Review Article

How Can Artificial Intelligence Improve Organizational Psychology?: A Systematic Review

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Abstract

Organizational Psychology is betting on Artificial Intelligence and tools to improve the employee experience in the workplace. The present review aims to expand the current knowledge on how Artificial Intelligence influences Human Resources, aiming to provide information on the current landscape of AI applications in the field of Organizational Psychology. The results obtained can be divided into five sections in the Quality of Life that workers have within their company, focusing on Recruitment, Job and Individual task analysis, Development, and Decision-Making. We can conclude that the application of Artificial Intelligence in Organizational Psychology is very prominent in different areas such as recruitment, decision-making, quality of work, and job and individual task analysis.

Keywords: Organizational psychology, Artificial intelligence, Employees, Workplace, Human resources, Decision making

Introduction

Organizational Psychology (OP) has been studied since the beginning of the 20th century by authors such as Scott or Munsterberg. It has come a long way since the early conceptualization of the worker as nearly a machine, to a more human approach that looks for employee well-being.[1] When approaching a definition of OP, the American Psychological Association (APA) defines it as 'the scientific study of human behavior in organizations and in the workplace'.[2] This concept applies principles of individual, group and organizational behavior to address work issues. It uses specialized knowledge about organizational and career development, attitudes, job and task analysis, human performance and factors and consumer behavior. In addition, this field of psychology applies different theories such as small group theory and process, criterion theory and development and decision theory. It also requires an ethical approach as well as administrative, executive and law knowledge,

given the complexity and implications of managing people in the workplace.[2] Other terms related to OP are Human Resources (HR) and Human resources management (HRM). Human resources management handles with recruitment, selection, retention, training and development and trying to achieve goals for the organization.[3] The department that is in charge of these functions within the company is HR.

Research in OP has had many trends along the years. Piwowar Sulej[4] conducted a novel review based on text-mining techniques to establish which were the main research trends in HRM from 2000 to 2020. They found four types of trends according to their prevalence over time.

1) **Long lasting trends** prevailed over the whole period; they were Diversity Management, Architecture and changing role of HRM, HR Development-practices, effectiveness, innovations and Team management.

2) **Declining trends** that had disappeared by the end of the period contains were the role of feedback in HRM, HRM and ethics, Development and utilization of human capital, Employee compensation and New and traditional career models.

3) **Emerging trends** ongoing by the end of the period were Employee participation, Challenges for international HRM, Psychological contract elements shaping the process and fulfillment, Work-life balance, Flexible employment from the perspective of HRM, High performance work systems, HRM for innovation, Knowledge sharing-factors, processes, Organizational commitment-mechanisms, factors, outcomes, Green and sustainable HRM, Leader member exchange, Talent management, Corporate social responsibility and HRM, Organizational ambidexterity, HRM in family firms and Mentoring-types and effects. Finally,

4) **Short-lived trends** that began and finished in that period. It can be said, given the emerging trends found by this review, that employees' attitudes towards work, colleagues, superiors and their organization are very important nowadays. Researchers are looking to improve performance while taking into account well-being and work-life balance. Also, a very important research topic considering today's fast paced technological environment is HRM for innovation, which is gaining weight as it helps take into consideration how HR systems can help introduce innovations in companies while promoting the use of new technologies like AI.

Referring to the current market environment in which OP operates, AI is appointed as the main contributing factor to have enhanced the 4th Industrial Revolution, which 'sees both human and machine intelligence as becoming increasingly intertwined'.[5] The 3rd Industrial Revolution was called the Digital Revolution and the 4th one is seen as 'a culmination of emerging technologies fusion into the physical and biological worlds the likes of which has not been seen before', with emphasis on the Internet of Things. The 4th Revolution is convergence at its highest and its impact can be impressive for developments in the business world. Still, as[6] conclude in their systematic review, the application of technologies from the 4th Industrial Revolution in HR Information Systems has not been sufficiently researched, outlining a gap for further investigation. Related to innovation, Choi & Valikangas,[7] talked about patterns of strategy to achieve it in the early 2000s. They observed a shift from a discrete strategy paradigm to a converged one. Convergence happens when the barriers between industries are blurred, mixing value propositions, technologies and markets. It leads to new and interconnected approaches that transcend original structures. Convergence might be regarded as one of the 4th Industrial Revolution's characteristics.

One convergence that is gaining interest in the OP field is its combination with very new and disruptive technologies such as Artificial Intelligence (AI).[8] According to Eubanks[8] when discussing the use of AI for HR, we see how companies nowadays want to be associated with technology no matter what the original purpose was and how HR is not excluded from this transformation. Employees are demanding engaging experiences, better conditions and growing opportunities and AI is shedding hope into HR to meet this demand, while also helping them manage the workload. Another factor that contributes to the adoption of these technologies is the market's current state, with trends like job-hopping or tele-working rising up. HR is expected to do more with less and AI can propose solutions that were not available before. Still, underline the need to consider employees' opinions, attitudes and possible consequences when applying strategies for digital transformation, since most literature refers to leaders' opinions.[9] Organizational culture and climate are pointed as key factors for digital transformation processes and outcomes. In Makarius[10] AI is conceived as a technology that has a more complex adoption process than others, with a need for social processes to achieve the best integration between AI and employees. Therefore, the role of OP and HRM is to enhance an optimal adoption between employees as well as inside their own functions to improve HR processes.

Understanding AI is necessary for OP researchers and practitioners that want to dig deeper into innovation. AI can be defined by four different perspectives according to Russell & Norvig.[11] The first one refers to the famous Turing Test, intelligent agents would be those that acted humanly. The abilities that the agent should have according to this approach would be Natural Language Processing (NLP) so it could communicate, knowledge representation to act as a memory, automated reasoning and Machine Learning (ML) to adapt information to each situation; and optionally computer vision and robotics to be able to move and manipulate objects. The second approach comes from cognitive science and views AI like a technology that thinks like a human. The third one, derived from the laws of logic, believes that technology must think rationally to be considered intelligent, which is controversial since the rationality debate in humans is still open. The last approach is the rational agent, one which is preferred by the authors, who think of AI as a technology or agent that acts humanly. A rational agent aims to achieve the optimal outcome. They could adapt depending on the situation, given that not every problem has a correct answer, so the authors propose the term 'limited rationality' to refer to situations where time is scarce and an action is needed. Zhang and Lu[12] define AI in their study about the current state of the art as 'an interdisciplinary subject that involves information, logic, cognition, thinking, systems, and biology. It has been used for knowledge processing, pattern recognition, ML, and NLP'.

Digging deeper into the specific types of AI related to OP, Berhil[13] conducted a review about AI and common algorithms applied in HR. Ordered by highest percentage of usage, they were Decision Trees (30% of use), Random Forest (17%), Support Vector Machine (17%), Logistic Regression (15%), K-Nearest (KNN) (11%), Multi-Layer Perceptron (4%), C4.5 algorithm (4%) and Gaussian Naïve Baye (2%). Pereira[14] proposed different types of AI and its relation with workplace outcomes in the HRM area. They divided it into Artificial Intelligence in general, Robots/Chatbots, Machine learning/deep learning, Computational intelligence/evolutionary programming, Virtual/Augmented reality, Soft computing/fuzzy systems and Physiolytics (wearable tech). Still, as seen in previous research,[6] adoption is not at its highest level and new developments are expected as technology advances and new HR topics are targeted.

Returning to the discussion of OP, some of the more targeted functions by this discipline should be explained to gain clarity and understand where AI could be better integrated. 1) *Employee Recruitment*, as Breaugh[15] describes, can be divided into two types depending on the direction it is intended. First, there is External Recruitment, which addresses the advertising of a job opening, the attraction of possible candidates, their screening and their acceptance of a job offer. It entails a complex process that leads to selecting the optimal candidate and their final onboarding in the company. Then, Internal Recruitment tries to find the best candidate inside the company's current team. 2) *Quality of worklife* according to Ahmad,[16] is the quality of life of employees at their workplace, without differentiating by type or size. It is shaped by different dimensions, which are Health and Safety, Employment Security, Job Satisfaction, Occupational Stress, Work Environment, Work-Life Balance and Human Relations. 3) *Job analysis* describes a broad variety of procedures for examining, documenting and drawing inferences about work activities, worker attributes, and work context.[17] It also gives knowledge about which capabilities are needed to effectively perform the job Brannick.[18] 4) *Training and Development* is an important function in order to promote professional growth among employees. A Training and Development program should comprehend knowledge, career development and goal setting. It should also be considered that employees thrive not only on financial profits, but they find significance in the inherent benefits of their jobs.[19] 5) *Decision Making* is an interdisciplinary process studied from different perspectives. Applications to the OP field have explored how decisions are made within the organization. Some of the traditional topics targeted are decision making in the recruitment process, decisions under uncertainty, performance evaluation and feedback acceptance, organizational withdrawal, compensation, strategic forecasting and human resources planning.[20,21] 6) *Performance evaluation* was originally described as a method to obtain individual indicators of how they are developing their work. Still this concept has expanded and includes evaluation at the groupal leve.[22] According to Landy & Conte,[3] 7) *Engagement* has further context-related organizational implications that can be assessed according to its construct. Neubert[23] suggest that *8) Assessment* in OP is capable of evaluating the learning and competence-related constructs in the workplace in a valid and reliable way.

The new era of knowledge and the newer developments in communication technologies are accentuating the use of data to improve several fields, and OP is not an exception. The impact of technology in the workplace has been studied for several decades but since new developments are ongoing investigation has to reach practice. There are some gaps in knowledge, such as having deeper understanding about the applications of technologies or employees attitudes towards these changes. The types of AI, their characteristics and what type of technology could be a better fit to certain functions of OP, are also future topics in research as the adoption of AI grows. In this context, the present study aims to fill these gaps by conducting a critical review of the literature related to the integration of AI into organizational strategy, synthesizing existing approaches and frameworks, highlighting potential benefits, challenges and opportunities and presenting a discussion on future research directions.

Literature Review

Previous literature contributing to this paper has provided in-depth knowledge of where technology applied to Human Resources (HR) is an important research topic, with AI being an advance for the field that needs to be more studied. Jatobá[24] in their systematic review about the evolution of AI in HR found that there is a limited amount of research of the topic. However, in the last few years there has been an increase of promising research. further investigation is needed to palliate the lack of a solid school of thought or definitive direction. The studies that revise this area can be divided into two types: general reviews that mention the different applications of AI in HR or specific ones that focus on one particular area or technique.

Regarding the former general reviews about the status of the issues have been published, each one following different objective but focusing on HR applications where AI had been implemented. George & Thomas[24] found functions such as talent acquisition, performance appraisal, learning and development and employee engagement to be the ones where AI had been applied. They also stated some of the benefits of implementing this technology and the function with more AI applications, which was recruiting and selection. Nawaz[26] also focuses on this topic, in his review that mentions nine functions of HR that could be improved by this technology, opening the door to improvement in more areas besides

those found in turnover prediction. These functions were Talent HR Planning, Recruiting and Staffing Employees, Employee Benefits, Employee Compensation, Employee and Labor Relations, HR Compliance, Organizational Structure, HR Information and Payroll and Employee Training and Development. Votto[27] conducted a systematic review to clarify the role of AI in Tactical Human Resources Information Systems (HRIS), identifying which components are represented in literature. They found representation for technical HRIS (Best Practices, Recruitment and Employee Training and Development) and managerial HRIS components (Employee Performance and satisfaction), the first one being more represented in literature. This Revision is well conducted and conceptualizes HR as Information Systems that can use AI to their benefits. Qamar[28] researched state of the art AI and HRM functions and found four main topics of analyses, one of them being very new as it refers to AI applied to Compensation. The other three are Staffing, Performance Management and Training and Development. One advantage of this study is that it takes into account different AI subfields (Expert Systems, Fuzzy Logic, Data Mining, Artificial Neural Networks, Genetic Algorithms and Machine Learning) and their literature representation in the four found HRM functions and a more general one. They also study the role of AI in HRM Decision-Making. Vrontis[29] conducted a review that aimed to uncover the impact of AI, robotics and other advanced technologies on HR Management (HRM), dividing the focus on HRM strategies and HRM activities.

On the specific side, there are reviews about AI in some of the specific applications for HR. For instance, HR analytics, which can be conceived as the use of data to improve HR decisions and optimize actions, can benefit from AI. Margherita[30] in his systematic review of HR analytics, considers AI to be a 'potentially disruptive innovation' and an 'exponential technology', which creates exponential organizations with disruptive approaches to HR. He found three major areas of key research topics: enablers of HR analytics (technological and organizational), applications (descriptive and diagnostic/prescriptive), and value (employee value and organizational value). He also discusses the role of AI as an exponential technology for HR Analytics, meaning that it is a technology set to disrupt the field with its innovation. Another example is Recruiting and Talent Acquisition, which is a prominent research area given the current market's needs for better candidates. Albert[31] reviewed the use of AI tools for Recruitment and Selection purposes, finding eleven specific areas where it could be applied, the problem they target, the solution and outcomes, the companies that have adopted them and their respective tools already in the market. These 11 areas could be divided into the two phases of the process, Recruitment (Vacancy Anticipation, Job Description Formulation, Vacancy Advertising and Candidate CV Screening) and Selection (Candidate Psychometric Testing, Interview (Video/F2F/Phone), Assessment Centre, Final Interview (Video/F2F/Phone), Background Check, Job Offer Extension and Employee Onboarding). The paper also finds eleven AI-tools to address each HR area, but it underlines the fact that practitioners are mainly focused on three types: chatbots, screening software and task automation tools. Finally, the adoption of AI for these purposes is not yet at its highest rates, with larger tech focused companies leading the path.

Regarding reviews for AI specific techniques, ,for example, exploring a semi-systematic review of the role of ML in HRM,[32] they (who is they?) describe the more important areas where ML has been applied. This points towards further development. They found ML to be stronger in Recruitment and Performance Management, while decision trees and text-mining algorithms were more important for HRM. This signifies the impotrtance of HR and ML experts working together to improve applications.

This present review aims to broaden the current knowledge about how AI influences HR. It follows a general approach in order to provide a general picture of the HR functions where AI has been applied to researchers and practitioners. It also aims to outline the possible gaps in knowledge for further research.

Objectives

The purpose of this systematic review is to provide information about the existing landscape of Artificial Intelligence (AI) applications in the field of Organizational Psychology (OP). Therefore, this review aims to collect and analyze literature about the main applications of AI in OP, its evolution and benifits. Within this systematic review, we attempt to expand understanding by answering the following research questions:

Q1: What have been the applications of AI on OP in the last few years?

Q2: What are the benefits of the use of AI in OP?

Q3: What have been the AI techniques and psychological instruments used in studies?

Methodology

Data sources and search strategy

Regarding the research questions, this study was conducted using a systematic search of the latest literature on the applications of Artificial Intelligence in Organizational Psychology (OP) in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[33] A description of the specific searching protocol employed to narrow down information and increase quality of the content addressed is described hereafter.

Eligibility criteria

A series of criteria were applied for inclusion in this review. First of all, we selected only those articles that specifically addressed AI applications in Human Resources (decision-making, recruitment, improving their career and position, etc) covering current or future implementations at the level of Organizational Psychology. Concerning the design type, the studies were limited to those that were scientific in nature, and articles with formats such as letters to the editor, book chapters, books, opinion articles and short commentaries were excluded. The exclusion criteria included the removal of duplicate articles, those that were not directly related to the subject matter, opinion pieces and those whose full text could not be found in the corresponding databases.

Regarding the timeframes and language of publication, studies selected were published from 2016 to 2021 because we wanted to take into account contemporary papers. They were written in English or Spanish and with full-text potential.

Literature Research

The review period commenced in October of 2021, and was followed by further updates in November, although the final search was updated on 31 December 2021. The databases selected for the research were Pubmed, American Psychological Association Psyc-Net, Web of Science (SSCI), PsycInfo, Proquest,Institute of Electrical and Electronics Engineers (IEEE) databases from October to December 2021. The used keywords referred to the fields of AI, and organizational psychology. The following combinations were applied:

1. Workplace Well-being AND Artificial Intelligence

2. Employee Management AND Artificial Intelligence

3. Job Recruitment AND Artificial Intelligence

4. Talent Management AND Artificial Intelligence

5. Job Well-being AND Artificial Intelligence

6. Artificial Intelligence AND Organizational Psychology

7. Organizational Behavior AND Human Resource Management AND Organizational Behavior. Also the Google Scholar database was searched for gray literature.

Study selection

Figure 1 Summarizes the methodology and shows the steps followed to obtain the final number of articles. In the identification phase, the online search yielded 5738 results, 1431 of which were eliminated as duplicates. The total number of articles after deleting duplicates was 4307, whose titles and abstracts were read together in order to include or discard articles for full-text reading. Of the

4307 articles that were analyzed, 4141 were screened and unanimously discarded for different reasons. The main reason was that the subject matter was not related to the objectives of the review, i.e. they used AI but not in OP or they talked about OP topics but AI was not present, also excluded were those that dealt with Psychology topics not related to HR or those of HR only related to the economic part.


Figure 1: Flow chart.
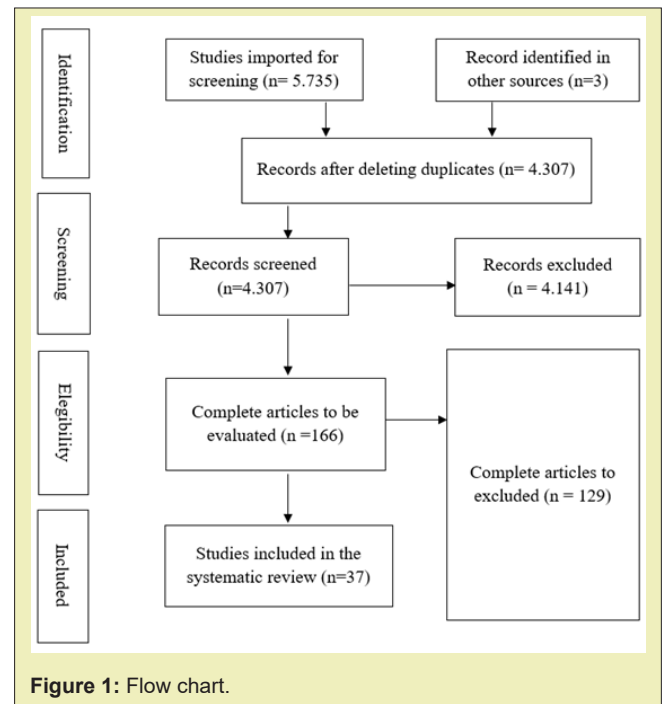
Once this screening was completed, a total of 166 articles were screened for full-text reading. In the case of 166 articles, their full version was analyzed with the following criteria: all those articles that embodied an AI model that would help HR staff members to make decisions, recruitment or career plan improvements. Finally, 16 articles were identified for inclusion in the review by unanimous agreement of the reviewers and the remaining 150 articles were excluded for the following reasons: most were studies on the accuracy of the models themselves in mathematical terms, others focused only on employees' perceptions of AI in their workplace, literature reviews or theoretical articles.

Results

The results can be divided into five big sections which are show in Figure 2. Of the 16 articles chosen for the review, 4 (25%) of them are part of the section of studies that focus on the Quality of Life that workers have within their company, 6 (37.5%) focus on Recruitment, 1 (6.25%) on Job and Individual task analysis, 2 (12.50%) on Development and 3 (18.75%) on Decision-Making.

In addition to the sections there are three distinct types of studies: first, those that apply an AI model to a real situation and analyze

its results (66.67%), secondly, those that evaluate how the use of AI affects people in the selection process or in their jobs (26.67%) and lastly, those that aim to report on the benefits that AI has on companies (6.67%).

Figure 2: Sections into which the results are divided.
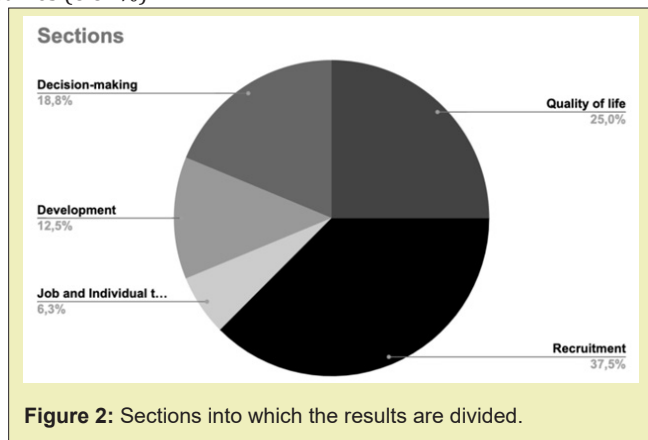
The research questions are presented below.

Research questions

RQ1. What have been the applications of Artificial Intelligence on Organizational Psychology?

Regarding the first question, there have been many and diverse studies that have focused on investigating the areas in which AI has been used or studied in OP. According to our results, we have been able to verify that there are five areas in which the implications of this discipline in OP have been used or studied.

Quality of work life

Nguyen & Malik[34] conducted a study in which they wanted to find out how employees were influenced by having AI to develop their work, for which they administered a Likert scale on job satisfaction. They found that when AI actually helps an employee's job, their job satisfaction and appreciation for the technology increases. They also found that the quality of the AI can affect employees' perceptions. Those who perceived AI as high quality were more satisfied with its application.

From their side, Bromuri[5] aiming to help customer service managers to predict the stress levels of their employees and their relationship with customer-related outcomes, created an AI model, specifically a Deep Learning (DL) Model, to analyze the emotional patterns of voice in call center interactions to predict discrete emotions and service agent stress. The DL Emotion Classifier achieved a balanced accuracy of 68 % predicting discrete emotions in service interactions. By integrating this model into a Binary Classification Model, it was able to predict service agent stress with a balanced accuracy of 80%. It also contributes to the study of the role of emotions in service interactions and employee stress.

Hungerbuehler[36] developed a fully automated chatbot ("Viki") to assess the risk of suffering from some mental illnesses in the workplace such as anxiety, depression, stress, burnout and insomnia. For this purpose, the authors conducted a pilot implementation in a small and medium-sized company where, in addition to the chatbot, participants were asked to fill in a questionnaire on issues related to these constructs. The results of the chatbot compared with those of the questionnaire detected mild scores for anxiety and depression and moderate scores for stress and insomnia. Considering these results, the authors determined that a chatbot-based workplace mental health assessment appears to be a highly attractive and effective way to collect anonymous mental health data among employees with response rates comparable to those of face-to-face interviews.

It is also important to consider physical health, which is why Márquez-Sánchez[37] developed an AI tool that assesses the employee's situation by analyzing environmental features such as physical working conditions like lighting or air quality. Using an architecture of intelligent Personal Protective Equipment (PPE) and wearable technologies, this article proposed three pieces of PPE (a Helmet, an Armband and a Belt) that process the information collected using AI techniques through perimeter computing. The proposed system ensures the safety and integrity of workers through early prediction and notification of anomalies detected in their environment. With this method, information about workers and their environment could be extracted and reported to HR so that they can reduce the rate of occupational accidents and illnesses, leading to a significant improvement of working conditions.

Recruitment

In the area of recruitment, several articles outline tools to make the recruitment process easier for HR staff as well as to reduce the human biases towards the candidate's personality. Specifically, Jayaratne & Jayatilleke[38] conducted research in which they sought to grasp the personality of a potential candidate before hiring them. They used data from more than 46,000 job applicants who completed an interview by answering an online chat and also a personality questionnaire. In order to automatically evaluate this data, these authors created a regression model using Natural Language Processing (NLP) and ML methods. The results obtained conclude that the ability of algorithms to objectively infer a candidate's personality using only the textual content of interview responses presents significant opportunities to eliminate the subjective biases involved in the interviewer's human judgment of the candidate's personality.

Until now, selection processes have always taken personality traits into consideration in the evaluation process of candidates. The main reason for considering the personality trait is to find

and recruit job candidates who have compatible traits with the company's current staff. This would help making the adaptation to the company's culture and environment an easier process for new hires. This assessment has been done manually so far. However, more and more studies are using AI to assess the personality of candidates prior to recruitment. Lee & Ahn[39], applied an AI model called Artificial Intelligence based Design (AID) platform, which matches the candidate's profile to the company, considering the company's preferences. After the implementation of the model in a company, the results showed that the use of this model was beneficial for companies. It produces a better-quality match between the candidate's personality characteristics and the requirements stated by the companies, compared to traditional methods.

Similar results are presented by Allal Chérif[40] who conducted an in-depth analysis of the use of AI in the selection process by five companies, combining AI and big data. In particular, this research looked at the following companies: LinkedIn, MOOCs with Udacity, L'Oréal's Reveal, Text Recruit's Ari chatbot and a massive data system with Randstad.tech. After investigating how these companies used AI for the recruitment process and according to the analysis results, implementing this type of technology brings benefits for the company. This type of research improves contact between recruiters and talent and optimizes a process that is faster, more systematic, more targeted and more objective.

New features have helped companies reach previously inaccessible targets and achieve better results in terms of attractiveness, integration and retention. So far, the studies presented above have focused on the benefits for the company, but other studies have focused more on the candidate's side, i.e. How they perceive that AI is involved in the selection process for the job they are applying for. This is why van Esch[41] decided to investigate what were the attitudes of candidates towards organizations that use AI in the recruitment process and how this influenced whether they complement the process or not. These authors administered an online survey about the possibility of applying for jobs where they knew AI was behind to more than 500 participants. This survey contained aspects relating to how new they saw it, how curious they were about it, their general attitude towards the organization and the job. The results revealed that the fact that companies used AI for the recruitment process did not affect whether candidates applied for that job. Organizations can therefore promote their use of AI in the recruitment process and focus on potential candidates who already have positive opinions of both the organization and AI.

In relation to the use of AI in recruitment processes, Black & van Esch[42] reported that AI tools for recruitment did not only help to save costs and select better candidates, but also to select passive candidates who had not been interested in the job offer and therefore had not been considered as potential candidates. Also,

candidates that are more satisfied with these AI procedures in recruiting are usually the ones more technologically advanced, which is in line with the fact that it tends to be technological companies or companies with technology at the forefront of the market, the ones that usually exploit these tools. Therefore, candidates satisfied with this technology tend to be a better match for this type of company, which is beneficial for employers and future employees.[43] While these results seem to be clear, further research has been done on the issue of job seekers' perspectives and intentions regarding the automation of these processes. For this reason, Wesche & Sonderegger[44] proposed to carry out three experiments to explore candidates' attitudes, each one carrying out the process in one way as opposed to the other. In the first study screening was performed by a human vs. an AI tool, In the second study screening and interviewing was performed by humans vs. AI screening and interviewing performed by humans, and the third study proposed screening and interviewing performed by humans vs. screening and interviewing by AI. The results showed that candidates preferred that the screening was performed by a person rather than an AI tool. Also, the negative perception increased when interviews were conducted by an AI instead of a person. Given these results that contradict the ones from previous studies, there is no reliable conclusion on which methodology candidates prefer, but it would probably depend on various factors (perception of the AI's fair treatment in the selection process, familiarity with the handling of new technologies or the application being simple and intuitive).

Job and individual task analysis

With respect to the job and individual task analysis, employee performance has always been something that has interested companies, so the level of performance of workers is appropriate, it must be known what are the attributes that most influence it. According to Molan & Molan[45] performance depends on the level of competence, psychological and health status, motivation and perceived stress. In order to find out which characteristics predominate most in each of the workers' performance a questionnaire was administered. The results of which were analyzed by means of an AI model, particularly a classification tree proposed by the authors. After analyzing the results of the questionnaire using AI methods, this study concluded that AI can be used to determine the real performance of workers and the extent to which attributes such as psychological or health status and perceived stress affect them. This allows HR workers the possibility of identifying the most important welfare attributes in order to determine adequate efficiency and thus improve working conditions and increase the level of performance.

Decision making

As far as decision-making is concerned, the studies that have been done so far have been varied, and can be split into two main

groups. In terms of decision-making in the selection process to help HR managers, Benabderrahmane[46] presented an AI model that analyzes existing job offers by processing the text of the offer content and investigating how many clicks each offer receives depending on its content. This is how it creates a large learning database. The AI then predicts the future clicks that the job offer will receive based on its content. The results provided in this research were promising, showing that through DL techniques the recommender system outperforms standard multivariate models. Therefore, this AI tool could help recruiters make decisions about the content of the job offers they are going to publish on the internet. Furthermore, it is of great interest to HR staff to know how AI and ML based automation can help them manage tasks, make decisions and decide what content should be included in job advertisements to attract more candidates. So far, this issue has been little studied. Furthermore Langer[47] proposed an investigation in which they analyzed how automated decision support systems affect personnel selection. To do this, they conducted laboratory experiments to test when it is best to support the decision-making process with AI. They used three groups formed by HR staff randomly assigned and performed five rounds of a recruitment task. The first group received a ranking of the applicants through an automated support system before the participants processed the applicant's information, the second group received a ranking afterwards and the third group did not receive any ranking. The results showed that satisfaction with the decision was higher for the support after processing group. In addition, participants in this group showed a more pronounced increase in self-efficacy in personnel selection compared to the other groups.

Nevertheless, AI has also been used in sports companies to help HR managers make decisions regarding which players to renew and which players to propose a new contract to. The study by Simsek[48] is an example of this, as they developed a ML prediction model that predicts the probability of a player's performance as a function of characteristics such as "Age", "Wins above replacement" and "the team in which a player last played". These authors suggest clear links between a player 's statistical performance and all of the above characteristics. This allows HR professionals to determine which players they should offer a new contract to based on the prediction of how they will perform.

Development

So far, the studies that have been presented have applied AI only for recruitment or only for decision-making. However, novel research by Wu & Sun[49] proposed an AI model that not only helps with the selection of external candidates, but also within the company itself. This is an arduous task for HR, so they proposed an AI model that not only accurately assesses the match between candidates and jobs but also evaluates which of the company's own em-

ployees are best suited to a particular job. To do this, they created a Radial Basis Function (RBF) neural network model of human job matching evaluation. Through this model they were able to assess the match of the job offered to the personnel with the relevant requirements for the job. In addition to this functionality, the model has the ability to not only perform this function in terms of new applicants, but can also assess which employees are best suited for a particular job within the company. The researchers conducted a case study, applying the model to several companies and demonstrated that this model had an adequate scientific basis to assist HR in personnel allocation and decision-making. This model helped the company to match staff to any position, thus maximizing the efficiency of decision-making. It has certain advantages in solving problems and can maximize the role of HR, broadening the talent pool for corporate management positions and also playing a leading role in the six main modules of corporate HR.

Such tools are often beneficial for large companies, which have a large number of employees and a wide geographical distribution. In some cases, companies themselves have so many employees that instead of making new job offers, they consider relocating an employee within the same organization. However, this process is costly, which is why *Hajnic & Boshkoska*[50] developed an AI model: Identity and Access Management System *(*IDAM). This model assists HR in decision-making for the selection of the most suitable employees in the company to transfer to an Organizational Unit (OU), this means without hiring new employees. This technology also allows the exchange of employees between organizational units, limited to the skills and requirements of the employees' OUs and avoids the overlapping of employees in organizational units for a pre-defined period of time. The implementation of the model in one company demonstrated that the development and implementation of IDAM in HR decision-making processes could have a direct impact on business agility, productivity, user experience, security risks and compliance.

RQ2. Which are the benefits of the use of Artificial Intelligence in Organizational Psychology?

As for the second question, mainly two types of benefits have been found: employees and companies. For employees, the main benefits of using AI in OP are related to employee satisfaction when AI actually helps them perform their work.[34] It has also been useful in preserving employee privacy, as chatbots have been shown to be effective in collecting anonymous data on sensitive topics such as mental health.[36] Regarding this, some models have been able to predict employee stress with high accuracy.[35] So that information about workers and their environment can be extracted and reported to HR to reduce the rate of accidents and occupational diseases, which would lead to a significant improvement.[37] Another advantage of using AI is that it is possible to know what the actual perfor-

mance of workers is and to what extent it affects or is affected by aspects such as psychological or health status and perceived stress.[41]

Regarding companies, AI models can help to objectively infer a candidate's personality using only the textual content of interview responses. This presents significant opportunities to eliminate the subjective biases involved in the interviewer's human judgment of the candidate's personality.[38] It has also helped to match the profile of the professional to the company, producing a better quality match between the candidate's personality characteristics and the requirements set out by companies.[39] This benefits companies by giving them the opportunity to have employees who are more in tune with them and with other candidates. In addition to attracting more affine employees, AI has managed to attract passive candidates who had not been interested in the job offer and had not been considered as potential candidates for the job, thus saving time and money spent on the selection process.[42] Implementing this type of technology brings benefits to the company, as it fosters contact between recruiters and talent and optimizes a process that is faster and more systematic, targeted and objective. The new features help companies to reach previously inaccessible targets and to achieve better results in terms of attractiveness, integration and retention.[40]

Some models that have been applied to various companies showed that they have an adequate scientific basis to assist HR in personnel allocation and decision-making.[49] Having the support of AI helps HR staff to match candidates to any position by providing them with greater self-efficacy in making recruitment decisions.[47] It also helps them write content about job offers to be posted on the internet, thus helping HR maximize the efficiency of decision-making about which topics to use.[46] In terms of employee matching, in companies with a larger number of employees and a larger geographical spread, AI helps HR making decisions and selecting the most suitable employees for transferring to an organizational unit.[50] This can have a direct impact on business agility, productivity, user experience, security risks and task compliance. In addition to decision support and recruitment, AI also offers HR workers the possibility of identifying the most important welfare attributes to determine appropriate efficiency and improve working conditions to increase the level of performance.[45]

In conclusion, using AI in OP has certain advantages in solving problems both on the employee side to handle stressful situations and on the company's one to help recruiting and screening new profiles.

RQ3. What have been the AI techniques and psychological instruments used in studies?

A distinction can be made between those that use machine learning to analyze language and those where machine learning is used to analyze other types of data.

As for studies that use machine learning to analyze language, there are four studies. First, in order to facilitate and guide recruiters to post a job on the Internet, Benabderrahmane[46] propose a new job board recommendation system. It is a tool called Doc2Vec, it is integrated and used to analyze the textual content of job postings. Then the job seeker's click sequence history on various job boards is stored in a large learning database and finally, it is represented as a time series. For this purpose, a deep learning model is used to predict the future values of clicks on the job boards.

Secondly, other authors who also used language techniques were[38] specifically they applied models using machine learning to perform Natural Language Processing (NLP).[38] They use an NLP model that evaluates the answers given to online questions and a personality questionnaire of potential job candidates. The algorithms' ability to objectively infer a candidate's personality using just the textual content of an interview presents significant opportunities to avoid biases involved in human judgment.

Finally, the two researches that proposed chatbots were text-based. Hungerbuehler[36] developed "Viki" with the goal of exploring whether using a text-based chatbot could assess employees' risks for depression, anxiety, stress, insomnia, burnout and work-related stress. "Viki" uses conversational style and gamification features to improve engagement. The other chatbot, Ari from Text Recruit and a massive data system with Randstad. tech Allal-Chérif[40] are employed to conduct job interviews and match a candidate and a job using AI.

Research using data other than language to apply AI models is presented below. To learn about employee well-being, Molan & Molan[45] administer the Questionnaire of Actual Availability (QAA), which is analyzed by applying decision tree algorithms. A clustering analysis integrated into the QAA ensures efficient feature construction and selection.

Hajnic & Boshkoska[50] developed a classification model implemented in a decision support (DS) platform for employee transfer (IDAM: Identity and access management system). The proposed web-based DSS IDAM platform for assessing employees of specific organizational units or other entities has its place in organizations with a large number of employees, spread over a wide geographical area in many organizational units. The SD model was developed for the redistribution of employees and the algorithm for ranking employees with similar attribute values.

Simsek[48] aimed to use past variables to predict future variables. To do so, they developed a prediction model, using the design science research paradigm and cognitive analytical management (CAM) theory to develop the research framework. By collecting a dataset on MLB free agents between 2013 and 2017, they built a decision support tool using artificial neural networks.

In order to assess the personality of candidates applying for job offers, Lee & Ahn[39] administered the Myers-Briggs Questionnaire (MBTI) to learn about their personality.[51] Finally, they developed a model called an AI-based design (ADI) platform to assess two main characteristics: skill preferences, characteristics and area of work for both the industrial organization and job candidates. The main reason for considering personality traits is to find and hire job candidates who have the same trait as the current employees of the company, so that adapting to the culture and environment does not become a difficult process for new hires.

Márquez Sánchez[37] developed an AI model to ensure the safety and integrity of workers through early prediction and notification of anomalies detected in their environment. The AI tool developed assesses the employee's situation by analyzing the characteristics of the environment such as physical working conditions. Using an architecture of smart Personal Protective Equipment (PPE) and wearable technologies, this paper proposes three pieces of PPE (a helmet, an armband and a belt) that process information collected using AI techniques through perimeter computing.

The selection process is an arduous task in HR, which is why[49] propose an AI model that, in addition to accurately assessing the match between candidates and jobs, evaluates which of the company's own employees are best suited for a given job. For this, they created a radial basis function network (RBF) model to evaluate the match for job posts. With this model they were able to evaluate that the job post requirements were met by the candidates.

Other studies have not used AI directly, but have studied how it is perceived in companies. The following questionnaires have been used for this purpose.

Nguyen & Malik[34] analyzed the quality of AI service. For this purpose, they adminstered a scale that includes the four dimensions of AI service quality. The scale analyzes perceptions of responsiveness, reliability, empathy and assurance of AI service.[52] The scale for measuring AI satisfaction has three items and is adapted from Wang.[53] To measure job satisfaction, they used the three-item job satisfaction scale adapted from Akhavan & Mahdi Hosseini.[54]

Secondly, two academic studies have also been conducted to study aspects related to selection processes. Specifically, van Esch[41] aimed to explore what are the attitudes of candidates with respect to companies that use AI for recruiting. To do this, they administered to more than 500 participants an online survey about the likelihood of applying for jobs where AI is implemented. This study used scale components comprising five items that measure the perceived likelihood that a person would progress through the stages of a job application process, from contacting the company to accepting the position if offered. The assessment is performed us-

ing Job Application Likelihood (JAL). In addition, other self-report instruments were used, such as Technology Use Motivation (TUM) to assess motivation for using technology by Dong.[55] To assess the novelty of activity, researchers used Novelty of Activity, (NOA)[56] Attitude Towards the Organization was used by Aaker[57] to measure employees organizational attitudes. Finally, to assess anxiety, Winterich & Haws[58] used Anxiety (ANX).

Finally, Langer[47] studied how the use of AI affects decision support in personnel selection. For this purpose they carried out an experimental design in which 3 groups were formed and each one was assigned a different condition in order to know which of the three groups benefited more from AI in recruiting. Participants responded to all self-report measures on a scale of 1 (strongly disagree) to 7 (strongly agree) on enjoyment and monotony, satisfaction with the decision, perceived responsibility for the decision, general self-efficacy in personnel selection, task-specific self-efficacy, and performance. The analysis of all results is presented in Table 1.

Discussion

Based on the results of this analysis, we can conclude that AI application in OP is very prominent in different areas such as recruitment, decision-making, quality of work, development and job and individual task analysis. Firstly, we consider the contribution that this review paper has to the existing literature. Secondly, we expose the possible future investigation lines to follow in order to improve the development of this field.

In this review, we intended to analyze the research extracted from the aforementioned databases, in which AI had been used for OP to improve HR performance in the company. With the emergence of the 4th Industrial Revolution, we observed an increase in research about the use of AI to improve employee quality of life, job analysis and individual task analysis. In this way, in addition to helping HR in arduous tasks such as those of personnel selection or decision-making, it also helps HR in personnel management, benefiting the employee as well. However, we have identified other types of studies that relate both variables, but without actually testing an AI model. These investigations have explored how the employee perceives the use of AI in the company as well as if AI helps HR in the recruiting process (before, during or after selection) through experimental methodology.

Therefore, our contribution is to verify the already existing knowledge about the main areas where AI is applied in OP. It also addresses in which new HR fields AI is currently being applied to as well as providing knowledge about how it is perceived, something very important to help HR managers in their work. We seeked to provide inductive information on the current state of AI within HR based on a systematic, literature-driven methodology that is replicable for future research opportunities in both the academic community and industry practitioners.

Table 1: Summary table of the selected articles for review.

Study	Author / Year	Methods/Aims	Field	Advantages	Techniques	Findings
A Two-Wave Cross-Lagged Study on AIService Quality: The Moderating Effects of the Job Level and Job Role	Nguyen, T. M., & Malik, A. (2021)	To know how AI affects an employee´s work.	Quality of Work Life	Employee satisfaction	Four-dimensional scale adapted from Wixom and Todd (2005), Wang et al. (2019), Akhavan and Mahdi Hosseini (2016)	They found that the quality of AI can vary according to employees' perceptions. Those who perceive AI as high quality are satisfied with its application.
AI-enabled recruiting in the war for talent	Black, J. S., & van Esch, P. (2021).	The objective is to learn how companies can benefit from using AI for the recruitment process.	Recruitment	Saving time and money invested in the selection process		Report that AI tools for recruitment help to save costs, select better candidates and select passive candidates who had not been interested in the job offer
Changing the means of managerial work: effects of automated decision support systems on personnel selection tasks	Langer et al. (2021)	Analyze how automated decision support systems affect personnel selection to see when it is best to support the decision-making process with AI.	Decision-making	Helps HR managers match candidates to any position by providing them with greater self-efficacy in making recruitment decisions	All the sizes self-report in a scale	The results showed that HR staff make better decisions when The AI supports them after their decision.
Chatbot-Based Assessment of Employees' Mental Health: Design Process and Pilot Implementation	Hungerbühler et al. (2021)	Developed a fully automated chatbot to assess the risk of suffering from some mental illnesses in the workplace such as anxiety, depression, stress, burnout and insomnia.	Quality of work life	Preserve employee privacy	Chatbot "Viki"	The results of the chatbot compared with those of the questionnaire detected mild scores for anxiety and depression, moderate scores for stress and insomnia.
Industrial human resource management optimization based on skills and characteristics.	Lee, D., & Ahn, C. (2020).	Create an AI model that matches the candidate's profile to the company's profile	Recruitment	Helped to adapt the profile of the professional to company, higher quality of coincidence among the characteristics of personality of the candidate and the requirements exposed by the companies	Machine learning - Prediction model	The results show that using this model is beneficial for companies, as it produces a better quality match between the candidate's personality characteristics and the requirements stated by companies than traditional methods.
Intelligent Platform Based on Smart PPE for Safety in Workplaces	Márquez-Sánchez et al. (2021)	Develop an AI tool to assess the employee's situation by analyzing the environment such as physical working conditions like lighting, air quality, etc.	Quality of Work Life	Reduce rate of accidents and diseases of professionals	Machine learning - Prediction model	This AI model ensures the safety and integrity of workers through early prediction and notification of anomalies detected in their environment
Intelligent recruitment: How to identify, select, and retain talents from around the world using artificial intelligence	Allal-Chérif et al. (2021)	Analyze how five companies are using artificial intelligence in recruitment processes	Recruitment	They help the companies to reach previously inaccessible goals and achieve better results in terms attraction, integration and retention	Chatbot "Ari"	Implementing this type of technology brings benefits for the company, as it fosters contact between recruiters and talent and optimizes a process that is faster, more systematic, more targeted and more objective.

Marketing AI recruitment: The next phase in job application and selection	Van Esch et al. (2019)	Investigate what candidates' attitudes were towards organizations using AI in the recruitment process and this influences whether or not they would complement the process.	Recruitment	what is the performance real of the workers and to what extent do they affect attributes like the state psychological or of health and the perceived stress	Job Application Likelihood (JAL), Technology Use Motivation (TUM), Novelty of Activity(NOA), Attitude Towards the Organization (ATO), Anxiety (ANX).	The use of AI by companies in the recruitment process does not affect whether candidates apply.
On the predictive analysis of behavioral massive job data using embedded clustering and deep recurrent neural networks	Benabderrahmane et al. (2018)	Analyze existing job advertisements to understand the text of the advertisement content and investigate how many clicks each advertisement receives based on its content to create an AI model to help HR managers write more attractive advertisements.	Decision-making	Helps to write the content of the job offers to be published on the internet	Deep learning	This AI tool helps recruiters to make decisions about the content of the job offers they post on the internet.
Optimization and Simulation of Enterprise Management Resource Scheduling Based on the Radial Basis Function(RBF) NeuralNetwork	Wu, Y., & Sun, X. (2021)	Propose an artificial intelligence model that accurately assesses the degree of match between candidates and jobs and evaluates which of the company's own employees is best suited for a given job	Development	Assist human resources in staffing and decision making	Radial basis function (RBF) neural network model	This model has an adequate scientific basis to assist human resources in staff allocation and decision-making.
Predicting Personality Using Answers to Open-Ended Interview Questions	Jayaratne, M., & Jayatilleke, B. (2020)	Create an AI model that automatically assesses the personality traits of a potential candidate before hiring them	Recruitment	Eliminate subjective biases involved in the interviewer's human judgment of the candidate's personality.	Machine Learning - NLP	The ability of algorithms to objectively infer a candidate's personality using only the textual content of interview responses presents significant opportunities to eliminate the subjective biases involved in the interviewer's human judgment of the candidate's personality.
Predictive data analytics for contract renewals: a decision support tool for managerial decision-making	Simsek et al. (2020)	Develop a machine learning prediction model that predicts the probability of a player's performance based on characteristics such as "Age", "Wins above replacement" and "the team in which a player last played".	Decision-making		Deep learning (RNN)	The proposed predictive models allow HR professionals to predict how a player will perform and then determine which players can be offered a new contract.
Repelled at first sight? Expectations and intentions of job-seekers reading about AI selection in job advertisements	Wesche, J. S., & Sonderegger, A. (2021)	Find out job seekers' perspectives and intentions with regard to the automation of recruitment processes through AI.	Recruitment			The results showed that candidates were more likely to perceive that the detection was performed by a person rather than by an AI tool.

Sustainable level of human performance with regard to actual availability in different professions	Molan, G., & Molan, M. (2020).	To understand the performance level of employees through other aspects such as competence level, psychological and health status, motivation and perceived stress.	Job analysis and individual tasks	Identify which are the most important welfare attributes to determine adequate efficiency and thus improve working conditions to increase the level of performance	Decision trees	AI can be used to determine the real performance of workers and the extent to which attributes such as psychological or health status and perceived stress affect them.
Using AI to predict service agent stress from emotion patterns in service interactions.	Bromuri et al. (2020)	Aiming to help customer service managers predict the stress levels of their employees, and their relationship with customer-related outcomes	Quality of work life	Predicting employee stress	Machine Learning - Prediction model	The deep learning emotion classifier achieved a balanced accuracy of 68% in predicting discrete emotions in service interactions. By integrating this model into a binary classification model, it was able to predict service agent stress with a balanced accuracy of 80%.
A Disruptive Decision Support Platform For Reengineering the StrategicTransfer of Employees	Hajnić, M. & Boshkoska, B. M. (2021)	Develop an artificial intelligence model (IDAM), which assists human resources decision-making for the selection of the most suitable employees for transfer to an organizational unit.	Development	Make decisions on the selection of the most suitable employees for transfer to an organizational unit.	Machine learning - Classification model	The development and implementation of IDAM in HR decision-making processes can have a direct impact on business agility, productivity, user experience, security risks and compliance.

In relation to the lines of research that explore AI applications within OP, we conclude there is gaps in the research. Although it is true that there are many areas of HR that are covered by the application of AI, there are still domains that, while having been explored for other contexts, have not been included for these purposes. Especially, in the field of quality of life at work, research has focused mainly on using AI to screen, for example, stress, depression or insomnia. Considering that we are talking about symptoms that occur at work, no AI technique used so far detects all these symptoms together, it is always used to detect each symptom individually. It would be interesting to focus on this line of research so that the AI could detect these symptoms together, since as we know, there are established syndromes that unify several of the aforementioned symptoms.

For future research, the findings of this review can guide the academic community and businesses to better understand what AI is used for and what it can be used for. In particular, future lines of research could follow the direction mentioned above, to conduct studies on AI and well-being in order to screen not only symptoms (insomnia, stress) in the workplace, but also syndromes, such as burnout, or, in contrast, positive factors that really help to increase the quality of life at work, such as the level of employee engagement. This can provide HR staff with the opportunity to employ new technologies that help and streamline time-consuming and costly processes such as knowing the well-being of workers and provide benefits such as saving time and money.

Declaration of Conflict of Interest

The author declares that no conflict of Interest.

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