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The Possibilities of Using Artificial Intelligence as a Key Technology in the Current Employee Recruitment Process

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Abstract: The current business environment faces numerous new challenges closely linked to the rapid development of information and communication technologies, which influence the corporate landscape. This article focuses on exploring the possibilities of integrating artificial intelligence, as one of the key technologies of today, into the recruitment process. Its aim is to examine the potential applications of artificial intelligence across various stages of employee recruitment. To achieve this goal, the authors employed various methods and techniques, including the PICOS framework, scientific mapping, and case study analysis. The outcome of this study identifies opportunities for leveraging artificial intelligence in the employee recruitment process within corporate settings. The results reflect the current research gaps concerning the analysis of the personnel processes and conceptualizing the implementation possibilities of artificial intelligence in these processes. The contribution of this article to the academic community lies in its conceptualization, providing a foundation for further research focused on analyzing the impacts of integrating AI into recruitment processes.

Keywords: artificial intelligence; management; HR; recruitment

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1. Introduction

In today's dynamically changing field of management and business, we are increasingly facing challenges that are strongly influenced by modern information and communication technologies (Soviar et al. 2015; Štaffenová and Kucharčíková 2024). These technologies play a key role in shaping the environment in which businesses operate and also open up new opportunities in the area of human resources management (HRM) (Talíř and Straková 2023). In an ever-evolving technological environment, it is crucial to support an informed and flexible workforce, especially in situations characterized by unpredictable changes typical of VUCA scenarios (Daroshka et al. 2024; Sarkar 2016). The VUCA concept provides a useful framework for understanding the volatile, uncertain, complex, and ambiguous business environment (Timana 2023).

Experts often discuss the change in HRM due to the automation of some work activities (Kucharčíková et al. 2023). This change will have a significant impact on the labor market and the specific workers involved in recruiting and selecting employees (Fritts and Cabrera 2021; Vedapradha et al. 2019). With projections suggesting the replacement of manual work by machines, the so-called talent search is gaining importance (França et al. 2023).

Many authors (Dulebohn and Stone 2018; Benson et al. 2002; Waheed et al. 2020) describe the transformation of human resource management into electronic management. Electronic HRM (E-HRM) can be defined as a set of policies, activities, and services in human resource management that are supported by computer hardware and software (Marler and Fisher 2013). E-HRM has revolutionized the way businesses manage their HR by utilizing technologies to streamline and optimize personnel processes (Thite 2019). These processes are referred to as e-HRM functions or functional modules. By leveraging technology, these modules can automate manual tasks, improve the data accuracy, and

increase the overall efficiency, allowing HR professionals to focus on strategic initiatives and talent development.

One of these processes is employee recruitment. Recruitment is a key process within HRM in an organization that ensures that positions are appropriately filled to achieve the goals and meet the needs of the business (Decenzo and Robbins 2011). This process consists of identifying, sourcing, and selecting candidates that best fit the requirements and qualifications of the job (Ahmed and Adams 2010).

In today's digital age, e-recruitment, or electronic recruitment, has become a key tool for many businesses (Fernandes and Machado 2022). With the development of the internet and social media, the recruitment process has significantly sped up and become more efficient (Hosain et al. 2020). E-recruitment can be characterized as the electronic form of employee recruitment in companies (Alamro et al. 2018).

This method of recruitment presents several challenges, including filling jobs more quickly, examining applicants' experience, skills, and abilities more thoroughly, and improving the integration of new hires into the company culture (Allal-Chérif et al. 2021; Fachrizal et al. 2019; Rodríguez-Sánchez et al. 2019). Such changes require considerable effort on the part of recruiters. To cope with these challenges, technological innovations such as artificial intelligence (AI) have started to be used in the recruitment process (Fritts and Cabrera 2021; Vedapradha et al. 2019; Geetha and Reddy 2018). The speed of recruitment becomes a critical factor for the competitiveness of organizations in the labor market and creates the conditions for the successful acquisition of qualified employees (Vetráková et al. 2018). AI can significantly accelerate the recruitment process (Vedapradha et al. 2019). It helps to reduce time-consuming activities, automate and streamline resume checks, more efficiently match job requirements with candidates' existing skills, and enable faster and more effective decision-making (Horodyski 2023; Gusain et al. 2023).

AI can be defined as a set of information and communication technologies that mimic human intelligence to improve, streamline, and simplify human work (Schutzer 1990; Olan et al. 2022). It can be perceived in four basic dimensions: (1) as a technology (a set of tools and systems) (Yau et al. 2021), (2) as a simulation element (a means of modeling human intelligence) (Enholm et al. 2022), (3) as a machine capability (their ability to perform tasks previously exclusively associated with humans) (Kanade 2022), or (4) as a scientific discipline (a field focusing on the research and development of such technologies) (Antoni et al. 2020). However we perceive AI, this concept is always associated with two fundamental attributes: autonomy (the ability to perform tasks in complex conditions without constant human supervision) and adaptability (the ability to improve performance by learning from experiences) (Panerai 2018).

According to a 2017 survey from Statista.com of 8815 respondents, which included talent acquisition professionals and hiring managers, as many as 67% of the respondents say that artificial intelligence helps to reduce the time-consuming nature of the hiring process (Statista.com 2022). In addition, Intelion Systems reports that the use of AI in recruitment is growing, with 35% to 45% of companies already using tools for this purpose (Intelion Systems 2023). They also point out that as many as 99% of Fortune 500 companies are already using AI in some way in recruitment.

To effectively harness AI, HR practitioners need to understand the basic workings of these technologies (Charlwood and Guenole 2022). Otherwise, the inefficient use of these tools, and even the disadvantaging or discrimination of applicants in the recruitment process, may occur (Fernández-Martínez and Fernández 2020). This article examines the potential uses of AI in the various stages of employee recruitment. It emphasizes the growing interest among professionals in the role of AI in management, including HRM. However, it also points out a lack of research regarding the definition of specific activities within employee recruitment where AI could be applied (Nawaz 2019). Therefore, the authors analyze various software solutions tailored for employee recruitment. Based on these data, potential applications of AI in the employee recruitment process can be identified, supported by specific examples from practice. Such a conceptual framework

could subsequently aid the academic community in analyzing the impacts of AI on the efficiency of employee recruitment, and, similarly, it could serve as an inspiration for businesses in implementing AI into this process.

2. Results

The authors of the article focused on two research questions. With these questions in mind, the research results are divided into two parts.

2.1. Defining the Key Technology of Today in the Context of Management-Oriented Scientific Publications

Research question Q_1 aims to assess the position of AI as a key ICT in contemporary academic research, with a particular focus on its use in management. Answering this question required first defining the specific ICTs that management researchers most often focus on in their publications. Between 2001 and 2023, 31 core technologies were identified. An overview of these ICTs is shown in Table 1.

Table 1. Technologies in the period 2000–2022.

Year	Number of Publications	Technology
2001	20	email, internet, world wide web
2002	29	internet, world wide web
2003	12	computer, world wide web
2004	41	business intelligence, email, internet, world wide web
2005	72	data warehousing, internet
2006	150	email, internet
2007	180	intelligent agents, world wide web
2008	255	artificial intelligence, business intelligence, data warehousing, social networks and media
2009	259	artificial intelligence, data mining, intelligent agents, RFID
2010	229	cloud computing, intelligent agents, smart grid, social networks and media, web 2.0
2011	333	artificial intelligence, autonomous robots, data mining, data warehousing, intelligent agents, RFID, smart grid, virtual reality, web 2.0
2012	229	artificial intelligence, cloud computing, data mining, data warehousing, RFID, social networks and media, virtual reality, web 2.0
2013	249	artificial intelligence, business intelligence, cloud computing, data mining, data warehousing, intelligent agents, smart technologies, virtual reality
2014	232	artificial intelligence, cloud computing, data mining, data warehousing, intelligent agents, smart technologies, social networks and media, web 2.0, wireless sensor networks
2015	254	artificial intelligence, big data, business intelligence, cloud computing, intelligent agents, smart grid, smart technologies, social networks and media, web 2.0
2016	384	artificial intelligence, big data, business intelligence, cloud computing, data mining, data warehousing, internet of everything, internet of things, smart technologies, social networks and media
2017	278	artificial intelligence, big data, business intelligence, cloud computing, intelligent agents, internet of everything, internet of things, smart grid, smart technologies, wireless sensor networks
2018	256	artificial intelligence, autonomous robots, big data, business intelligence, cloud computing, data mining, expert systems, industrial internet of things, internet of everything, internet of things, smart technologies, social networks and media, virtual reality

Table 1. *Cont.*

Year	Number of Publications	Technology
2019	286	artificial intelligence, augmented reality, autonomous robots, big data, business intelligence, cloud computing, edge computing, expert systems, industrial internet of things, intelligent agents, internet of everything, internet of things, RFID, smart technologies, social networks and media, virtual reality, wireless sensor networks
2020	307	artificial intelligence, augmented reality, autonomous robots, big data, blockchain, cloud computing, edge computing, expert systems, industrial internet of things, intelligent agents, internet of everything, internet of things, smart grid, smart technologies, virtual reality, wireless sensor networks
2021	266	artificial intelligence, augmented reality, autonomous robots, autonomous vehicles, big data, blockchain, business intelligence, cloud computing, data warehousing, digital twin, edge computing, expert systems, industrial internet of things, intelligent agents, internet of everything, internet of things, smart grid, smart technologies, swarm intelligence, virtual reality, wireless sensor networks
2022	247	artificial intelligence, augmented reality, autonomous robots, autonomous vehicles, big data, blockchain, business intelligence, cloud computing, digital twin, edge computing, expert systems, industrial internet of things, intelligent agents, internet of everything, internet of things, smart grid, smart technologies, swarm intelligence, virtual reality, wireless sensor networks
2023	252	artificial intelligence, augmented reality, big data, cloud computing, internet of things, internet, smart technologies, social networks and media, unmanned aerial vehicles, virtual reality

Source: own elaboration.

Consequently, it was essential to identify modern technologies from all the available options. For this purpose, four parameters were established (see Section 4): timeliness, number of publications, and sufficient development usability in the present. Based on these parameters, seven technologies were selected to represent the technologies of today. These are artificial intelligence, big data, blockchain, business intelligence, cloud computing, internet of things, and virtual reality. Figure 1 presents the number of publications in the WOS database that address the area of management within each defined modern ICT.

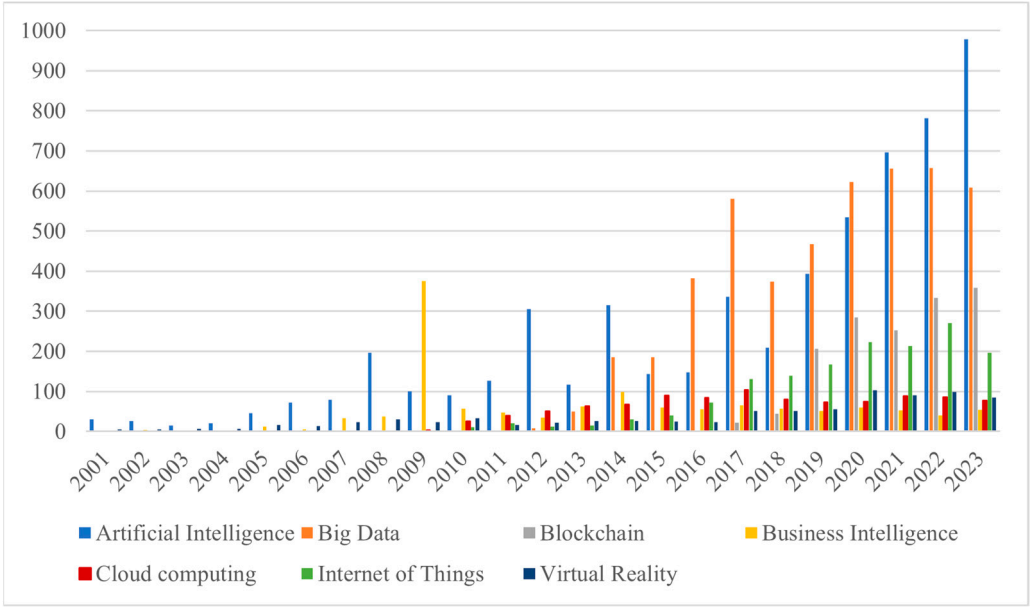

Figure 1. Comparison of the number of publications defined by modern ICT for the years 2001–2023. Source: own elaboration.

Based on this figure, it is evident that the authors in the management field have focused most on AI, business intelligence, and big data technologies over the period 2001–2023. Interestingly, 2009 is the year when the authors mostly focused in their publications on business intelligence technology. Such an interest in this technology may have been spurred by the global economic crisis (Carvalho and Sassi 2014; Edelhauser et al. 2010), during and after which organizations focused more intensively on optimizing their business processes (Chuah and Yeoh 2009), increasing efficiency (Bucher et al. 2009), and improving the use of the available data to support decision-making processes (Feng et al. 2009). Consequently, we see the rise of big data technology in 2016–2020. This increase has been noticed by several authors (Almeida 2022; Šuštaršič et al. 2022). According to some authors (Lu and Zhang 2021), this may be related to the development of other technologies such as blockchain or AI. Indeed, these very technologies are very closely linked to big data technology. This interconnection can also be observed in Figure 1, where, as of 2019, there is a growing interest in AI technology among the management academia.

Figure 2 below shows the percentage of management-focused publications related to the defined advanced technologies in the WOS database for the period 2001–2023.

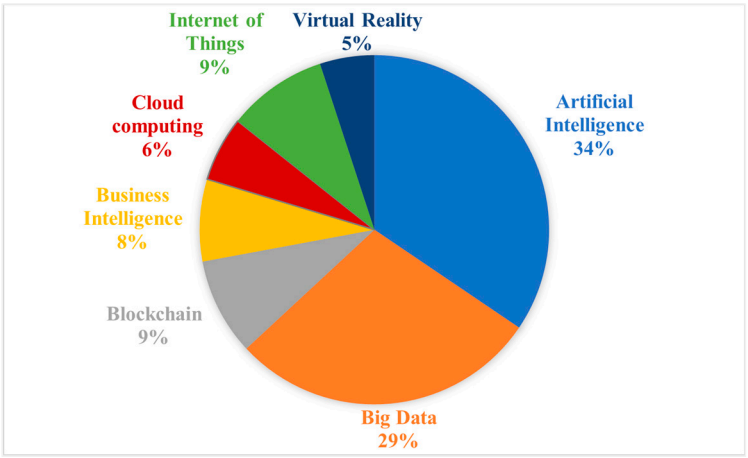

Figure 2. Percentage of publications focusing on specific modern ICT over the period 2001–2023. Source: own elaboration.

Based on the largest number of publications focusing on AI (Figure 2), it can be assumed that this technology is the key one among the defined modern ICT competencies. To verify this assumption, the VOSviewer tool, specifically the scientific mapping method, was used to analyze 1765 publications published for the year 2023. These articles were focused on the defined modern ICTs of today in the WOS database. The results of this analysis, which are presented in Figure 3, show some interesting findings.

From Figure 3, it can be inferred that there is currently a significant interest among the authors of management science papers in technologies such as AI, big data, and blockchain. If the keywords of specific technologies are compared, the keyword "big data" has the most frequent occurrence. Its total occurrence is 291, which is 16.49%. The second most frequent keyword is "artificial intelligence" with 264 occurrences, representing 14.96%. However, if we take a better look at all the keywords, it is possible to see that there are other modifications of specific keywords. For example, it is possible to see the keywords "artificial-intelligence" with a total occurrence of 153 or "ai" with an occurrence of 55. At first glance, it may seem that the keyword "big data" is the most frequent, but it is necessary to compare the different keyword modifications (Table 2).

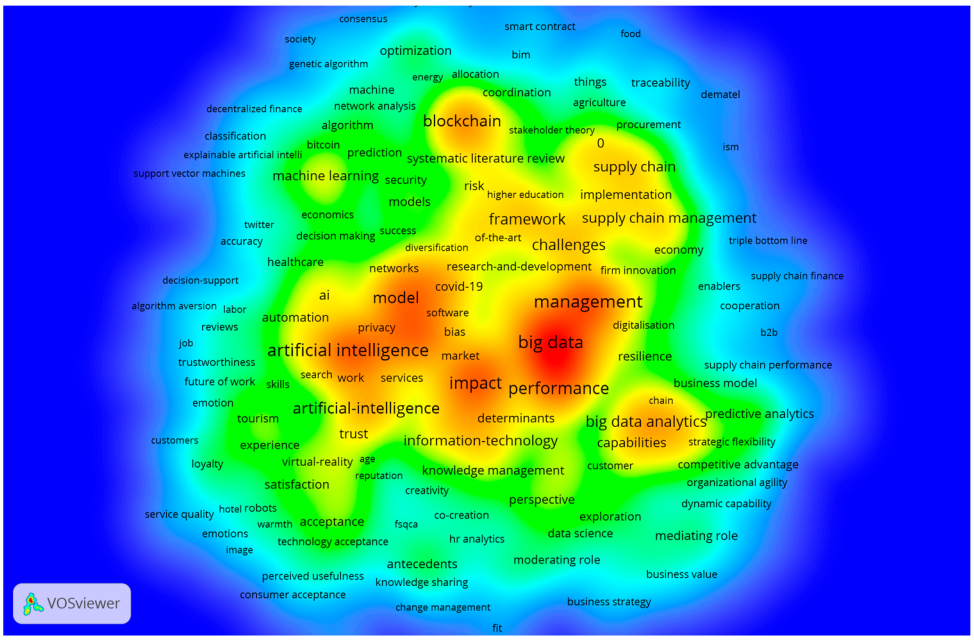

Figure 3. Density model. Source: own elaboration.

Table 2. Overview of the occurrence of modifications of specific keywords.

Technology	Keyword Modification	Occurrence	Cumulative Occurrence	Share
Artificial intelligence	"ai" "ai adoption" "artificial intelligence" "artificial intelligence (ai)" "artificial- intelligence"	55 5 264 31 153	508	28.78%
Big Data	"big-data" "big data" "big data analytics" "big data analytics capability"	8 291 138 12	449	25.44%
Blockchain	"blockchain" "blockchain adoption" "blockchain technology"	188 7 67	262	14.84%
Internet of things	"internet of things" "IoT" "internet of things (IoT)"	43 32 16	91	5.16%
Virtual reality	"virtual-reality" "virtual reality"	24 24	48	2.72%
Cloud computing	"cloud computing" "cloud computing adoption"	26 13	39	2.21%
Business intelligence	"business intelligence"	25	25	1.42%

Source: own elaboration.

According to this overview of the keyword modifications, it can be stated that the authors of the scientific articles in the field of management most often explore AI technology (28.78%), followed by big data (25.44%), blockchain (14.84%), internet of things (5.16%), virtual reality (2.72%), cloud computing (2.21%), and finally business intelligence (1.42%). In addition, specific subsets of AI such as ML (71 occurrences), DL (19 occurrences), and Natural Language Processing (NLP) (11 occurrences) are also covered. These specific subsets of AI further confirm that researchers are primarily focusing on AI technology.

The key position of AI technology in the analyzed publications is also evident from the network model (Figure 4). Using this model, the interconnection of each technology with other keywords of the analyzed publications is visualized.

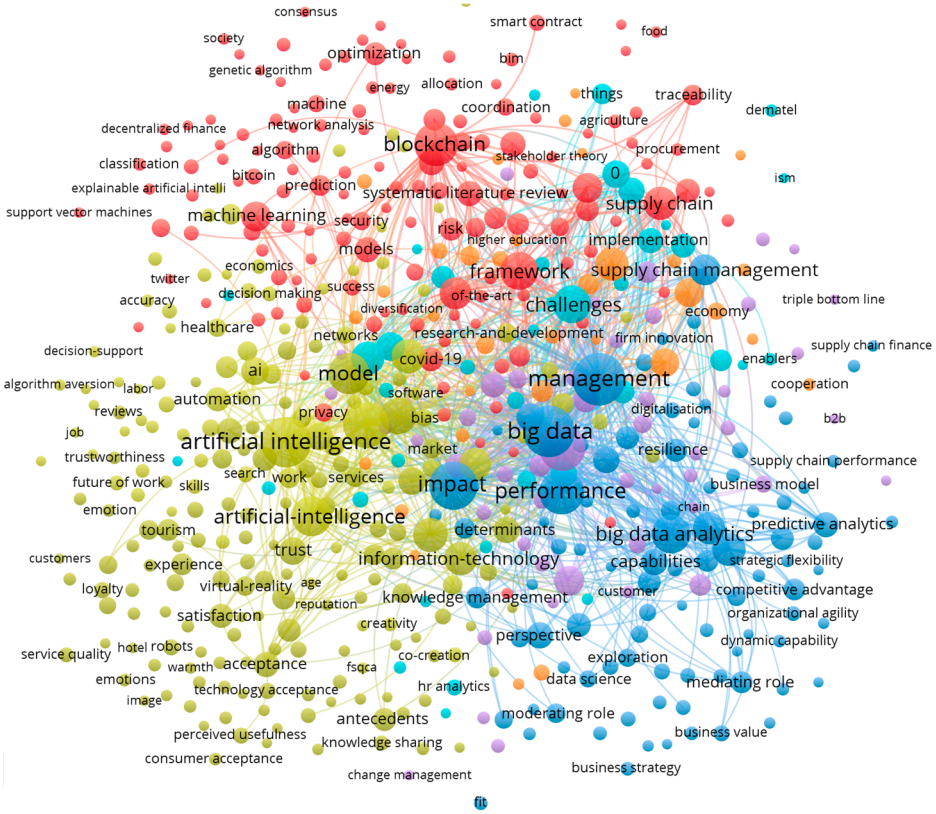

Figure 4. Network model. Source: own elaboration.

Figure 4 shows the three main clusters of keywords and their interrelationships. The largest cluster is the one around AI technology, indicating that the largest number of other keywords, and therefore specific publications, are associated with this technology.

From the information provided, AI technology has the largest number of authors of scientific publications who specialize in the field of management. Based on these findings, this technology can be identified as a key technology in the current academic research in the field of management.

2.2. Analysis of the Possibilities of Using AI in e-Recruitment

The second research question focused on the specific use of AI in e-recruitment. The task of this part of the paper was to define the specific activities within recruitment where there is the greatest potential for the use of AI technology. The study compared 128 software and systems where AI is integrated. By comparing these software and systems, we defined 18 features that are most provided to customers in such systems. In the following Figure 5, you can see these features and their percentages of use.

As can be seen in Figure 5, the most offered features of AI software and systems include features such as building, tracking, and maintaining candidate relationships (82%), creating and tracking interviews (72%), or searching saved resumes (70%). However, the frequently provided features also include posting, tracking, and managing open job offers on multiple channels (67%), analysis and reporting on the effectiveness of the recruitment process (67%), but also, for example, converting CVs into a structured format for storage purposes (66%), or searching and managing potential candidates, their applications, and CVs (63%).

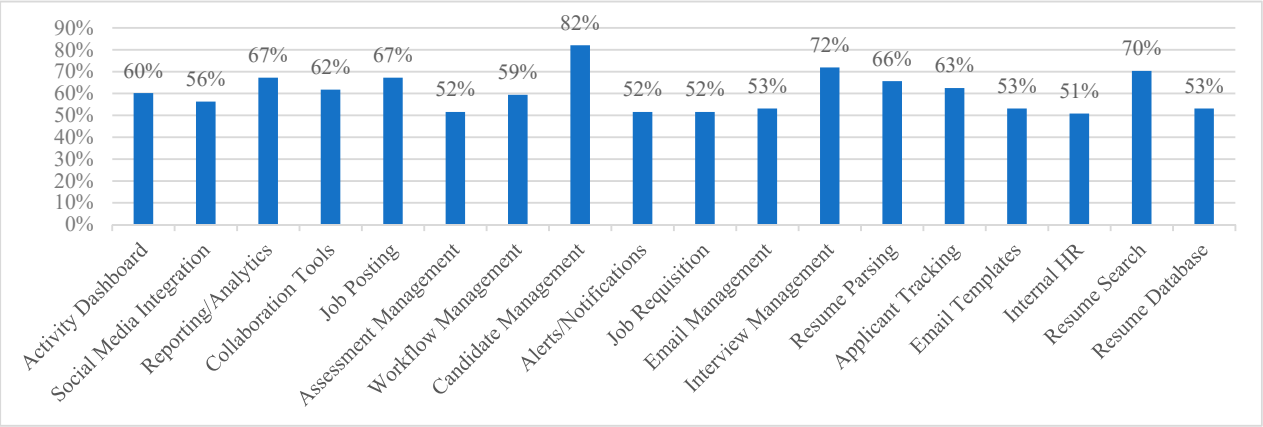

Figure 5. The most common features of recruitment software and systems. Source: own elaboration.

The individual features can then be broken down into individual activities that are carried out in companies before, during, or after recruitment. These activities are (1) recruitment planning, (2) preparing and posting job offers, (3) searching and managing candidates, (4) collecting and managing resumes, (5) screening and testing candidates, (6) administering interviews and assessments, or (7) evaluating the effectiveness of the process. However, some features support the management of the entire recruitment process. In Table 3 below, one can see the features assigned to each recruitment activity.

Table 3. Overview of activities in the recruitment process and their respective features.

Activity	Feature	Feature Description
Recruitment planning	Job Requisition	scheduling a new employee
Preparation and publication of job offers	Job Posting	posting, monitoring, and managing job offers on various channels (e.g., social media, company career site)
	Email Templates	pre-prepared examples and templates for emails
Candidate search and management	Social Media Integration	integration with social networks, e.g., Facebook, Twitter, LinkedIn
	Candidate Management	building, monitoring, and maintaining relationships with candidates
	Email Management	integration with email, e.g., Gmail, Outlook, Yahoo
	Applicant Tracking	searching for and managing potential candidates, their applications, and CVs
Managing CVs	Resume Parsing	converting your CV into a structured format for storage purposes
	Resume Search	search for saved CVs
	Resume Database	a searchable repository of candidate profiles
Screening and testing of applicants	Assessment Management	creating tests or questionnaires for candidates
Management of interviews and assessments	Interview Management	creating and tracking interviews
Evaluating the effectiveness of the process	Activity Dashboard	dashboard to view activity statistics
	Reporting/Analytics	analysis and reporting on the effectiveness of the recruitment process

Table 3. *Cont.*

Activity	Feature	Feature Description
Managing the recruitment process	Collaboration Tools	communication and cooperation
	Alerts/Notifications	alerts/notifications within the system
	Internal HR	recruitment software for internal recruiters or HR managers
	Workflow Management	creating, designing, and visually representing the recruitment process

Source: own elaboration.

These activities show the most significant potential for the use of AI in the recruitment process. It enables more efficient and accurate candidate assessment, the automation of repetitive tasks, and the identification of the most suitable profiles for specific job roles. As a result, the entire recruitment process is streamlined and the success rate of selecting qualified candidates is increased. There are many real-world examples of the use of AI in these processes.

1. Recruitment planning

The use of AI in recruitment planning provides innovative and effective elements to the recruitment process. Microsoft is an example where AI-powered tools automatically schedule interviews based on the time availability of the recruiter and the candidate, eliminating the need for lengthy haggling over time (Yakubu 2021). AI predictive software tools also can anticipate an employee's departure from a job (Mohammed 2019). These tools analyze an employee's behavior and predict the likelihood with which they will quit based on the available data. This allows businesses to identify potential departing employees early and take preventive action. Companies such as IBM and Facebook use software tools, including Bamboo HR, Job Rate, and Monster Talent Management, to achieve these goals (Albert 2019; Holubčík and Soviar 2021). The implementation of these tools benefits businesses in the form of lower turnover, recruitment and training costs, the increased efficiency of the recruitment processes, and the ability to respond more quickly to changes in the workforce (Bazán et al. 2018; Allal-Chérif et al. 2021). It is important to stress that the ethical and transparent processing of employee data is essential when using these software tools. The monitoring and analysis of employee behavior should be carried out in compliance with the applicable legislation and respect the protection of personal data in order to avoid misuse or discrimination based on personal information.

2. Preparation and publication of job offers

Properly targeting a segment of applicants is a critical factor for successful recruitment, and improper targeting can result in a loss of time, money, and energy for the employees involved. Optimizing this process using AI and ML allows you to reach potential candidates more efficiently and minimize losses. Tools such as ClickIQ, PandoLogic, and Recruitz are being used by companies including Netflix and YouTube to properly target and attract the right candidates (Albert 2019). In the case of IBM, a key aspect of carefully selecting candidates is the IBM Watson Orchestrate 3.1 software (also referred to as IWO). This tool uses AI to analyze the job market and previous recruitment experience to identify the most suitable candidates. With the help of AI, it predicts the time to fill a job position and allows the recruiters to focus on important requirements and candidate relationships while the AI analyzes the potential candidates (Yabanci 2019; IBM 2023).

Identifying the need to hire a new employee and optimizing the job description create job offers that often depend on the subjective preferences of the employer or team. The use of AI in the job offer creation process through optimization software helps to create objective and attractive offers. These tools promote diversity in the workplace and ensure fair and objective selection of candidates as implemented by Cisco (Keiff et al. 2022). The

use of AI can optimize the formulation of job offers and ensure their attractiveness and relevance to the target group of candidates (Nalgoo 2023).

3. Candidate search and management

Microsoft uses AI tools in the recruitment process to find potential candidates for open positions. These tools are built on ML algorithms that automate the process of searching and identifying suitable candidates (Yakubu 2021). ML algorithms are run based on a given set of job requirements, including specific qualifications, experience, and skills. These algorithms search a variety of sources and databases, including online professional networks, resumes, and other public information, to identify potential candidates who best match the given requirements. With AI, the entire candidate search and identification process is automated, enabling a faster and more efficient acceleration of the recruitment and candidate sourcing process. It also enables the discovery of candidates who might otherwise be overlooked (Waheed et al. 2019; Alzhrani 2020).

The communication with candidates during the recruitment process is now changing dramatically thanks to the use of AI in various chatbots. Chatbots are virtual assistants, often powered by AI technology, that can independently make contact with applicants through various communication channels such as emails or dialog boxes (Koivunen et al. 2022). Chatbots enable personalized communication with applicants and, through the use of AI, can provide real-time information and tailor it based on applicants' qualifications, experience, and interests (Daktela 2023), leading to better matching of applicants for individual positions.

The examples of businesses using chatbots in the recruitment process are many. Companies such as Sephora, eBay, H&M, Pizza Hut, and others use chatbots from providers such as IBM, Nuance, NextIT, and others. These chatbots have different names, such as JIM, MYA, WATSON, VERA, and others (Albert 2019; Holubčík et al. 2023; Žuľová 2021). The effective functioning of chatbots in the real world is shown by examples of companies that have successfully implemented them. PwC uses a chatbot called PwC Career Compass that interacts with candidates, providing them with tailored recommendations and advice based on their qualifications and experience (PwC 2023). Another example is L'Oreal, which uses a chatbot called Mya to save recruiters' time and efficiently interact with many candidates at once (Lewis and Marc 2019). Adecco also uses an AI-powered chatbot that not only interacts with candidates but also maps the personality and cultural similarities between the candidates and the business, contributing significantly to recruitment efficiency (Kindly 2023).

4. Managing CVs

CVs are one of the key sources of information about candidates, and nowadays they are becoming an integral part of the recruitment process. The gradual integration of AI technologies into resume analysis is becoming a common and essential tool that significantly improves the efficiency and accuracy of this process. These technologies enable the rapid and efficient filtering of a vast number of applications. Automated systems are being created that scan CVs and identify keywords and their synonyms, enabling the rapid identification of suitable candidates for a specific job and saving recruiters' time. AI technologies also analyze various factors in resumes and, based on this, predict how likely a candidate is to be a good fit for a given job (Dixit et al. 2022). In addition, these technologies reveal potential biases in the recruitment process, such as gender or age biases, which help to ensure a fair and objective selection of candidates (IBM 2023). A significant advantage of AI technologies is also the validation of the issues associated with unstructured text-based CVs. Using NLP and algorithms, relevant keywords and phrases are identified, which quickly filters out unqualified candidates and allows the most suitable candidates to be identified (Yakubu 2021).

Firms, including leading companies such as IBM, Microsoft, PwC, L'Oreal, and HireVue, are actively using AI technologies to analyze CVs, improving the efficiency and accuracy of their recruitment processes (Albert 2019; Lewis and Marc 2019; HireVue 2023;

PwC 2023). The use of AI technologies in resume analysis provides companies the ability to quickly and efficiently evaluate a large number of candidates, which is particularly beneficial for organizations with high volumes of applications (Albert 2019).

5. Screening and testing of applicants

In the context of using AI in recruitment processes, there is often talk of screening or vetting candidates. This process enables the rapid analysis of applicants' digital footprints and provides valuable information about their profiles, helping businesses to select potential employees. Various social networks such as LinkedIn, Facebook, Twitter, and Instagram are used in the screening process to provide a comprehensive picture of applicants (Allal-Chérif et al. 2021). The analysis of social media posts and statuses is a key aspect of screening. AI enables the evaluation of the moods and emotions of candidates based on their online behavior (Garg and Goel 2021). This information about an applicant's personality and cultural patterns, as well as their approach to work, can be used to decide their suitability for a particular job. Another important element is the collection of information about applicants' past jobs, which AI can use to predict an applicant's expected salary (Dixit et al. 2022). However, when screening applicants, it is important to respect their privacy and adhere to privacy rules to prevent misuse or discrimination.

Traditional psychometric tests are often used in the identification of candidates' personalities and are modified with AI to make them more attractive and relevant (Rodríguez-Sánchez et al. 2019). Companies such as Unilever, Tesla, or Accenture integrate these tests into their selection processes using tools such as Arctic Shores or Pymetrics (Albert 2019). Assessments of personality (Dixit et al. 2022) and emotional intelligence (Allal-Chérif et al. 2021) allow companies to gain a comprehensive view of candidates, which is key for making informed decisions about the suitability of candidates for their teams and work environments (Dixit et al. 2022).

6. Management of interviews and assessments

AI is not only used to pre-assess candidates before the interview but also during the interview itself, especially if the interview is conducted online via video chat. With the proliferation of online interviews, accelerated by the COVID-19 pandemic, video interviews have become a key element in some recruitment processes. Using AI, HR staff can create questions for candidates based on the data collected from previous employees with the same job (Dixit et al. 2022). An example is HireVue, which developed a system that analyzes video interviews, including body language, facial expressions, and the applicant's voice. Based on comparisons with the current employees, it suggests suitable candidates (Garg and Goel 2021; HireVue 2023).

AI can also be used to assess a candidate's abilities based on their answers and responses to questions (Nexttech 2021). For example, Microsoft uses AI-powered video interviewing tools to conduct initial interviews with candidates remotely. NLP algorithms are used to analyze each candidate's responses, tone of voice, and facial expressions to assess their suitability for the position (Maree et al. 2019; Yakubu 2021).

7. Evaluating the effectiveness of the process

The use of AI in evaluating the effectiveness of the recruitment process can occur in several ways, contributing to an objective, fast, and accurate assessment. In this case, AI can be used to monitor individual recruitment process effectiveness indicators such as the following (Recruiters LineUp 2023):

- Candidate quality—the skills and qualifications of the candidates recruited, cultural fit of candidates within the organization, feedback from hiring managers and new hires, and performance of new hires over time;
- Time to fill positions—the total time required to fill open positions, identifying any delays or inefficiencies in the process;

- Retention rate—the length of time new employees remain with the organization, comparison with industry standards, and assessment of any need to improve the recruitment process to increase retention rates;
- Cost—the total cost of the recruitment and selection process, including advertising costs, agency fees, and staff time, evaluating the return on investment in talent acquisition;
- Diversity—demographics of new hires, comparison to overall organization demographics, and identifying the need to improve appeal to diverse candidates;
- Candidate Experience—candidate feedback on their experience during the process, possible negative comments or reviews on job review websites, and assessing the impact of the candidate experience on their perception of the organization;
- Hiring Manager Satisfaction—the hiring manager's satisfaction with the quality and suitability of candidates, assessment of whether the recruitment and selection process is meeting hiring managers' needs, and analysis of hiring managers' feedback on the recruitment and selection process.

These innovative applications of AI in the recruitment process allow companies to evaluate candidates faster and more objectively, improving the overall efficiency and success in recruitment activities. The increased automation and efficient use of data demonstrate how AI is helping to transform and modernize recruitment processes.

3. Discussion

The authors of the article extensively discuss the potential uses of AI in the recruitment process as a key aspect of human resource management (HRM), which plays a crucial role in organizations today (Wei and Lau 2005; Tummers et al. 2015). The implementation of AI in recruitment processes provides numerous advantages and risks, which researchers explore in scholarly publications (Gusain et al. 2023; Dixit et al. 2022).

One of the most significant advantages is AI's capability to process and analyze large volumes of resumes and candidate data within a short timeframe (Ochmann and Laumer 2021). This approach significantly enhances the efficiency of the entire recruitment process (Tërstena et al. 2020), allowing recruiters to devote more time to personal interaction with candidates and strategic decision-making (Gilch and Sieweke 2021).

Another advantage is the ability of AI algorithms to evaluate candidates based on objective criteria such as experience, education, and skills, thereby increasing the likelihood of selecting the most qualified candidates (Faliagka et al. 2012; Freire and de Castro 2021). Furthermore, the use of AI helps to minimize potential biases and provides objective evaluations based on data (Strang and Sun 2022).

AI contributes to building a positive employer brand and enhances employee loyalty through professional engagement and personalized recruitment approaches (Zhao et al. 2019; Black and van Esch 2020). Despite these benefits, concerns and challenges are associated with the use of AI in the recruitment process. One of the primary concerns is the possibility that AI may be susceptible to biases and lead to discrimination against candidates based on personal characteristics such as gender or race (Adamovic 2022; Chen 2023). Therefore, developing and implementing ethical AI algorithms that ensure fairness towards all applicants is essential (Köchling and Wehner 2020).

Trust and transparency are crucial aspects that need to be ensured so that both candidates and recruiters have a clear understanding of how AI makes decisions and processes their data (Kirya 2020; Chowdhury et al. 2023). A transparent process contributes to building trust and improves the overall perception of the recruitment process (Chiwara et al. 2017).

Looking ahead, AI could develop even more advanced analytical capabilities that enable evaluating not only the hard but also the soft skills (Strang and Sun 2022) of candidates and predicting their performance based on more sophisticated data analysis (Chen et al. 2022; Eom et al. 2022). AI could also actively recommend candidates based on their individual profiles and skills, thereby ensuring better alignment between the job requirements and applicant qualifications (Allal-Chérif et al. 2021).

With the increasing availability of data and technological advancements, AI is expected to be more widely implemented not only in large corporations but also in small- and medium-sized enterprises (Lada et al. 2023; Bettoni et al. 2021; Bhalerao et al. 2022), leading to more efficient and improved recruitment processes.

These aspects clearly illustrate the dynamics and potential that AI brings to enhancing and transforming the recruitment processes. It is essential to continue the discussions and research efforts to ensure that the use of AI in recruitment processes is always aimed at achieving optimal outcomes and adhering to the highest ethical standards.

4. Materials and Methods

The aim of the article is to explore the potential uses of artificial intelligence in various stages of employee recruitment. In this regard, two research questions were formulated. The first question focuses on the recent increasing interest among the academic community in utilizing AI in management, including HRM.

> Q_1: What is the current position of AI in contemporary academic research with a focus on management?

Within this research question, a funnel approach was applied, meaning, initially, the authors focused on all technologies, then on modern ones, and, finally, identified the key current technology.

The first step involved analyzing keywords to identify specific technological topics and concepts that researchers focused on in each year. In identifying ICTs, it was necessary to start by looking for secondary sources containing information on current technological trends in management. The first step was to use keywords such as "ICT" OR "information and communication technology". Subsequently, the focus was on the scientific field of management. The last criterion was to limit the selection of studies to the period from 2001 to 2023. Based on these criteria, articles in the Web of Science database were searched to identify specific technologies. In total, up to 4820 articles were identified. In total, up to 31 technologies were defined. The next step was the selection of modern ICT. In the absence of a precise definition of modern ICTs in the secondary sources retrieved, the purpose of this article needed to establish their characteristics based on indicators. These indicators are the following:

- Relevance—current technologies are based on the latest research, development, and innovation in the industry. Thus, modern ICTs can be said to be up to date if they are current trends in businesses and other ecosystems;
- Several publications—modern technologies are often reflected in a high number of publications and technical articles detailing their development, benefits, and application possibilities. This indicator suggests that the technology is a hot topic in the academic and professional community;
- Sufficient development—modern technologies have mature and proven concepts, methods, and solutions, signaling their robust base and ability to be applied in practice. If the technology is only at the level of abstraction, it cannot be considered modern but future-proof;
- Usability in the present—current technologies are up-to-date and applicable, with their benefits and ability to improve existing processes or contribute to innovation visible and recognized in practice.

Based on these indicators, it was possible to categorize the identified technologies into traditional, modern, and future. Considering the established parameters, 7 technologies were defined as modern. In the last step, it was necessary to define the key technology of today from the specific 7 modern technologies that were identified in the previous step. Several articles (Gerken 2023; Lohr 2023; Shah 2022) testify that the key technology of the present is AI, but this assumption needs to be verified at the level of academia. To this end, the scientific mapping method was used. Scientific mapping is a bibliometric tool used to analyze and extract information from scientific outputs. Its main purpose is to provide

objective criteria for the evaluation and analysis of academic research results (Moral-Munoz et al. 2019). The bibliographic data of individual academic publications have been used to create scientific maps, and there are different types of these maps (Eck et al. 2010). In this thesis, the Visualization of Similarities (VOS) technique, specifically the VOSviewer version 1.6.20 tool, was used.

VOSviewer uses an algorithm to visualize networks in a two-dimensional space, where publications form nodes and mutual citations between them form edges. In addition, the algorithm assigns nodes to clusters that group closely related nodes. Each node is assigned to only one cluster, enabling a meaningful visual representation. Mathematically, the algorithm is expressed as the sum of squares of the Euclidean norm of the differences of the node positions (Kirby 2023):

$$V(x_1, \ldots, x_n) = \sum_{i<j} S_{ij} \left\| x_i - x_j \right\|^2$$

where

$x_i = (x_{i1}, x_{i2})$ indicates the position of item i in the two-dimensional map;
$\|$-$\|$ denotes the Euclidean norm.
The minimization of the objective function is performed concerning the constraint

$$\frac{2}{m(n-1)} \sum_{i-j} \left\| x_i - x_j \right\| = 1$$

Publications were retrieved from the WoS database based on the search string 'artificial intelligence' OR 'business intelligence' OR 'cloud computing' OR 'big data' OR 'virtual reality' OR 'internet of things' OR 'blockchain'. These keywords stemmed from the preceding second step, where modern ICTs were defined. The search for publications was limited to 2023 to obtain up-to-date information on which of these technologies were most frequently described within scientific publications. A total of 1765 management publications were identified. Bibliographic records from these publications were then imported into the VOSviewer version 1.6.20tool.

The second research question specifically concerned the potential applications of AI in specific parts of employee recruitment:

Q_2: What are the current trends in the use of AI in recruitment processes?

To answer the second research question Q_2, the authors of the paper followed the PICOS framework used in determining the criteria for selecting relevant sources (Yuan et al. 2024). The acronym PICOS stands for participants, intervention, comparator, outcomes, and study design. In the context of this article, these are the following:

- Participants: specific AI tools and systems that are primarily intended for use in the recruitment process;
- Intervention: the activities for which AI tools and systems are used;
- Comparator: Examples of activities for which specific AI is used;
- Outcomes: Improved time efficiency in recruitment;
- Study design: Analysis of case studies.

By intentional selection, a total of 128 software and systems focused on supporting employee recruitment were chosen. As no new findings would have been identified with additional solutions, the analysis was concluded due to theoretical saturation. Based on these findings, specific functionalities of these AI software and systems were defined. These functionalities were then combined into specific activities to identify recruitment processes with the highest potential for AI integration. Subsequently, specific use cases of AI in these activities were analyzed.

The methodological procedure for the development of the article is illustrated in Figure 6.

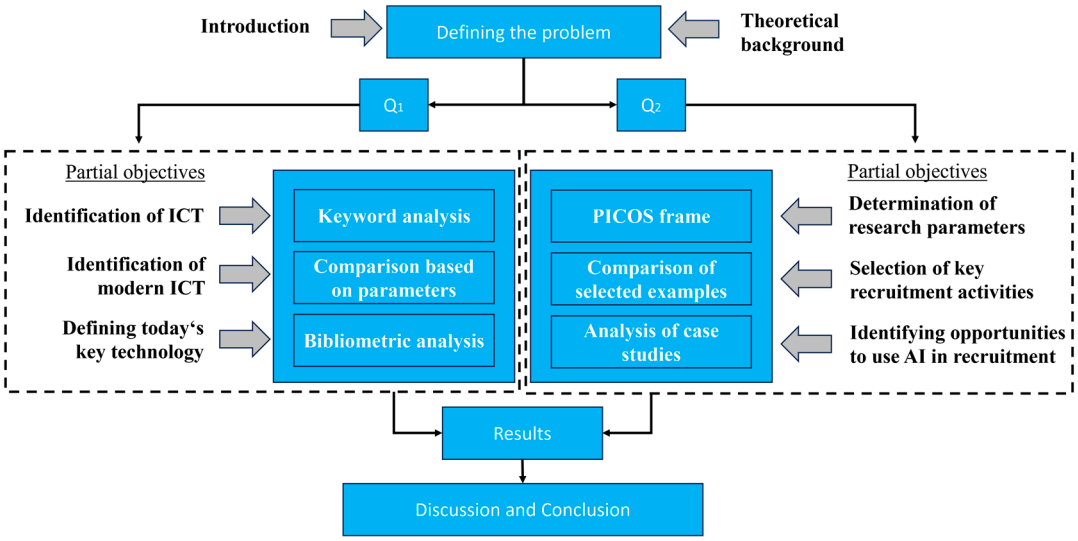

Figure 6. Graphical representation of the methodological procedure. Source: own elaboration.

5. Conclusions

The article extensively examines the possibilities of utilizing AI in the employee recruitment process, emphasizing it as a key technology of the present. At the outset, AI is defined as a modern technology with a specific focus on its impact on the academic field of management. This approach does not confine AI to an abstract concept but presents it as a tangible reality that becomes an integral part of the study and research in management. This establishes a connection between the theoretical understanding and practical application of AI.

Furthermore, the article thoroughly analyzes the position of AI in comparison to other technological innovations. The goal of this analysis is to highlight the significance of AI in the context of modern information and communication technologies. Specific emphasis is placed on the central role that AI occupies in technological trends and innovations, particularly within the academic research domain of management.

After analyzing the position of AI, the article delves into the important aspect of defining specific functions that AI systems can fulfill in the employee recruitment process. This step expands the view of the concrete benefits of this technology in the work environment. The article meticulously describes various possibilities that AI already has within recruitment activities. The authors emphasize how AI can streamline various aspects of recruitment, including qualification assessment, shortening the candidate selection process, and even personalizing the interactions with job applicants. This way, the article provides practical insight into how AI can become an integral part of recruitment strategies and contribute to their effectiveness. Defining the specific functions of AI in the recruitment process provides readers with a clearer view of how this technology can impact the everyday operations in human resources and personnel management.

The examples of the specific AI utilization possibilities in the recruitment processes in the article serve as illustrations of the efficiency and advantages of this technology in practice. The authors provide concrete examples of situations where AI can provide significant improvements, thereby establishing a connection between the theoretical perspectives and real-world applications in recruitment. These examples may include faster evaluation of candidate resumes using machine learning algorithms, automated processing of written tests, or even the predictive analysis of candidate behavior based on data from online interactions. This way, readers are offered a concrete understanding of how AI can be implemented in real-world settings and how it can contribute to optimizing recruitment processes. The practical examples of cost-effective AI utilization further support the arguments for integrating this technology into the recruitment ecosystem, bringing it closer to wider acceptance and successful implementation in practice.

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