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## **The Efficiency of AI**

*From the perspective of candidates that went through a recruitment and selection process with AI*

João André Regateiro Cidré

Master in Human Resources Management and Organizational Consulting

Supervisor:

Prof. Aristides I. Ferreira, Associate Professor, ISCTE Business School, Department of Human Resources Management and Organizational Behaviour

September 2023

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Department of Human Resources and Organizational Behavior

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## **Acknowledgements**

Firstly, I want to thank everyone that has motivated me and helped me in all sorts of ways to make this dissertation possible throughout these months.

Second, to my dissertation supervisor, Professor Aristides Ferreira, who has been my mentor and helped me a lot to achieve this goal, to you I express my sincere gratitude and appreciation. The constant feedback, availability, and patience were fundamental for the concretization of this project, without which it would never be possible.

I want to thank to everybody who participated in this study and had the time and patience to answer to the questionnaire. The feedback received about online recruitment was fundamental to complete this study.

To my family I want to thank you for all the support and for the motivation you gave me all throughout the masters, it was more than I could ask for and without it would never be possible for me to be where I am and to be who I am.

Finally, to my friends and colleagues, who have been by my side in this process, I want to express my deepest gratitude for all the help, motivation, and much more, and I am glad I could be part of such an amazing group of people in this master.

“All our dreams can come true; if we have the courage to pursue them.” – Walt Disney

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## **Abstract**

The advancement of technology has helped organizations improve their areas of human resource management, as for example with the application of artificial intelligence in recruitment and selection. This study aims to examine the efficiency of online recruitment, using the perspective of candidates. It included 101 candidates, that answered a questionnaire using multiple scales to assess the factors related to online recruitment, such as, the engagement, and bias that the candidates perceive. The candidates' sociodemographic aspects, age, sex, education, were also measured. Aspects, such as, the job position they applied, and the area they entered in the organization were also assessed. It was found in the results, some correlations between the factors and online recruitment efficiency, and a mediation effect between the engagement in the relation between online recruitment bias and efficiency. With these results, it was highlighted that is important to improve the engagement of the candidates towards online recruitment, since it will diminish the effect of perceived bias and improve the efficiency of online recruitment.

**Keywords:** online recruitment, bias, engagement, efficiency

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## **Resumo**

O avanço da tecnologia tem ajudado as organizações a melhorarem as suas áreas de gestão de recursos humanos, como por exemplo com a aplicação de inteligência artificial no recrutamento e seleção. Este estudo tem como objetivo estudar a eficiência do recrutamento online, utilizando a perspectiva dos candidatos. Foram incluídos 101 candidatos, que responderam a um questionário utilizando múltiplas escalas para examinar os fatores relacionados com o recrutamento online, como o empenho e o preconceito que os candidatos identificam. Foram medidos os aspetos sociodemográficos dos candidatos, idade, sexo, escolaridade. Também foram avaliados aspetos como o cargo a que se candidataram e a área em que integraram na organização. Foram encontradas nos resultados algumas correlações entre os fatores e a eficiência do recrutamento online, e um efeito de mediação entre o empenho na relação entre o preconceito e a eficiência do recrutamento online. Com estes resultados, destacou-se que é importante melhorar o empenho dos candidatos no recrutamento online, uma vez que diminuirá o efeito do preconceito identificado e melhora a eficiência do recrutamento online.

**Palavras-chave:** recrutamento online, preconceito, empenho, eficiência

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## **Introduction**

Recruitment is a Human Resources (HR) process where the goal is to attract candidates that are qualified for a job position whereas Selection is where the right candidate is selected for that position. According to Geetha and Reddy (2018), “the use of Artificial intelligence and machine learning for job search would reduce the time and cost for both company and the candidate” (Geetha and Reddy, 2018; p. 7). Thus, reaffirming the importance of Artificial Intelligence (AI) in terms of the efficiency as an instrument, but also in psychological terms since the use of AI can improve candidate engagement. And so, by integrating the job demand-resource (JD-R) model, the main goal of this study is to understand what is the efficiency of online recruitment from the perspective of candidates that went through a recruitment and selection process with AI. It is important to study this question, since there are studies that focus mainly on the perspective of recruiters that use online recruitment, leaving the gap of the perspective of the candidates to be understood. For example, in the paper (Li et al., 2021), where they investigate the usage of artificial intelligence in recruiting and the perception of the recruiters when using it.

In the world of online recruitment, there are practical gaps that specify some of the challenges that job-seekers face when in a recruiting process. These gaps can difficult the engagement, fairness, and efficiency of the online recruitment in the eyes of the candidates. This study aims to fill in the gaps that mentioned before, through the understanding of the perspectives of the candidates, since they are key users in the uprising of online recruitment.

Nowadays, in such a technological era, companies rely much more in the application of AI in some of the processes that previously were conducted by humans only, such as Recruitment and Selection (R&S). It is important to understand that AI is a tool created to make tasks and activities more effective and efficient, “such as data extraction from curricula, analysis of the professional profile, candidate engagement, job interview, contract proposal are theoretically to be performed by AI algorithms” (Rezzani et al., 2020; p.26).

AI has enabled companies to increase their number of applicants, for example, “in 2017 L’Oréal used AI to not only present its opportunities to active candidates but to

identify passive candidates as well. Consequently, it received 2 million resume's for only 5,000 positions" (Black et al., 2020; p. 8). Not only that, AI can also be used to improve the selection of candidates for a specific position and can even be applied in order to select specific aspects of the company (culture, leadership, etc.) to show the candidates, in order to have a higher likelihood of application. Thus, the question: if a company uses AI in their recruitment and selection process, does that affect the candidate engagement?

AI has the stigma of being untrusted by people, however, in 2019, Van Esch, Black and Ferolie, discovered in their study that there is a positive relationship between technology use motivation and job application, using anxiety and the attitude towards the organisation as moderators and the novelty of activity as mediator. There were limitations to this study, even though it is possible to affirm that companies should invest more in AI based R&S processes to help fight the stigma and to improve people perception on the digitalization of Human Resources Management (HRM). And so, the question that is formulated is: what are the intrinsic motivators related to AI? To understand the efficiency of AI in terms of psychological effects, it is necessary to understand what are the main motivators that lead people towards AI and especially motivators that come from within.

Finally, it is important to understand which are the principal ethical issues that AI raises, to understand what the opportunities, risks and ambiguities regarding AI are, and how it will affect the companies that are using it. "This rise of new AI recruiting practices comes with new ethical quandaries for organizations and society" (Hunkenschroer et al., 2022; p.17). According to the authors mentioned before, one of the main ethical opportunities and risks is the human and algorithmic bias, respectively. One effect, for example, of the AI bias is a homogenic workforce, since the algorithm will select candidates based on certain profiles and traits.

This study is divided in five different sections: literature review, methodology, results, discussion, and conclusion. The literature review aims to create a theoretical framework connected to the online recruitment efficiency and the factors that influence it. Also, it presents the conceptual model, as such, the hypotheses that worked as a guide for this study. In the second chapter, it is described the sample that was used, as well as the scales, how the data was collected, and, finally, the analytical strategy that was applied for this study. In the third section, the results of the research are presented. The fourth chapter, the discussion, is where the results of this study are discussed and linked with the literature framework that was previously mentioned. Furthermore, it is divided in

three sections: theoretical contributions, practical contributions, and limitations and future research. The final chapter is the conclusion for this study.



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# **1. Literature Review**

## **1.1 Artificial Intelligence in Recruitment and Selection**

Recruitment and Selection is the process of attracting and selecting the best people for the right position. Nowadays, this process is becoming more and more digital and, thus, the introduction of AI in recruitment and selection.

In this study is important to understand the efficiency of AI. As several studies have shown, AI seems to be a positive contribute in many ways to the R&S process, for example the “time saved can improve recruiters’ effectiveness through an increased focus on strategy” (Ore et al., 2021; p.9). This effect on efficiency can also reciprocate towards the candidate, since the recruiter can have more time to focus on a better experience for the possible future employee.

It is said that we are in the Fourth Industrial Revolution (Geetha & Reddy, 2018), and so the importance of applying AI is in constant growth. Geetha and Reedy named in their study, seven characteristics that show the importance of AI in Recruitment, like so: “Time saving; Mapping of Talents; Cost Saving; Hire with Quality; Query redressing; Unbiased recruitment; and Quality aspirants” (Geetha & Reddy, 2018, p. 8). This shows that the use of AI as a tool has a lot of positive contributes towards the company, the recruiter, and the candidate.

This chapter will focus mainly on three subjects, that were proven by the analysis of the data collected, respectively, Online Recruitment Engagement, Online Recruitment Bias, and Online Recruitment Efficiency. These are the principal topics for this literature review, but firstly the explanation of the model used for the study.

## **1.2 Job demand-resource (JD-R) model**

The JD-R model states that every occupation has its own set of job demands and resources. This model has been used to measure the effects that job resources and demands have on employees and their organizational outcomes (Bakker & Demerouti, 2007). Therefore, in this scale, job demands are defined as “those physical, psychological,

social, or organizational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort or skills and are therefore associated with certain physiological and/or psychological costs” (Bakker & Demerouti, 2007, p. 312). Job resources are defined as “those physical, psychological, social, or organizational aspects of the job that are either/or: Functional in achieving work goals, Reduce job demands and the associated physiological and psychological costs, stimulate personal growth, learning, and development” (Bakker & Demerouti, 2007, p. 312). However, it can be used in different fields and with different resources and demands. Thus, the choosing of this model since it can be applied towards the goal of this study.

Resulting from the job demands and resources, is the development of either strain or motivation. Strain is the result of the demands imposed on the individuals and can have implications in terms of mental and physical health. Motivation, in this case, comes from the recourses that might impose a certain intrinsic or extrinsic motivation on the individual, to result in greater outcomes (Bakker & Demerouti, 2007).

Since the goal of this study is to understand the efficiency of the artificial intelligence in the recruitment process, the JD-R model was chosen, since it focuses on the impacts that strains and motivations have. Thus, in line with existing literature, there are job demands and resources that result from artificial intelligence in online recruitment. The ethical restraints that one person perceives can be identified as the demand of the online recruitment process, and so, resulting from that, the bias that the candidates feel can be identified as the restrain, which, according to the model may have a negative impact on the outcome. On the other hand, the job resource for the online recruitment process is the intrinsic motivation that the candidates can have towards AI application, thus this will originate the motivation, online recruitment engagement, that is hypothesized to be positively correlated with the outcome. Finally, it is hypothesized that the online recruitment engagement can have a mediator effect on the online recruitment bias, and so improving the outcome.

### **1.3 Intrinsic motivation and AI**

As discussed, AI can have an impact on the likelihood of application by the candidate, for example. And so, another goal of this study is to understand some of the intrinsic

motivators around the candidates related to innovative recruitment and selection processes, like the use of AI. Intrinsic motivation is defined as:

“Intrinsic motivation exists when engaging in an activity by itself is fun, provides a sense of accomplishment, enhances a sense of independence, elevates personal feelings of confidence, and/or increases feelings of being innovative, independent of outcomes that engaging in the activity might produce.” (van Esch et al., 2021, p. 121).

Candidates nowadays, value companies that use technology, like social media and AI, in their recruitment process, making them more attractive and in result, the candidates will be more likely to complete the job application process (Allden & Harris, 2013; p. 4). Showing that, if a candidate has the intrinsic motivation towards technology, it can give them satisfaction in completing that recruitment process that uses AI.

Another type of intrinsic motivation can be the anticipated intrinsic rewards by participating in the innovative recruitment process (van Esch et al., 2021). This intrinsic motivation is related to the expectations of the candidate towards the use of a new technology that will in result give them a “sense of accomplishment, independence, confidence, and feelings of being innovative” (van Esch et al., 2021; p.3).

Finally, the fact that the use of AI in recruitment and selection processes is recent, the candidates can view that novelty as something attractive to them and use that intrinsic motivation to follow through with an application for a job in that organization.

#### **1.4 Online recruitment engagement**

Employee engagement can be defined as “employee outcomes that enhance organizational success with better financial gains” (Bates, 2004; Richman, 2006; cited by Braganza et al., 2021, p. 1537), meaning that, one engaged employee will contribute with positive outputs for the organization, such as bigger commitment, greater satisfaction, and improved performance (Suhartanto et al., 2018; cited by Braganza et al., 2021; p.487).

However, the adoption of AI can affect the engagement of the employees since it can create a sensation of job insecurity and “weaken the relational aspects of psychological contracts on the other hand” (Braganza et al., 2021; p. 486). There are

studies that hypothesize the replacement by AI of some tasks that are usually made by humans, rather than completely “steal” that job (Arntz et al., 2016; cited by Braganza et al., 2022; p.2). And so, sometimes higher levels of AI can lower the levels of engagement in some employees and in future candidates.

In a study published by Prentice, Wong, and Lin (2023), they state that AI-powered tasks can be helpful for employee’s job behaviours and engagement, however they studied the effect of “job security as a regulation condition for employee engagement and performance” (Prentice et al., 2023; p.2). Job security is defined as “employees’ perception of their position with the organisation in the future” (Kuhnert and Palmer, 199; cited by Prentice et al., 2023, p.3), and even though it is more common to be perceived by the people in the organizations, candidates can also have some perception of the job security, making it important in this relationship with the adoption of AI.

With the advancement of technology, individuals become more and more engaged with its novelty, and organizations can benefit with that by implementing new technologies in their processes, thus attracting more candidates (Eveleth et al., 2015; cited by van Esch et al., 2019). There are studies that have shown how artificial intelligence can engage their employees (Mittal et al., 2023), and the factors that can be applied to candidates as well. They enumerate three topics where the application of AI can improve engagement: Communication (1), through chatbots, for example, where candidates can receive faster feedback; Recognition (2), associated with communication, candidates that receive feedback, will feel recognized, and so improving their engagement in the organization; Personalization (3), AI can analyse the candidate’s data and give personalized feedback, this topic, is once more related with the previous two.

There are studies that connect the individual enjoyment with their engagement with e-recruitment processes. Brahmana and Brahmana (2013) state that if the e-recruitment process is perceived by the individual as a “enjoyable, exciting, fun, and interesting experience” (Brahmana & Brahmana, 2013; p.3) they will have higher commitment with the recruitment process and complete their application. Thus, as mentioned before, it is hypothesized that the engagement that one candidate feels towards the online recruitment will have a positive effect in its efficiency:

H1 – Online Recruitment Engagement is positively associated with Online Recruitment Efficiency

For this variable, it will be applied and modified, the Work Engagement Scale (Schaufeli & Bakker, n.d.), as the authors state that individuals engaged with their work “have a sense of energetic and effective connection with their work activities and they see themselves as able to deal well with the demands of their job”, one can assume that people engaged with AI can have the same perception (Schaufeli & Bakker, n.d.; p. 4).

## **1.5 Impact of AI in R&S**

The application of AI in Human Resource Management can have an impact either in the organization or in the candidates, since, in the beginning, both parties try to obtain most of the information possible about each other, to see if they “still find the other party attractive and decide whether they want to proceed with the process or not” (Li et al., 2017; Uggerslev et al. 2012; cited by Wesche & Sonderegger, 2021, p. 1).

For the candidates, when reading the job advertisement, the first impression can determinate “whether or not they will enter the recruiting process” (Reeve & Schultz, 2004; cited by Wesche & Sonderegger, 2021, p. 1). And so, it is important to understand what are the effects, whether they are positive or negative, through the candidate’s perception on the use of AI in the recruitment and selection process. This first impression is called an applicant reaction, and it can “affect attitudes, intentions, and behaviours” (Hausknecht, Day, & Thomas, 2004; McCarthy et al., 2017; Ryan & Ployhart, 2000; cited by Wesche & Sonderegger, 2021, p. 2). For example, in interviews, there are studies that show the difference in online interviews and face to face interviews perception by the candidate, showing a negative impact on the job seeker (Blacksmith et al., 2016; cited by Wesche & Sonderegger, 2021). Those negative impacts will change the candidate’s perception on AI based recruitment, like the absence of fairness that is perceived. For instance, as Wesche and Sonderegger hypothesized, candidates will have “lower justice perception regarding the recruitment process with AI, comparing with the traditional recruitment process” (Wesche & Sonderegger, 2021, p. 3).

## **1.6 Online recruitment bias**

The rise of AI brings new ethical challenges for organizations and for the people that use it as well. According with the study of Hunkenschroer and Luetge (2022), one of the most common ethical risks is the bias that can occur when using AI in recruitment. AI can create bias in different ways and therefore presents a risk for the recruiters and for the candidates. For example, the AI starts to discriminate candidates that are female, it may prejudice the recruiters in their search for the right talent, but it can also prevent for candidates to follow through with an application, thus affecting the diversity of the workforce as well. However, bias created by the AI can be fixed with a change in the algorithm, and so organizations should not be afraid to use AI, instead, invest in the awareness of their programmers about the ethical risks.

The strain created by the ethical restraints, results in the absence of fairness created by the AI application in the recruitment and selection process. This absence of fairness, results from one of the most common ethical risks of AI, the occurrence of bias (Hunkenschroer & Luetge, 2022). Bias can be created in various ways, some directly others indirectly, and some authors state that there are three main ways for bias to occur: “design principles, feature selection, and training data” (Yarger et al., 2020; p.2). This absence of fairness via bias, can lead to “a reinforcement of gender and racial stereotypes” (Hunkenschroer & Luetge, 2022; p. 18). As stated in Nelson’s study (2019), what is known as artificial intelligence bias, occurs when a model that uses AI keeps producing the wrong results. However, this only happens due to choices of a human being, for example, “data blending methods, model construction practices, and how results are applied and interpreted” (Nelson, 2019; p.1), which means that these results come from a human’s judgment.

Contrary to some research, there are authors that believe that humans can prevent the occurrence of this bias, by programming it with the “ability to bypass candidates’ names, gender and age, that are the primary source of bias” (Upadhyay et al., 2018; cited by Johansson et al., 2019; p. 18). There are also different ways to prevent the candidates perception of existing bias, such as, “adopting highly structured hiring procedures and training hiring decisions makers” (Bendick & Nunes, 2012; cited by Johansson et al., 2019).

According to Bogen (2019), algorithms are supposed to help in many steps in the recruitment process, but they create various risks as well, like the replication of “institutional and historical biases” (Bogen, 2019; p.2). For example, it was shown in a

study, that “85% of Facebook ads for supermarket cashiers were presented to women” (Bogen, 2019; p.2). There are many studies that show that “AI bias generally harms women, people of color, gender minorities, and those at the intersections of these identities” (Buolamwini et al., 2018; cited by Mills & Whittaker, 2019; p. 8). Although, algorithmic bias exists, it may not be intentional, and so this ethical risk should be considered and reported every time it occurs, to prevent it from happening in other occasions. Hence, it is hypothesized that the bias perceived by the candidates can negatively affect online recruitment efficiency:

H2 – Online Recruitment Bias is negatively associated with Online Recruitment Efficiency

### **1.7 Online recruitment Efficiency**

Finally, the outcome of the correlation with the multiple variables, will be the efficiency of AI applied in the recruitment and selection process. Artificial intelligence can be applied in various ways, one of them being in the recruitment process. It can have various benefits, such as reducing time-consuming activities, matching the job requirements with the skills of the available candidates, and the screening of resumes (Vedapradha et al., 2019).

In organizational terms, the efficiency of AI allows organizations to gain deeper insights into talent requirements through strategies (Leong, 2018; cited by Ore & Sposato, 2021). In personal terms of the candidates, organizations that use AI and new technologies can market that in their advantage, since possible candidates, whom view e-recruitment as a more effective way of job hunting, will become more interested in the organization, thus having more chances of following with an application (Howardson and Behrend, 2014; cited by Wesche & Sonderegger, 2021).

Online recruitment is one of the most used types of recruitment nowadays. Also known as E-recruitment, it is described as “when an organisation uses the internet, specifically online websites, for employers to post a vacancy about a specific position and where people looking for employment can post their resume where it matches” (Huang, et.al., 2019; cited by Pio et al., 2021; p. 3). And why is it so effective this usage of online



recruitment? Because artificial intelligence has the ability to “learn, understand, and make decisions” (Pio et al., 2021; p. 3).

When an organization uses online recruitment, it is facilitating the recruiters’ job and, thus, there are advantages for them in this case. However, there are some mutual advantages for the candidates as well. E-recruitment is an efficient tool to reduce the stress of the candidates, the time they waste on the recruitment process is less than the usual, and so it can make the candidates feel more productive.

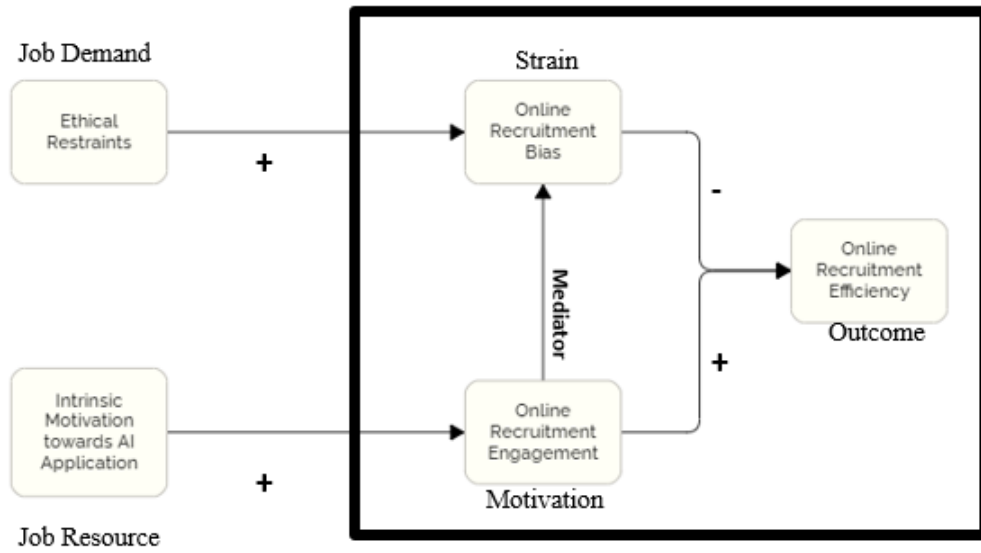
Another advantage for the candidates is that they can become part of a “larger pool of talented and experienced candidates” (Pio et al., 2021; p. 7), which means they can apply for jobs internationally and so have better chances in finding a job they feel engaged with and enjoy. And even if they get rejected by the organizations, the candidate can have a better experience, if they can learn from the feedback they receive, for example, “AI systems allow feedback about their qualifications and skills that these candidates can develop further in the future” (Upadhyay & Khandelwal, 2018 cited by Johansson et al., 2019; p. 18).

On the other hand, online recruitment also has disadvantages. “One remarkable disadvantage of using online recruitment is the possibility for discrimination between active internet and non-internet users” (Dhamija, 2012; cited by Johansson et al., 2019; p.16), which means that, there are individuals that are being “discriminated” from certain opportunities because they might not have access to the internet.

Therefore, the engagement in online recruitment will have a mediation effect on the relation between the bias that the candidates feel towards online recruitment and the efficiency of it:

H3 - Online Recruitment Engagement mediates the negative effect that Online Recruitment Bias has on Online Recruitment Efficiency

## 1.8 Research Model



*Fig. 1.8.1 Conceptual Model*

*Note: in the highlighted area the studied model is presented.*

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## 2. Methodology

In this chapter, it will be discussed the research method of this study, being the “techniques that are used for conduction of research including data collection and analysis tools”, according to Kothari (2004; cited by Ragab & Arisha, 2018, p. 4). According to Bell (2005; cited by Ragab & Arisha, 2018, p. 1) “the methodology has to be selected based on the nature and scope of the topic at hand”, thus, the importance of having a well-defined research question to choose the right methodology to use.

In the next chapters it will be discussed the sample, the procedure, and the instruments.

### Sample and Procedure

The sample for this study consists of people that went through online recruitment to understand their perception on the factors previously mentioned in the literature review and the collection of data took place in the beginning of this year.

		<i>n (%)</i>
<b>Sex</b>	Male	29 (28,7%)
	Female	68 (67,3%)
<b>Education</b>	High school	18 (17,8%)
	Degree	33 (32,7%)
	Bachelor's Degree	4 (4,0%)
	Postgraduate	10 (9,9%)
	Master's degree	18 (17,8%)
	Doctorate	2 (2,0%)
	Attends University	12 (11,9%)
<b>Position that applied for</b>	Manager	25 (24,8%)
	Assistant	24 (23,8%)
	Intern	27 (26,7%)
	Other	21 (20,8%)

<b>Sector that integrated in the company</b>	Administrative	15 (14,9%)
	Financial sector	14 (13,9%)
	Human Resources (HR)	22 (21,8%)
	Commercial	11 (10,9%)
	Operational or Production	15 (14,9%)
	Information Technologies (IT)	8 (7,9%)
	Other	12 (11,9%)

*Table 2.1 – Characterization of the Participants*

The sample for this study was constituted by 101 individuals, however, in the 101 answers there were 4 with values missing so the total is 97, with ages between 19 and 60, and with an overall mean of 32 years ( $n = 31,89$ ). In terms of gender, 68 participants were females (67,3%) and 29 were males (28,7%).

Most of the individuals had a bachelor degree ( $n = 33$ ), followed by individuals with high school complete and a master's degree ( $n = 18$ ). Internship was the most applied position by the participants in this study ( $n = 27$ ), and 22 participants were integrated in the Human Resources Sector (21,8%).

Data was analysed with the program IBM SPSS Statistics 28 and the PROCESS procedure. Descriptive statistics and principal component analysis were first conducted. Then with the groups that were created from the principal component analysis, it was conducted reliability tests and the correlations between them.

### **Instruments**

***Intrinsic Motivation towards AI application.*** The first one was for the intrinsic motivation, and the scale that was chosen was the “Intrinsic Motivation Inventory” (Ryan & Deci, 2000). Participants answered this questionnaire based on their interest or enjoyment regarding online recruitment. It consists of a scale with 45 items, rated on a 7-

point scale (1=Not at all true; 2=Almost always not true; 3=Generally not true; 4=Somewhat true; 5=Generally true; 6=Almost always true; 7=Very true), however only four items were chosen for this study, like “*I really enjoyed doing online recruitment*”, and “*Online recruitment was fun to do.*”. The subscale of interest/enjoyment, that was used in this questionnaire, is the one that, according with the authors, measures intrinsic motivation (Ryan & Deci, 2000), and so, the higher the results the stronger the intrinsic motivation is.

**Online Recruitment Engagement.** Third, to measure the engagement towards online recruitment, the scale selected was “UTRECHT Work Engagement Scale” (Schaufeli & Bakker, 2004). This scale has two versions, one with 17 items, and one with nine items, that was the one selected for this study. This scale is also rated on a 7-point scale (1=Never; 2=Hardly never; 3=Rarely; 4=Sometimes; 5=Frequently; 6=Often; 7=Always). It is a useful scale to measure the engagement of the participants towards online recruitment, with items as such “*When using online recruitment, I feel full of energy.*”, and “*I feel happy when I use online recruitment.*”. Higher scores in this variable indicated higher values of engagement in the participants when using online recruitment.

**Online Recruitment Bias.** To measure the bias that one feels towards online recruitment, the scale that was used and adapted, was the “Biased Attitudes Scale (BiAS)” (Watts et al., 2019). This scale has 32 items, divided in four categories: Simplification, Verification, and Regulation. For this study, it was selected four items from the category simplification, and they are rated in a 5-point scale (1=Totally disagree; 2=Disagree; 3=Neither disagree nor agree; 4=Agree; 5=Totally agree). The four items were reversed, meaning that the lower the score in this variable, the less bias the participants would feel towards the online recruitment. The participants had to read some of the following statements, “*I feel that it is problematic how easily the online recruiting algorithm changes its decision as soon as new information is presented to it*” or “*Feelings of fear and anxiety can cloud one's judgment while participating in online recruiting*”, and then answer accordingly with the scale.

**Online Recruitment Efficiency.** Finally, to better understand the efficiency online recruitment, it was important as well to use and adapt a scale, and in this case, the “e-recruitment perceived benefits scale” (Mohamed Badr ElDin Aboul-Ela, 2014). The initial scale had 24 items, however, for this study, only five were selected, rated on a 5-point scale (1=Totally disagree; 2=Disagree; 3=Neither disagree nor agree; 4=Agree;

5=Totally agree). This scale is useful to measure the perception of the participants regarding the efficiency of the online recruitment, with items like, “Online recruitment saves me a lot of time”, or “The time required for the online recruitment process is less than that allocated for traditional recruitment methods”. The score in this variable helps to understand if the participants feel that online recruitment is more efficient than other ways of recruiting.

### 3. Results

#### Dimension Reduction: Principal Components Analysis

To reduce the 27 variables existing, it was necessary to run a principal component analysis, so that is possible to find new ones that don't correlate. After two tests, the final result were 20 variables, and the results were the following.

<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</b>		<b>,914</b>
<b>Bartlett's Test of Sphericity</b>	Approx. Chi-Square	1721,742
	df	190
	Sig.	<,001

*Table 3.1 - KMO and Bartlett's test*

As it can be seen in Table 3.1 the value of KMO is higher than 0.7 ( $0.914 > 0.7$ ) and the value of sig. is lower than 0.05, which means that the null hypothesis is rejected, and so, meaning that there are pairs of variables that related with each other.

According to the Kaiser criterion, the number of components created were three, since the number of PCs higher than one where three, and the first three PCs explain around 70% as it can be seen in the next table.

<b>Components</b>	<b>Total</b>	<b>Initial Eigenvalues Cumulative %</b>
<b>1</b>	10,893	54,464
<b>2</b>	1,826	63,596
<b>3</b>	1,463	70,912

*Table 3.2 - Kaiser Criterion*



Thus, the final solution was three components divided in the following way. The first one was named Online Recruitment Engagement, the second one, Online Recruitment Bias, and the final one, Online Recruitment Efficiency.

	Component		
	1	2	3
49 Eu fico empolgado quando estou a participar no recrutamento online.	<b>,878</b>	-,159	,175
43 Eu sinto-me entusiasmado com o recrutamento online.	<b>,860</b>	-,153	,165
23 Eu descreveria o recrutamento online como muito interessante.	<b>,849</b>	-,152	,140
47 Sinto-me orgulhoso de mim mesmo quando participo no recrutamento online.	<b>,838</b>	-,123	,149
46 Sinto-me feliz quando uso o recrutamento online.	<b>,834</b>	-,137	,230
44 O recrutamento online inspira-me.	<b>,819</b>	-,113	,112
24 Eu achei o recrutamento online bastante agradável.	<b>,814</b>	-,112	,230
48 Sinto-me focado ao participar no recrutamento online.	<b>,812</b>	-,184	,157
45 Quando penso em processos de recrutamento e seleção, sinto que o recrutamento online é a melhor opção.	<b>,797</b>	-,194	,198
22 O recrutamento online foi divertido de se fazer.	<b>,783</b>	-,141	,293
21 Gostei muito de fazer o recrutamento online.	<b>,749</b>	-,242	,281
42 Com o recrutamento online, sinto-me eficiente e empenhado.	<b>,747</b>	-,210	,236

41 Ao usar o recrutamento online, sinto-me cheio de energia.	<b>,746</b>	-,122	,287
33 Culturalmente aceitável:Culturalmente inaceitável	-,192	<b>,834</b>	-,066
35 Tradicionalmente aceitável:Tradicionalmente inaceitável	,042	<b>,763</b>	,060
34 Individualmente aceitável:Individualmente inaceitável	-,378	<b>,715</b>	-,193
32 Legítimo:Ilegítimo	-,359	<b>,660</b>	-,252
63 O método de recrutamento online está associado ao conceito de eficiência de tempo.	,193	-,109	<b>,814</b>
62 O tempo necessário para o processo de recrutamento online é menor do que o alocado para os métodos tradicionais de recrutamento.	,229	-,065	<b>,801</b>
61 O recrutamento online poupa-me muito tempo.	,307	-,077	<b>,749</b>

*Table 3.3 - Components characterization*

After finding these three components, it was necessary to test their reliability. For a variable to be reliable, their Cronbach alpha must be higher than 0.7. In the first component, their  $\alpha$  was 0.968. In the second component, their  $\alpha$  was 0.790. And finally, for the third component, their  $\alpha$  was 0.780. Meaning that all three components were reliable.

	<b><math>\alpha</math></b>
<b>Online Recruitment Engagement</b>	,968
<b>Online Recruitment Bias</b>	,790
<b>Online Recruitment Efficiency</b>	,780

*Table 3.4 - Cronbach Alphas*

### Correlations between components

In Table 3.6 it can be found the values of the means and the standard deviations of the variables, but also the correlation between them. According with the results there is a correlation amongst them all, but the highest correlation is between Online Recruitment Engagement and Online Recruitment Efficiency ( $r = 0.522$ ;  $p < 0.01$ ), and the lowest ( $r = -0.317$ ;  $p < 0.01$ ) between Online Recruitment Bias and Efficiency.

Variables	Mean	SD	1	2
<b>1. Online Recruitment Bias</b>	3.41	1.22		
<b>2. Online Recruitment Efficiency</b>	4.08	1.32	-0.317**	
<b>3. Online Recruitment Engagement</b>	4.32	0.68	-0.484**	0.522**

Notes: \*\*.Correlation is significant at the 0.01 level (2-tailed).

Table 3.5 - Means, standard deviations, and correlations

The results showed that the dependent variable Y (OREF) is positively correlated with the mediator M (ORE), and the independent variable X (ORB) is negatively correlated with both variables, thus confirming both hypotheses 1 and 2 that were created in the model for this study (H1 – Online Recruitment Engagement is positively associated with Online Recruitment Efficiency; H2 – Online Recruitment Bias is negatively associated with Online Recruitment Efficiency).

### Main analysis: Mediation analysis of the moderator Online Recruitment Engagement in the relationship between Online Recruitment Bias and Efficiency

H3 - (“Online Recruitment Engagement mediates the negative effect that Online Recruitment Bias has on Online Recruitment Efficiency”)

To test the hypothesis h3, the mediating effect of the engagement in the relationship between online recruitment bias and the efficiency was studied, using the PROCESS procedure, and applying the model 4 for mediations. As it can be seen in Table 3.7, bootstrapping (95 percent confidence interval (CI) around the indirect effect) confirmed the mediation effect for the online recruitment efficiency variable, and so, confirming the hypothesis mentioned in the title.

The indirect effect did not contain 0 [-0.238, -0.049], thus supporting the hypothesis that Online Recruitment Engagement mediates the relationship between Online Recruitment Bias e Online Recruitment Efficiency. However, when analysing the direct effect of X on Y, it did contain 0 [-0.155, 0.062], showing that the online recruitment engagement is not affected by the perception of bias in the recruitment process by the individuals.

	<b>M (Online Recruitment Engagement)</b>		<b>Y (Online Recruitment Efficiency)</b>	
	Coeff.	SE	Coeff.	SE
<b>X (Online Recruitment Bias)</b>	-0.522**	0.095	-0.047**	0.055
<b>M (Online Recruitment Engagement)</b>	-	-	0.248**	0.051
<b>Constant</b>	6.097	0.344	3.170	0.353
	$R^2 = 0.234$		$R^2 = 0.278$	
	F (1,99) = 30.304		F (2,98) = 18.897	
	P < 0.01		P < 0.01	
<b>Total, Direct, and Indirect Effect of X on Y</b>				
	Boot Effect	Boot SE	Bias Corrected and accelerated CI	
<b>Direct Effect of X on Y</b>	-0.047	0.055	[-0.155, 0.062]	
<b>Indirect Effect of X on Y</b>	-0.130**	0.050	[-0.238, -0.049]	
<b>Total Effect of X on Y</b>	-0.177	0.053	[-0.281, -0.071]	
<i>Notes: n = 101. Coeff. = regression coefficients; X = antecedent variable; M = mediator; Y = dependent variable; results are based on 10,000 bootstrap samples. *p&lt;0.05; **p&lt;0.01; ***p&lt;0.001; ****p&lt;0.1</i>				

Table 3.6 - Model coefficients for Online Recruitment Engagement as a mediator

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## 4. Discussion

### Theoretical contributions

The present study aims to understand the efficiency of artificial intelligence in online recruitment, through the perspective of the candidates. Thus, the main goal was to understand what were the first and last impressions of the candidates that used or had an opinion regarding the recruiting processes that apply some sort of artificial intelligence. Furthermore, to understand if the factors that were hypothesized to have some influence, like bias, or engagement would show up on the results. For this study it was created three hypotheses based on the model that was mentioned before.

Firstly, it was found in this study that the online recruitment bias had a negative correlation with the online recruitment efficiency. This goes in line with the findings in the previous literature that stated that one of most common ethical risks is the bias that can occur when using AI in recruitment (Hunkenschroer & Luetge, 2022). Thus, confirming the hypothesis, that the online recruitment bias is negatively associated with the online recruitment efficiency, and continuing in line with the literature that shows that even though algorithms are supposed to improve the efficiency of the recruiting process, they also create some obstacles that are perceived by the candidates (Bogen, 2019). In conclusion, the candidates see the artificial intelligence as something that is associated with bias, and thus, having lower justice perception towards the recruitment process with AI, comparing to the regular recruitment process (Wesche & Sonderegger, 2021b).

Engagement with online recruitment is another factor that was proven by the results to be relevant towards AI efficiency, since it can be seen having a positive correlation with so. This goes along with the findings in the literature, that show how the novelty of this technology can positively influence the candidates to apply and go through the recruitment process (van Esch et al., 2019). Furthermore, by being something new in the eyes of the candidates it can bring them enjoyment and satisfaction which some authors state that can be correlated with engagement towards recruiting processes that use AI (Brahmana & Brahmana, 2013). These findings also contradicted some of the literature that correlate the use of artificial intelligence in recruiting processes with the feeling of insecurity and lack of psychological connections (Braganza et al., 2021b).

In line with the third hypothesis, online recruitment engagement can act as a mediator on the negative impact that the online recruitment bias has on the efficiency perceived by the candidates of the online recruitment. This means, that the candidates that perceive the existence of bias in the recruiting process, due to the usage of artificial intelligence, can overcome that perception if they become engaged with the recruiting process, also, due to the application of artificial intelligence. This goes accordingly with the findings in the literature review, when some authors, stated that when a candidate has intrinsic motivation towards technology, in this example artificial intelligence, they are more likely to finish the recruiting process than others (van Esch et al., 2021). Thus reaffirming, the findings on the efficiency of AI in the recruiting processes. However, further research is needed to better understand this mediation between engagement and the perceived bias, in terms of online recruiting.

Finally, the results found in this study enrich previous existing models, like the JD-R model (Bakker & Demerouti, 2007), that was used for the model in this study. The findings show that candidates with higher engagement with online recruitment, as their job resource, can overcome their perceived bias, as their job demand, and reach the outcome, of a perceived online recruitment efficiency.

### **Practical implications**

In terms of practical implications, if we consider the areas in HR management, the results presented apply to the areas of recruitment and selection and enhance the efficiency of HR management. Regarding recruitment, when candidates apply for opportunities online, the usage of artificial intelligence, as it can be seen by previous studies, it can be either positive or negative, especially in terms of first impressions by the candidates (Wesche & Sonderegger, 2021). HR departments need to invest more in online recruitment, since it can provide engagement for their candidates, as it can be seen in agreement with literature (van Esch et al., 2021). The application of AI in recruiting systems can change how recruiters, as well, do their job, since it can help them with data analysis for better selection of the candidates (Ore & Sposato, 2021).

When discussing the practical implications in selection, as it was introduced before, besides the candidate's perception of fear in terms of creating bias, since the trust in artificial intelligence regarding this part of job seeking can be still very low (Hunkenschroer & Luetge, 2022), it can put some pressure on the recruiter's job, with the

speculation of artificial intelligence replacing them. However, the candidates perceive that the inputs of humans can be necessary (Ore & Sposato, 2021). Companies need to understand that the application of artificial intelligence in their selection process can help them in various ways, as previous literature has stated (Geetha & Reddy, 2018), that the combination of humans and AI can improve efficiency in the recruiting and selecting process.

Finally, the practical implications to improve the efficiency in online recruitment for the candidates, is that it reduces the time spent in such processes, in comparison with the old methods of recruitment. As it has been found in the results of this study, where all the variables that were part of the component regarding online recruitment efficiency were about time efficiency, for example “Online recruitment saves me a lot of time”. This time saved impacts the recruiters as well, since they can focus more on strategizing ways to improve the candidate experience through recurring feedback, which will consequently result in a improve employer branding (Ore & Sposato, 2021).

### **Limitations and future research**

The present study has limitations, and it is necessary to address them. The first one is the fact that this study was only able to understand the candidate’s perception in different times of the online recruitment process. For future research, it would be better to have a deeper understanding on one group of candidates, before and after going through an online recruitment that uses artificial intelligence.

Other limitation was the size of the sample. For this study there were 101 answers collected, and so, for future research, a bigger sample should be used, to better understand the perception of such candidates. Also, another limitation was the fact that the answers were collected via survey and in one moment only, so, for future studies it would be interesting to change the method of collecting answers, through interviews for example, to have a deeper understanding of the perception of the candidates and conduct the interview in different times.

Regarding the design of this study, another limitation is the fact that is correlational, and not experimental, thus for future research it would be enriching to use independent variables to study their effect on other dependent variables regarding online recruitment.



Another limitation in this study, goes along with the results found, since it is highlighted that the engagement towards the online recruitment can overcome the bias felt by the candidates, working towards the efficiency of online recruitment. For future research, it would be interesting to understand other factors that can influence the candidate's perception in terms of online recruitment.

## **5. Conclusion**

The present study has helped to better understand the perception of the candidates in terms of online recruiting, and the factors that positively and negatively influence such perception. The results have provided the information needed to better understand the factors that mostly impact those who use or have used online recruitment. By studying the factors that impact most candidates, it was possible to understand that is better to engage the people in the novelty of artificial intelligence in the recruiting processes, thus decreasing the impact of negative factors, like bias.

Furthermore, future research should investigate other perceptions in different areas of HR Management, that could be related with the application of artificial intelligence. With this, it would help to evolve towards a future with better and more efficient recruiting process, due to the application of artificial intelligence.

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