THE EFFECT OF DIGITALIZATION ON HUMAN RESOURCE MANAGEMENT PRACTICES: A BIBLIOMETRIC ANALYSIS

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Abstract: *This study examines the intersection of digitalization and human resource management (HRM) practices through a bibliometric analysis. Utilizing the VOS Viewer program for quantitative analysis and supplemented by qualitative content reading, the research explores key trends, themes, and authorship patterns within the existing literature. The primary data source is the Web of Science database, yielding 268 relevant studies published between 2005 and 2023. Findings indicate a growing interest in the topic, particularly within the management discipline, and highlight key HRM practices impacted by digitalization, including recruitment, training and development, performance management, and career management. The analysis reveals that digitalization enhances HR efficiency, reduces costs, and supports learning and development, while also presenting challenges such as data security risks, skill gaps, and potential resistance to change. Co-authorship and citation networks identify influential authors and emerging research clusters. The study underscores the interdisciplinary nature of digital HRM research and calls for broader database inclusion to enhance future bibliometric studies.*

Keywords: *Digitalization, Human Resources, Human Resource Management, Digital Economy, Digital Transformation Jel Classification*

Digitalization has led to profound changes in the business world over the past few decades, demonstrating the potential to enhance efficiency, reduce costs, and foster innovation across various sectors. These changes have reshaped the way businesses operate and have led to the emergence of new business models. One significant area impacted by digitalization is human resource management (HRM). HRM encompasses the processes of managing and developing an organization's most valuable asset: Human capital. The integration of digital technologies into HRM practices has facilitated more effective and efficient execution of these processes.

The intersection of digitalization and HRM is the focus of this study, which aims to identify key trends, themes, and authorship patterns in the existing literature and to identify research gaps in this area. Digitalization is transforming HRM functions such as recruitment, training and development, performance management, and career management, presenting new opportunities and challenges. For instance, digital recruitment platforms enable the selection of candidates from a broader pool, while

automated assessment systems accelerate the recruitment process and facilitate more objective decision-making. Similarly, digital training and development tools provide easier access to continuous learning and development processes for employees.

However, the impacts of digitalization on HRM are not limited to opportunities and advantages. This process also brings various challenges, such as data security risks, skill gaps, and resistance to change. Data security and privacy concerns, in particular, are significant issues in digital HRM applications. The storage and processing of employee data in digital environments increase the risk of misuse or unauthorized access to this data. Therefore, organizations must take measures to minimize these risks when implementing digital HRM practices.

In this study, important theoretical and practical insights are aimed to be provided through a thorough analysis of the intersection of digitalization and HRM, as well as the existing literature in this field. Quantitative data of publications in this area will be examined through bibliometric analysis to identify research trends and key themes. Additionally, the impacts of digitalization on HRM and significant research topics in this field will be explored in more detail through qualitative content analysis. In this context, a contribution to digital HRM research is aimed, and the study is intended to serve as a guide for future research.

The Fourth Industrial Revolution signifies a profound shift in our lifestyles, employment patterns, and interpersonal interactions. It marks a new era in human progress, made possible by remarkable technological advancements akin to those seen in the first, second, and third industrial revolutions. These breakthroughs are blending the physical, digital, and biological realms, offering both tremendous potential and significant risks. The rapidity, scope, and depth of this revolution compel us to reconsider the development of nations, the creation of value by organizations, and even the essence of humanity itself. The Fourth Industrial Revolution extends beyond mere technological change; it presents an opportunity to empower a wide range of individuals, including leaders, policymakers, and people from various income brackets and nations, to leverage the merging technologies for the purpose of constructing an inclusive, human-centered future. The genuine potential lies not only in technological advancements but also in identifying ways to enable as many individuals as possible to positively influence their families, organizations, and communities (World Economic Forum, 2023).

Digitalization, a concept introduced by the Fourth Industrial Revolution, is often defined in conjunction with digitization. Digitization is the simple process of converting analog information into digital formats, such as scanning a document or digitizing sound recordings. It also encompasses the shift from manual to digital processes, like replacing paper forms with online versions that feed data directly into a database. The often-discussed “paperless office” represents the ultimate goal of digitization. In contrast, digitalization involves leveraging digital technology, along with digitized information, to generate and extract value in innovative ways (Gobble,

2018: 56). This aligns with the definition provided by the Oxford English Dictionary, where digitization is described as 'The action or process of digitizing; the conversion of analog data, especially in later use, images, video, and text, into digital form.' However, it should be noted that there is currently no distinct definition of 'digitalization' in the dictionary, and it is still equated with 'digitization' (Oxford English Dictionary, 2023).

According to the definition provided by Brennen and Kreis (2014), who are among the most frequently cited and widely accepted authors on the concept of digitalization, digitization is described as the material process of converting individual analog streams of information into digital bits. In contrast, they characterize digitalization as the way in which many domains of social life are restructured around digital communication and media infrastructures.

Digital transformation is a term often used in tandem with digitalization. This more extensive concept pertains to a strategic business transformation driven by customer needs, necessitating comprehensive organizational adjustments and the adoption of digital technologies (Bloomberg, 2018: 5). Digital transformation encompasses alterations across various dimensions, which encompass (Parviainen et al., 2017: 64)

- Process Level: Embracing novel digital tools and optimizing workflows by minimizing manual tasks.
- Organizational Level: Introducing fresh services, abandoning outdated methods, and delivering existing services through innovative approaches.
- Business Domain Level: Modifying roles and value chains within ecosystems.
- Society Level: Transforming societal structures, such as the nature of employment and methods of exerting influence on decision-making processes.

This paper concentrates on the initial two tiers: the process, and organizational domain aspects of digitalization, with a particular emphasis on strategies that companies can employ in human resource departments.

How will the increasing integration of digitalization into our lives impact human resources activities? Embracing new technologies that significantly streamline each task is inevitable. Consequently, it is evident that human resources professionals will need to acquire several new skills to adapt to these technological changes. According to the "Future of Jobs Report 2023" by the World Economic Forum (p. 39), creative and analytical thinking stands out as the most crucial skill, with technological literacy ranking third. Skills closely associated with digitalization, such as artificial intelligence, big data analysis, network management, and cybersecurity, as well as programming, are also deemed indispensable for future job roles. An analysis of the significance of technological skills across sectors reveals that they will make up 67.9% of the skills required in the "Employment Services" sector between 2023 and 2027 (p. 41). Professionals in this field will likely require retraining to engage in more practical tasks, demanding a blend of analytical thinking abilities and technical expertise in

emerging technologies. This may encompass specific digital proficiencies, including mastery of diverse programming languages (Conceição et al., 2023: 30).

So, in which areas will HR professionals who can acquire these new skills apply them? In other words, in which practices of Human Resources can digitalization be applied? First of all, it should be clarified what is meant by HR practices. According to Ulrich and Dulebohn (2015: 200), HR practices are summarized in four key areas. The first pertains to people. HR activities shape the movement of individuals within an organization, encompassing various practices related to workforce planning, recruitment, training, development, and employee retention. The second area is performance. HR work emphasizes accountability through performance management, including setting standards, measuring performance, distributing rewards, and providing feedback. The third area involves information flow. HR may also manage the flow of information vertically, horizontally, and externally within an organization. The fourth area relates to the nature of work itself. HR work encompasses understanding how the organization accomplishes tasks (e.g., through teams), establishing workforce policies, and managing physical work environments. Another classification on HR activities include communication, employee engagement, training and development, hiring and selection and reward systems (Langwell and Heaton, 2016: 653). In general terms, HRM can be defined as encompassing activities related to acquiring, retaining, empowering, and motivating employees. Consequently, HRM activities include recruitment and selection, ensuring effective teamwork, organizing training programs, conducting performance evaluations, and providing performance-based feedback (Kaya et al., 2010: 2033: 2034).

In fact, the relationship between technology and HR is not a recent development. In 1998, Lepak and Snell coined the term ‘virtual HR’ to describe strategic human resource management in the 21st century. At the time, this concept seemed futuristic, but today it is widely recognized as an accurate prediction. According to the study, IT plays a crucial role in reducing costs and enhancing productivity by automating routine HR tasks and practices. Furthermore, providing line managers and employees with remote access to HR databases and information empowers them to handle HR activities themselves, leading to quicker response times and improved service levels. The transformative potential of IT in HR is underscored by its capacity to facilitate communication and information sharing without the constraints of time and space (Lepak and Snell, 1998: 219-220).

The HR department has consistently led the way in incorporating technology within businesses. In fact, one of the earliest instances of automation in corporate operations was the handling of payroll tasks. Over time, HR has persistently blended innovative technology with traditional procedures. In the field of technology research, the term ‘e-HRM’ came into prominence after the 1990s. The term ‘e-commerce,’ which stands for electronic commerce, paved the way for the emergence of this term (Lengnick-Hall and Moritz, 2003: 365). E-HRM is defined as ‘a way of implementing HR

strategies, policies and practices in organisations through a conscious and directed support of and/ or with the full use of web-technology-based channels' (Ruël et al., 2004: 365-366). E-HRM has revolutionized the way HR professionals operate, leading to significant transformations in key HR processes. Recruitment and selection, performance evaluation, compensation and benefits, training and development, career management, health and safety protocols, employee relations, retention strategies, and even the facilitation of work-life balance have all been profoundly impacted by these new technology-driven systems (Ensher et al., 2002: 240).

E-HRM involves the setup of computer hardware, software, and electronic networking resources. These components facilitate HRM activities, such as policies, practices, and services, by coordinating and controlling the collection of individual and group-level data and the creation and communication of information within and between organizational boundaries (Marler and Parry, 2016: 2234). An all-encompassing e-HRM system might comprise enterprise resource planning software (ERP), HR service centers, interactive voice response (IVR), web-based applications, voice recognition systems (VRS), as well as dedicated portals for both managers and employees (Lengnick-Hall and Moritz, 2003: 365). Today, it is understood that digitalization and digital human resources are more than e-HRM. This represents the fresh perspective on digital HR, where SMAC (Social, Mobile, Analytics, and Cloud) technologies are harnessed to redefine the employee experience, making work easier, real-time, more productive, and ultimately more rewarding (Stephan et al., 2016: 97). Machine Learning, AI, and Cloud computing are employed to enhance operations like forecasting, modeling, and streamlining business processes for increased efficiency. Virtually every company now offers HR services universally accessible through technology and web-based applications, leading to a significant transformation in the field of human resource management. These trends center around the diverse tools and techniques employed to carry out various HR functions, as exemplified by the following (Sengupta et al., 2021: 10171):

- Utilization of recruitment software that employs algorithms to assess a candidate's suitability for the applied role.
- Adoption of feedback tools such as Impraise and Culture Amp to conduct regular performance evaluations for employees.
- The growing reliance on cloud-based HR software, which enables access to applications from anywhere, provides automatic software updates and enhances data security.
- One of the emerging trends in HR digitalization is HR Analytics, which is increasingly integrated into modern business operations. Predictive analytics, modeling techniques, and statistical software are employed to evaluate employee performance and analyze income distribution among employees.

E-recruitment is a prominent area of study when investigating the widespread adoption of digital tools in HR practices. Based on a recent study conducted by

Chugunova and Danilov (2023: 73), the highest percentage of companies that claim their HR processes are entirely or primarily digital is in job postings, with 70% of companies creating and publishing their job vacancies in a fully or predominantly digital manner. This is trailed by digital internal communication (53%), workforce planning and forecasting (47%), HR controlling (46%), compensation and benefits (46%), and administrative tasks (46%). According to research by the Society for Human Resource Management (SHRM), employee referrals remained the primary source of high-quality applicants, but as early as 2007, four out of the top five applicant sources were web-based (as cited in Johnson and Gueutal, 2011: 9). Similarly, in a survey, it was found that 73.5% of respondents maintain social network accounts, with the most popular choices being Facebook at 65%, LinkedIn at 40.2%, and Twitter at 20.1%. Moreover, some companies (10.3%) reported their presence on other social networking platforms such as Instagram, Pinterest, and Google+ (Melanthiou et al., 2015: 41).

Digital technologies are simplifying the process for both managers and employees to input and retrieve compensation and benefits information. The availability of an expanding array of cloud applications and Platform as a Service (PaaS) solutions in this field is broadening the possibilities for digitizing the administrative procedures associated with compensation and benefits management (DiRomualdo et al. 2018: 238).

Innovative manufacturing firms are merging adult learning principles with advanced technology systems to revolutionize their existing training programs, enabling a level of empowerment and engagement that was previously unparalleled. This novel approach effectively conveys information in a manner that resonates with younger generations, concurrently reducing expenses and yielding enhanced outcomes. For instance, HR managers are diversifying content presentation to accommodate individual learning preferences. They may use 3D graphics to engage visual learners or record sessions to support those who prefer auditory learning (Amladi, 2017: 68).

Artificial intelligence (AI) in all its various manifestations, ranging from robotic process automation (RPA) to machine learning and natural language processing (NLP), has already showcased promising outcomes. For instance, machine learning has proven to be up to 17 times more precise than alternative methods in predicting employee resignations. In talent acquisition, AI-driven candidate screening can enhance hiring accuracy and at Unilever, it has reduced the time it takes to hire by 75%. Recruiters at companies like Johnson & Johnson, Atlassian, Twitter, and others are harnessing NLP to enhance the quality of their job listings, fostering a more inclusive work environment. According to a Bain survey, approximately half of all companies are presently using or experimenting with RPA in at least one HR process, with expectations of adoption reaching 74% within the next two years (Heric, 2018: 2).

Methodology

The study aims to offer readers a comprehensive view of the concepts of digitalization and human resources through a bibliometric analysis, utilizing quantitative data and numerical indicators. Additionally, it seeks to provide a literature summary by employing content reading to analyse studies that address these two concepts together.

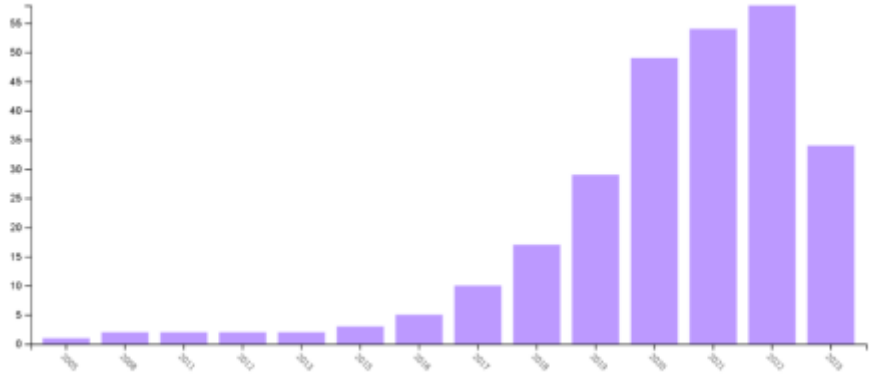
The data analysis was conducted using the VOS Viewer program, and the study's findings were further supplemented through content reading performed by the researcher. Thus, a mixed-method approach was employed, encompassing both quantitative literature review with bibliometric analysis and qualitative content reading.

The primary limitation of this study is its reliance solely on data from the Web of Science database, excluding other databases like Scopus and TR Index. This restriction hinders the ability to draw comprehensive conclusions on the subject. While this study was not conducted during the pandemic, it's worth noting that some of the analyzed articles were written within the constraints of the pandemic period. It's important to acknowledge the potential influence of this exceptional circumstance on the content of the studies. Consequently, this can also be regarded as a limitation of the study.

Bibliographic Data

On September 12, 2023, a search was conducted in the Web of Science database using the keywords 'digitalization' and 'human resources' across all fields. This search yielded a total of 268 results, including 159 articles, 95 proceeding papers, 13 review articles, 10 early access publications, 6 book chapters, and 1 retraction spanning various fields. Most of these studies (95 studies) are indexed in ESCI and 59 of them are included in Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH). Science Citation Index Expanded with 48 studies, Conference Proceedings Citation Index – Science (CPCI-S) with 47 studies and Social Sciences Citation Index (SSCI) with 41 studies are among the other prominent indexes.

An analysis of publication years reveals that the earliest study in this field dates back to 2005, while the most recent one was conducted in 2023. As depicted in Graph 1, there has been a growing number of studies related to digitalization and human resources over the years. The spike in 2023 is due to the ongoing nature of this year's data. Based on trend analysis, it is projected that the total number of studies will surpass the 2022 figure by year-end, reaching 77 studies (with 2019 as the base year set at 100). This upward trend in research output indicates a sustained interest in these topics.



Graph 1: Publication Years

Although studies on digitalization and human resources span across various disciplines, they are predominantly concentrated in the field of management. A breakdown of subcategories in Web of Science reveals 62 management studies in this field, followed by 52 in business, 43 in economics, and 19 in environmental sciences. Additionally, there are studies in disciplines such as agronomy, education, computer science, and law, underscoring the interdisciplinary nature of this subject.

Citation topics under meso and micro subheadings were also examined, revealing that most of the studies were from the management discipline, with 58 studies. Design and manufacturing had 29 studies, followed by 13 studies each in the fields of communication and social reform, 12 studies in the risk assessment category, and 11 studies in the economics category. Regarding micro topics, the most prominent categories were Industry 4.0 with 25 studies, job satisfaction with 12 studies, and knowledge management with 10 studies.

Co-Authorship of Authors

Using the co-authorship analysis of authors, a network map was generated based on the criteria of at least 1 publication and 1 citation. Among the names with the highest connections, 8 authors were identified, resulting in a total of 28 connections that form a single cluster (see Figure 1). When analyzing author co-authorship, it becomes evident that no author has more than two studies on the subject. This reflects the current nature of the topic, which lacks an extensive history.

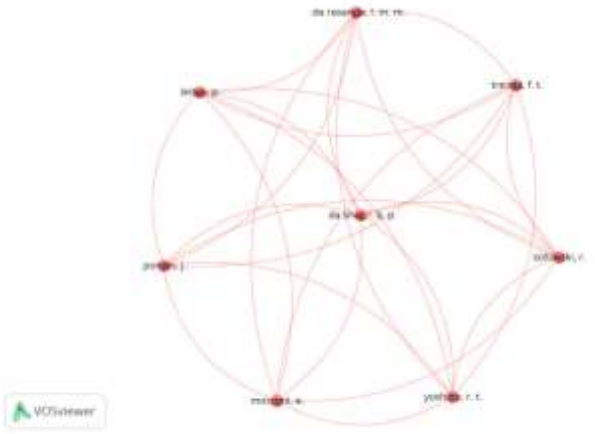


Figure 1: Co-authorship of authors

Citation of authors

One study and one citation were selected as the minimum thresholds for authors' citation analysis to include a broader range of documents in the review. Out of 153 authors, 88 had both a study and a citation, with 10 of them exhibiting highly related citations. Figure 2 displays this relationship network.

In terms of study citations, Fernandez Vicenc and Eva Gallardo lead with 35 citations, followed by Chang Xiaoxi, Liu Guanjian, Wang Lijun, and Zhou Yu with 22 citations. A comparison of these numbers with the links in Figure 1 reveals that the most frequently cited authors are not the ones with the highest collaboration levels. On the other hand, comparing the number of citations with the co-citation network in Figure 2, it's evident that there is a relationship between the two, as authors like Chang Xiaoxi, Liu Guanjian, Wang Lijun, and Zhou Yu, who are among the most cited, also appear in the co-citation network.

Analysis of Keywords

Keywords play a crucial role in locating and categorizing studies, serving as valuable tools for researchers to efficiently navigate and classify academic literature. In the analysis of keywords, a minimum occurrence of 1 was chosen to include all keywords. Out of 189 studies with keywords, 'digitalization' emerged as the most frequently used keyword with 22 occurrences, followed by 'human resources' with 10 occurrences. 'Human resource management' appeared in 6 studies, 'digital economy' in 5 studies, and 'digital transformation' in 4 studies. The selection of the 5 most frequently used keywords for this study was based on this analysis.

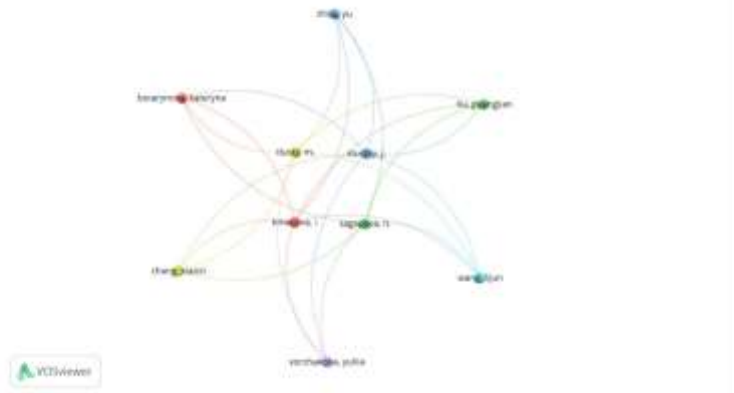


Figure 2: Co-citation of authors

Figure 3 shows that 167 out of 189 keywords are highly related to each other, and that digitalization is frequently juxtaposed with keywords such as digital economy, advance analytics, collective intelligence, cultural heritage, industry 4.0 and human resources. As can be seen, the word human resources is also frequently juxtaposed with keywords such as sustainable development, cognitive modeling, blocking factors.

The frequent usage of terms such as 'digital human resources,' 'advanced analytics,' 'digitization,' 'small and medium-sized enterprises,' 'sustainable

development,' 'need for change,' and 'blocking factors' in contemporary studies is particularly notable. This prevalence indicates that these topics are currently at the forefront of research and discussion.

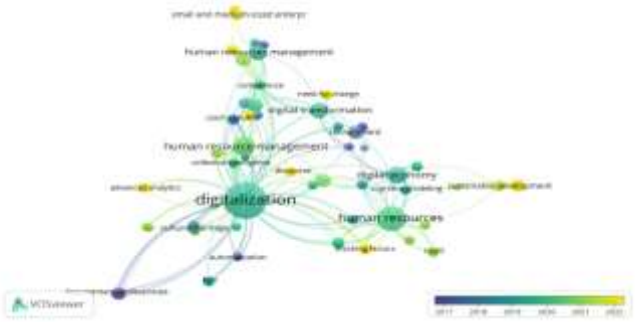


Figure 3: Co-occurrence of keywords

Bibliographic Coupling of Documents

Bibliographic coupling refers to a common work cited by two independent sources. In the bibliographic coupling analysis, the full counting method was employed, and studies with a minimum of 1 citation were considered. Out of 50 related studies, 26 met these criteria. Figure 4 illustrates that 8 of these studies share strong bibliographic connections. Notably, most of these related studies belong to the field of engineering and were conducted between 2018 and 2022.

The publications with the highest number of bibliographic matches are Fernandez (2021) with 35 citations, Zhou (2021) with 22 citations and Kuzior (2022) with 20 citations. The publications with the highest total link strength were Blstakova (2020) with six links, and da Silva (2022) and Fernandez (2021) with three links each.

Figure 4: Bibliographic coupling of documents

Conclusion

This study provides a comprehensive examination of the intersection between digitalization and human resource management (HRM), highlighting significant trends, themes, and research gaps in the existing literature. Key areas of interest and ongoing debates within the academic and professional communities have been identified through the conduction of a bibliometric analysis and qualitative content analysis. The transformative impact of digital technologies on HRM practices is underscored by our findings, and insights for future research and practical applications are offered.

The analysis reveals that digitalization has profoundly reshaped traditional HRM functions, leading to more efficient, effective, and innovative practices. Digital tools and platforms have revolutionized recruitment processes, enabling organizations to reach a wider pool of candidates and streamline selection procedures through automation and artificial intelligence. Training and development have also been significantly enhanced, with e-learning platforms and virtual training sessions providing flexible, accessible, and personalized learning opportunities for employees.

Moreover, performance management has been transformed through the use of data analytics and real-time feedback systems, allowing for more accurate and timely assessments of employee performance. Digital career management tools have also facilitated better career planning and development, helping employees navigate their career paths with greater clarity and support.

Despite these advancements, the study also highlights several challenges and concerns associated with the digitalization of HRM. Data security and privacy issues are paramount, as the increased reliance on digital systems raises the risk of data breaches and unauthorized access to sensitive employee information. Organizations must implement robust security measures and adhere to stringent data protection regulations to mitigate these risks.

Additionally, the rapid pace of technological change necessitates continuous upskilling and reskilling of the workforce. Organizations must invest in ongoing training programs to ensure that employees possess the necessary digital competencies to thrive in a digitalized work environment. Resistance to change is another significant challenge, as employees and HR professionals may be hesitant to adopt new technologies and alter established practices. Effective change management strategies are essential to address these concerns and facilitate a smooth transition to digital HRM.

The study also identifies several research gaps that warrant further exploration. Future research should delve deeper into the long-term impacts of digital HRM on organizational performance and employee well-being. Investigating the ethical implications of digital HRM practices, particularly concerning data privacy and algorithmic decision-making, is another critical area for future inquiry. Moreover, comparative studies across different industries and geographical regions could provide valuable insights into the contextual factors influencing the adoption and effectiveness of digital HRM.

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