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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

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

DİJİTALLEŞMENİN İNSAN KAYNAKLARI YÖNETİMİ UYGULAMALARI ÜZERİNDEKİ ETKİSİ: BİBLİYOMETRİK BİR ANALİZ

Hatice ÇOBAN KUMBALI*

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: M50, O15

Öz

Bu çalışma, dijitalleşme ve insan kaynakları yönetimi (İKY) uygulamalarının kesişimini bibliyometrik bir analizle incelemektedir. Nicel analiz için VOS Viewer programı kullanılarak ve nitel içerik okumalarıyla

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desteklenerek, mevcut literatürdeki temel eğilimler, temalar ve yazarlık desenleri araştırılmıştır. Birincil veri kaynağı olarak Web of Science veritabanı kullanılarak 2005-2023 yılları arasında yayınlanmış 268 ilgili çalışma elde edilmiştir. Bulgular, özellikle yönetim disiplininde bu konuya artan bir ilgi olduğunu göstermekte ve dijitalleşmeden etkilenen başlıca İKY uygulamalarının işe alım, eğitim ve geliştirme, performans yönetimi ve kariyer yönetimi olduğunu ortaya çıkarmıştır. Analizler sonucunda, dijitalleşmenin İK verimliliğini artırdığı, maliyetleri azalttığı, öğrenme ve gelişimi desteklediği ancak veri güvenliği riskleri, beceri eksiklikleri ve değişime direnç gibi zorlukların da var olduğu ortaya konmuştur. Ortak yazarlık ve atıf ağları, etkili yazarları ve ortaya çıkan araştırma kümelerini belirlemektedir. Çalışma, dijital İKY araştırmalarının disiplinler arası doğasını vurgulamakta ve gelecekteki bibliyometrik çalışmaları geliştirmek için daha geniş veritabanı incelemelerine ihtiyaç olduğunu belirtmektedir.
Anahtar Kelimeler: Dijitalleşme, İnsan Kaynakları, İnsan Kaynakları Yönetimi, Dijital Ekonomi, Dijital Dönüşüm
Jel Sınıflandırması: M50, O15

1. Introduction

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.

2. Literature Review

2.1. What is Digitalization?

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.

2.2. The effect of Digitalization on HR Activities

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).

All these studies and classifications indicate that digitalization has significant relevance to HR functions across various contexts. Among the HR functions, those that prominently feature in the era of extensive digital tool integration include recruitment, compensation, training and development, and performance appraisal. This study will concentrate on these four functions and investigate their digitalization initiatives.

3. 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.

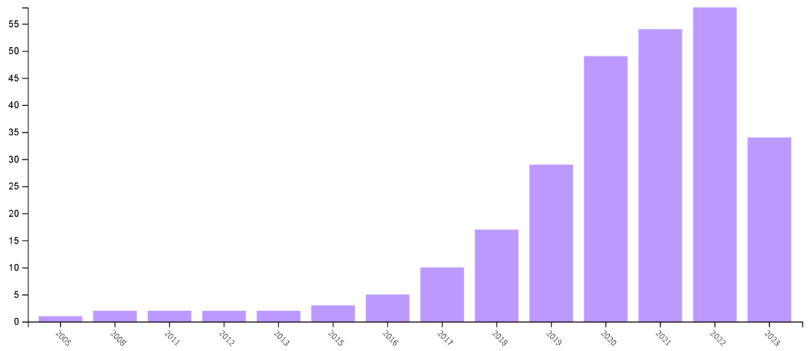
The primary limitation of this study is its reliance solely on data from the Web of Science database, excluding other databases like Scopus and TR Index. This restriction hinders the ability to draw comprehensive conclusions on the subject. While this study was not conducted during the pandemic, it's 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.

4. Findings

4.1. 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

Source: Web of Science

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.

4.2. 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.

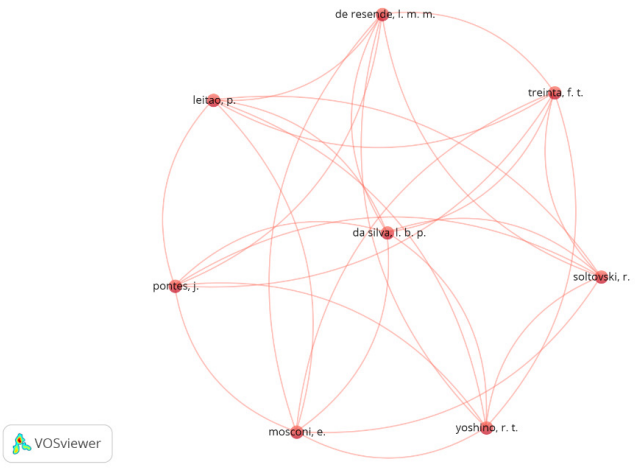


Figure 1: Co-authorship of authors

4.3. 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.

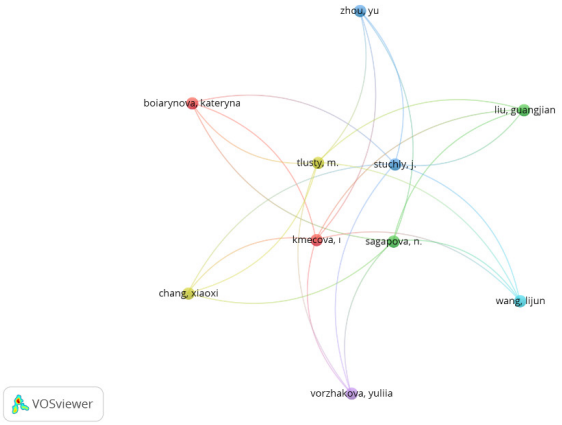


Figure 2: Co-citation of authors

4.4. 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 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.

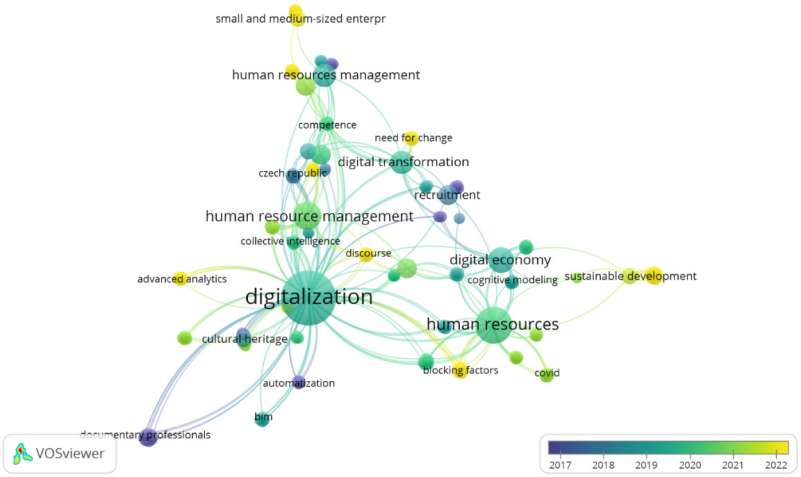


Figure 3: Co-occurrence of keywords

4.5. 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.

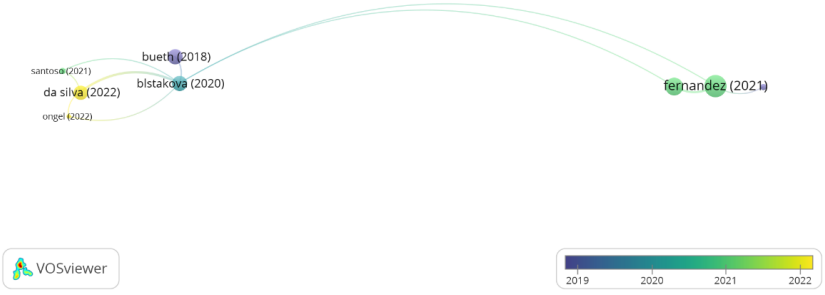


Figure 4: Bibliographic coupling of documents

4.6. Co-citation of cited authors

Different sources cited in a publication are called co-citation. In the co-citation analysis of cited authors, those with at least three citations were included, resulting in 33 out of 1,310 authors meeting this criterion. Among them, 22 authors were found to have highly related citations, as depicted in Figure 5. The most co-cited authors are Popkova with 7 citations and Hecklau, Marler, Ulrich and Kuzioh with 5 citations each. It's worth noting that this analysis is based on Vos Viewer's 'Web of Science data includes only the first author of a cited document,' and it's essential to consider that other authors also contribute to the citations.

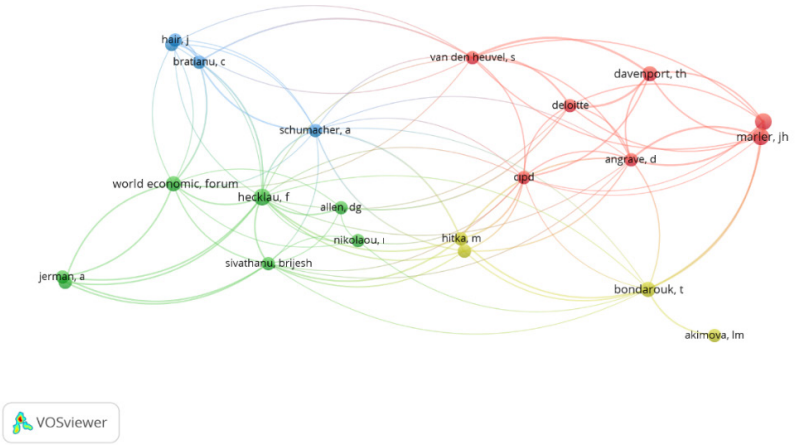


Figure 5: Co-citation of cited authors

5. Content Reading of Management Studies

As evident from the bibliographic data, studies focusing on digitalization and human resources fall under the realm of management science. Therefore, all management studies related to these concepts and indexed in Web of Science are examined under this title.

To offer an overview of the studies, the 'management' category from Web of Science was selected, resulting in 62 studies. The oldest of these studies is a book chapter published in 2012 (Duparc, 2012), while the most recent is an article published in 2023 (Asatiani and Norstrom, 2023). These studies include 33 articles, 29 proceeding papers, 5 early access publications, and 1 book chapter.

To conduct a content reading, it is attempted to access all studies categorized under 'management,' but seven of them could not be obtained. One study was excluded, as it was in Russian. Consequently, a total of 54 studies were included and thoroughly examined in the content reading. Paper filtering stages summary is given in Table 1 and full list of studies included in the research is given in Appendix A.

Table 1: Paper filtering stages summary

Stage	Description	Papers
Search	An initial search was performed in the Web of Science database by using 'digitalization' and 'human resources' keywords.	268
Restriction	Out of the 20 categories, the 'management' category, which has the highest number of articles, was selected to make the sample specific.	62
Full text discovery	All studies in the management category were attempted to be accessed, but full texts of seven studies could not be retrieved.	55
Final sample	One of the full texts was not included in the analysis because it was in Russian.	54

After the filtering process, 54 papers were analyzed to address the research questions. There are two primary research questions in this study:

RQ1: Which human resource practices have been investigated within the realm of digitalization?

RQ2: What are the challenges and opportunities for digitalization of HR activities?

5.1. Digitalized HR Practices

Under this heading, we examine HR practices that are intertwined with digital technologies, based on RQ1.

Digital technologies in HR encompass advancements such as mobile applications, the Internet of Things, artificial intelligence, big data, cloud computing, and a variety of hardware and software tools. Studies evaluating the relationship between digitalization and HR particularly focus on training and development, performance management, career management, and especially recruitment (Kambur and Yildirim, 2023: 438-441; Vorzhakova and Boiarynova, 2020: 143; Duparc, 2012: 144). As a result of integrating digital applications into HR processes, studies indicate that electronic HRM, or e-HRM, has emerged (Alan, 2023: 38, Kmecová et al., 2021: 235; Zhou et al., 2021: 21).

Recruitment process, one of the most important applications of human resources, is among the functions that are evaluated with digital technologies. In recent years, there has been a revolution in recruitment due to the advent of internet technologies, particularly social media networks like Facebook, LinkedIn, and X. This has given rise to e-recruitment, where all recruitment activities, from finding and attracting to evaluating potential candidates, are conducted using internet technologies (Alan, 2023: 42). According to Vardarlier and Ozsahin (2021: 17)'s research, HRM managers frequently utilize social media tools for recruitment, with LinkedIn being their preferred platform for all HRM processes. Research indicates that using LinkedIn in the recruitment process enhances HRM performance. Novac and Ciochină (2018: 746) reported that most participants agreed that the main advantage of using social media tools is time efficiency. These tools help HR managers and recruitment agencies quickly gather candidate information, interact with passive candidates, and filter them during the screening process. Additionally, interviewees noted that having an online social network presence is beneficial for job-seeking candidates, as not all positions are listed on recruitment websites.

New technologies such as big data and artificial intelligence can support the decision-making process in recruitment by automatically matching candidates' CVs with job descriptions (Ozkan-Ozen and Kazancoglu, 2022: 326). The application of AI in the recruitment stage of HR simplifies managers' tasks and helps them make accurate matches. While humans still make the final decision, AI aids them in recognizing and aligning candidate criteria with job requirements. Typically, HR professionals spend around 30% of their time planning and interviewing candidates during recruitment. AI tools can streamline this process by quickly identifying candidates who best fit the job requirements, saving significant time (Kambur and Yildirim, 2023: 438). Vorzhakova and Boiarynova (2020: 144) also state that the use of artificial intelligence in the recruitment process is prevalent in candidate search, evaluation, interviews, and hiring stages.

Training and development is the second most important function of HRM in the digitalization process, following recruitment. Borovskikh et al. (2020: 827) stated that internet resources are used for the professional training of employees, while Vardarlier and Ozsahin (2021: 14) revealed that social media tools, especially LinkedIn and Google+, are also utilized in training activities. With this shift, large organizations have adopted web-based training programs, alleviating the administrative burden on HR managers. E-learning, as defined by Stone and Dulebohn (2013), includes synchronous and asynchronous training using various instructional tools such as texts, graphics, videocassettes, CD-ROMs, online learning, video conferencing, and interactive TV. These technologies enable organizations to train employees globally, significantly reducing the costs of traditional face-to-face training (Kambur and Yildirim, 2023: 440). Modern learning systems such as Pathgather, Degreed, SAP Jam, Oracle's Video Learning, Workday Learning, and Skillsoft's new platforms have emerged, offering educational materials, video, and mobile learning solutions. Platforms like Coursera, Udacity, EdX, and Udemy, along with others, provide micro-learning opportunities and integrate extensive web-based libraries of Massive Open Online Courses (MOOCs). These systems allow employees to engage with experts online in their respective fields at convenient times (Alan, 2023: 41-42). Using those new systems in applications such as orientation and in-job training is effective in terms of decreasing the learning time (Ozkan-Ozen and Kazancoglu, 2022: 326).

Performance management is another prominent function in the digitalization of human resources. Zhou et al. (2020: 24) base their prediction that digitalization in human resources will enhance firm performance on two main grounds. First, the effective collection, processing, and use of employee data through digital technologies can significantly improve HR functions. Second, data analysis can identify key personnel whose performance has the most substantial impact on the business. Likewise, Vorzhakova and Boiarynova (2020: 143) noted that managers can obtain employee data, such as work history, team details, and performance ratings. Additionally, conversational AI can provide insights into analytics and key performance metrics by interacting with chatbots. Kambur and Yildirim (2023: 427) also highlighted the effectiveness of AI tools for performance evaluation, noting that they can quickly and objectively assess employees. Moreover, AI facilitates the measurement of daily performance rather than annual evaluations. Since performance evaluation is an ongoing process, it is more beneficial to observe the entire working period, not just the yearly results. Chen et al. (2021: 6, 22) take a broader perspective and state that ICTs transform performance appraisals, making

them more comprehensive, objective, and transparent. They emphasize that the more companies apply ICTs, the more standardized and transparent their performance appraisal and promotion mechanisms can become. This ensures that female employees are evaluated more fairly, thereby accelerating career development.

Career development has also become an area where human resources are increasingly leveraging digital tools, but it was evaluated as the least mentioned function in the analysed studies. AI tools can assist the HR department in offering tailored career development through various learning and development programs. These initiatives will boost employee productivity and job satisfaction, lower work-related stress, decrease employee turnover, and provide numerous other advantages (Alan, 2023: 42). Moreover, the e-career management counseling process has transformed the traditional approach by enabling instant communication between organizations and employees/consultants. Companies and personnel can interact through website recordings and video conferencing systems to receive career counseling services. This service significantly influences employees' promotion decisions and job choices. Another benefit of using digital tools in career management is the ability to make fair decisions regarding promotions. AI helps ensure promotions are unbiased, fair, and based on talent. Without AI, it is challenging for managers to make impartial decisions, as human actions are often influenced by emotions (Kambur and Yildirim, 2023: 441-442). Chen et al. (2021: 15) have also demonstrated that information and communication technologies make promotions fair and transparent, enabling women to achieve equal conditions with men.

Apart from the aforementioned core HR functions, the analyzed studies also associate digitalization with talent management (Santoso et al., 2021; Vardarlier and Ozsahin, 2021; De Bruyne and Gerritse, 2018), salary and compensation management (Kambur and Yildirim, 2023; Vorzhakova and Boiarynova, 2020), and workforce planning (Minbaeva, 2021).

5.2. Impact of Digitalization on HR Activities

Under this heading, we analyzed the positive and negative effects of digitalization on HR applications, as per RQ2.

Undoubtedly, digitalization is an area where applications are assessed based on both positive and negative outcomes, with continued implementation driven by the predominance of positive results. In the scientific studies reviewed for this research, the foremost positive aspect of digitalization in human resources is the increase in efficiency. For HR, digitization entails incorporating extensive digital practices into all processes and systems, while also achieving operational efficiency and cost optimization using digital tools (Minbaeva, 2021: 4). Similarly, Zhou et al. (2021: 22) highlighted the concept of efficiency when defining the digitalization of HRM, describing it as the use of digital technologies and relevant data to enhance efficiency and effectiveness in the field. The analysis of current labor market trends has shown that the ongoing development of human resources in the IT sector, along with employees' professional growth and career satisfaction, generally leads to increased efficiency (Melkumyan and Sahakyan, 2022: 43). In general, although many studies state that

digitalization in human resources increases efficiency, research on how and in which areas efficiency is increased is limited. For instance, Novac and Ciochină (2017: 104) mention time efficiency in the context of recruiters directly identifying candidates in online environments by using desired filters and selecting the right CVs based on specific profile characteristics. Borovskikh et al. (2020: 829) emphasize in their study on communication efficiency that various cloud solutions are employed to improve organizational communication and manage existing personnel effectively.

Automation of routine tasks can be expressed as a positive aspect that boosts efficiency. Artificial intelligence presents HR with an opportunity to automate routine and low-value tasks, allowing professionals to concentrate on more strategic initiatives (Vorzhakova and Boiarynova, 2020: 143). The initial computer-based systems created for HRM primarily automated payroll and other data-related tasks. Nowadays, AI assists in automating the interview process, evaluating both spoken and written assessments. Software like "Ay" enables digital interviews, enhancing the candidate experience with AI support. Besides, tools such as "Amy" and "Clara" are utilized for scheduling interviews and study sessions (Kambur and Yildirim, 2023: 433-434). Furthermore, Robotic Process Automation (RPA) utilizes intelligent AI or machine learning to mimic and automate repetitive tasks traditionally performed by workers, especially in data-intensive processes. RPAs can handle tasks like email management, data entry, report generation, and invoice processing. Also, cloud-based solutions such as Microsoft 365 enhance collaboration and productivity. AI tools enable HR departments to personalize career development through various learning programs, potentially reducing stress and turnover while boosting job satisfaction (Alan, 2023: 42).

Another factor that is considered as an advantage in the digitalization of HR and supports effectiveness is cost advantage. Vardarlier and Ozsahin (2021: 3) identify cost reduction, decreased bureaucracy, and savings on paper as key benefits of digital human resources management. In their studies, Novac and Ciochină (2017: 104; 2018: 474) emphasize that online recruitment activities are more cost-effective compared to traditional methods. Melkumyan and Sahakyan (2022: 38) also support this view. Borovskhik et al. (2020:830) describe the benefits of the use of the personnel electronic document management system, emphasising that it significantly reduces the cost of sending the document. Vorzhakova and Boiarynova (2020: 127) demonstrate through their multivariate multicriteria analysis that the adoption of artificial intelligence reduces human error and enhances efficiency in terms of time and costs. Kambur and Yildirim (2023: 430) similarly argue that AI applications significantly reduce business costs, streamline core HR functions, enhance HR's data analytics capabilities, and automate candidate information presentation, thereby potentially lowering operational expenses. The study also indicated that technology-based training activities (p. 440) and AI-based performance appraisal systems (p. 441) also lead to cost reductions.

Facilitating and supporting learning is also one of the positive aspects of digitalised HR practices. Information technology applications create learning opportunities (Mahmoodi et al., 2023: 1461) and new technologies bring new approaches to learning, for example, cloud technologies can be used for distance learning in the coming years (Borovskikh et al., 2020: 829-830). On the other hand, employees have the opportunity to follow trainers and participate in training sessions via social

media, allowing them to gain new knowledge and experiences related to their field of expertise (Vardarlier and Ozsahin, 2021: 5). AI also allows educational platforms to emulate the success of popular services like YouTube and Netflix, enhancing educational results. Key areas influenced by this technology include personalized learning pathways, e-learning analytics, and conversational interfaces (Vorzhakova and Boiarynova, 2020: 145). Additionally, AI can identify and recommend appropriate training programs for specific units and technologies. By analyzing work performance, it can also suggest various development options for employees. This allows employees to attend training sessions at their convenience, saving time and avoiding irrelevant information. Furthermore, AI can be utilized to collect feedback from these training sessions (Kambur and Yildirim, 2022: 440).

While digitalizing HR functions offers numerous benefits, it also presents challenges such as data security risks, skill gaps, and potential resistance to change, which can impact the successful implementation of digital HR systems. Data security is one of the most concerning issues in digitalization. In the analysed studies, it is stated that cloud-based systems raise doubts about data security and privacy (Kambur and Yildirim, 2022: 435). Similarly, Alan (2023: 51), citing Malik et al. (2022), states that the adoption of AI has significant negative impacts, including the potential risk of data security breaches, drastic organizational changes resulting from digital transformations, and increased business risk and insecurity.

One of the disadvantages of Industry 4.0 adaptation and technology use is the skills gap. Gyurák Babeľová et al. (2022: 9) identified the need for education, retraining, and adaptation as the reasons for this disadvantage. Employees should receive technical training when new digital and AI technologies are introduced in the HR unit. Without this training, they might experience uncertainty and resist the changes, perceiving digital technologies as a threat (Kambur and Yildirim, 2022: 442).

Although the cost factor in the digitalization of HR is generally seen as an advantage, it is sometimes viewed as a disadvantage because implementing new technologies can be costly. For instance, establishing Industry 4.0 infrastructure involves significant expenses for organizations, including ongoing costs for training employees in digital systems. The return on investment for these expenditures is uncertain, posing a challenge for workforce development in Industry 4.0 (Ozkan-Ozen and Kazancoglu, 2023: 316). Similarly, Kmecová et al. (2021: 243) noted that digitizing human resources will demand considerable time and large investments. For SMEs with few employees, the benefits may not outweigh the costs.

One HR function where the drawbacks of technological applications are evident is performance appraisal. Minbaeva (2021: 5) illustrated the negative impact of digital technologies on performance evaluations using IBM as an example. IBM implemented an algorithm that assigned points to assess employee performance. Higher points meant greater job security. However, the algorithm was flawed, awarding more points to newer employees, regardless of skill. Consequently, those with only a few years at IBM received more points than long-term employees. Despite 80% of experienced, older workers being deemed "good enough to stay at current job levels or be promoted" by the company, the algorithm's results indicated that 20,000 older workers should face early retirement, voluntary resignation, or termination.

According to Mahmoodi et al. (2023: 1467-1471), while new technologies have positive effects in terms of increasing employee motivation and individual satisfaction, they have negative effects in terms of organizational values, stress, and time management. Similarly, Palumbo and Cavallone (2022: 11) argue that although digitalization has positive effects on flexibility and adaptability, it can also have side effects on employees' psychosocial well-being by increasing work intensification, disrupting social exchanges, and fostering job insecurity. In the study, the areas where employees are negatively affected are detailed as time pressure, poor relationships with colleagues, difficulties in interacting with customers and irregular working hours. It is emphasised that digitalization always makes employees accessible, and this situation removes the boundary between work and life. Digitalization, which causes a decrease in face-to-face interaction, is considered negative in psychosocial terms.

The introduction of Industry 4.0 affects not only business process performance and employee efficiency but also impacts the employees personally. Although Industry 4.0 technologies are designed to enhance and simplify employees' work, they impose new challenges that some employees might struggle to meet. Additionally, automation has the potential to threaten or replace certain jobs (Gyurák Babeľová et al., 2022: 11). AI can automate or eliminate routine and repetitive tasks, potentially reducing the workforce in certain areas. At the same time, it can create new job opportunities just as quickly (Kambur and Yildirim, 2023: 442).

6. 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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