



REVIEW ARTICLE



<https://doi.org/10.1057/s41599-024-03795-8>

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# Mapping the main research themes in digital human resources

Laura García-Fernández<sup>1</sup>, Marta Ortiz-de-Urbina-Criado<sup>1</sup> & María-José García-López<sup>1</sup>

The COVID-19 pandemic sped up the digitalization process and revolutionized the world of the digital employee. And today, advances in artificial intelligence are having a major impact on the field of Digital HR. In that context, further literature review work is needed on the term Digital HR to complement previous studies and lay the foundation for more pioneering literature on this topic. Then, the aim of this paper is to provide a framework for organizing the main themes discussed in the pioneering literature on digital HR by answering the following research question: What is the knowledge structure of the research in the field of digital human resources? An adaptation of the PRISMA model is used to structure the research design. Applying a mixed methodology, this paper uses a bibliometric technique to identify the main topics studied in Digital HR. Subsequently, in-depth analysis and logical reasoning are applied and a model is proposed based on four questions (how, what, where, who) in order to understand and develop research on digital HR. The RQ4 Digital-HR model constitutes a useful tool in academic, practical, professional, and social contexts. It is worth highlighting the importance of the inclusion of artificial intelligence in the daily processes of a company, and therefore in the progress of the proposed research topic.

## Introduction

The world is witnessing constant change due to digitalization and its effects on companies and their staff. The pandemic accelerated the adoption of digital technologies, which had an immense impact on all business sectors and brought about permanent changes in the workplace (Gkinko and Elbanna, 2023). Many organizations started working in hybrid mode, combining digital ways of working with the traditional ways of working prior to the pandemic. Moreover, the use of digital technologies and the acceptance of more agile and flexible procedures and rules have changed the way in which work is being done (Mičić and Mastilo, 2022).

In general, our daily lives have been altered by technological advances, one of the most innovative being the advances in artificial intelligence, which is transforming the way people carry out their daily activities of work, communication, and decision making (Duke, 2022). The concept of artificial intelligence seems to be relatively recent, and in many cases, its true meaning or significance is unclear. However, it was not until the 2010s that the AI paradigm was reconfigured to be based on the classification and storage of massive data (Cetindamar et al. 2024).

<sup>1</sup>Universidad Rey Juan Carlos, Madrid, Spain. ✉email: [l.garciafer.2022@alumnos.urjc.es](mailto:l.garciafer.2022@alumnos.urjc.es)

Human resource management has evolved over time. Twenty-five years ago, its main focus was on implementing practices that promoted the development of organizations. However, the need for organizations to adapt to more competitive environments has forced businesses to adjust the traditional business management model, moving from strategic management to a more sustainable management approach (Villajos et al. 2019). One of the main factors influencing the adaptation of human resources management to the new sustainable management model has been digitalization (Le et al. 2024). Through digitalization, all employees, professionals, managers and business leaders, who are key to making the necessary changes to increase workplace productivity, can see their tasks facilitated through this phenomenon. In this context, human resources management develops practices that promote the welfare of the employee and the company (Le et al. 2024). Thus, in recent years, and especially during the COVID-19 pandemic, Digital Human Resources (Digital HR) has received a great deal of attention, particularly regarding Digital Employees and Digital Leaders. Advances in artificial intelligence are having a major impact on the field of Digital HR (Gkinko and Elbanna, 2023). Although there are still few publications on the acceptance of the effects of AI on workers and how the current increase in the use of digital technologies affects the skills and expectations of the digital workforce (Alan, 2023; Cetindamar et al. 2024).

In the academic context, there has been a surge in the literature on Digital HR. However, literature review studies on this topic are lacking, with most of them focusing on analyzing the digital workplace phenomenon (De Moraes et al. 2024; Marsh et al. 2022; Mičić and Mastilo, 2022), digital employee experience (Moganadas and Goh, 2022), and workforce training in digital workplaces (Patino and Naffi, 2023). Only two reviews address the issue of Digital HR more generally. Theres and Strohmeier (2023) conducted a meta-analysis to analyze theories applied in research on Digital HRM adoption and proposed a unified theory. Alan (2023) performed a co-word analysis, considering Electronic Human Resources Management (e-HRM) as the main term, and analyzed previous literature found in the Web of Science (WoS) for the period of 2012–2022.

Thus, further literature review work is needed on the term Digital HR that analyzes the literature published before and during the pandemic to complement previous studies and lay the foundation for more pioneering literature on this topic. The interest in analyzing changes during the pandemic is motivated by the fact that adapting to the new context requires new human resources actions that are closely related to the phenomenon of digitalization. Digital HR is a constantly evolving topic, and pioneering studies are fundamental to understanding this new phenomenon. Today, there is also the challenge of appropriately and ethically adopting artificial intelligence in the context of human resources (Cetindamar et al. 2024; Gkinko and Elbanna, 2023). In the face of a novel topic, it is important to gain an overview of the aspects studied, to understand the changes that have occurred around the pandemic, and to provide a logical framework of analysis by which to explore such phenomena.

This paper aims to provide an overview of the pioneering research landscape in the field of digital HR, filling in some of the existing research gaps. As a complement to Alan's (2023) work, this research will focus on the topic of 'digital HR' and conduct a co-word analysis to identify the main themes studied. Moreover, a second step, which is not usually included in previous literature reviews on this topic, will be carried out to detect the applications of digital human resources. To this end, a model based on questions (how, what, where, who) is proposed to facilitate the understanding and development of digital HR research.

Thus, the aim of this study is to provide a framework for the organization of the main themes that are discussed in the

pioneering literature on Digital HR. The research question addressed is What is the knowledge structure of the research in the field of digital human resources? To answer this question, the Background section is developed and a mixed methodology is applied, adapting the PRISMA process. A bibliometric technique is used to identify the main topics studied in Digital HR. Subsequently, in-depth analysis and logical reasoning are applied to propose a model and some lines of future research. Finally, the Conclusion section contains theoretical and practical implications, the study limitations, and future lines of research.

This paper is an original contribution. Literature reviews, and more on rapidly developing novel topics, play an important role in advancing research as they help to synthesize and organize existing knowledge and identify areas or topics for future research. This article proposes an integrative review (Patriotta, 2020) that offers another voice to guide and write new articles on digital human resources. Authors such as Post et al. (2020) have also highlighted the importance of literature reviews as they can serve several purposes such as helping researchers understand the research topic, discerning important and under-examined areas and connecting research findings from disparate sources to create new perspectives and phenomena. Moreover, the topic "Digital HR" calls for looking for models that help connect academic research with the business world. As Markman (2022) proclaims, academia is challenged to develop research that addresses current problems affecting people, business and society to make the world a better place. In that line, the RQ4 Digital-HR model constitutes a useful tool for academic, practical, professional, and social contexts.

## Background

The global pandemic has accelerated digital transformation in every sense, and the rise of digital technology in the workplace is unstoppable (Kalischko and Riedl, 2021). Technology plays a vital role in our day-to-day lives. Digitization has arrived, yet what that means or entails at a work and/personal level remains unclear. According to Kraus et al. (2022), it is necessary to have a fundamental understanding of literature reviews as independent studies. Therefore, the key texts must be identified that lay the foundations of Digital Human Resources Management (Digital HRM) before undertaking a bibliometric study.

**Main concepts.** Few papers over the last decades have provided a clear, agreed-upon definition of the term "Digital Human Resources Management" that is shared by the scientific community. Most papers have only superficially addressed the whole social and economic context that affects the new confection of digital employee models. Moreover, papers have tended to narrow their focus to a specific aspect of human resources management (Alan, 2023; Costa et al. 2022), digital employee experience (Moganadas and Goh, 2022), and job performance (Kalischko and Riedl, 2021; Marsh et al. 2022), analyzing the situation individually and rather than as a whole. Therefore, the starting point for this study is to introduce some of the terms or concepts commonly used in previous literature on digital HR. Two widely used terms are "digital worker" and "digital employee". A key resource in any company is the employee, the one who can contribute to superior and solid performance over time (Moganadas and Goh, 2022). For example, Fuchs (2014) defines digital employees as the workforce required for the existence, use, and application of digital media. Other studies define digital employees as those employees whose work is performed primarily using digital resources (Nelson, 2018). IBM (2024) states that "in the past, the term 'digital worker' described a human employee with digital skills, but more recently, the market

has defined it as a category of software robots, which are trained to perform specific tasks or processes in partnership with their human colleagues.”

Another concept used is “digital workplace.” As management has adapted to new technologies, the workplace has also had to adapt. This new leadership style brings with it concepts such as flexibility, which in this context refers to the non-limitation of the workspace to a specific physical location. This new digital workplace refers to the set of technologies that employees use to perform their functions (Marsh, 2018) and includes, among others, the intranet, communication tools, e-mail, CRM, etc. It also refers to a set of procedures and rules that maximize productivity and improve collaboration, communication, and knowledge management (Micić et al. 2022). Some researchers use the term “digital labor”, which initially referred to the unpaid work performed by consumers online during leisure time. However, this term is now used to describe all work in which digital technology plays a role (Jarrett, 2022). The term has also been used to describe employees who work independently, receiving low wages and no social security, in business models supported by digital platforms, such as Uber (Fumagalli et al. 2018), or to describe the workforce that uses other business models that are also based on digital platforms, such as Facebook or Google, and that capture information to transform it into big data (Fuchs and Sevignani, 2013).

In that context, another important concept is digital platform. Digital platforms are transforming almost every industry today (Reuver et al. 2018). They are continuously evolving and becoming increasingly complex. These digital platforms are the ones that facilitate online communities of consumers (Reuver et al. 2018). While there are several definitions of digital platforms that refer to the codes, software, and hardware of which they are composed, for this study the most suitable definition of digital platform would be the environment in which companies combine all the information available from their stakeholders to generate or co-create value (Karhu et al. 2018). According to Murati (2021), a digital platform is an open infrastructure that exercises a facilitator role or a high level of control and influence over providers and users.

The meeting point of each one of these concepts is the term Human Resource Management, which is understood as the processes that involve activities from recruitment to salary management and that are carried out simultaneously (Alan, 2023). All of these processes have been equipped with more technology and innovative methods over time. Thus, the concept has evolved to Digital Human Resource Management (HRM), understood as the set of software, hardware, and digital resources designed to automate the HR function (Jani et al. 2021; Marler and Parry, 2016), or in other words, to develop consistent, efficient and high-quality HR practices through the use of digital transformation and new technologies (Bondarouk and Brewster, 2016).

**Previous literature reviews.** Previous literature reviews established a set of definitions that, despite using common concepts, have left nuances that have yet to be fully addressed in subsequent works. Most of the work that reviews previous literature has focused on studying digital workplaces. Micić and Mastilo (2022) conducted a systematic literature review on the digital transformation of the workplace and employees’ workplace preferences. The search terms used were “digital workplace”, “COVID-19”, and “innovation”, and the search was limited to English language papers published after 2010. The benefits of digital workplace transformation are analyzed and the critical success factors and significant challenges are identified.

Marsh et al. (2022) studied the application of digital technologies in the workplace with a particular focus on their dark side. They conducted an integrative literature review and limited the search to papers published between January 2007 and June 2020 that were written in English and carried out in Western countries only (in the United States, Europe, Canada, Australia, Latin America, and New Zealand). De Moraes et al. (2024) conducted a systematic review of the literature on the design of digital workplaces. Their main results include a definition of digital workplace and a four-phase model with guidelines for designing digital workplaces. Patino and Naffi (2023) conducted a systematic review of training approaches and resources for workforce development in digital workplaces. Using the PRISMA model, they analyzed articles published between 2020 and 2022. Their paper offers research-based perspectives and recommendations for employee training in highly digitalized workplaces.

Another aspect that has been studied is the experience of the digital worker. Moganadas and Goh (2022) discuss the concept of digital employee experience (DEX). They conducted a comprehensive literature review on DEX by analyzing the content of academic publications and professional reports. They used the Scopus and Google Scholar databases to identify “DEX” or “digital employee experience” in their title, abstract, and keywords and found 17 articles between 2016 and 2022. To complement these papers, they included grey literature to identify studies that addressed a similar topic, such as digital transformation, digital workplace, and employee experience.

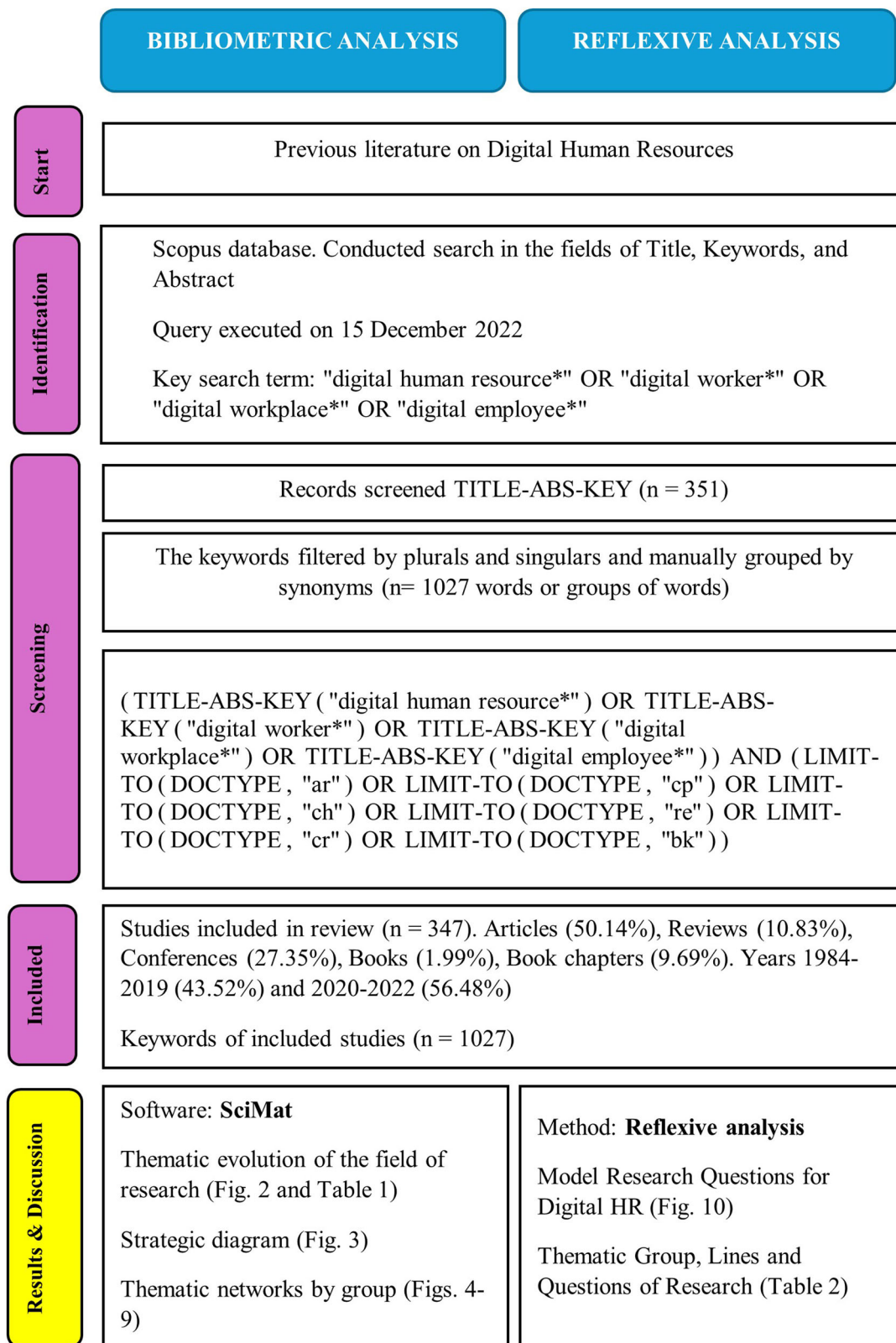
Finally, a few papers have reviewed the literature on human resource management in a digital environment. Theres and Strohmeier (2023) analyzed the phenomenon of digital HRM. In their paper, they present an overview of the theories applied in digital HRM adoption research and propose a unified theory. To test their theory, they performed a combination of meta-analysis and structural equation modelling. Alan (2023) presented a systematic bibliometric analysis of electronic human resource management (e-HRM) by conducting a literature search in the Web of Science (WoS) for the period of 2012–2022.

## Methodology

Figure 1 presents the methodological process used in this study. The methodological design used includes two parts. In the first, a multi-step process has been followed to perform the bibliometric analysis: sample selection, filtering of documents and keywords, and co-word analysis. In the second, a reflexive analysis was carried out. To facilitate the understanding of the process followed, the PRISMA 2020 statement has been adapted, which has been designed primarily for systematic reviews of studies (Moher et al. 2010; Page et al. 2021). The adaptation of the PRISMA process provides a more transparent view of the methodology used and the analyses carried out.

The Scopus database was used. There is an open debate regarding whether Scopus or WoS is superior. Both have advantages and disadvantages (Stahlschmidt and Stephen, 2020). The Scopus database was chosen for this paper because it offered a larger sample of documents than did WoS. Although the research on Digital HR began over 35 years ago, most of the articles have been published in the last three years, demonstrating the impact of the COVID-19 pandemic on this topic. Until the year 2016, contributions were sporadic, and it is not until a year later, in 2017, that the research begins to approach 25 articles per year. Of the total of articles (347), 56% (196) were published between 2020 and 2022, with 2021 being the most important year, when a total of 82 articles (25%) were published.

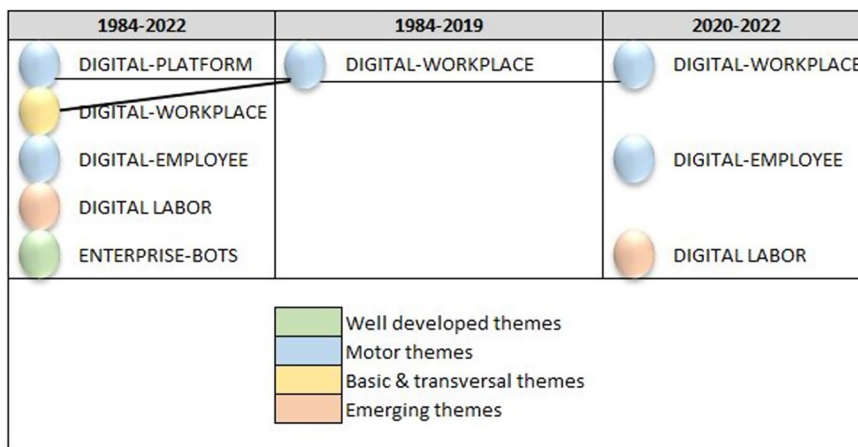
A co-word analysis in conjunction with the SciMat program was used to identify the various themes covered in the literature on Digital HR (Cobo et al. 2012). Of the many tools that enable



**Fig. 1 Methodological process.** Own elaboration based on the PRISMA model.

co-word analysis, SciMat was chosen for its ability to carry out the analysis with simplicity and rigor. Moral-Muñoz et al. (2019; 2020) describe the various tools that are available for bibliometric analysis and comment on SciMat as being a valid tool for co-word analysis. SciMat was suitable for achieving the objective of this

paper because it analyzes the keywords of selected articles and calculates the strategic diagrams and networks for each thematic group. Moreover, SciMat incorporates all the necessary elements (methods, algorithms, and measurements) for performing a co-word analysis and obtaining its visualizations (Cobo et al. 2012).



**Fig. 2 Thematic evolution of the field of research.** Results from SciMat, diagram composed of themes by number of documents for all the periods.

Periods	Thematic groups	Group type
1984-2022	Digital platform	Motor
	Digital employee	Motor
	Digital workplace	Basic-transversal
	Enterprise bots	Well developed
	Digital labor	Emerging
1984-2019	Digital workplace	Motor
2020-2022	Digital employee	Motor
	Digital workplace	Motor
	Digital labor	Emerging

Source: own elaboration.

Regarding the strategic diagram, centrality and density are calculated for each thematic group (Cobo et al. 2018). Centrality is a measure of the importance of a theme in the development of a field of knowledge. Density reflects the strength of a network’s internal relationships, thus identifying the level of development of that theme. The strategic diagram classifies the themes into four groups (Cobo et al. 2018). In the upper-right quadrant are the motor themes, which comprise themes that have strong centrality and high density. In the upper-left quadrant are the well-developed and/or isolated themes. The themes in the lower-left quadrant are presented as emerging or disappearing themes, while in the lower-right quadrant are themes that are considered basic and transversal themes.

**Results**

This section presents the results of the co-word analysis. The bibliometric technique is suitable for identifying the knowledge structure of a research topic. Given the volume of articles published between 2020 and 2022, two periods of analysis were carried out to compare the networks that emerged prior to and after the COVID-19 pandemic. Figure 2 shows the evolution of all the topics mentioned, their typology, and how, depending on the period, they transform into a new topic.

Table 1 presents the evolution that Digital HR research has experienced during these years.

**Main themes studied in Digital HR.** Regarding the total period (1984-2022), previous research focused on “digital workplace” and “digital platform” and “digital employee” as the motor themes. “Digital labor” appears as an emerging topic and as something remarkable. Despite not being connected to the

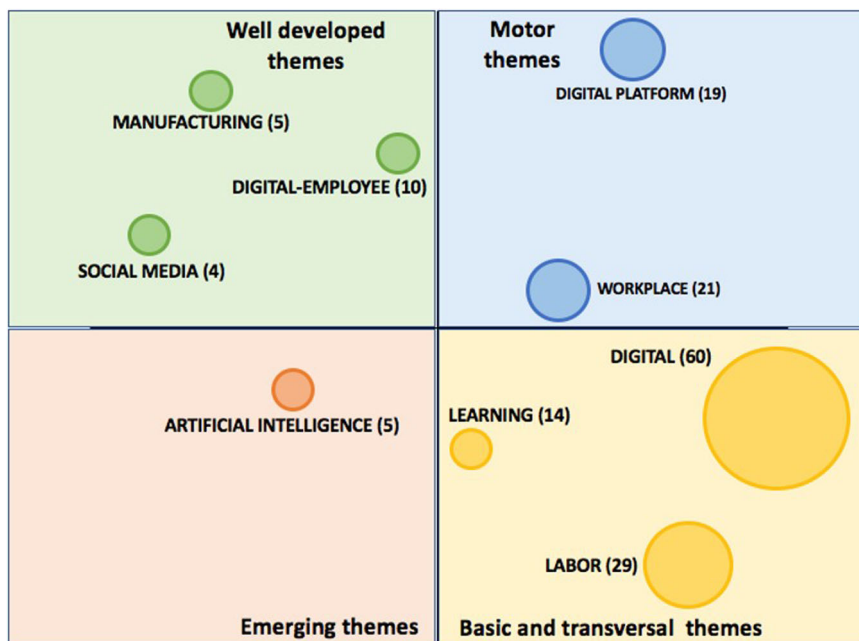
human resources area, this entire digitization process is linked to the topic “enterprise bots”, a concept that had previously been highly developed in scientific fields. During the pre-COVID period (1984-2019), the motor theme was the “digital workplace”. During the COVID period (2020-2022), the motor themes were “digital employee” and “digital workplace”. Lastly, the emerging theme for all the periods is “digital labor”.

During the first period (1984-2019), only one theme, “digital workplace”, is positioned as a motor theme. It makes sense that after the 4<sup>th</sup> industrial revolution, developed between 1950 and 1970, a study period would begin regarding how this digitization has affected the workspaces as well as how to continue innovating and improving them. Companies have needed workplaces to be transformed from a traditional perspective to a digital one (Colbert et al. 2016; Kaarst-Brown et al. 2018), since this change is key to organizational success (Colbert et al. 2016, Köffer, 2015).

In the 2020-2022 period, two additional topics to those appearing in the previous period emerge. These are “digital employee” and “digital labor”, positioned as a motor and an emerging theme, respectively. These topics correlate with what occurred during the pandemic, which forced the digitalization of all types of situations. As a result, the research on this area has focused on the employee and, above all, the digitization of work that, as mentioned, appears as an emerging topic.

Based on these results and for the completion of the analyses, a manually and logical regrouping of themes was conducted in the SciMat program, and another strategic diagram was identified. Figure 3, which presents the strategic diagram obtained from this new analysis, shows that the motor themes are “digital platform” and “workplace”. “Manufacturing”, “digital employee”, and “social media” are well-developed themes. “Digital”, “learning”, and “labor” are positioned as basic themes. Finally, the emerging theme is “artificial intelligence”. A logical knowledge structure of the study topics can be observed. On the one hand, what emerges are the themes related to the more digital aspect of work, namely “digital”, “digital platform”, and “digital employee”. On the other hand, there are items that refer to the more physical aspect, “labor” and “workplace”. Tangential to the most digital aspect linked to work is the communication channel or media used at work, “social media”. In turn, in the main sector where the research is applied or where the literature has further explored these issues, the theme of “manufacturing” is also well defined.

Also evident in the diagram is the channel through which employees can progress in the work environment, through “learning”, a Human Resources practice that has been developed for some time but has become more crucial in recent years. Learning is the key to employees acquiring digital competencies



**Fig. 3 Strategic diagram.** Results from SciMat, diagram composed of themes by a number of documents for all the periods.

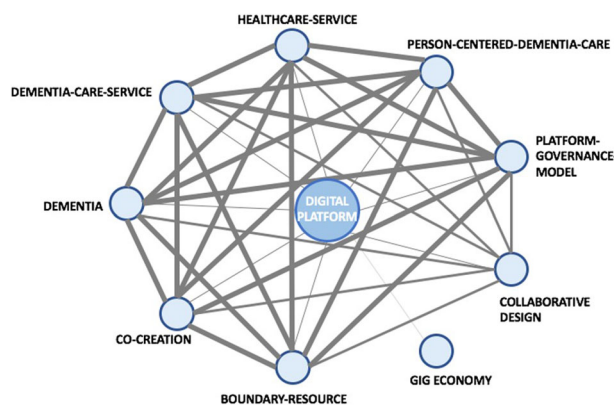
and feeling comfortable in digital work environments. Finally, as an emerging topic, is everything related to “artificial intelligence”. This topic, of relatively recent creation, has all the works published in the year 2022 or later, and is creating a highly critical space in the business environment, and in this particular case, in everything related to Human Resources and how to implement it in departmental processes.

**Thematic networks in Digital HR.** It is interesting to know the thematic networks in which the most significant keyword (the one with the highest centrality) is placed at the center. The size of each node represents the number of documents containing that word, and the thickness of the line indicates the strength of the association between those topics.

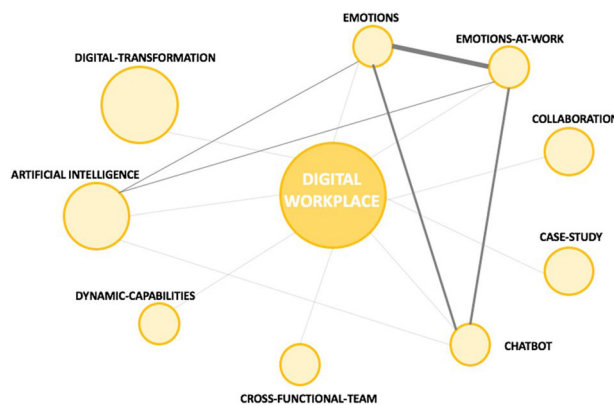
*Digital platform.* Analysis of the “Digital Platform” subnetwork (Fig. 4) for the period 1984–2022, reveals four documents and a wide network of terms that correlate with each other. The most notable relationships are those related to health care. However, within our scope, there are several studies that focus on the use of digital platforms as a means of offering work in the “gig economy.” Taylor et al. (2017) define the concept of Gig Economy as the use of applications or platforms for work.

The analysis also revealed the importance of collaborative work for the improvement of digital platforms, as shown through the connections between the terms “collaborative designs” and “co-creation”. The research also showed two important advances in what has been studied in recent years: the flexibility that this type of work facilitates (Soriano and Cabanes, 2020) and how these new jobs can change the lifestyle of digital employees (Graham et al. 2017).

*Digital workplace.* The “Digital workplace” network (Fig. 5) for the period 1984–2022 includes six documents and shows that the most important keywords in the cluster are “digital transformation” and “artificial intelligence”. Again, it is crucial for this network to talk about “collaboration”, as well as “cross-functional teams” and their “dynamic capabilities” that play a special role in developing the digital workplace. As Selimović et al. (2021) posit, the inclusion of the employee in the decisions on digital

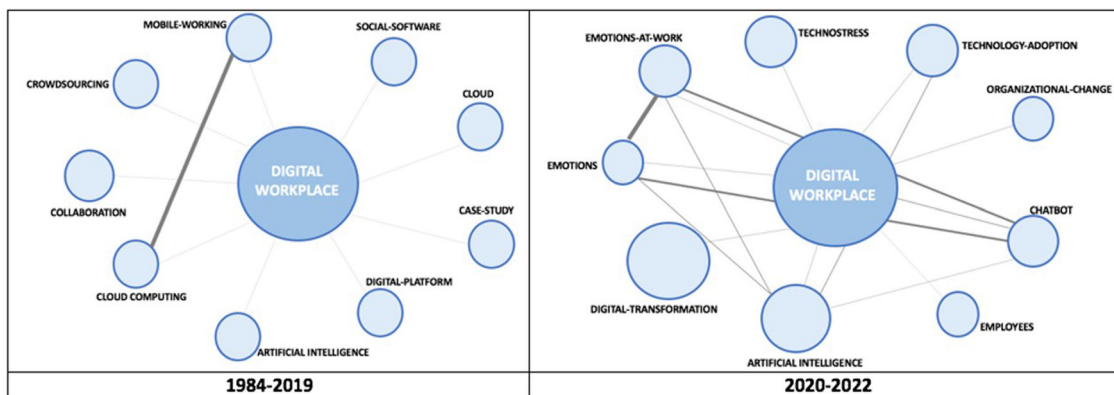


**Fig. 4 Thematic network for “digital platform” cluster (1984–2022).** Results from SciMat cluster network for the digital platform.

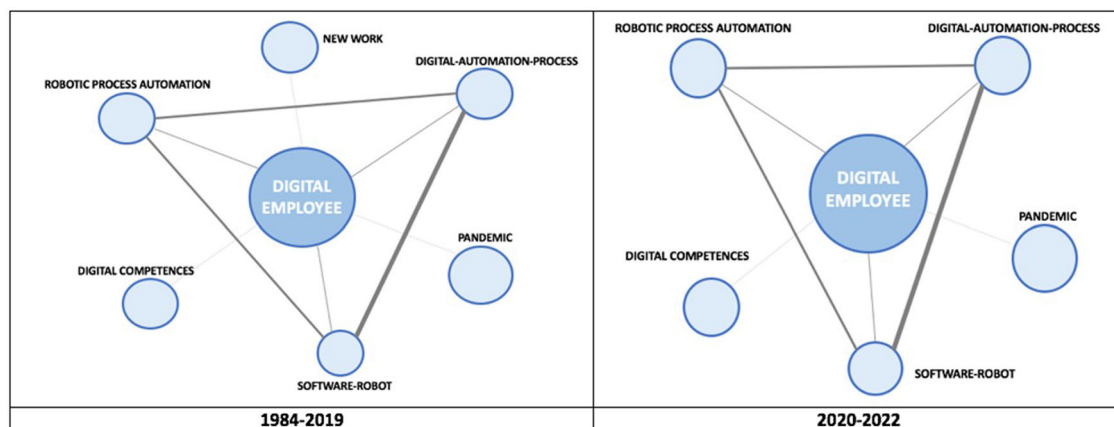


**Fig. 5 Thematic network for “digital workplace” (1984–2022).** Results from SciMat cluster network for the digital workplace.

transformation is a key to its success. Moreover, the use of artificial intelligence, through the “chatbots” makes improvement in the workplace possible (Cetindamar et al. 2024). In both cases, the focus is placed on the inclusion of the employee as a key part of



**Fig. 6 Thematic network for “digital workplace” (1984–2019 and 2020–2022).** Results from SciMat cluster network for the digital workplace.



**Fig. 7 Thematic network for “digital employee” (1984–2022 and 2020–2022).** Results from SciMat cluster network for digital employees.

these processes. This demonstrates a strong relationship between digital and emotions in the cluster, since understanding how the use of technology affects employees’ emotions (Gkinko and Elbanna, 2022) is one of the most relevant topics in the current research.

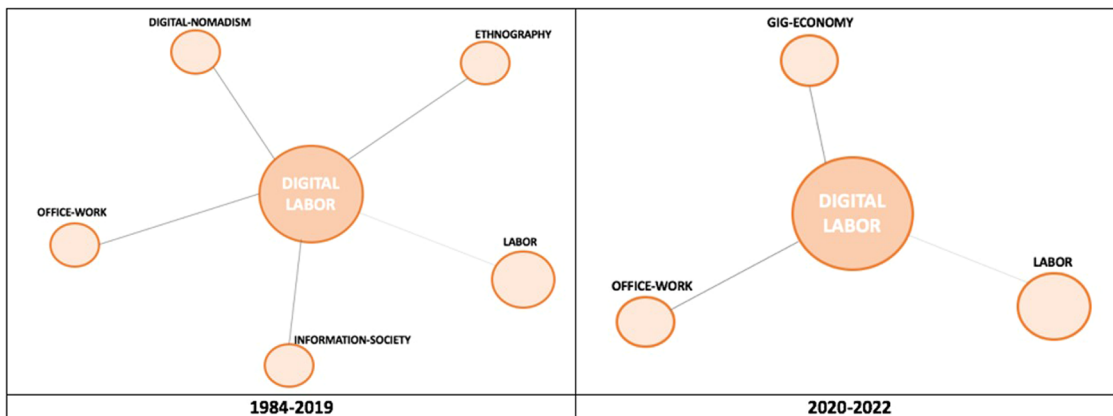
The analysis of the “Digital workplace” network (Fig. 6) for the period 1984–2019, which contains 15 documents, reveals the strong presence of terms related to a collaborative work environment, such as “collaboration”, “cloud”, “cloud computing”; or even advancing further in the collaboration itself, it becomes necessary to talk about “digital platforms” or “crowd-sourcing”, as means for it, being the key tools for developing the digital workplace (White, 2012; Attaran et al. 2019). Indeed, the most remarkable aspect of the network is the strong connection between “cloud computing” and “mobile working”. It must be considered that during these years, prior to the COVID-19 pandemic, the now-standardized option of mobile working was merely a practice applied by a few companies. Thus, it makes sense that during these years of strong digitization, research focuses on it. There is also one term, “artificial intelligence” (here also mentioned as “social software”), that researchers start to investigate during these years, since its use in the digital workplace is continuing to increase (Martensen et al. 2016) and, as could be seen throughout the paper, it will also become of vast importance for other networks.

For the last years (2020–2022), “Digital workplace” network (Fig. 6) contains the highest number of documents (16) and shows two remarkable themes “digital transformation” and “artificial intelligence”. In the figure can be seen a triangle formed by “emotions”, “emotions at work”, and “chatbot”, as employee users experience a connection emotion when using artificial intelligence

(Gkinko and Elbanna, 2022), and there is an effort to understand how employees will accept these new systems in the enterprise context (Brachten et al. 2021). Moreover, in these recent years, the changes that companies must make to achieve the digitalization of the workplaces takes on a special relevance. Thus, it is not surprising that the investigation is linked to “organizational change” and “technology-adoption”. It should not be overlooked that none of these changes would be possible without including the “employees” in said decisions (Cetindamar et al. 2024).

There is a topic that remains throughout the analysis: “artificial intelligence” (Fig. 6). However, there is a positive evolution between the topics analyzed prior to the pandemic and those analyzed after it. In the first period (1984–2022), the topics were focused on how the workplace should be or what it should contain and how it should be digitized, as well as on platforms and software and everything related to the cloud. However, during the pandemic period, some changes were perceived, with the introduction of themes arising from having been forced to implement the digital work modality. These topics include technostress, emotions, and employees, as well as everything related to organizational change.

*Digital employee.* The “Digital employee” network (Fig. 7) for the period 1984–2022 contains 10 documents and shows, as previously mentioned, the relevance of the pandemic in this research. In this sense, it is crucial to understand how this situation affected the employee, the work itself, and the life experience of employees (Muszyński et al. 2021). Above all, it shows a strong connection between the concepts related to “Robotic Process Automation” (RPA), “digital automation process”, and “software robot”, as a means to increasing productivity in a company, leaving the



**Fig. 8 Thematic network for “digital labor” (1984–2022 and 2020–2022).** Results from SciMat cluster network for digital labor.

routine tasks to RPA and assigning employees to perform more difficult tasks (Choi et al. 2021). Clearly, it is crucial to talk about the “digital competencies” that employees have or need to acquire to be included in the “new work” that globalization is forcing us to implement.

The “Digital employee” network, for the last years (2020–2022) (Fig. 7), with eight documents, shows that there have been no changes in recent years compared to what was already being studied. The only difference is that the research in these years does not focus on the new types of work, implemented post-pandemic, but studies how to improve the implementation of RPA (Costa et al. 2022) to achieve better economic results and an improved digital employee experience.

*Digital labor.* The “Digital labor” network (Fig. 8) for the years 1984–2022, contains nine documents and shows a star-shaped network characterized by the presence of keywords that only correlate with the cluster topic. The main theme of the cluster is the work itself with its main versions, with research on the best type of work being very common (Babapour Chafi et al. 2022): office work or digital work (commonly called digital nomadism). There is also an important connection with the information society.

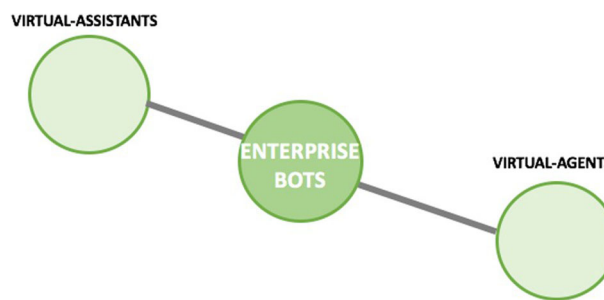
“Digital Labor”, for the last years (2020–2022), provides six documents (Fig. 8). Studies related to the “gig economy” and the types of jobs related to digital platforms proliferate during this period. In addition, once the pandemic period was over, it was expected that employees would return to office work. Thus, there arises a need to understand which work model (remote, face-to-face, or hybrid) is more productive and which is more valued by the employee (Babapour Chafi et al. 2022).

A comparison of studies prior to the pandemic with those of recent years reveals that initially there were several issues related to digital work, whereas in recent years these have been reduced to two issues: office work or work through digital platforms.

*Enterprise bots.* The “Enterprise bots” network for the period 1984–2022 (Fig. 9) contains two documents that co-relate two concepts, virtual assistants and virtual agents, as being crucial to understanding the differences between them, and above all, to understanding the differences in use between the individual and the business context (Stieglitz et al. 2018). The focus was therefore on teaching an employer how to effectively introduce these systems in the company (Brachten et al. 2021).

**Discussion**

The results of this study complement those of previous literature review studies. Alan (2023) focused on the term Electronic



**Fig. 9 Thematic network for “enterprise bots” (1984–2022).** Results from SciMat cluster network for enterprise bots.

Human Resources Management (e-HRM) and conducted a review of the literature included in WoS from 2012 to 2022. Our study focused on the term “digital human resources” and used the Scopus database. Our study also included pioneering literature up to 2022 and an analysis of the differences between the pre-pandemic period (1984 to 2019) and the peak years of the pandemic (2020–2022).

Alan (2023) categorizes the research on this topic into three groups: the theoretical studies and theories used in the studies reviewed, empirical qualitative studies, and empirical quantitative studies. Alan (2023) presents summary tables for each category that include following information: related theoretical framework, related terms, studies, typology of study, aim of the study, and the main findings and propositions. In a complementary way, this current paper presents the studied themes and classifies them into four groups according to the strategic diagram and analyses the networks for each thematic group. Additionally, based on the results obtained in the previous section, a process of analysis and reflection was carried out to establish the roadmap of topics studied and to define the emerging and future topics. Four main research questions (how, what, where, who) are considered to propose a model (Fig. 10).

The RQ4 Digital-HR model presents four fundamental questions for understanding and developing research on digital HR -Research Questions for Digital HR.

The basis of the proposed model (Fig. 10) refers to “where” to apply it. The results of the analysis show that there is a sector where deep research on the subject has already been carried out, the manufacturing sector. However, the research should not stop there. Future research should take this model to other sectors of much greater complexity and scope, such as the service sector.

The pillars that support the model, “the what,” are on two levels: the advances in the digitalization of work on the one hand and, on



the other hand, all the learning that a company can guarantee to its employees and that employees are able to assimilate. Clearly, the cross-cutting issue, “the who,” is the digital employee, the workforce member that drives the change, the one who is able to implement any Human Resources practice, and therefore the one who is able to assimilate business-driven change.

The roof of the model is “the how.” The implementation of all the changes we are forced to make is only possible through the implementation and improvement of three items in our daily processes: firstly, the digital platforms that we use every day at work, secondly, the management of information through the channels provided by the company, and thirdly—and most importantly—the inclusion of artificial intelligence in all our processes, as a means of improving productivity. This technology is transforming, and revolutionizing, the future of workspaces to make them more productive (Gkinko and Elbanna 2022), but again studies on the subject do not address how to accomplish this. Most of the texts reviewed on the subject focus on investigating some aspect of the implementation of artificial intelligence systems and their errors (Costa et al. 2022) or on employees’

acceptance of or trust in such technology (Gkinko and Elbanna, 2023). However, the work of Gkinko and Elbanna (2022) offers a starting point for how to incorporate this technology into a company, since the emotions of employees need to be taken into account when such tools are being created in order to facilitate their inclusion in day-to-day activities.

This makes it vital to focus the research on Digital HR, which requires researchers to collaborate to determine the what, where, how, and who. Based on the questions in the model, a further step has been taken to identify the aspects that would be interesting to analyze in future work to answer each of these fundamental questions.

**WHAT:** In reference to this, it is important to discover what digital processes should be introduced in our daily lives, what learning tools will help us to channel digitization, and what new labor trends can be found in the post-COVID stage.

**WHERE:** Future research should focus on analyzing what kind of workspaces exist in the labor market. This first line of research will undoubtedly lead towards the different sectors of activity, so it is also important to see what we know about the different sectors and their relationship with Digital HR, especially in the service sector, since globally it is the most present sector of activity.

**HOW:** Research should continue to determine how to do this and, as broken down in the table, it is important to address how to adopt digital platforms in the work environment, how to adapt existing social networks to the business context, and how to apply new artificial intelligence models.

**WHO:** As mentioned in this paper, digital HR is a transversal entity in all these lines of research. However, it is not left out of the future lines of research since it is essential to understand who this digital HR includes.

Finally, based on the results of this study (thematic groups) and the proposed model (questions), Table 2 presents a proposal for future research lines and questions.

The proposed model revolves around four fundamental research questions (Fig. 10). The importance of researchers developing the ability to formulate questions has an epistemological background expressed by Bachelard (1982, p. 16) as ‘for a scientific spirit all knowledge is an answer to a question. If there was no question, there can be no scientific knowledge’. It should be noted that the quality of the questions asked is closely related

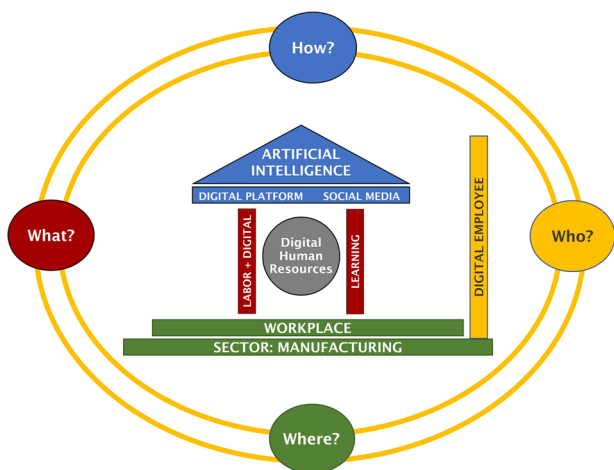


Fig. 10 The RQ4 Digital-HR model. Own elaboration.

Table 2 Future research lines and questions.

Question	Thematic groups	Future Research Lines	Future Research Question
How	Digital platform	Mechanisms for adopting digital platforms in the context of smart-human resources	How should digital platforms be adopted for smart-human resources framework?
	Social media	Adapting social networks for HR digitization	How should social media be adapted for the digital human resources context?
	Artificial intelligence	Applying artificial intelligence	How should AI be applied in a smart digital HR context?
What	Digital	Introducing digitization in the daily processes of the company	Which digital processes should be introduced in a company’s day-to-day operations?
	Learning	Channeling digitization through the learning process	Which learning tools help us to channel digitalization?
	Labor	Analyzing the future of work, discovering emerging jobs (thanks to digitalization processes and the inclusion of Artificial Intelligence) and disappearing jobs (as a result of robotization of routine tasks).	What new labor trends can be found in the post-COVID stage?
Where	Workplace	Reviewing the types of workspaces that currently exist in order to later analyze how to digitize them.	What types of workspaces exist in the labor market?
	Manufacturing	Developing scientific research in other sectors	What has been researched in the service sector on Digital Human Resources?
Who	Digital employee	Identifying digital human resources	Who are the digital human resources?

Source: own elaboration.

to the prior knowledge they have about a given topic (Neber and Anton, 2008). Systematic questioning about different phenomena fosters meaningful learning by drawing on prior knowledge in a non-arbitrary and non-literal way (Moreira, 2000). Furthermore, knowing the background of a subject facilitates scientific modelling, an activity inherent to science, which can be understood as a process of constructing models for the purpose of apprehending reality (Giere, 1988) and providing answers to questions formulated about real facts or assumptions (Halloun, 1996). The model presented in Fig. 10 and developed in Table 2, helps to logically order the themes studied in the previous literature and to propose emerging and current themes of great interest for the development of the literature on digital HR.

In addition, the model helps to sort out what company should focus on meeting the needs of its employees without leaving its own needs behind, first the basis, then the pillars and finally the roof. In this regard, it is important to start managing the workers' workplaces to adapt them to the environment. Subsequently, the training needs of employees must be addressed, along with the necessary adaptations to enable them to function digitally. Thirdly, companies must develop internal and external communication systems that allow them to be in contact with all their stakeholders. Only having developed these points will be able to focus on meeting current social demands and introducing artificial intelligence in their daily work.

Therefore, if companies' human resources departments understand this model and its order, will be able to act effectively and thus be more ethical and sustainable. On the other hand, acting in an inverted order will leave some of the pillars of the Triple Bottom Line uncovered, with the risks that this entails. The Triple Bottom Line (triple P's) model is a model that calls for corporate commitment to measure its social (Person), environmental (Planet), and financial (Profit) impact. This is why it becomes necessary to have a human resources management model adapted to the current and changing context of the organization (Kramar, 2014).

In turn, for the employee, the implementation of a model will help them to prioritize their needs to be covered by the company so that, once managed, they can lead to a higher and better performance and thus achieve a high level of well-being at work. Ruiz-Palomino et al. (2019) explain that a good way to improve a company productivity is to promote corporate wellness and entrepreneurship.

## Conclusions

This paper has answered the question What is the knowledge structure of pioneering research in the field of digital human resources? A mixed methodology was used to identify the main topics studied in Digital HR and to propose a model and some future research lines and questions.

This article presents an integrative review to generate ordered knowledge spaces, which as Patriotta (2020) explains serves to 'put boundaries around an existing area of research in order to provide an organized sample of what is available and build a platform for future research' (p. 1274).

## Implications

*Theoretical implications.* In terms of theoretical implications, this paper highlights the interest of extending current research to concretely define what the digitalization of work means as well as its implications and requirements. This will enable the discovery or even the proposal of new digital work models, incorporating those positions redefined as a result of the incorporation of artificial intelligence and thus make it possible to delimit digital HR. On the other hand, it is noted that the incorporation of new trends in the market must be reflected in the teaching/learning

methods to achieve greater professionalization. In turn, a company will become the protagonist in designing these new training processes that are linked to its specific professional activity and the profile of its employees. On the other hand, emphasis can be placed on studying how to increase productivity through the application of artificial intelligence in routine tasks.

In addition, based on the proposed model, an expansion of research on Digital HR human resources is proposed, incorporating new lines and research questions, which will lead to a new categorization of workplaces according to their capacity to adopt digital models. This will lay the foundation for a new labor framework and the development of innovative capabilities in this regard. This broadening of research can be related to the development of thematic lines and professional sectors, especially in the service sector, thus accommodating the most important sector for the European economy. Future research can consider the development of new TAM (Technology Acceptance Model) models to measure the adoption of digital technologies in digital work environments. Social networks used in the work environment can also be investigated to detect those that best help to channel the processes of labor digitalization.

*Practical implications.* In terms of practical implications, the results obtained and the proposed model can be used to encourage the application of new technologies in the work environment; guarantee employees digital learning processes to increase productivity, facilitating this new learning process; and create policies and standards that include artificial intelligence and social networks in the business environment, thus standardizing their proper use to generate greater productivity and economic results. New and innovative workspaces can also be developed in order to integrate the improvements derived from digitalization and artificial intelligence. Information channels can also be developed to connect the new processes with stakeholders and adapt the work activity to the new demand of employees and the market, thus including, from its conception, digital natives in the entire process.

*Social Implications.* The results also have social implications. In this sense, the study of the digitization of human resources helps to adapt the usual performance of employees to the inclusion of new technologies in the business environment and to involve employees in training processes to promote professional and labor development. In turn, it can be used to involve employees in the development of new workspaces to maximize productivity, for the implementation of new work models designed by the company and the use of social networks as a means of labor communication. As a corollary, artificial intelligence can be considered as a tool to improve productivity, reducing the volume of monotonous or routine tasks and reinforcing those in which only the employee can provide real value.

**Limitations and future research lines.** The authors acknowledge the limitations of the methodology used in this study and call for further research to expand our understanding of the topic. Future studies could complement the co-word analysis with other bibliometric techniques such as co-citation analysis and develop theoretical and empirical models on the applications of digital human resources.

## Data availability

Documents that support the findings of this study can be consulted in the Scopus database by following the search procedure indicated in the methodology section.

Received: 29 May 2023; Accepted: 16 September 2024;

Published online: 27 September 2024

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### Acknowledgements

This paper has been supported by Project PID2021-124641NB-I00 of the Ministry of Science and Innovation (Spain) and by research group in Open Innovation, Universidad Rey Juan Carlos (Spain). Open Access funding enabled and organized by Project V1313 “Sustainability Support”, signed under Article 60 of the LOSU between the Universidad Rey Juan Carlos (Spain) and the company Triple Sustainability SLU to carry out scientific-technical work and training activities.

### Author contributions

Authors contributed equally to this work, and they jointly supervised this work. Contributors to the concept or design of the article: LGF, MOUC, MJGL. Contributed to

analysis and interpretation of data: LGF, MOUC, MJGL. Drafting work or critically revising it for important intellectual content: LGF, MOUC, MJGL. Final approval of the version: LGF, MOUC, MJGL. Agreement to be responsible for all aspects of work: LGF, MOUC, MJGL.

### Competing interests

The authors declare no competing interests.

### Ethical approval

Ethical approval was not required as the study did not involve human participants.

### Informed consent

This article does not contain any studies with human participants performed by any of the authors.

### Additional information

**Correspondence** and requests for materials should be addressed to Laura García-Fernández.

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