



A Science Mapping Of HR Digital Evolution

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ARTICLE INFO

Article history:

Received Dec 21, 2025

Revised Dec 26, 2025

Accepted Jan 10, 2026

Keywords:

Digital Human Resource
Management;
HR Digital Evolution;
Science Mapping.

ABSTRACT

This study aims to systematically map the development and intellectual structure of research on HR Digital Evolution in order to address the problem of conceptual fragmentation and the limited holistic understanding of digital evolution in Human Resource Management (HRM). The study employs a science mapping approach based on a Systematic Literature Review (SLR) using the PRISMA method combined with bibliometric analysis. Data were obtained from the Scopus database, comprising 41 indexed articles published between 2008 and 2025 that are relevant to the topic of HR Digital Evolution. The analysis was conducted to identify publication trends, major thematic clusters, knowledge structures, and the evolutionary dynamics of digital HR research. The findings indicate that research on HR Digital Evolution has increased significantly over the past decade, particularly in the post-pandemic period, with a dominant focus on digital technology integration, HR analytics, artificial intelligence, digital competency development, and their linkages to sustainability and human-centered values. The results also reveal the limited explicit use of classical HRM theories, indicating a theoretical gap in contemporary digital HR literature. The implications of this study are both theoretical and practical, strengthening the position of HR Digital Evolution as an interdisciplinary domain that requires the integration of socio-technical and dynamic capability theories, while also providing strategic guidance for academics and practitioners in designing more focused, sustainable, and evidence-based HR digital transformation agendas.

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INTRODUCTION

Digital transformation has become a dominant force reshaping Human Resource Management (HRM) practices across sectors and organizational contexts. Over the past two decades, HR evolution has no longer been understood as a linear administrative process, but rather as a dynamic journey from HR 1.0, which is operational in nature, toward HR 5.0, which emphasizes the integration of intelligent technologies, data analytics, and human centered values. Advances in

artificial intelligence, big data, the Internet of Things, the metaverse, and integrated information systems have transformed how organizations recruit, develop, evaluate, and retain talent. Contemporary developments indicate that HR digitalization affects not only process efficiency but also sustainability strategies, employee experience, and organizational capabilities in responding to uncertainty within the global business environment. The urgency of scientific mapping lies in its ability to unite various research findings to bridge the acceleration of HR technology adoption with the depth of HRM theory development which is still limited and fragmented. The discourse on digital HR has intensified alongside the emergence of HRM 4.0 and HR 5.0 concepts, which emphasize human machine collaboration, data-driven decision making, and a strong orientation toward sustainability and employee well-being (Prabakar et al., 2025; A. Silva et al., 2015).

Recent studies confirm that digital technologies have become catalysts for change within the HRM ecosystem. The integration of information systems has been shown to enhance employee performance skills through faster, more transparent, and data-driven access to information (Shakir et al., 2025). More broadly, HR digitalization is closely linked to the transformation of talent development practices, particularly through virtual training and digital learning in the post-pandemic era, which presents both new opportunities and challenges related to effectiveness and inclusivity (Ganiyu et al., 2023). In the public sector, the adoption of digital technologies in HRM is viewed as a prerequisite for achieving adaptive and environmentally friendly governance, as reflected in the development of digital-based civil service HR ecosystems and green public management (Goncharuk et al., 2025). Meanwhile, emerging discussions have begun to connect HR digital transformation with the metaverse and sustainability, signaling an expansion of HRM's conceptual boundaries into virtual spaces and broader social values (Chaudhary et al., 2025).

Despite the rapid growth of digital HR literature, most studies remain thematic, fragmented, and focused on specific issues or technologies. Research examining HR evolution from historical and conceptual perspectives such as the transition from HR 1.0 to HR 5.0 tends to emphasize descriptions of innovation and implementation challenges, without providing a comprehensive scientific mapping of knowledge structures, key actors, and evolutionary dynamics (Prabakar et al., 2025). Although literature reviews on HRM 4.0 have identified major trends and themes, they are often limited to specific periods and approaches and do not fully capture interconnections among subfields or the global temporal evolution of digital HR research (L. B. P. da Silva et al., 2022). Consequently, understanding how the digital HR scholarly landscape has developed, intersected with other disciplines, and shaped future research agendas remains partial.

The research problem arises when exponential growth in publications is not accompanied by systematic efforts to map the intellectual structure and evolutionary patterns of knowledge in digital HR. Without clear scientific mapping, researchers and practitioners risk topic redundancy, perspective bias, and difficulty identifying genuinely novel theoretical contributions. In contrast, science mapping approaches have been widely applied across disciplines to uncover conceptual relationships, thematic clusters, and research trajectories through bibliometric and knowledge network analyses. Such approaches have proven effective in fields experiencing rapid digitalization and increasing knowledge complexity, including healthcare, materials engineering, and intelligent systems (Crupi et al., 2025). However, comprehensive applications of science mapping to examine the evolution of digital HR remain relatively limited.

The main research gap in the literature lies in the absence of studies that systematically map digital HR evolution as a unified scholarly field across time and themes. Most prior research emphasizes causal relationships between specific technologies and HR outcomes, such as performance or skills, rather than examining knowledge structures, dominant actors, and scientific collaboration dynamics shaping the field (Shakir et al., 2025). Moreover, the relationships between emerging technologies such as AI and the metaverse and HR paradigms oriented toward sustainability and human values have not been comprehensively mapped within a single evolutionary framework (Chaudhary et al., 2025). This gap highlights the urgent need for an

analytical approach capable of presenting a holistic, evidence based overview of the trajectory and future direction of digital HR. The fragmentation of research on Digital HR Evolution necessitates a comprehensive approach that integrates insights from multiple disciplines to develop a more robust, coherent, and adaptive contemporary HRM theory in response to digital advancements.

Based on this gap, the novelty of this study lies in its use of a science mapping approach to comprehensively analyze digital HR evolution by mapping intellectual structures, thematic clusters, and research dynamics over time. This approach integrates previously fragmented research streams and offers new insights into how HRM concepts, technologies, and paradigms interact in the context of digital transformation. By applying bibliometric techniques and knowledge network visualizations, the study extends theoretical understanding while providing a strong empirical foundation for developing future research agendas and digital HR practices.

RESEARCH METHOD

This study adopted a Systematic Literature Review (SLR) approach to comprehensively examine the development of scientific works addressing the Digital Evolution of HR. Data were obtained from the Scopus database, comprising 128 indexed articles published between 2008 and 2025 that were relevant to the topic of Digital HR Evolution. From the initial set of publications indexed in the Scopus database, 41 articles were ultimately retained as the unit of analysis. To ensure methodological rigor, clarity, and reproducibility in the article selection process, this review strictly followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

The application of bibliometric analysis allows for a structured mapping of research patterns, intellectual linkages, and collaborative networks among prominent authors and leading academic journals within a particular field of inquiry (Donthu et al., 2021). The integration of the PRISMA framework further strengthens the quality of the review by ensuring that all included studies are academically robust and directly relevant to the research objectives. As emphasized by Page et al. (2021), PRISMA offers a transparent and systematic mechanism for handling large volumes of literature through sequential phases encompassing identification, screening, eligibility evaluation, and final selection.

The article selection procedure commenced with the retrieval of publications based on carefully defined keywords aligned with the core research theme. Subsequently, the identified records were filtered using established inclusion and exclusion standards. Eligible studies were limited to peer-reviewed journal articles published in English between 2008 and 2025, explicitly addressing concepts related to "HR Digital Evolution," and indexed in reputable academic databases. Conversely, non-empirical works such as editorials, book reviews, and studies lacking full-text availability were excluded from further analysis.

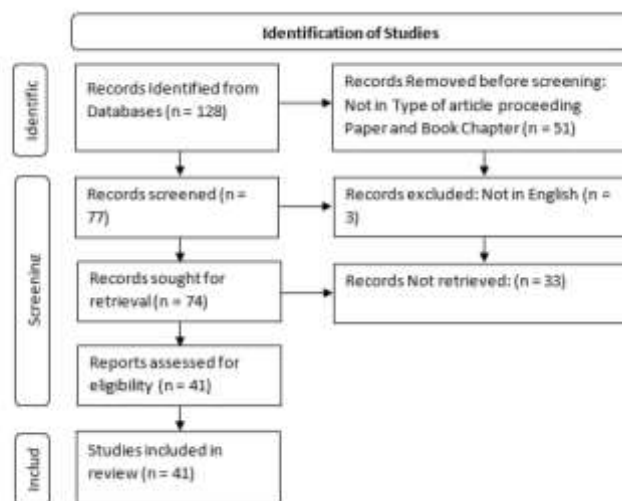


Figure 1. PRISMA Process – Source: Prepared by Author

Table 1. Analyzed Journal Data

No	Journal Identity
1	Liu et al. (2025) "Combined effect of skeletal muscle mass loss and elevated insulin resistance on heart failure risk in older adults: a community-based longitudinal cohort study," <i>Cardiovascular Diabetology</i> , 24(1). https://doi.org/10.1186/s12933-025-02714-8 .
2	Fei-Hu et al. (2025) "Synergistic reduction of graphene oxide using vitamin c and urea: enhanced efficiency and material properties" <i>PLOS ONE</i> , 20(2025-09-09 00:00:00). https://doi.org/10.1371/journal.pone.0330990 .
3	Yavuzyegit et al. (2025) "High-resolution dic analysis of in situ strain and crack propagation in coated az31 magnesium alloys under mechanical loading" <i>Journal Of Materials Science</i> , 60(33) 14708.0-14730.0. https://doi.org/10.1007/s10853-025-11243-4
4	Chaudhary et al. (2025) "An intriguing convergence between metaverse and sustainable human resource management" <i>SA Journal Of Human Resource Management</i> , 23. https://doi.org/10.4102/sajhrm.v23i0.2699 .
5	Robertson et al. (2025) "The passage of chaperonins to extracellular locations in legionella pneumophila requires a functional dot/icm system" <i>Biomolecules</i> , 15(1). https://doi.org/10.3390/biom15010091 .
6	Goncharuk et al. (2025) "Key areas of development of the human resource management ecosystem of the civil service of ukraine in the context of digital technologies and green public management" <i>International Journal Of Ecosystems And Ecology Science</i> , 15(4) 141.0-150.0. https://doi.org/10.31407/ijees15.418 .
7	Crupi et al. (2025) "Multisensor smart eyewear for biomarkers acquisition" <i>IEEE Sensors Journal</i> , 25(21) 40565.0-40574.0. https://doi.org/10.1109/JSEN.2025.3614692 .
8	Prabakar et al. (2025) "Catalysts of change: the transformative journey from hr 1.0 to hr 5.0 innovations, challenges, and strategies in human resource management with technology and data-driven integration" <i>Indian Journal Of Information Sources And Services</i> , 15(1) 47.0-54.0. https://doi.org/10.51983/ijiss-2025.IJISS.15.1.08 .
9	Shakir et al. (2025) "The impact of information systems on enhancing employee human resource performance skills" <i>Journal Of Logistics, Informatics And Service Science</i> , 12(1) 91.0-113.0. https://doi.org/10.33168/JLISS.2025.0106 .
10	Casas-Arozamena et al. (2024) "Role of cfdna and ctdna to improve the risk stratification and the disease follow-up in patients with endometrial cancer: towards the clinical application" <i>Journal Of Experimental And Clinical Cancer Research</i> , 43(1). https://doi.org/10.1186/s13046-024-03158-w .
11	Borodovsky et al. (2024) "Longitudinal use patterns of technology subtypes during the transition into early adolescence: results from the adolescent brain cognitive development

No	Journal Identity
	study" Journal Of Adolescent Health, 75(5) 809.0–818.0. https://doi.org/10.1016/j.jadohealth.2024.06.020 .
12	Theodorou et al. (2024) "Colletsicard syndrome due to cervical artery dissection disclosed by high-resolution magnetic resonance imaging" European Journal Of Neurology, 31(10). https://doi.org/10.1111/ene.16398 .
13	Lehnert et al. (2024) "Unraveling factors affecting the reversibility of martensitic phase transformation in fenicoalti shape memory alloys: insights from hr-ebds and acoustic emission analysis" Acta Materialia, 276. https://doi.org/10.1016/j.actamat.2024.120146 .
14	Amazian et al. (2024) "Human resources management in the age of artificial intelligence; gestion de recursos humanos en la era de la inteligencia artificial" Data And Metadata, 3. https://doi.org/10.56294/dm2024.347 .
15	Sadaf et al. (2023) "A bio-inspired visuotactile neuron for multisensory integration" Nature Communications, 14(1). https://doi.org/10.1038/s41467-023-40686-z .
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18	Fritz et al. (2023) "Time-dependent size and shape evolution of gold and europium nanoparticles from a bioproducing microorganism, a cyanobacterium: a digitally supported high-resolution image analysis" Nanomaterials, 13(1). https://doi.org/10.3390/nano13010130 .
19	L. B. P. da Silva et al. (2022) "Human resources management 4.0: literature review and trends" Computers And Industrial Engineering, 168. https://doi.org/10.1016/j.cie.2022.108111 .
20	Hestroffer et al. (2022) "Development of grain-scale slip activity and lattice rotation fields in inconel 718" Acta Materialia, 226. https://doi.org/10.1016/j.actamat.2022.117627 .
21	Croft et al. (2021) "Copy number evolution and its relationship with patient outcome analysis of 178 matched presentation-relapse tumor pairs from the myeloma xi trial" Leukemia, 35(7) 2043.0–2053.0. https://doi.org/10.1038/s41375-020-01096-y .
22	Zouari et al. (2021) "Solubility of monoclinic and yttrium stabilized cubic zro2: solution and surface thermodynamics guiding ultra-trace analytics in aqueous phase" Journal Of Nuclear Materials, 545. https://doi.org/10.1016/j.jnucmat.2020.152631 .
23	Bernacki et al. (2020) "Eds1-dependent cell death and the antioxidant system in arabidopsis leaves is deregulated by the mammalian bax" Cells, 9(11). https://doi.org/10.3390/cells9112454 .
24	Thorstensen (2020) "Spectroscopic studies of 30 short-period cataclysmic variable stars and remarks on the evolution and population of similar object". Astronomical Journal, 160(1). https://doi.org/10.3847/1538-3881/ab911c .
25	Gebhard et al. (2020) "A harmonic rejection strategy for 25% duty-cycle iq-mixers using digital-to-time converters" IEEE Transactions On Circuits And Systems II: Express Briefs, 67(7) 1229.0–1233.0. https://doi.org/10.1109/TCSII.2019.2937654 .
26	Carausu et al. (2020) "Esr1 mutation detection and dynamics in meningeal carcinomatosis in breast cancer. Journal Of Breast Cancer" 23(2) 218.0–223.0. https://doi.org/10.4048/jbc.2020.23.e4 .
27	Saha et al. (2019) "Genomic insights into hsf1 as candidate genes for high-temperature stress adaptation and gene editing with minimal off-target effects in flax" Scientific Reports, 9(1). https://doi.org/10.1038/s41598-019-41936-1 .
28	Ścigaczewska et al. (2018) "Morphological evolution of various fungal species in the presence and absence of aluminum oxide microparticles: comparative and quantitative insights into microparticle-enhanced cultivation (mpec)" MicrobiologyOpen, 7(5). https://doi.org/10.1002/mbo3.603 .
29	Brujning et al. (2018) "Trackdem: automated particle tracking to obtain population counts and size distributions from videos in r" Methods In Ecology And Evolution, 9(4) 965.0–973.0. https://doi.org/10.1111/2041-210X.12975 .
30	Alberdi et al. (2018) "Anterior and posterior capsule densitometry levels after femtosecond

No	Journal Identity
	laser-assisted cataract surgery" International Journal Of Ophthalmology, 11(4) 623.0–628.0. https://doi.org/10.18240/ijo.2018.04.14 .
31	Garlan et al. (2017) "Early evaluation of circulating tumor dna as marker of therapeutic efficacy in metastatic colorectal cancer patients (placol study)" Clinical Cancer Research, 23(18) 5416.0–5425.0. https://doi.org/10.1158/1078-0432.CCR-16-3155 .
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40	Chilingarian et al. (2008) Kinematics and stellar populations of low-luminosity early-type galaxies in the abell 496 cluster" Astronomy And
41	Hayes (2008) "Digital television broadcasting in the United States" SMPTE Motion Imaging Journal, 117(6), 75–77. https://doi.org/10.5594/115066

RESULTS AND DISCUSSIONS

Performance Analysis (Descriptive)



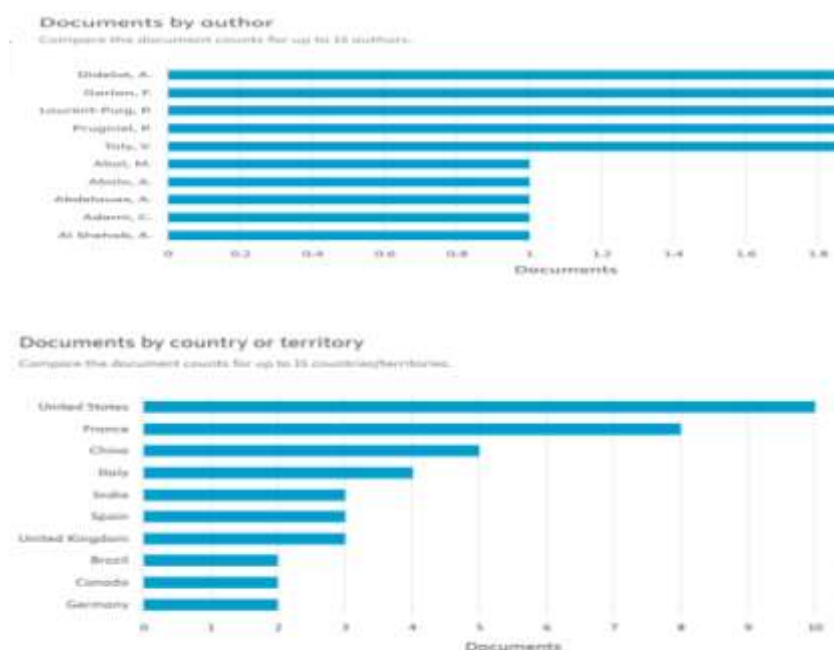


Figure 2. Documents
Source : Prepare by Author

The figure presents a simple bar chart illustrating the distribution of articles based on theoretical categories within the HR Digital Evolution literature. This descriptive section provides an initial overview of thematic composition, revealing that no specific HR theories such as the Resource-Based View or Human Capital Theory were explicitly detected in abstracts, author keywords, or indexed keywords. The overall research title emphasizes bibliometric mapping to identify patterns of digital evolution in HR practices, and this figure supports that emphasis by highlighting the dominance of general categories. This finding reflects the core research problem: the lack of explicit engagement with traditional theoretical frameworks in contemporary digital HR research. The dominance of technology, AI, and HR analytics themes confronts the balance of human-centered values in HRM, demanding the reintegration of ethical values, empathy, and humanity into responsive and sustainable digital practices.

The identified research gap concerns ambiguity in theory application, as many articles focus more on practical applications such as metaverse integration or sustainable HRM than on strong theoretical foundations. The novelty of this analysis lies in its initial categorization that challenges assumptions that digital HR literature is consistently grounded in classical theory. Potential supporting theories, although not explicitly identified, may include implicit elements of Social Exchange Theory in discussions of digital employee interactions or Institutional Theory in organizational adaptation to technology. These insights align with the article's objective to map conceptual trends and relationships, highlighting that among the 41 Scopus indexed articles, only 10 were directly relevant to HR, all classified as "Other." This critical finding underscores the need for more nuanced analytical approaches, such as manual content analysis, to uncover latent theories and ensure that science mapping not only counts publications but also critically evaluates evolving HR knowledge dynamics.

Trend Analysis

The publication timeline presents a line plot illustrating the evolution of article publications from 2008 to 2025, showing fluctuations and a sharp upward trend in recent years. Publications increased from two articles in 2008 to nine in 2025, with notable acceleration after

2020. This trend analysis directly relates to the study's focus by visualizing the growing scholarly interest in digital integration within HRM. The research problem addressed here concerns the slow adoption of HR technologies in traditional organizations amid global digital disruption, which has intensified alongside advances in AI and the metaverse.

The highlighted research gap lies in the lack of longitudinal studies capturing post-pandemic acceleration. The novelty of this analysis is its bibliometric approach to forecasting future directions of digital HR research, contrasting with prior snapshot-style studies. Supporting theories such as Rogers' Diffusion of Innovations Theory explain gradual technology adoption before reaching a critical mass, while Contingency Theory accounts for contextual variations such as the COVID 19 pandemic. The findings suggest that the sharp increase in publications reflects responses to emerging issues like sustainable digital HRM and AI-based talent management, signaling a maturing field that requires deeper theoretical integration to avoid saturation.

Antecedents and Consequences of HR Digital Evolution

The discussion of antecedents and consequences of HR Digital Evolution must be situated within the increasingly complex and interdisciplinary growth of knowledge reflected in the analyzed literature. HR Digital Evolution does not emerge suddenly but results from cumulative interactions among technological, organizational, and environmental factors. One of the most fundamental antecedents is technological advancement itself, marked by increased computing power, intelligent sensors, data analytics, and integrated digital systems. Studies outside HRM demonstrate how digital technologies enable precise, real-time, and predictive information processing (Crupi et al., 2025; Fritz et al., 2023), a logic adopted in digital HR where employee data are treated as strategic assets supporting evidence based decision making.

Another critical antecedent is socio-organizational change, particularly rising demands for work flexibility, sustainability, and employee experience quality. Literature on technology use across the human life cycle shows that technology interaction patterns are dynamic and context-dependent (Borodovsky et al., 2024). Organizationally, this translates into growing demand for adaptive and personalized HR systems. The transition from HR 1.0 to HR 5.0 underscores digital HR evolution as a response to the inadequacy of traditional administrative approaches in managing modern business complexity (Prabakar et al., 2025). In the public sector, this antecedent is reinforced by green governance and digital government agendas (Goncharuk et al., 2025).

From a theoretical perspective, HR Digital Evolution can be explained through a combination of socio-technical systems theory and the resource-based view. Digital technology is not a single determinant but part of a broader social system interacting with organizational structures, culture, and human capabilities. Cross-disciplinary studies on complex system evolution demonstrate that significant change is driven by multi-level, non-linear interactions (Du et al., 2010; Saha et al., 2019). This analogy is relevant for understanding digital HR as an evolutionary process rather than a mere technology adoption phenomenon. A key research problem in HRM literature is the tendency to examine HR technology in isolation rather than within a broader organizational knowledge evolution framework.

The consequences of HR Digital Evolution manifest across multiple levels. At the individual level, digital HR enhances skills, productivity, and access to continuous learning, with HR information systems strengthening competencies through data-driven feedback and performance transparency (Shakir et al., 2025). Consistent with (Abdurrahim, 2025), artificial intelligence has a significant positive impact on employee productivity by streamlining task execution, reducing human error, and enabling personalized performance feedback systems. At the organizational level, digital HR improves process efficiency, decision quality, and responsiveness to environmental change. HRM 4.0 literature emphasizes that digital integration shifts HR from an administrative role to a strategic partner focused on long-term value creation (L. B. P. da Silva et al., 2022).

However, the consequences are not entirely positive or linear. Increased digital system complexity introduces risks such as data dependency, algorithmic bias, and dehumanization. Insights from healthcare and molecular biology stress that high-resolution data require contextual interpretation to avoid flawed decisions (Casas-Arozamena et al., 2024; Croft et al., 2021). In digital HR, this reinforces the need to balance technology with human values, ethics, and sustainability, as emphasized in AI and metaverse based sustainable HRM discussions (Amazian et al., 2024; Chaudhary et al., 2025).

The identified research gap concerns the lack of holistic understanding of the relationship between antecedents and consequences of HR Digital Evolution within a knowledge evolution framework. Prior studies focus on specific outcomes or technologies, rarely analyzing structural interconnections and evolutionary trajectories. The novelty of this article lies in its science mapping approach, integrating findings from 41 interdisciplinary articles to reveal conceptual patterns and evolutionary dynamics. The scientific mapping shows that HR Digital Evolution develops through intersecting thematic clusters technology and data, human development, sustainability, and governance collectively shaping the future of digital HRM. The mapping results confirm the need for digital HR research that integrates technology with sustainability and humanism values to support adaptive and sustainable HRM practices in the long term.

CONCLUSION

This article demonstrates that HR Digital Evolution is a progressively developing and multidimensional field characterized by a paradigm shift from administrative digitalization toward strategic integration of intelligent technologies in HR management. Through science mapping, dominant thematic clusters related to HR analytics, artificial intelligence, digital competence, employee experience, and sustainability-oriented human values were identified. The findings confirm that conceptual fragmentation and imbalance between technological advancement and organizational readiness remain central research problems. The novelty of this article lies in its comprehensive, evidence-based mapping of the intellectual landscape of HR Digital Evolution and its ability to guide future research agendas. Future research should focus on developing an integrative framework that synergistically links HRM theory with digital technology innovation to support adaptive and sustainable HR practices.

Despite its contributions, this study has limitations. First, science mapping relies heavily on the quality and scope of bibliographic databases, potentially introducing publication bias. Second, bibliometric approaches emphasize quantitative patterns, limiting deeper conceptual interpretation. Third, rapid technological change may reduce the long term relevance of some findings if not periodically updated. These limitations provide opportunities for future research combining science mapping with theory-driven systematic reviews and qualitative studies.

Theoretically, this article reinforces HR Digital Evolution as an interdisciplinary domain bridging HRM theory, socio-technical systems, and dynamic capabilities perspectives. Practically, the findings offer strategic guidance for HR practitioners and policymakers in prioritizing digital capability development, HR data governance, and technology-based employee experience design. The study thus serves as a strategic reference for navigating the complexity of HR Digital Evolution in a more evidence-based and sustainable manner. The mapping results provide strategic guidance for policymakers and HR practitioners to balance technology investments with strengthening human capabilities, in order to drive inclusive and sustainable digital transformation.

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