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The application of Artificial Intelligence (AI) in the recruitment process: An approach to the application guideline and future implications.

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# 1. INTRODUCTION

## 1.1 AIM OF THE REVIEW

Technology has been spreading during the last decades. Technological advancement has developed so fast and invaded our everyday lives. One of the most outstanding innovations has been artificial intelligence (AI). When people hear the word AI, they may first think of what they can see in Star Wars or Terminator movies: Futuristic robots, smarter than humans that destroy what they please. Fortunately, for us, this is pure science fiction. Instead, AI is Siri of our iPhones, automated cars, the content we find on social media, maps, videogames, etc. AI has come to facilitate our lives including our working life. As in many other industries, the recruitment sector has been affected by the development of AI. Back in 2008, Bretones & Rodríguez were speaking about the high benefits of press advertisement to attract candidates. Today, only a few years later, online job posting and recruitment has become mainstream and professionals started studying the implications and benefits of new technologies in the recruitment process.

In this thesis, I will review the state of the art regarding the application of AI in recruitment in order to better understand its outcomes and implications for the future of recruitment. Even if it has become a popular topic in the last years, most papers claim the benefits of AI assessment tools in recruitment, without providing information on how to obtain those benefits and what to consider in order to apply it responsibly. In this thesis, I propose global guidelines to have in mind whenever a recruitment organization decides to implement AI. Furthermore, recruiters are scared that a machine might replace them in the future. The review shows that this may partly happen, but not how they expect.

As we cannot stop AI development and constant evolution, it is important to learn how to adapt ourselves to this fact in order to know how to face the future properly. Therefore, the aim of this thesis is to offer a balanced view of advantages and disadvantages of AI, and serve as a general guideline to inform those interested in applying it.

## 1.2 APPROACH TO TRADITIONAL RECRUITMENT

Recruiting is the psychosocial process of attracting individuals on a timely basis, in sufficient number and with appropriate qualifications, to hire the most suitable candidates to carry on a specific job within an organization (Bretones & Rodríguez, 2008; Mondy, 2008;). There are different opinions about which are the stages that compose the recruitment process. The common phases among the different models

in the literature include: building a job description, sourcing, screening, interviewing, engagement and selection (Hekkala, 2019).

Recruiters spend between 8 and 9 hours to review 100 CV for a specific job and from the total amount of resumes reviewed, 80% applicants are rejected (Benfield, 2017). It is also common to get an idea of the candidate's personality by checking her or his social presence online manually (Faliagka et al., 2015). Screening requires many hours, and this does not necessary result in a successful recruitment (Dagleish, 2005). Conventional recruitment is not efficient nowadays since it involves a huge investment of time and it does not always lead to optimal results (Ahmed, 2018)

According to Edwards (2016) internal hiring is the first option for companies to fill in a vacancy. The second option is looking for candidates based on referrals of other employees, and only afterwards comes the third option, using external recruitment. He argues that online applications are examined only if no other method has worked. The reason behind this is that companies are trying to reduce time-consuming processes, which involves a high cost.

### **1.3 BRIEF DESCRIPTION OF AI**

According to Shapiro (2006), Artificial Intelligence (AI) is a field of computer science and engineering concerned with the computational understanding of what is commonly called intelligent behaviour, and with the creation of artefacts that exhibit such behaviour.

AI is an emerging technology, which is growing at a great speed and gaining more attention every year. AI software is flexible and can automate those tasks, which do not require high levels of creativity thanks to algorithms, which are a systematic procedure for solving a problem or accomplishing some end (Chichester & Giffen, 2019). Algorithms and machine learning tools can rapidly ingest data, identify patterns, optimize, and predict trends. The systems are able to comprehend speech, analyse mood, personality or honesty by using a pattern matching, identify pictures... which allows them to learn, and in a certain way, predict possible outcomes or consequences, and then make a decision based on diverse criteria (Ahmed, 2018). Although machine learning cannot still perform human cognitive abilities, advanced machines can do the basic functions such as learning, making decisions and thinking (Bhalgat, 2019).

### **1.4 WHY AI IN RECRUITMENT?**

AI has been spreading throughout the world resulting in great chances to change the way of working in lots of labour sectors, including Human Resources, and specially, recruitment (Schweyer, 2016; Vedapradha, et al., 2019). The motivation to use AI in

HR comes from the desire to reduce human error and biases that can conduct to bad performance in decision making, or leaving employers in risk of discrimination (Chichester & Giffen, 2019), as well as reducing time and cost of the process by automation. As I said before, algorithms are designed to predict, and hiring is essentially a prediction problem that tries to find out which candidates would perform the job properly (Nawaz, 2019).

## 2. CURRENT APPLICATION OF AI ASSESSMENT TOOLS IN RECRUITMENT

Many companies are starting to use different AI recruitment tools to enhance the recruitment process (Krishnakumar, 2019; Vedapradha et al, 2019). Figure 1 shows the functions 40 recruitment professionals undertake through AI assessment tools in 2019.

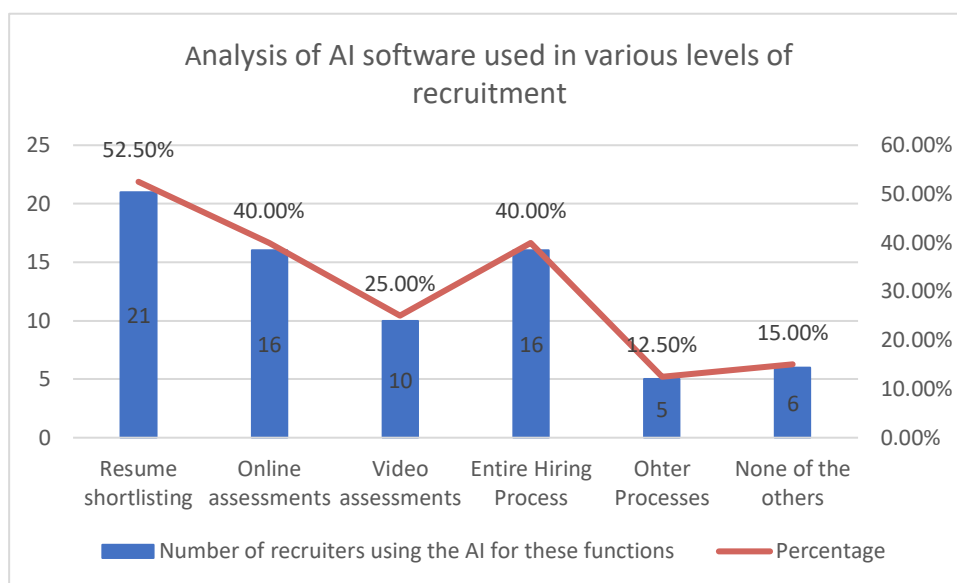


Figure 1. Analysis of AI software used in various levels of recruitment. Own elaboration based on *An exploration of how Artificial Intelligence is impacting Recruitment and Selection process* by Bhalgat, K. H. (2019). (Doctoral dissertation). Dublin Business School, Dublin, Ireland.

As we can see, AI is mostly used for resume shortlisting, online assessments and for the entire hiring process. This is linked to the capability of AI to accelerate the initial phases of the recruitment through automation and providing extra information to the recruiters analysing the applicants' social media and their activity on job advertisement websites. However, according to the HR research institute (2019), only 10% HR professionals are doing a high use of AI in recruitment today. The use of social media to check candidates' personalities, background, activity, is more spread among professionals, since they are sources of data (Edwards, 2016).

As we can see in Table 1, the different functions these tools perform are scanning resumes, sourcing, screening, video interviewing, matching and improving the candidates' experience. These examples provide a global view on how AI assessment tools are already supporting and influencing the process.

Table 1

*AI assessment tools, functions and current use*

<b>Function</b>	<b>Name</b>	<b>Detailed function</b>	<b>Examples of Companies using the tool</b>
Resume scanning	Skillate	Scans resumes through social media to validate data.  It does the skill.job position matching (Vedapradha et al., 2019).	Big Basket InMobi
Video interview	HireVue	Automated video interview.  Analyses the candidates to gather extra information for the recruiter (Krishnakumar, 2019)	Caltex, Ikea, Vodafone
Sourcing and matching	Entelo	Predicts what candidate is more likely to leave his/her job (Vedapradha et al., 2019).  Sourcing and skill job position matching.	SONY, Hallmark, tubitv
Job posting analysis and enhancement	Textio	Analyses the meaningful and common language style from documents posted to estimate the accuracy of the predictions based on the advertisements posted by the companies (Vedapradha et al., 2019).  Improve job postings, and facilitate the differentiation of candidates.	Spotify, NBA, Dropbox, McDonalds, Nestle, Expedia

Resume scanning and skill-job matching	CVviz	<p>Matches right candidates for the right job.</p> <p>Candidate sourcing automation. Gives insight into the hiring process, improves quality of hire and streamlines the administrative tasks.</p> <p>It understands resumes contextually and can find out where each candidate fits best.  <a href="https://cvviz.com/career">https://cvviz.com/career</a></p>	Societe Generale, Alstom transport, headsminds
Chatbot	Mya-a	<p>Enhances personalized candidates' experiences and understands them better from their profiles.  <a href="https://www.mya.com/">https://www.mya.com/</a></p>	L'Oréal, Adecco
Video interview	Panna	<p>Evaluates, voice and face recognition.</p> <p>Detects strange movements or if a candidate is cheating getting help from someone with another electronic device.  <a href="https://panna.ai">https://panna.ai</a></p>	Mroads, mobitv.
Sourcing, screening	Harver	<p>Pre-employment assessment software for volume hiring, a selection platform with predictive analytics and workflow automation.</p>	McDonals, Booking, Netflix, Heineken
Performance prediction	SkillSurvey	<p>Predicts an individuals' performance. <a href="https://harver.com/">https://harver.com/</a></p>	Adidas, Reebok
Culture and position matching	TalentFit AI	<p>Builds a psychological profile of each candidate and judge how well they would fit in the culture of the organization.</p>	AppArmor, Opencare, Andgo



*Note:* Own elaboration based on Artificial Intelligence: A Technological Prototype in Recruitment by Vedapradha, R., Hariharan, R., & Shivakami, R. (2019). *Journal of Service Science and Management*, 12(3), 382-390 and from Assessing the Fairness of AI Recruitment systems (Master Thesis) by Krishnakumar, A. (2019).

### 3. BENEFITS

According to Melder (2018) and Bhalgat (2019), there are four key benefits in applying AI in recruitment:

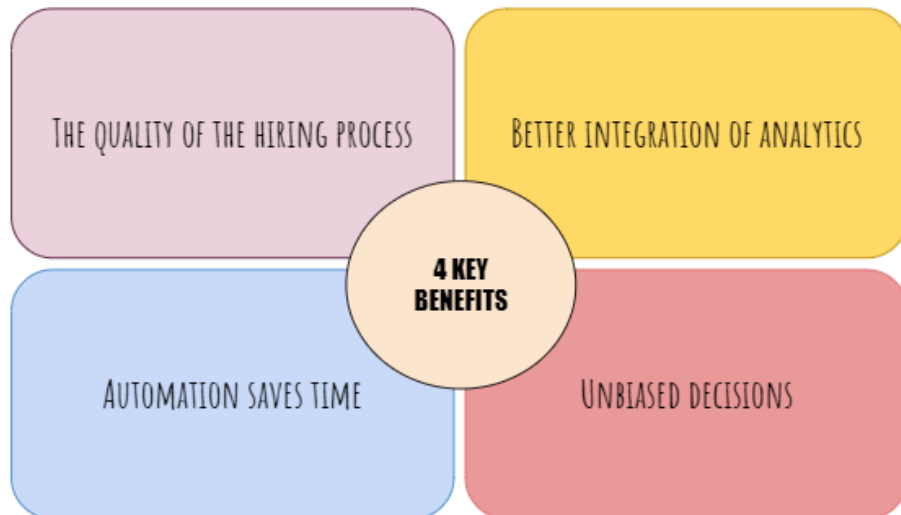


Figure 2. The four key benefits of AI in recruitment. Own elaboration based on The Role of Artificial Intelligence (AI) in Recruitment [Blog post] by Melder, B. (2018, September 24). Retrieved from <https://www.talentlyft.com/en/blog/article/207/the-role-of-artificial-intelligence-ai-in-recruitment>

1. How can the **quality of hiring** increase? There is a big pool of applicants that HR personnel need to review to be able to select the right one. AI allows recruiters to collect more data on each candidate and as a result, evaluate them more effectively thanks to algorithms.
2. We get a **better integration of analytics**. The AI software can select candidates based on their skills and find the best position for them more accurately than humans do. This way productivity rises and candidates are more motivated to improve their skillset.
3. A direct implication is **time saving**. In a few seconds, AI analyses big amounts of data and provides comprehensible results which can be used by recruiters to make decisions. AI solutions save money and resources.
4. Finally, according to AI tools companies, AI can **avoid human biases** and create a fairer progress. However, we will discuss later that to get a 100% fair process, the process needs to fulfil some requirements and taking into account lots of responsibilities. AI makes organizations get the chance to

welcome to their teams the best applicants based on their real potential and personality, if we consider the information AI provides as the most reliable. I will also discuss this topic later.

More specifically, other authors focus on the benefits of AI in the different phases of the recruitment process:

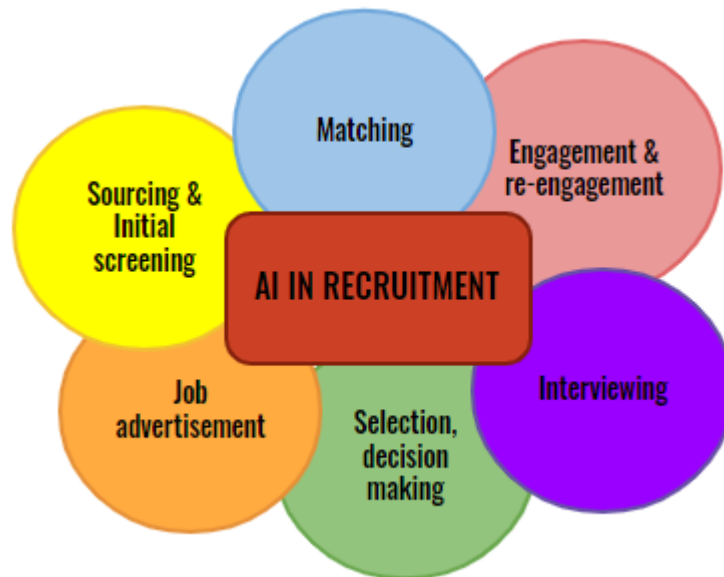


Figure 3. The areas of the recruitment process affected by AI. Own elaboration based on the different literature of the bibliography.

### 3.1. JOB ADVERTISEMENT AND AUTOMATED MATCHING

It becomes almost impossible to analyse properly where the ads appear, for whom, determine the best process for each one, the right amount, when to release them, remove them or modify, to get and keep the job seeker's attention. These tasks are easy for AI, which can perform them in less than a second, however, recruiters invest a huge amount of time and still they are susceptible to lots of mistakes (Schweyer, 2016). AI allows them to save time and costs, leading at the same time to better results.

AI uses the history of the candidates' online activity in order to post improved and targeted ads, which will be seen by the right people in the right moment, thanks to algorithms (Krishnakumar, 2019). They can learn about people's profession, interests, skills, sites they visit on the web and if they are actively looking for a job by gathering information from social media and job posting websites. This kind of technology learns how likely it is that the person will click or not in the job advertisement and how to adjust the title or when to place it so that candidates are more receptive (Schweyer, 2016). For example, *Textio* suggests the probability of responses and gender appeal of the message of the advertisement. Some of these

issues may be considered an invasion of privacy. Therefore, organizations must take into account the laws regarding individual rights and data protection policies must be up-to-date.

### **3.2. INITIAL SCREENING AND SOURCING**

Screening, sourcing and assessment are easy tasks for AI (Kibben, 2016). Processing incoming applicants requires lot of time and work. The AI system can resume the screening beyond keywords, matching experience or education with other data (Krishnakumar, 2019). Some are able to provide the recruiter a view of how the candidates demonstrate their skills (Bhalgat, 2019). For instance, Mya, is a chatbot in charge of two tasks, one of them is doing the first level screening: it decides if the applicants must be rejected or forwarded, saving hours of manual candidate screening for recruiters (Schweyer, 2016). Moreover, these processes become more objective regarding the candidate's ability and skill since, sometimes, humans opinions are wrongly based on a personal feeling or emotion such as fatigue, as well as stereotypes or prejudices that affect us unconsciously. Therefore, automating these processes can be positive (Kibben, 2016). Nevertheless, it is also true that human intuition, not present in AI, may lead to taking accurate decisions and in many cases is necessary. Automation is useful as an assessment tool for humans, not the opposite.

### **3.3. CANDIDATE EXPERIENCE: MATCHING, ENGAGEMENT AND RE-ENGAGEMENT**

Recruiters are not the only ones getting benefits from new technologies. Being a job seeker can result quite exhausting since there are infinite job postings on the net. Programmatic technology helps people find jobs they would not have seen and helps recruiters to find candidates they might have not discovered otherwise (Schweyer, 2016). Berthiaume (2016) is convinced that better targeted ads result in more and better applications for the companies since developing machine learning can prevent AI from making the same mistakes as humans.

According to Geetha and Bhanu (2018), job seekers usually apply for jobs using different job sites, but the amount of them going back to the application after it is low. The AI tool keeps in touch with the candidate by sending automated emails, getting quicker responses from the candidates.

Certain technology, such as chatbots, help employees to access important information about policies and procedures from any part of the world (Ahmed, 2018). Furthermore, a positive outcome of chatbots is their availability: 24h per day. According to a Survey of ServiceNow in 2017 with 350 HR leaders showed that 66% believed that chatbots were preferred by employees for transactional inquiries about

paid-time-off policies, open enrolment and leaves of absence, making them feel more comfortable (Ahmed, 2018).

It is often occurring that after the potential candidates send their applications, a “black whole” appears. Research shows that 75% percent of hiring organizations do not give feedback to unsuccessful candidates, whereas 18% of the candidates stop being customer of the company that rejected them (Charlier & Kloppenburg, 2017). For instance, if a candidate applies for a position in a company that sells a specific product, once the person is rejected, he/she stops consuming that product. Another study carried out by Wright (n.d.), showed that from 132 participants between 21 and 25 years old, 71% who had previously applied for a job did not get feedback. The ones who got a slow reply may not join the company as a result: 51% suggest it would depend on the company and 27% say they would not join.

Sometimes it takes time to review all the applications and to create a proper bridge of communication between recruiters and candidates. Chatbots can fill this gap managing the experience and engagement of all applicants. The software provides the applicants a personalized experience during the interaction with the organization (Krishnakumar, 2019). Schweyer (2016) explains that they can have conversations with the candidates and reply to their doubts about the hiring process, the application status and even review the application with them. This way the chatbot can also determine how interested an applicant is and, eventually, schedule their first interview. They can add more information to the applicant’s resume by interacting with him/her as well (Nawaz, 2019). For example, Mya, the AI software mentioned before, performs the task of kindly rejecting candidates suggesting them other job openings or inviting them to register in the talent platform of the organization (Schweyer, 2016). It also provides a personalized experience for the candidates by understanding better their profiles (Krishnakumar, 2019). Furthermore, AI improves matching by analysing candidates-platform’s interaction and social media, combining information about what they do at work and leisure activities, and how this can affect their work behaviour (Schweyer, 2016). This way, the applicant, can see a whole post of job advertisement that suits him/her without spending lot of effort in searching, while recruiters get better-matched candidates for the job opportunities.

### **3.4. INTERVIEW AND DECISION MAKING ASSESMENT**

On the final phase of the recruitment process, selection, AI can perform automated video interviews, assessing the candidates autonomously. *HireVue* is a video interviewing software that is able to compare the candidate with the high-performing employees of the company by analysing keywords, facial-expression and tones the candidate is using during the interview (Krishnakumar, 2019). Hoffman (2015) claims that in low-skilled positions, algorithms are able to choose qualified applicants more efficiently than managers. Chafin et al. (2016) concluded that it is different for middle

and higher skilled positions. Although AI can lead to a better decision making, in order to get the maximum benefit from algorithms, recruiters are required to guide the AI in what they are looking for. The conclusions of the research show that secondary screening, interviewing and hiring decision should be done by humans assisted by AI, leaving for AI initial screening, job ads posting and maybe to make final selection in high volume low-skilled positions (Schweyer, 2016).

We can see how AI enhances speed and accuracy, decreases the costs and improves candidate management. Human bias often causes high quality applicants to be rejected before the interview stage (Ahmed, 2018). AI has the capability to eliminate discrimination from the process. Not only this, AI does not have to face human necessities such as resting. Fatigue is something that easily leads humans to errors. During an interview, the interviewer personal, mental, physical condition and emotions may provoke an irrational decision (Bhalgat, 2019). For instance, it may happen that the recruiter decides to hire a candidate because he/she was the best of that day although maybe not the best of the whole process (Danieli et al., 2016). The lack of emotion of AI can provide an objective assessment.

## 4. RISKS

The most cited potential disadvantage is dehumanization, the loss of human touch (Hr.com, 2019). According to the HR research institute (2019), 69% HR professionals agree that this will be a potential negative impact of using AI in recruitment, whereas other authors argue that exactly the opposite may happen: recruiters getting rid of administrative task will have more time to invest on going into a more personal level with promising candidates. The study showed that the second most cited negative impact is the potential discrimination based on gender, ethnicity or others, because of bad programming, which is explained in the next section in more detail.

The following disadvantage involves the online activity of the applicants. It may be hard to believe that in the developing technological era we are living now, there are still people who are not “connected” but sure, there are, and these people will face a big disadvantage when seeking for a job. People may not update their LinkedIn profile or may have little information, which would be not trustworthy presentations of them (Hekkala, 2019). It could happen that a good potential candidate who is not very active online may miss out and find it harder to get a job, since AI recruitment software gets data from our online activity in order to find the best candidates and adjust the job posting (Goyal, 2017). This way, we create an online activity dependency. In addition, Van Esch et al. (2019) explains how the negative feeling of being victim of privacy invasion affects candidate’s motivation to apply for a job. He also argues that the presence of AI tools can provoke anxiety on candidates because they do not understand AI yet. Nevertheless, this fact does not seem to affect negatively the application process.

### 4.1. THE MATTER OF JUSTICE

AI implies lot of benefits but how can AI make fair decisions? It could happen that if it is not used properly, instead of creating fairness, discrimination is promoted.

AI systems cannot work without training data (Ahmed, 2019). This means that they learn from the past, therefore, we have to assume that the training data accurately represents the population, and that the population from which the training sample is collected is the same as the one on which the model will be applied (Calders & Žliobaitė, 2013). Therefore, if we can find discrimination in the history of the data and in the current management, and the machine learning and performance uses these data, then, same discrimination cases will occur. In addition, there are sampling biases that can make that specific social groups are over or under-represented (Krishnakumar, 2019). For instance, Buolamwini & Gebru (2018) tested the accuracy of facial recognition software. The results showed that the classifiers were performing

better on male faces than female faces, and always better on lighter faces than darker faces, failing up to 34.7% of the times on black female face recognition, while on lighter males the error rate was between 0.0% and 0.3%. This means that if the software in charge of facial recognition of the potential candidate during the interview does not have the proper training sample, it could promote discrimination towards female and dark people. It would be a similar case if for instance, a specific company has never hired women for high-qualified positions and the training data works based on this history. The outcome will be that women will be still discriminated for those positions. Algorithms have to be adjusted deleting these kind of biases to avoid institutionalizing them (Ahmed, 2019).

Krishnakumar (2019) argues that algorithmic focus is something that can lead to discriminated, unfair and illegal decision-making. Algorithmic bias happens when humans who designed the algorithms build unconscious biases into it and promote discrimination within a group (Chichester & Giffen, 2019). So, even if it is inappropriate and illegal to use gender, race and sexual orientation information during the hiring process and, for instance, the software is told not to discriminate by gender, there are a huge number of possible contexts that may do a “hidden” discrimination (Krishnakumar, 2019). For instance, racial discrimination may be hidden in demographic data: people living in the same neighbourhood usually get credit denial, then the system will be able to guess all the people living in that area belong to the same ethnicity (Ruggieri, Pedreschi & Turini, 2010). What if the system is just choosing people not living further than 5 km from the workplace but all those people result to be white? Then unintentionally it will be discriminating other ethnicities. Another different case of discrimination would appear against those people who decide not to be active on social media. As mentioned previously, the AI software compiles and analyses thousands of online data of candidates and uses that information to decide whether to attempt attracting them or not, which means that those people who decide not to share their private lives online, will face more problems to find a job.

There is also the issue of opaqueness. Machine learning techniques are complicated, sometimes even its own creators struggle to find their logic, and the huge amount of data can make decision-models incomprehensible. This can provoke a decrease in the honesty and comprehension of the feedback for the potential candidates (Krishnakumar, 2019). If even the creators of the system, sometimes face difficulties to understand the decision-models, it can happen that it is hard to explain the reason behind a decision taken by the AI system. Therefore, it becomes harder to give a proper or honest feedback to candidates because even the recruiters may not understand why the AI system reached that decision or feedback which is being transmitted to the applicant.

Despite the possible inconveniences, what we can ensure is that if we take in account and identify the biases that could lead to an unfair decision, there is always the



chance to work on its improvement. If machine learning, training data, and data samples are properly led and aimed, it should provoke a positive impact on recruitment and a huge decrease of discrimination, creating like this a more fair process. We can find several examples of this: Data analytics could be used to assess pay equity (Ahmed, 2019). Another good point is that it reduces discrimination by eliminating interviewing biases such as recency effect or primacy effect. According to Ahmed (2018), humans make decisions based on how good we feel, most hiring managers make a decision on a candidate within the first 60 seconds of meeting him/her, usually based on look, handshake, or speech; and in the end, they admit that they still get 30/40% of their candidates wrong. AI assessment can change this. Moreover, in the interview Schweger made to Forman (2016), he spoke about how fatigue can affect recruiter's choice on applicants. He said that people who apply earlier to a position have more chances to be hired just because recruiters are so tired after reviewing tons of applications. AI deletes this bias providing same chances for all applicants regardless of the moment they applied for the position.

## 5. GUIDELINE FOR THE APPLICATION OF AI

### 5.1. BARRIERS TO CONSIDER BEFORE THE IMPLEMENTATION OF AI RECRUITMENT TOOLS

Although the implementation of AI sounds attractive, there are some issues to consider when deciding to apply it in recruitment.

Adaptation to the new technology is necessary: It is almost impossible for a company to operate successfully without any adaptation level to the new technology (Martincevic & Kozina, 2018). The organization should redefine what “digitalizing”, “automation” or “AI assessment” means. The adaptation will largely determine how the organization will be able to achieve its goals, and it will require a technical team. Therefore, it is necessary to have a chief digital officer or similar to control how AI tools are used and to solve any problems or doubts of the recruiters using them. Moreover, companies must reflect and analyse the AI platform capabilities and how it is supporting them (Charlier & Kloppenburg, 2017). It has to be considered how well AI is able to comprehend the organization’s values and exactly the kind of applicants the company wants (Johansson & Herranen, 2019).

We cannot make a proper use of AI without knowing how to train it. It is fundamental to train people to train machines, so that biases can be avoided, and this is indeed one of the greatest challenges that must have in consideration all the risks of the implementation of AI mentioned.

According to a survey carried out by the HR research institute in 2019, 68% HR professionals agreed that the main reason why they were not implementing AI software in recruitment was not having enough budget to invest on it. The second reason with 43% votes, was the lack of professionals skilled in the area. This refers to the talent gap: when companies cannot afford specialised people who know how to use it, program it or perform the ongoing maintenance. The other barriers exposed in the results of the survey were, third, the lack of belief that AI can make a difference in recruitment (34%); fourth, the lack of interest among the leaders (31%); and finally, the belief of not having a real need for the AI technology (20%).

Another barrier is the aforementioned risk of unconscious or hidden discrimination. Discrimination can provoke negative outcomes. For instance, a fail trial of hidden bias occurred in Amazon (2015) when the recruiter software the company was using was favouring men candidates over women.

Another challenge is the cultural barrier. It is hard for AI to understand cultural behaviours and barriers, and this is one of the reasons why human participation should not be eliminated (Johansson & Herranen, 2019).

When implementing AI into recruitment, employers must be concerned about the private data regulations and usage. Confidential data must be secure and only authorized persons should have access to it. Because of this, there is also a limitation on the availability of data (McGovern et al., 2018).

Finally, McGovern et al., (2018), stress the limited proven application saying that many products and services feasibility are based on proof of concept only, which means the advantages of AI recruitment tools are based on theories more than experienced facts.

## **5.2. RESPONSIBLE APPLICATION OF AI RECRUITMENT ASSESMENT TOOLS**

Responsible application of AI recruitment implies important legal considerations to be made. Technology should be used to improve fairness of current recruitment by eliminating discrimination, and respect the individuals' privacy, for that, it is essential that employers learn about how not to provoke the opposite effect.

In 2017, Dignum established three principles for automation: accountability, responsibility and transparency. These principles are necessary if we want to apply properly the new technology:

- Accountability consists on the obligation of the system to explain and justify its actions based on the algorithms and data used in order to make the decision within the whole morality values and societal norms in the context (Dignum, 2017). The idea is to eradicate unconscious discrimination, as well as working with a system that provides feedback regarding personal traits of candidate's decisions, conditions to deal with similar situations in a different way, and information on how it reached certain decision (Krishnakumar, 2019).
- Responsibility links the agent's decision to the user, owner, developer and all the people whose actions influenced the decision (Dignum, 2017). We must control the risks and potential negative consequences of the technology, and to do this, AI systems should be able to deal with security attacks and reconsider the applicants who were discriminated because of biases (Krishnakumar, 2018). The quality of the system must be reviewed and promote reflexivity to learn about its status, goal, risks and data (Owen e al.,

2013). It always has to be adapted to society laws and values (Krishnakumar (2019).

- Finally, there is transparency, which refers to the capacity to inspect the origin and dynamics of the data used, as well as the working of the algorithms (Dignum, 2017), to make sure the data are legally obtained and are reliable. It is essential in order to achieve accountability and responsibility (Krishnakumar, 2019).

According to Chichester & Gifeen (2019), companies must take responsibility on the AI tools they want to apply, and for this, they must critically think about the information they want to learn or process with the software. Once this is done, they can look for the AI software that best fits them and, in case of doubt, contact the developer. The responsibility of avoiding unconscious discrimination biases is from the employer.

As we could see, algorithms work with collected data to be able to predict future outcomes. The accuracy of predictions depends on the data analysis, which means, it is important to revise the data and make sure it is reliable (Chichester & Gifeen, 2019). The training data must be secure for machine learning purposes. As the system is constantly collecting data and learning, it must be trained and retrained to remove factors that contribute to biased outcomes (Larsen, 2018).

It is true that AI can automate a lot of work but is important not to remove completely human participation from the process. AI software decreases human error, but in order to make it more effective, it is important to regularly review the automated decision-making programs and the data used (Chichester & Gifeen, 2018) by carefully testing the presence of adverse impact in the predictions of the model (Larsen, 2018).

Employers must respect the General Data Protection Regulation (GDPR), which is the law that regulates the protection of natural persons (any individual human being) regarding the processing of personal data and rules relating to the free movement of this data in the EU (Krishnakumar, 2019). As the use of AI in the workplace increases, there will be more data collected about employees and applicants, which will lead to stricter protection of personal data regulations. We need educated employers who regularly analyse the data and how the data is being used to prevent illegal violations of privacy (Chichester & Gifeen, 2018). For instance, Chatbot should never store any personal identifiable or confidential information when the candidate is requesting information to the Chatbot and requires that he/she provides the system certain kind of personal information (McGovern et al., 2018). This will ensure consistency of the recruitment system (Krishnakumar, 2019). Moreover, employees must be aware of the use of their data, so that they get better results, and once again, that is the employer's responsibility. Finally, the IT security department should do policies in order to clarify everything to the employees (McGovern et al., 2018).

### 5.3. HOW TO APPLY AI RECRUITMENT TOOLS IN ORDER TO BE SUCCESSFUL

According to Danieli et al., (2016) there are five principles to support successfully the recruitment process with algorithms: picking the right performance metric, collect right variables, gather many data points, “compare apples to apples” and anticipate incentives. Other authors like Guenole & Feinzing (2018) and Chichester & Gifeen (2019) suggest some ideas or tips that we should always have in mind. Building on the contributions of the previous authors, I propose the following principles for the successful implementation of AI tools in recruitment.

1. **Educate and enable employees:** First, make sure the team of workers understands how to work with the AI tool in order to get the most positive outcome from it. Managers must provide training to the employees so that they learn how to use the tools and about the implications of the application. If they know and understand the role of the software, they will see it as an ally. It can be frustrating to try to do a job with someone or something that it is hard to understand, and therefore, people do not perform at their best. It is important to remember that the AI is an assessment tool and cannot perform the whole process by itself. A good idea is to do a first education campaign meeting to make sure everyone gets a first understanding approach to the new implementations (Kogan, 2018).
2. **Employee’s empowerment:** Once you have the product and a trained team, if we want that the implementation of AI works, employees should be empowered to use it. The previous statement is the first step to empowerment. The system should not make them feel they are replaced, but motivate them (Guenole & Feinzing, 2018). Only with a human-machine collaboration, we can get the greatest benefit: employees have to be empowered to think critically and find the problems that AI can fix (Kogan, 2018) but Humans are still the ones making the decisions. The use of AI tools provides the chance to employees to develop themselves in the most personal part of the recruitment process and making better decisions.
3. **Picking the right metric:** It is of extreme importance to have in mind a global idea of the result we want to achieve in order to be able to pick the right performance metric, which means giving accurate instructions to the software on how to reach the goal (Danieli et al., 2016; Guenole & Feinzing, 2018;). Employers should not forget that the software is not perfect and it must be trained to be improved (Guenole & Feinzing, 2018). A good example of this are chatbots, the more you challenge them with questions, the more they can learn.

4. **Metric adjustment:** We must adjust the metric according to the performance and the difficulty of the task (Danieli et al., 2016).
5. **Humans-in-the-loop:** Humans must decide which are the variables that must be collected according to the recruiter preferences (Danieli et al., 2016). It should be considered that one of the challenges of using AI is the fact that the system is not able to understand cultural barriers. In order to improve the system considering this fact, international companies must provide the AI tool with international data from different regions to be able to do the best recommendations (Guenole & Feinzing, 2018).
6. **Constant data gathering:** Data must be collected constantly even after being hired: performance should be tracked and keep records of the applications. The more data the algorithm has, the better are its predictions and can be used for future hiring (Danieli et al., 2016).
7. **Data review:** Data must be continuously analysed to be sure there are no factors that could lead to negative outcomes (Chichester & Gifeen, 2019).
8. **Transparency:** It implies clarifying to employees the aims, recommendations, the data used, variables influencing decisions and the expected accuracy of the system (Guenole & Feinzing, 2018).
9. **Anticipation of incentives:** Sometimes applicants and employees may feel incentivized to trick the metric, in a way that a superficial action or information that they provide may be analysed by the system and increase their chances to get a job. For instance, there can be someone who is motivated to close deals at any cost, which will increase his/her "score" but actually, it is not of great value to the company. Companies must anticipate this by creating metrics to be strategic and avoid it (Danieli et al., 2016).

## 6. IMPLICATIONS

There are diverse implications of the application of AI in recruitment, ranging from the benefits and risks to how it is going to affect recruitment in the next years. As it has been explained, the major risks of AI recruitment tools are the potential negative outcomes due to bad programming or bad implementation. Controlling for these negative outcomes, we may obtain positive implications:

- **Time saving:** All the hours spent filtering thousands of CVs and online job-board profiles for new employees is arriving to an end (Ahmed, 2018). A company specialized on AI recruitment, ensures that the AI candidate sourcing algorithm can reduce the hiring process from 34 days to 9 days which is reflected in a 73.53% increase in candidate sourcing and efficiently regarding discrimination (Ahmed, 2018).
- **Mapping of talents:** AI assist the recruiters in acquiring the best talent required. It targets competency to place candidates in the right position (Geetha & Bhanu, 2018).
- **More quality aspirants:** As a result of better targeting and matching, AI enhances the quality of the hiring selecting the best candidates, so this way, companies always get talented applicants (Geetha & Bhanu, 2018).
- **Cost saving:** AI not only reduces time but also the cost per hire by around 71%. It improves the quality and the time-line of the process, which results in increasing recruiter's efficiency (Ahmed, 2018; Geetha & Bhanu, 2018). If Amazon had not used AI technology to hire its 541,000 employees in 2017, the recruitment process would have implied costs of \$999,805,100 (Ahmed, 2018). Cost saving allows companies to invest in more strategic recruitment (Benfield, 2017)
- **Query redressing - Engagement:** Candidates and employees get updated information and get immediate responses for their queries. Both are more satisfied and engaged, reducing turnover ratio (Geetha & Bhanu, 2018).
- **More efficiency:** More possibilities, more quality and less time and cost. For instance, *HireVue* or *Mya* have as an aim to simplify the interview process by creating a pre-recorded video of an interview that allows recruiters to interview more potential future employees (Ahmed, 2018). Recruiters can reach a lot more potential candidates with less effort.

- **More productivity:** The implementation of AI enhances reliability and as it reduces weight of administrative work; employees have more time to develop their skill, become more productive and work better (Vedapradha et al., 2019).
- **Unbiased recruitment:** Machines do not make human mistakes (Geetha & Bhanu, 2018). Machines are susceptible to make human mistakes, as long as humans do not take care of the data and history they are using to train the software, so it is important to have in mind that this outcome is responsibility of the company. If employers are educated and responsible, then they can get the unbiased recruitment.
- **A great responsibility:** Franklin D. Roosevelt inspired the famous comic artists Stan Lee with a phrase that would become famous on his comics: “A great power involves great responsibility” –Uncle Ben said to Spiderman. The truth of this phrase is reflected in what is upcoming in the near future. AI means power, power to do and achieve things that once were taking a lot of time and effort, power that if not used properly, can be used to attempt people’s rights and even lives. AI can do great things for humanity, or in this case, for recruitment, however, how great or bad these things are, depends strictly on how responsible, educated and human we are.

There is something else worth to consider: In order to get most benefit out of AI recruitment, companies should have the adequate tools to train people and machines. It is the most certain way to assure the effectiveness of the AI based recruitment and that the use of this new technology is not only an ongoing trend (Rasmussen & Ulrich, 2015). Results and true implications are very subjective up to every individual company. That AI gives very good results in a particular area in a specific company does not mean that the same will happen in another one. The software needs to be adapted and people should be trained to know how to use it at its best.

Nowadays, only 10% of HR professionals are doing a high use of AI, however, 36% expect to be in high use by 2021 (Hr.com, 2019). The following table, shows how the use of AI will change by next year per areas:



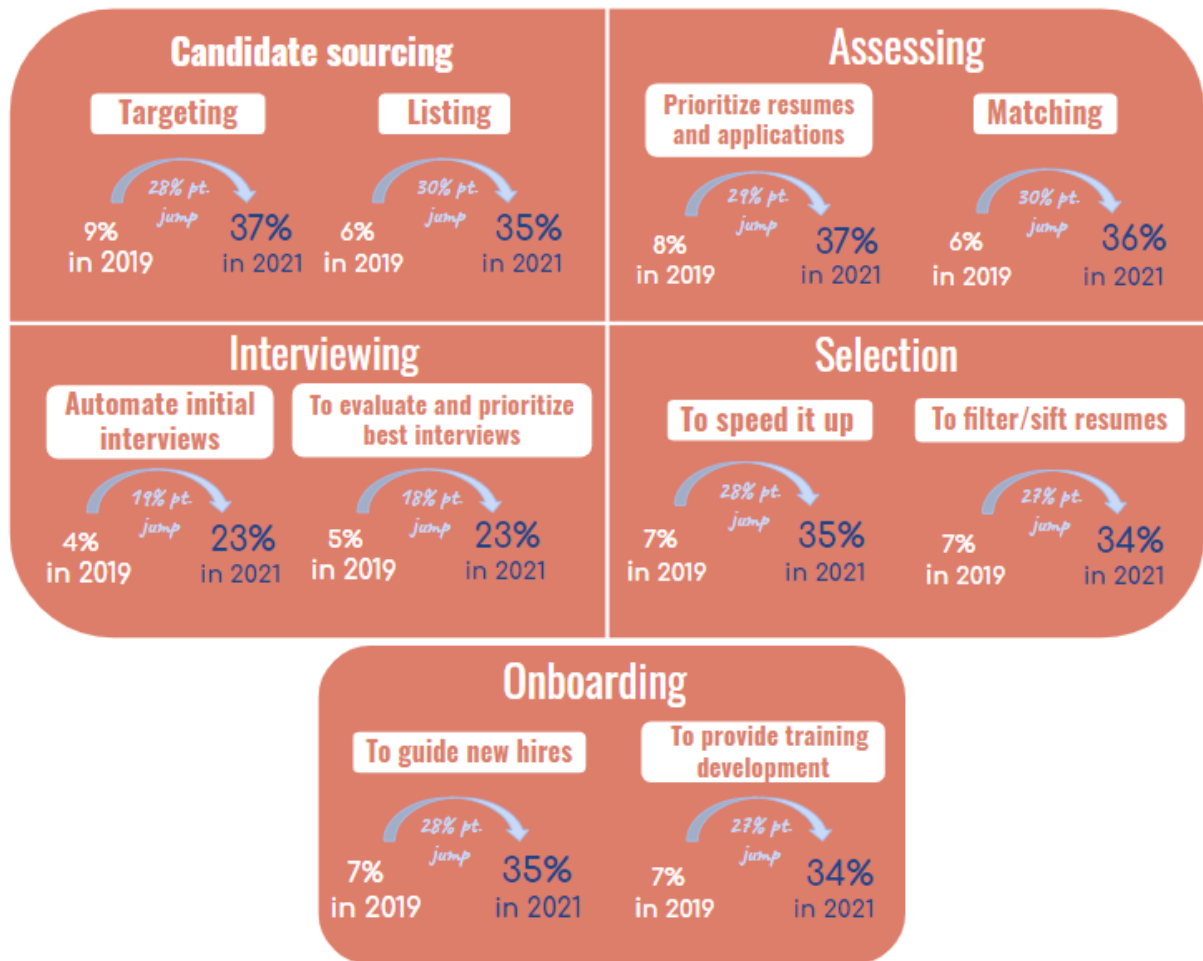


Figure 4. AI usage to high extend: The five key areas in which AI will increase is usage by 2021. Own elaboration based on “Artificial intelligence in Talent Acquisition” by HR research institute (2019). Retrieved from [https://www.hr.com/en/resources/free\\_research\\_white\\_papers/hrri---ai-in-talent-acquisition-2019-research\\_jwmzvb12.html](https://www.hr.com/en/resources/free_research_white_papers/hrri---ai-in-talent-acquisition-2019-research_jwmzvb12.html)

## 7. FUTURE OF RECRUITMENT

During the last recent years, AI has increased popularity. Some recruiters doubt about AI's ability to perform their jobs while others are afraid of being replaced (Melder, 2018). In this section, we focus on a common fear among recruiters: How is AI going to change the recruiter's job? Is AI going to replace humans at the workplace?

Huang & Rust (2018) classified AI into four types: mechanical, analytical, intuitive and empathetic. The first two are the ones introduced to a larger extent into jobs and the ones who will likely replace human labour. Intuitive and empathetic type are still under development, although they are growing at high speed, and at some point they may threaten problem-solving and high-level jobs also within the selection process. According to Hogg (2019), the adoption of AI is increasing its presence at the workplace, but there are still doubts about whether it will threaten current jobs.

It is a demonstrated fact that machines are better at performing repetitive work, but at the same time, this is the reason why the value of human work is going to increase (Melder, 2018). The routinely part of the labour is being replaced; while analytical thinking, strategizing and driving change are gaining importance (Guenole & Feinzing, 2018).

For the moment it seems that automation will reduce employment among the recruitment sector. However, selection and hiring processes will still have place for recruiters for a decade or more to come (Schweyer, 2016). This is because human intervention is needed for the last stages of the process: interviewing and selection (Nawaz, 2019). AI can improve the decision making in the late phases of recruitment but not make better decisions by itself (Schweyer, 2016). However, we saw how technology reduces human effort, mistakes and burden (Nawaz, 2019).

According to Charlier & Kloppenburg (2017), 65% workers think that technology will improve their job prospects in the future. By avoiding human mistakes, recruiters will get a more objective and fair assessment of candidates, experiencing great advances in the applicant tracking system (Kibben, 2016). Vedapradha, Hariharan & Shivakami, (2019) carried out a study in which they wanted to evaluate and analyse the adaptability of AI in the recruitment of candidates by Human Resource personnel in an organization and their performance after the implementation of the AI. Results showed that recruiters were incrementing their productivity and improving their performance. Productivity was increasing by training the personnel in how to use AI tools strategically. Automation was decreasing the workload, allowing HR personnel to dedicate more time to strategic tasks. Moreover, AI as a support was improving HR professional's performance because of a better reliability of the reports. The

conclusion is that there was a significant positive influence of AI on the performance of recruiters, after implementing AI.

Job posting, screening, scheduling time, meetings and interviews are most probably going to be automated and if AI is implemented responsibly, it will benefit HR, since HR employees will be able to dedicate more time in thinking, creativity, relationship building, emotional intelligence and coping with problems (Ginu & Thomas, 2019). Ahmed (2018) claims the future is going to be centred on the employee experience and taking engagement down to the individual level. Rishabh Kaul from Belong.co, affirmed that by 2021, AI based tools would become mainstream in recruitment (Chaflin, Danieli, Hillis, Jelveh, Luca, Ludwig & Mullainathan, 2016).

According to Ginu and Thomas (2019), there is a misconception that by introducing AI in HR, HR jobs are at risk. Nevertheless, the support of AI in charge of monotonous administrative repetitive task, is what is going to allow to professionals to focus at the strategic level. The way recruiters work, perform, interact with clients and among them, their tasks and their physical location, will change (Kibben, 2016): Automation in organizations reinforces the workforce planning and recruitment (Bhalgat, 2019).

Recruiters make out of their work something more strategic (Bhalgat, 2019; Guenole & Feinzig, 2018; Kibben, 2016). Negotiations, appraisal of cultural fit and rapport building should still be conducted by humans (Upadhyay & Khandelwal, 2018). Language biases and cultural understanding are a challenge for AI and it is not able to understand cultural barriers (Johansson & Herranen, 2019; Nawaz, 2019). Human abilities like persuasion, establishing relations with candidates or emotional intelligence, that are needed to convince the candidate to stay with you are abilities that AI cannot deal with (Kibben, 2016). Machines cannot do better than humans the task of interacting with another human (Nawaz, 2019). They do not have the ability to leave a feedback after a video interview, lacks empathy and cannot “personally” meet a candidate or interact with sense emotion and this is something that will not be changing in the future (Ahmed, 2018).



Figure 5. Human and machine intervention in strategic decision making. Adapted from *Artificial Intelligence in HR: A no brainer* by Charlier, R., & Kloppenburg, S. (2017). Netherlands: PwC. Retrieved from <https://www.pwc.nl/en/Services/people-and-organisation/our-services/people-analytics-and-insight.html>

AI frees recruiters up to be more strategic and participating in more impactful projects than administrative tasks (Kibben, 2016). Candidates will tend to apply for the most relevant jobs for them according to their preferences (Van Esch et al., 2019). It is also important to mention how candidates experience automation. Although we

already mentioned the benefits for the applicants previously, James Wright Survey (n.d.) suggests that 73% of candidates get a negative perception of the company when it is using an automated recruitment process, against a 5% who thought the perception improved. Participants claimed that they expect a personal touch and they preferred human interaction for screening, interviewing and even salary negotiation, since their belief is mainly that without human interaction, the recruiters would miss important points about them.

We can conclude that, AI transforms the majority of the process into automation performed by a machine and that most professionals agree this is needed to enhance the whole process (Vedapradha, Hariharan & Shivakami, 2019; Nawaz, 2019). In 2016, Angela Hood (As cited in Schweyer, 2016, p.8) exposed 70% of the hiring process involves sourcing and screening, which is tiring and can be easily automated. However, the rest 30% is what recruiters really want to do and are better than AI. She claims that automation will not replace the good recruiters who perform this 30%.

The conclusion is that, humans are not going to be replaced, but instead they will have the chance to develop their skills, especially the ones that differentiates us from machines, and dedicate time to perform what they really like. New jobs and positions will be required, some of them will remain, and others will adjust to be integrated with the new technology, but there is no machine better than humans in interacting with another human, and as we could observe, people prefer a human touch.

## 8. DISCUSSION

All in all, AI boosts the success in the recruitment process (Gupta et al., 2018). Organizations can reduce, improve and speed up the process by using AI software in initial screening, sourcing, job advertisement and matching; however, within the interview and selection process, technology should be used strictly as an assessment tool. Humans are better at high decision-making (i.e. those decisions considered as “difficult” that imply considering lots of information such as personality, emotions or intuition and have great consequences. They are key for the last stages of the recruitment process) and possess emotional and cognitive abilities needed to succeed, that AI cannot replace (Gupta et al., 2018; Schweyer, 2016).

AI improves the recruiter experience, not only by creating a more efficient process by decreasing cost-time ratio and rising up the quality, but also reducing administrative and repetitive work load. As a result, recruiters get more time to develop themselves in the high stages of recruitment and prioritizing strategic thought. Those skills which result impossible for a machine learning such as emotional intelligence, creativity, building relationships or understand culture, will become more valuable. The role of the recruiter will change and new jobs will appear. AI will replace some jobs but it seems that mostly will provide the chance to positively shape and conduct the current ones. According to Kogan (2018), those companies who invest in both human and machine capital will be the ones to reap the greatest benefits.

The candidate experience will improve as well. Thanks to AI, candidates will get the right job advertisement and the best matchings according to their talents and skills. It keeps the applicants easily engaged by sending automatic emails or replying their queries with chatbot. Nevertheless, as we saw, only 10% of recruiters use AI in the process at a high level, this means that not all candidates should expect the use of AI during their recruitment, and most of them still prefer a more “human” process. Eventually, we all will get used as we got used to cars, smartphones or automated cars, since by 2021, 36% of recruiters expect to be in high use of AI recruitment tools (Hr.com, 2019).

Obviously, success of the implementation of AI in recruitment depends on each company’s needs. For instance, a positive impact seen in an organizations thanks to AI, may not be seen in another. It is important to empower employees to use technology as an ally and train them on how to get the most out of it. Moreover, machine learning implies a great responsibility and it can create a fair unbiased process offering equal opportunities to candidates, or well, the opposite if the training and history data is not reviewed, therefore promoting discrimination. It is necessary to develop classification techniques to prevent it (Calders & Žliobaitė, 2013) and do

constant checks, as well as understanding the laws of protection of personal data and privacy. A deeper level of transparency will improve the job seeker perceptions about the employers who will gain better reputation, image and brand (Gupta et al.,2018).

## 9. CONCLUSION

It is a fact that AI recruitment assessment tools are becoming popular due to the apparent high benefits it provides and, thus, organizations are already considering their implementation for the near future. The reasons behind their popularity are based on the idea that AI recruitment tools have the capability to create a fair process and help to get high quality and optimal results in less time and costs than humans can do. However, there are several important risks and challenges to take into consideration before a successful implementation. Companies must be very well informed on how to apply them, legal issues and how to eliminate non desirable biases from the metric. Therefore, it requires educating employees, constant supervision and high responsibility.

There is a misconception about AI replacing human labour, but instead, studies show how humans can benefit from it. The implementation of AI software and automation releases employees from workload, allowing them to be more strategic and become more productive. AI is able to improve the applicant's experience and the reputation of the organization. Furthermore, we must not forget that the success of the implementation of AI recruitment tools can differ from one company to another.

It is important to keep studying the impacts and implications AI in recruitment can offer, as well as the real benefits, since AI is evolving at a fast speed and this implies constant changes on its application.

Last, but most important, human labour is and will still be necessary in the future to perform all those tasks which require what only humans can do, therefore, human touch (and skills) will become more valuable and will not disappear.

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## 10.1. TABLES AND FIGURES.

*Table 1.* Own elaboration based on Artificial Intelligence: A Technological Prototype in Recruitment by Vedapradha, R., Hariharan, R., & Shivakami, R. (2019). *Journal of Service Science and Management*, 12(3), 382-390 and from Assessing the Fairness of AI Recruitment systems (Master Thesis) by Krishnakumar, A. (2019).

*Figure 1.* Own elaboration based on *An exploration of how Artificial Intelligence is impacting Recruitment and Selection process* by Bhalgat, K. H. (2019). (Doctoral dissertation). Dublin Business School. Dublin, Ireland.

*Figure 2.* Own elaboration based on The Role of Artificial Intelligence (AI) in Recruitment [Blog post] by Melder, B. (2018, September 24). Retrieved 29 April 2020 from

<https://www.talentlyft.com/en/blog/article/207/the-role-of-artificial-intelligence-ai-in-recruitment>

*Figure 3.* Own elaboration based on the different literature of the bibliography.

*Figure 4.* Own elaboration based on *Artificial intelligence in Talent Acquisition* by HR research institute (2019). Retrieved 16 April 2020 from HR. com: [https://www.hr.com/en/resources/free\\_research\\_white\\_papers/hrri---ai-in-talent-acquisition-2019-research\\_jwmzvb12.html](https://www.hr.com/en/resources/free_research_white_papers/hrri---ai-in-talent-acquisition-2019-research_jwmzvb12.html)

*Figure 5.* Charlier, R., & Kloppenburg, S. (2017). *Artificial intelligence in HR: A no brainer*. Netherlands: PwC. pp. 1-8. Retrieved 17 April 2020 from <https://www.pwc.nl/en/services/people-and-organisation/our-services/people-analytics-and-insight.html>