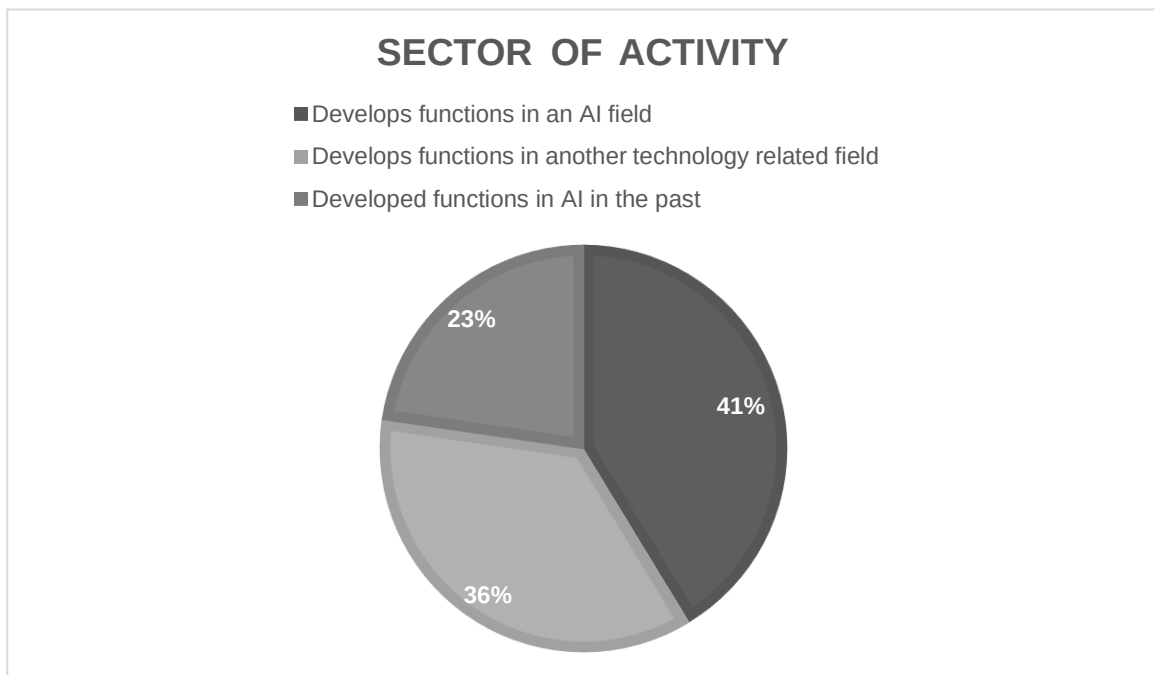
	N	%
Gender		
Female	58	38,7
Male	92	61,3
Age		

18 - 29	49	32,7
30 - 35	49	32,7
36 - 40	28	18,7
41 - 50	9	6,0
> 50	15	10,0
Work in a AI related field		
No, but I have in the past	34	22,7
No, but I work in a technology related field.	54	36,0
Yes	62	41,3

Source: Self-elaborated

The sample for the AI study consisted of 150 individuals, that performed functions in an AI field (41.3%, n=62), other technology related field (36%, n=54), and participants that developed functions in AI in the past (22.7%, n=34).

Figure 4.1: AI Respondents sector of activity



Source: Self-elaborated

4.2.2 HR Sample

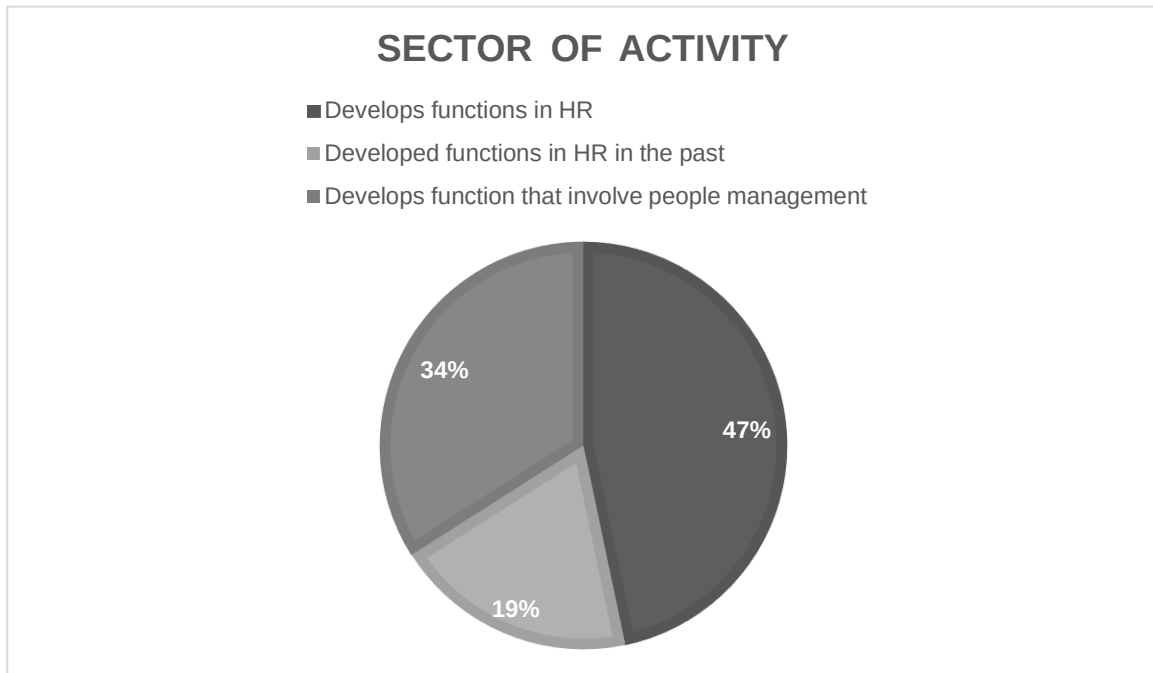
The sample for the HR study consisted of 150 individuals, that perform functions in HR (46.7%, n=70), participants that developed functions in a HR field in the past (19.3%, n=29), and participants that develop functions that demand people management (34%, n=51). And a sample of 150 HR responses. Most were female (66.7%) and aged 41-50 years (22.7%) and worked in an area related to human resources (46.7%).

Table 4.2 – Sample Characterization HR survey (N = 150)

	N	%
Gender		
Female	100	66,7
Male	50	33,3
Age		
18 - 29	33	22,0
30 - 35	24	16,0
36 - 40	31	20,7
41 - 50	34	22,7
> 50	28	18,7
Currently work in a HR related field		
Yes	70	46,7
No, but I've done it in the past	29	19,3
No, but the role I currently develop involves people management	51	34,0

Source: Self-elaborated

Figure 4.2: HR Respondents sector of activity



Source: Self-elaborated

This type of non-probabilistic sampling is called convenience sampling. It consists in using a group of individuals who are available or a group of volunteers. (Carmo & Ferreira, 2008) This implies that we are dealing with a exploratory study whose results obviously cannot be generalized to population to which the convenience group belongs. (Carmo & Ferreira, 2008) So the results of these questionnaires and of this thesis should be analyzed and interpreted with caution, in order not to incur an error of undue generalization.

4.3. Ethics and Validity of Study

In qualitative research, validity seeks to indicate what constitutes research well done, reliable, worthy to be made public to contribute to the knowledge. Adapting the quantitative concept for qualitative research, checking the validity of a research would be determine whether it truly measures truly what the researcher set out to measure, whether their methodological processes are coherent, and their results are consistent. Validity can be viewed generically as the correspondence between research and reality. (Ollaik & Ziller, 2012) In all research projects the first step to create a new questionnaire is to gather information and review literature and existing surveys before creating a new one. It makes no sense to generate a new set of questions if there is preferable existing questions or surveys that have demonstrated validity, with appropriate acknowledgment or citation. (Story et al., 2019).

Having this in mind, the two previously mentioned surveys were adapted from interview questionnaires to online surveys, keeping the questions core and allowing only respondents to give a longer answer if they wished to do it.

Ollaik & Ziller (2012) conceptualized and grouped in three large blocks different conceptions of validity in qualitative research. The three blocks being the validity in the formulation, in the development and in the results. The formulation can be confirmed in the degree to which a measure represents exactly what is expected and if it can be replicated. (Hair et al., 2009) The development validity can be measured looking into the research and making sure if it contains premises from which the conclusion can be logically extracted, with a focus on procedures, emphasis on methodology. (Ollaik & Ziller, 2012). Validity in results can be found if the researcher is able generalize or extrapolate the results (replicability) verify that the results are true and reliable (Ollaik & Ziller, 2012).

Before handing out the questionnaires, the advisor professor and subject matter experts were asked for feedback and input not only to give insights on the theme, but also to identify potential issues and suggest improvements. After they were sent out there was continuous monitoring especially in open ended questions answers to ensure the validity of responses and address possible misunderstandings.

Analysis of Results

The statistical analysis involved descriptive statistics measures (absolute and relative frequencies, means and respective standard deviations) and inferential statistics. In this case, the Fisher's exact test and the Chi-square test of independence were used. The Chi-square assumption that there should be no more than 20% of cells with expected frequencies less than 5 was analysed. In situations where this assumption was not satisfied, the chi-square test was used by the Monte Carlo simulation. Differences were analysed with the support of standardized adjusted residuals. The significance level to reject the null hypothesis was set at $\alpha \leq .05$.

Statistical analysis was performed using SPSS software (Statistical Package for the Social Sciences) version 28 for Windows.

5.1. AI and its role as possible replacement of people in recruitment processes

Given the RQ1 of this study it was important not only to understand if it was possible to replace people in recruitment and selection processes but also see in which stages the experts in the field believe AI can be implemented. When questioned about the specific stages where AI can be used in the recruitment process the section with the highest percentage was the CV selection one (42%). Followed by Personality Tests (15.3%) and the Performance Evaluation (10%) phases. It is also relevant to highlight the 29.3% that believe all the stages mentioned in the questionnaire can be conducted through the use of AI.

Table 5.3 – AI survey: What stages of recruitment do you think AI can be used?

	Frequency	Percent
CV selection	63	42,0
Personality tests	23	15,3
Interviews	5	3,3
Performance Evaluation	15	10,0
All stages of the process	1	0,7
All but interviews	1	0,7
All mentioned above	44	29,3
none	2	1,3

Total	150	100,0
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Source: Self-elaborated

These results can be compared to the ones obtained from the study developed by Karaboga and Vardalier (2020) on the use of artificial intelligence in recruitment processes. In both CV selection was the “winning” category. In this study interviews and personality tests also had a bigger frequency. Looking back into the literature review on AI in HR all the previously mentioned stages already have some sort of AI intervention in a large set of companies nowadays. (Kettler & Kehneryp, 2019).

Rather than just assessing the stages in which AI could play a part the survey also included a question directed to AI experts so they could express their view on the full replacement of a human in the process:

Table 5.4 – AI survey: Can AI replace people in recruitment processes?

	Frequency	Percent
No	43	28,7
Partially	86	57,3
Yes	19	12,7
Not Yet	1	,7
Partly now, but with future developments 100%	1	,7
Total	150	100,0

Source: Self-elaborated

When faced with this last question, more than half of respondents (57.3%) consider that Artificial Intelligence can partially replace people in recruitment processes and 12.7% consider that yes, without reservation. Although a large number agrees that AI can replace at least partially people in the processes, a little over half also consider that artificial intelligence in recruitment processes can affect candidate evaluation processes in both ways. A 37.3% say that it affects the candidate evaluation positively.

Once again, the results in by Karaboga and Vardalier (2020) match the ones of the handed-out in this study questionnaire. Around half the respondents chose partially, followed by a bigger frequency of “No” and a smaller percentage of “Yes” responses.

5.2. Benefits of artificial intelligence to recruitment

The first set of questions in the AI survey focused on the benefits and areas where AI can act as a positive tool to the recruiting stages. Intending to answer the RQ2 about the benefits of artificial intelligence in recruitment processes. Most respondents chose time saving (23.3%), speed (14)% or Equality in the process (11.3%) as main benefit.

Table 5.5 – AI survey: Benefits of artificial intelligence in recruitment processes

	Frequency	Percent
Accessibility	1	0,7
All of the above	73	48,7
Equality in the process	17	11,3
none	1	0,7
Money Saving	1	0,7
Simplification of work processes, leaving more time for a greater investment of time in more complex processes	1	0,7
Speed	21	14,0
Perhaps the filtering process could be sped up. The real efficiency would already need another analysis.	1	0,7
Time Saving	35	23,3

Source: Self-elaborated

Karaboga and Vardalier (2020) study participants are focused on time saving. In addition, equal treatment of candidates, rapid process progress, and healthy interpretation of candidates were also counted among the benefits that artificial intelligence provides to the recruitment process.

Only 23.3% of the respondents to this study questionnaire indicate that they have had the opportunity to use AI in the Recruitment and Selection process, but those who have all state that AI in Recruitment and Selection brought gains/benefits to their work. This small percentage of usage can have different meanings.

Table 5.6 – HR survey: Have you had the opportunity to use AI in the Recruitment and Selection process?

	N	%
No	115	76,7
Yes	35	23,3
Total	150	100,0

Source: Self-elaborated

Table 5.7 – HR survey: If you answered yes, do you think AI in Recruitment and Selection brought gains/ benefits to your work?

	N	%
Yes	35	100%
Total	35	100,0

Source: Self-elaborated

According to the literature review, supposedly, most HR experts/ recruiters use ML to some extent (Kettler & Kehneryp, 2019), but in this case for the Portuguese professionals most of them affirm that they don't. The survey from where the HR survey of this thesis was adapted from - Jatoba,M. et al (2019) work – also reflect low usage of AI in HR, with 63% of their respondents mentioning they never used it.

There could also be a possibility that HR professionals might still lack some information about what exactly AI and its tools are: when asked about the definition of AI, most HR respondents (82%) indicate that AI is an area of Computer Science that aims to make computers behave and think like humans, and 17.3% affirm that it is the use of computers for intelligent activities.

Table 5.8 – HR survey: What is for you AI?

	N	%
It is an area of Computer Science that aims to make computers behave and think like humans.	123	82,0
It is an area that develops software for people with high IQ.	1	,7
It is the use of the computer for intelligent activities.	26	17,3

Source: Self-elaborated

Out of both this study results and the results of Karaboga and Vardalier (2020) study the time saving aspect is the most popular amongst respondents. When questioned about this topic the majority of HR professionals (51.4%) also agree that using AI helps reduce time spent on Recruitment and Selection and 44% answered “maybe”. Only 4.7% disagreed with the statement.

Table 5.9 – HR survey: Do you agree that using AI helps reduce time spent on Recruitment and Selection?

	N	%
No	7	4,7
Perhaps	66	44,0
Yes	77	51.4
Total	150	100,0

Source: Self-elaborated

The proportion of respondents who consider that AI in Recruitment and Selection is an important tool for the evolution and growth of Human Resources rises to an expressive 67.3%, although about a third have the opposite opinion. This opinion is shared relatively similarly by men and women, Fisher's test, $p = .098$. The proportion of subjects who do not believe that the AI can fully replace a recruiter / manager in the recruitment / selection process is significantly higher among subjects in the highest age group (60.7% vs 39.3%), $\chi^2 (2) = 13,581$, $p = .009$.

Table 5.10 – HR survey: Do you think that AI in Recruitment and Selection is an important tool for the evolution and growth of Human Resources?

	N	%
No	49	32,7
Yes	101	67,3
Total	150	100,0

Source: Self-elaborated

When AI professionals were confronted with the question of how AI can affect recruitment processes, one third of the respondents do not consider leaving the decision-making stage to

artificial intelligence in recruitment processes adequate, however 64% consider it adequate or partially adequate.

Table 5.11- AI survey: How does the use of artificial intelligence in recruitment processes affect candidate evaluation processes?

	Frequency	Percent
Both ways	84	56,0
Negative	9	6,0
It can save time in selecting candidates but will eventually lead to resumes that are specifically designed to trick the system.	1	,7
Positive	56	37,3
Total	150	100,0

Source: Self-elaborated

5.3. Downsides and risks of AI's impact in recruitment processes.

RQ3 focused on possible downsides from using AI in recruitment processes. Out of the 150 respondents of this study 22.7% chose lack of catching details as main disadvantage, 18.% opted for unemployment (18.%) and 20% for Decreased intimacy. Some of this problems were also raised in the literature review by other authors: people losing their jobs to automation, AI can be used for undesirable purposes, the use of these systems can result in a lack of accountability, amongst many others (Russel & Norvig, 2013)

Table 5.12 – AI survey: What are the downsides of artificial intelligence regarding recruitment processes?

	Frequency	Percent
ALL	13	2,7
Data manipulation	20	13,3
Decreased intimacy	30	20
Lack of catching details	34	22,7
manipulation of information, for example above in sorting CV's it would be possible to create something specific for the system to consider as good	1	0,7
Other	3	0,7

Objective judgments	11	7,3
Unemployment	27	18,0
Wrong decision	10	6,7
Total	150	100,0

Source: Self-elaborated

When it comes to the selection part of the process AI respondents showed less skepticism than HR ones. 46% of the respondents look at it as being partially proper and 18% say it is proper to allow AI to do it.). So even though the AI field can also open space for some ethical risks: like people losing their jobs to automation, manipulation of systems for undesirable purposes, lack of accountability, amongst many others (Russel & Norvig, 2013), a large percentage of inquired experts (64%) considered it proper or partially proper.

Table 5.13 – AI survey: What do you think about leaving the decision-making stage to artificial intelligence in recruitment processes?

	Frequency	Percent
Not proper	54	36,0
Partially proper	69	46,0
Proper	27	18,0
Total	150	100,0

Source: Self-elaborated

In the HR survey the scenario was a bit different and only a small percentage (11.3%) believe that AI can fully replace a recruiter / manager in the recruitment / selection process. Female HRs believe more that AI can fully replace a recruiter / manager in the recruitment / selection process than male HRs (26% vs 5%), the difference being statistically significant, Fisher's test, $p = .002$. Age does not influence HR's opinion on this issue, $\chi^2(8) = 6,381$, $p = .632$.

Table 5.14 – HR survey: Do you believe AI can replace fully a recruiter / manager in the recruitment / selection process?

	N	%
No	127	84,7

Yes	17	11,3
Perhaps	6	4,0
Total	150	100,0

Source: Self-elaborated

This concerns were raised by many other authors. The lack of a humanistic insight and understanding are important together with the capacity to adjust to the dynamic reality, that is something a machine is for now still unable to do. (Kettler and Kehneryp, 2019) These results possibly indicate that even with the strong subjective and imprecise component, the personal interview has, when making the final decision it will most likely be the one that affects the most the final decision and selection of a candidate (Chiavenato, 2014).

Conclusion

6.1. Final Considerations

In the past few years and in recent decades, research on intelligent systems has seen substantial growth across diverse industries. It is a new realm of technology and innovation that is constantly gathering more attention from the public. Furthermore, these AI tools have proven to be valuable aids for individuals and businesses in improving their performance in everyday tasks. As these IT changes occur, the field of Human Resources has also undergone significant evolution and continuous development, with daily emergence of new challenges and an increasing demand for advanced technological solutions to deal with all the data presented.

The research presented here delved into the intricate landscape of Artificial Intelligence adoption in the field of recruitment and selection processes. It builds upon the preceding scrutiny of data gathered from questionnaires and literature review pertaining to Artificial Intelligence and the processes of recruitment and selection, in conjunction with insights from earlier scholars. By employing a combination of descriptive and inferential statistical methods, this study sought to address several research questions and shed light on the benefits and drawbacks of AI in recruitment.

The first research question aimed to explore the feasibility of AI replacing humans in recruitment processes. Results indicated that 42% of respondents believed AI could be effectively utilized in CV selection, followed by 15.3% for Personality Tests and 10% for Performance Evaluation. An intriguing observation was that 29.3% of participants considered AI suitable for all stages of the recruitment process. When asked directly about the complete replacement of humans, 57.3% believed AI could partially replace humans in recruitment processes, while 12.7% were confident in its full replacement. This was a fairly interesting result having in mind the skepticism from most authors in the literature review with some specifications of AI tools and some risks they presented.

The second research question probed into the benefits of AI in recruitment processes. Findings revealed that respondents predominantly valued AI for its time-saving capabilities (23.3%), followed by speed (14%) and ensuring equality in the process (11.3%). Notably, a majority (67.3%) of HR professionals considered AI to be a crucial tool for the evolution and growth of Human Resources. The primary sentiment was that AI aids in reducing the time spent on recruitment and selection, with 51.4% agreeing and only 4.7% disagreeing. These results make sense having in mind the capabilities of these tools to evaluate and gather data so quickly.

The CV screening tools are a good example of a time saving appliance. A computer is going to be much faster than a human reading and processing all information from a CV.

Research Question 3 explored the potential downsides of integrating AI into recruitment processes. The main concerns raised by respondents were the lack of attention to detail (22.7%), potential unemployment (18%), and decreased intimacy in the hiring process (20%). Despite these concerns, 64% of respondents deemed it partially or entirely appropriate to entrust decision-making to AI in recruitment processes.

6.2. Contributions to the academy and companies

This research provides valuable insights into the integration of AI in recruitment processes. While respondents acknowledged the potential benefits of AI, such as time-saving and improved efficiency, they also expressed concerns about the loss of human touch and potential job displacement. These results underscore the complex and evolving relationship between AI and HR, suggesting that while AI can bring valuable tools, its full replacement of human decision-making in recruitment processes remains a topic of debate. As AI continues to advance, HR professionals must navigate the ethical, practical, and social implications of its integration to ensure a balanced and effective recruitment process.

As previously mentioned, the results from this study showed that, in the chosen sample, AI systems reveal a very low level of implementation in HR processes across companies of the respondents. This can be due to many reasons, unawareness of the existence and complexity of already used systems, lack of financial investment, lack of adherence and predisposition on behalf of recruiters to use these tools. The feedback given by AI experts can be used along with other studies in the matter to better decide which AI tools would be a better fit for the company.

6.3. Research limitations

This thesis was formulated through prior research in the field, along with primary data collected through questionnaires. The main limitation of this research stems from its relatively small sample size. Although the results match the information gathered from previous authors and studies it is necessary to evaluate this data with caution. It's essential to recognize that this research is exploratory in nature, and due to the study's limited sample size, it should not be considered as broadly applicable or representative. Besides the small sample it is also relevant

to have in mind that the HR respondent's perception came mostly from workers who are not in contact with this tools: a little more than half of the sample (52.7%) does not use AI in management process, and only 18.7% indicate that they use AI in Human Resources.

Considering the significance and potential impact of AI in recruitment processes, with a particular focus on the substantial benefits it can offer both companies and the broader public and recognizing the pressing need for the industry to embark on a journey of modernization to foster innovative and more equitable solutions, my recommendations aim to stimulate further exploration and investigation into this critical subject matter.

The survey aimed to uncover the prevailing sentiments and concerns of the public regarding AI's role in recruitment. Among the key findings, it is evident that most respondents (42.7%) view AI as a tool that will significantly ease the workload in recruitment. This perspective reflects an understanding of AI's potential to automate repetitive and time-consuming tasks associated with hiring processes, ultimately improving HR operational efficiency. Regarding Easing the workload, this percentage is higher in females (46.6% vs 40.2%), although the difference is not significant, Fisher's test, $p = .499$. This opinion is relatively constant by age group, $\chi^2(3) = 2,650$, $p = .499$. Moreover, 20.7% of respondents anticipate that AI will enhance decision-making efficiency by swiftly identifying the most qualified candidates. This expectation underscores AI's capacity to elevate the quality and speed of hiring decisions. Additionally, a substantial portion (25.3%) foresees an increase in AI's usage in recruitment, signaling a broader acceptance of AI technologies in the HR domain.

These survey results reveal a range of opinions on AI in recruitment, from optimism about its ability to enhance efficiency to concerns about job displacement and ethical considerations. The dissertation emphasizes the need for a balanced approach in integrating AI into recruitment processes, ensuring transparency, fairness, and ethical standards. As organizations continue to adopt AI-driven solutions, addressing these diverse perspectives will be crucial in shaping the future of recruitment practices. The study underscores the importance of responsible AI development and implementation to harness the potential of AI while mitigating potential risks and ensuring that hiring remains a fair and inclusive process.

6.4. Suggestions for future research

The first option for a new study would be to gather larger samples, from different markets and preferably in companies where these tools are already available so the answers of

the HR specialists would be more fact-based. Another option could be to analyze the topic from a financial perspective, that is: see how much the application of these mechanisms and even a full 100% AI recruitment and selection process would cost.

The last suggestion would have to do with the concerns raised by some of the respondents and authors about the risks this transformations would imply: data manipulation, lack of intimacy and job loss.

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Annex A – AI survey

Impacto e Implementação de Inteligência Artificial (IA) nas ferramentas de recrutamento e seleção dos Recursos Humanos (RH) | Impact and Implementation of Artificial Intelligence (AI) in Human Resources(HR) recruitment and selection tools

PT: O seguinte questionário é realizado com o objetivo de explorar a percepção de profissionais do impacto da IA em RH, bem como a percepção que existe sobre este Sistema Inteligente na automatização de processos e contribuições quando utilizada em processos Recrutamento e Seleção.

O questionário tem a duração aproximada de 3 minutos e destina-se a maiores de 18 anos, que já tenham exercido ou exerçam atualmente funções na área IA ou que desenvolvam funções que envolvam a área da tecnologia.

Ao preencher o questionário, autoriza o uso dos dados fornecidos para fins académicos, bem como sua divulgação em artigos científicos. Estes dados serão utilizados exclusivamente para este fim, sem qualquer referência a uma pessoa e/ou organização específica.

Para qualquer esclarecimento, ou para receber informações adicionais sobre o estudo, por favor contacte mariamiguel_99@hotmail.com.

Agradeço a sua colaboração!

The following questionnaire is conducted with the aim to reveal the perception of AI professionals and managers about AI in HR, as well as the use of this technology in the automation of processes and contributions when used in Recruitment and Selection processes. .

The questionnaire lasts approximately 3 minutes and is intended for people over 18 years old, who have already exercised or currently exercise a role in the field of AI or develop functions that involve technology sciences.

By completing the questionnaire, you authorize the use of the data provided for academic purposes, as well as its dissemination in scientific articles. This data will be used exclusively for this purpose, without any reference to a specific person and/or organization.

For any clarification, or to receive additional information about the study, please contact mariamiguel_99@hotmail.com.

Thanks for your collaboration!

maria.miguel.p.machado@gmail.com Switch account

Gender

*

Male

Female

Non-binary

Prefer not to say

Age

*

18 - 29

30 - 35

36 - 40

41 - 50

+50

1 - Do you currently work in a AI related field?

Yes

No, but I have

No, but I work in a technology related field.

2 - What do you think are the benefits of artificial intelligence in recruitment processes?

Time Saving

Equality in the process

Speed

All of the above

Other:

3 - In what stages of recruitment do you think AI can be used?

CV selection

Personality Tests

Interviews

Performance Evaluation

All mentioned above

Other:

4 - Can Artificial Intelligence replace people in recruitment processes?

Yes

No

Partially

5 - How does the use of artificial intelligence in recruitment processes affect candidate evaluation processes?

Positive

Negative

Both ways

Other:

6 - What do you think about leaving the decision-making stage to artificial intelligence in recruitment processes?

Proper

Not proper

Partially proper

Other:

7 - What are the downsides of artificial intelligence regarding recruitment processes?

Wrong decision

Decreased intimacy

Data manipulation

Lack of catching details

Unemployment

Objective judgments

Other:

8 - What are your thoughts on the future of artificial intelligence technologies in recruitment processes?

More intensive usage

Getting more efficient results

Replacing a human

Easing the workload

Getting efficient decisions

Other:

Annex B – HR survey

Impacto e Implementação de Inteligência Artificial (IA) nas ferramentas de recrutamento e seleção dos Recursos Humanos (RH) | Impact and Implementation of Artificial Intelligence (AI) in Human Resources(HR) recruitment and selection tools

PT: Olá! O meu nome é Maria Miguel e sou estudante de 2º ano do Mestrado em Gestão de Empresas lecionado pelo ISCTE Business School.

O seguinte questionário é realizado com o objetivo de explorar a percepção de profissionais de RH e gestores sobre a IA em RH, bem como a percepção que existe sobre este Sistema Inteligente na automatização de processos e contribuições quando utilizada em processos Recrutamento e Seleção.

O questionário tem a duração aproximada de 5 minutos e destina-se a maiores de 18 anos, que já tenham exercido ou exerçam atualmente funções na área de RH/recrutamento ou que desenvolvam funções que envolvam a gestão de pessoas.

Ao preencher o questionário, autoriza o uso dos dados fornecidos para fins académicos, bem como sua divulgação em artigos científicos. Estes dados serão utilizados exclusivamente para este fim, sem qualquer referência a uma pessoa e/ou organização específica.

Para qualquer esclarecimento, ou para receber informações adicionais sobre o estudo, por favor contacte mariamiguel_99@hotmail.com.

Agradeço a sua colaboração!

ENG: Hello! My name is Maria Miguel and I'm a 2nd year student of the MBA taught at ISCTE Business School.

The following questionnaire is conducted with the aim to reveal the perception of HR professionals and managers about AI in HR, as well as the use of this technology in the automation of processes and contributions when used in Recruitment and Selection processes. .

The questionnaire lasts approximately 5 minutes and is intended for people over 18 years old, who have already exercised or currently exercise a role in the field of HR / recruitment or develop functions that involve people management.

By completing the questionnaire, you authorize the use of the data provided for academic purposes, as well as its dissemination in scientific articles. This data will be used exclusively for this purpose, without any reference to a specific person and/or organization.

For any clarification, or to receive additional information about the study, please contact
mariamiguel_99@hotmail.com.

Thanks for your collaboration!

maria.miguel.p.machado@gmail.com [Switch account](#)

Gender

Male

Female

Non-binary

Prefer not to say

Age

18 - 29

30 - 35

36 - 40

41 - 50

+ 50

1 - Do you currently work in a HR related field?

Yes

No, but I've done it in the past

No, but the role I currently develop involves people management

2 - What is for you AI?

It is an area of Computer Science that aims to make computers behave and think like humans.

It is the use of the computer for intelligent activities.

It is a computer game designed to simulate situations and problems.

It is an area that develops software for people with high IQ.

3 - Does your company use or have already used AI in any management process?

Marketing

Finance and Administration

Human Resources

Customer Service

Do not use

4 - Have you had the opportunity to use AI in the Recruitment and Selection process?

Yes

No

5 -If you answered yes, do you think AI in Recruitment and Selection brought gains/ benefits to your work?

Yes

No

Not applicable

6 - Do you agree that using AI helps reduce time spent on Recruitment and Selection?

Yes

No

Perhaps

Other:

~

7 - Do you think that AI in Recruitment and Selection is an important tool for the evolution and growth of Human Resources?

Yes

No

8 - If you answered Yes to the previous question explain why or how you believe so.

9 - Do you believe AI can replace fully a recruiter / manager in the recruitment / selection process?

Yes

No

Other:

10 - Justify your answer to the previous question.

11 - Do you identify any negative consequence from the use of AI at your current job? If Yes, please justify.