



THE IMPACT OF DIGITALIZATION ON EMPLOYMENT AND HUMAN RESOURCE MANAGEMENT: AN ANALYTICAL AND CONCEPTUAL REVIEW

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Abstract: Digitalization fundamentally transforms employment, work organization, and human resource management (HRM). This paper analyses how digital transformation reshapes work structures, HRM practices, and employee well-being, with a particular focus on the role of technostress. Using an analytical and integrative approach based on recent scientific literature and international policy reports, it identifies key relationships between digitalization, technological demands, and organizational responses. The findings show that digitalization reconfigures rather than eliminates jobs, while AI-driven HRM enhances efficiency but raises ethical and psychological challenges. Technostress emerges as a critical mediator between digital demands and employee outcomes and can, under supportive HRM conditions, stimulate learning and engagement. The study proposes a conceptual framework positioning HRM as a moderator between digital transformation and employee well-being, emphasizing that successful digitalization depends on balancing technological efficiency with human sustainability.

Keywords: digitalization; human resource management; technostress; digital transformation; employee well-being; HR analytics

Introduction

Digitalization has become one of the defining forces shaping contemporary economies, comparable in impact to past industrial revolutions. It is not merely a technological process but a profound structural transformation influencing how value is created, distributed, and managed across all sectors. Over the past decade, automation, artificial intelligence (AI), big data, and the Internet of Things (IoT) have reshaped organizations and work processes, generating both opportunities and challenges (Ghobakhloo, 2019). These technologies drive efficiency and innovation but simultaneously introduce new social and psychological pressures that affect employment and human resource management (HRM) (Aly, 2022). Digital transformation has changed the nature of work itself. Traditional employment models are giving way to flexible, technology-mediated forms of labour that demand adaptability, autonomy, and lifelong learning (OECD, 2023). The shift from manual and routine tasks to knowledge-based activities redefines the relationship between employers and employees and calls for new managerial approaches. Within HRM, digitalization enhances operational efficiency through data analytics, automation, and AI-assisted decision-making, yet it also raises concerns regarding privacy, algorithmic bias, and employee

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autonomy (Bondarouk and Brewster, 2016; Vardarlier, 2020). The capability of organizations to align technological innovation with human needs has therefore become a central determinant of sustainable performance.

In parallel with these structural changes, researchers and practitioners increasingly emphasize the psychological consequences of working in digital environments. Poorly implemented technologies can generate cognitive overload, emotional exhaustion, and declining job satisfaction—phenomena collectively described as technostress (Brod, 1984; Tarafdar, Cooper and Stich, 2019). Conversely, when employees receive adequate training, feedback, and support, technological pressure can transform into a source of learning and engagement. Managing technostress has thus become a core element of sustainable HRM, requiring leadership empathy, open communication, and employee participation (Florkowski, 2019; Saini and Phoolka, 2024).

Across Central Europe, especially within the Visegrad (V4) countries, organizations face slower digital adoption and weaker innovation ecosystems (European Commission, 2024). Limited investment in workforce training and digital infrastructure constrains productivity and increases the risk of employee overload. Strengthening HRM capabilities—particularly digital competencies, communication, and adaptability—emerges as a strategic priority for building digital resilience (Nankervis and Cameron, 2023; Minbaeva, 2021).

The purpose of this paper is to integrate current knowledge on how digitalization influences employment structures, HRM practices, and employee well-being, with special attention to the mediating role of technostress. Using an analytical and integrative approach based on recent scientific literature and policy sources, the study develops a conceptual framework linking digital transformation, HRM, and employee outcomes. Its aim is to contribute to a better understanding of how human-centred HRM can transform technological change from a potential source of stress into an opportunity for organizational and personal growth.

Theoretical Background

Digitalization represents a fundamental transformation of economies and societies, influencing not only technology but also organizational culture, skills, and human relationships. It differs from digitization, which merely converts analogue information into digital form, by encompassing structural, behavioural, and cultural change within organizations (Gobble, 2018). Through the integration of automation, robotics, and data-driven decision-making, digitalization has become a key driver of productivity and innovation across sectors. This transformation, often framed as Industry 4.0, emphasizes the technological dimension of interconnected systems, cyber-physical infrastructure, and artificial intelligence (Ghobakhloo, 2019). In contrast, the concept of Society 5.0 focuses on a human-centred vision where technological progress serves social well-being and sustainability (Fukuda, 2020). Both paradigms highlight that successful digital transformation depends on harmonising technological efficiency with human adaptability.

Digitalization has far-reaching implications for employment and labour markets. Evidence from OECD (2023) indicates that digital technologies reshape rather than eliminate jobs. Routine and manual work is increasingly automated, while demand rises for analytical, creative, and digital skills. This shift produces a qualitative rather than quantitative transformation of work, where the capacity for lifelong learning and reskilling determines individuals' employability. Research in developing and transitional economies shows that the benefits of artificial intelligence and automation depend on the ability of institutions to convert technological innovation into inclusive growth (Aly, 2022). Without adequate investment in skills, digital transformation may widen social inequalities and deepen productivity gaps. In Central Europe, the Digital Decade Country Reports (European Commission, 2024) reveal significant differences in digital readiness, confirming that

workforce adaptability and innovation ecosystems remain decisive for competitiveness. Within human resource management, digitalization is more than the adoption of new tools; it represents a strategic redefinition of how organizations attract, develop, and retain talent. Early studies of e-HRM described the computerization of administrative processes such as payroll or recruitment. Recent perspectives, however, view digital HRM as a system that integrates technology with strategic decision-making and employee experience (Bondarouk and Brewster, 2016; Vardarlier, 2020). Artificial intelligence, analytics, and digital platforms allow for predictive workforce planning and personalized learning, but they also raise questions of transparency, privacy, and algorithmic bias. The key challenge is to ensure that technological solutions strengthen rather than replace human judgement. Aggarwal and Stanley (2025) propose the Techno-HRM Engagement Model, demonstrating that digital HRM can enhance employee engagement and agility when supported by participatory communication and continuous learning. These insights underline that HRM functions as a critical mediator between technological change and human outcomes.

As organizations accelerate digital transformation, the human costs of technological pressure have become more visible. The term technostress was introduced by Brod (1984) to describe psychological strain arising from difficulties in coping with new technologies. Subsequent research conceptualized technostress as a multidimensional construct consisting of several sources of strain—technological overload, complexity, invasion, uncertainty, and insecurity—that influence satisfaction and performance. Tarafdar, Cooper and Stich (2019) distinguished between techno-distress, which impairs well-being, and techno-eustress, which can stimulate innovation and learning. Their model emphasises that the impact of technology depends on contextual and organizational factors. When supported by appropriate training, feedback, and leadership, digital demands may transform into opportunities for growth and creativity. From the HRM perspective, managing technostress is integral to sustainable digital transformation. Empirical evidence shows that clear communication, participatory decision-making, and managerial empathy can reduce stress and enhance engagement (Florkowski, 2019; Saini and Phoolka, 2024). These findings correspond with the Job Demands–Resources (JD-R) theory, which explains that the balance between job demands, and available resources determines employee strain or motivation (Bakker and Demerouti, 2017). Digital environments intensify certain demands—such as information overload and constant connectivity—while requiring organizations to provide compensatory resources like autonomy, support, and digital literacy. HRM thus operates as a regulatory mechanism that shapes whether technological change produces fatigue or flourishing.

In the regional context, the European Commission (2024) reports persistent disparities in digital infrastructure and workforce preparedness within the Visegrad (V4) countries. Limited training and fragmented innovation systems hinder the effective implementation of digital HRM. Research among HR professionals highlights that developing digital competencies, communication, and ethical awareness is essential for digital resilience (Nankervis and Cameron, 2023; Minbaeva, 2021). Consequently, digital transformation should not be viewed merely as a technical upgrade but as an ongoing socio-technical process in which HRM aligns technology with human capabilities and organizational culture.

Methodology

This paper employs an analytical and integrative approach, combining elements of literature analysis, conceptual synthesis, and contextual comparison. Rather than conducting a formal systematic review, the paper focuses on identifying key theoretical patterns and research gaps in recent literature addressing the intersection of digitalization, employment, human resource management (HRM), and technostress.

The research draws primarily on peer-reviewed articles indexed in the Web of Science Core Collection (SCI-EXPANDED, SSCI, and ESCI) between 2015 and 2024. The selection was guided by the following keyword combinations:

digitalization OR "digital transformation" OR "Industry 4.0"

AND

"human resource management" OR HRM OR employment OR technostress

Approximately 70 relevant publications were identified and reviewed based on their relevance, citation impact, and thematic fit. In addition, policy reports and statistical data from the OECD, Eurostat, and the European Commission's Digital Decade Country Reports (2024) were used to contextualize macro-level findings, particularly for Visegrad (V4) countries.

The analysis combined qualitative content synthesis and descriptive bibliometric mapping. Bibliometric indicators — such as annual publication growth and leading journals — were derived from Web of Science exports and used to illustrate research dynamics rather than to produce statistical inferences.

Conceptually, the analysis sought to identify:

1. how digitalization influences employment and HRM practices,
2. how technostress emerges as a mediating factor, and
3. which HRM mechanisms mitigate or transform these effects.

The results were organized into three thematic domains — *digitalization and employment*, *digital HRM*, and *technostress and well-being* — to ensure coherence and comparability across studies.

Because the paper adopts a conceptual rather than empirical design, its findings rely on secondary data and scholarly interpretation. While the selection process ensures representativeness and validity, it does not claim full exhaustiveness. Future research could build on this framework through quantitative bibliometric analysis or empirical testing of the proposed conceptual model.

Results

The analysis reveals significant developments in research and practice related to digitalization, HRM, and technostress during the past decade.

Research Trends (2015-2024)

The bibliometric analysis based on the Web of Science Core Collection (SCI-EXPANDED, SSCI, and ESCI) for the period 2015–2024 demonstrates a sustained and accelerating growth of research addressing the intersections of digitalization, human resource management (HRM), and technostress. This upward trajectory reflects the increasing recognition of digital transformation as a systemic organizational and societal phenomenon, with implications reaching far beyond technological implementation.

The dataset includes 70 peer-reviewed articles, which were grouped into three thematic domains:

- (1) Digital transformation and employment
- (2) Digital HRM and HR analytics
- (3) Technostress and well-being

Publication and citation trends were analysed separately for each domain to identify shifts in scientific attention, theoretical development, and emerging subtopics.

(1) Digital transformation and employment

Figure 1 illustrates a clear intensification of publications and citations examining the impact of digital transformation on employment. Between 2015 and 2018, research in this area remained relatively limited and mainly descriptive, focusing on conceptual discussions of automation, robotics, and the principles of Industry 4.0. After 2018, the number of studies increased sharply, almost tripling by 2022. The COVID-19 pandemic further accelerated this trend in 2020–2021, when digital labour markets, teleworking, and remote management became central research topics.

Citations show a slightly delayed but steep upward curve, indicating that studies published between 2018 and 2020 now constitute the theoretical foundation of this field. Empirical evidence suggests that digital transformation leads primarily to job reconfiguration rather than job loss, as new roles emerge in data analysis, cybersecurity, and digital coordination (Aly, 2022; Christiaensen, Rutledge and Taylor, 2021; Cirillo et al., 2021). These findings confirm an ongoing structural transition toward knowledge-intensive and hybrid forms of employment, consistent with the European Commission's Digital Decade indicators (2024).

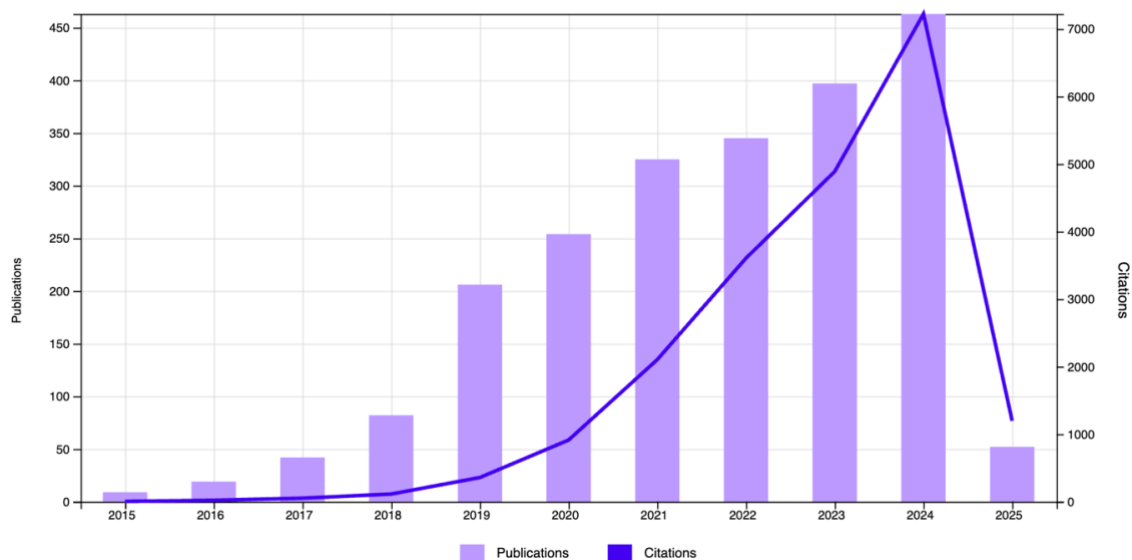


Figure 1. Annual publications and citations on digital transformation and employment (2015–2025).

Source: Authors' processing based on Web of Science Core Collection data (2024).

Another important pattern is the diversification of research methodologies. Early publications relied mainly on conceptual reviews and macroeconomic modelling, whereas more recent studies combine quantitative labour-market data with qualitative interviews across industrial sectors. The convergence of these approaches demonstrates that research on digital transformation and employment has evolved from a speculative discussion into an empirically grounded field with measurable socio-economic implications (OECD, 2023; European Commission, 2024).

(2) Digital HRM and HR analytics

Figure 2 illustrates the development of academic research on digital human resource management (HRM) and HR analytics based on data from the Web of Science Core Collection. The graph presents the number of publications devoted to this topic between 2021 and 2025, together with their citation counts, which helps to assess not only the quantitative

growth of research but also its academic impact and relevance within the scholarly community.

The results show that before 2021, research on digital HRM was relatively limited and mainly focused on partial aspects such as e-recruitment, online learning, or digital assessment systems. A significant rise in publications occurred after 2021, when digital HRM became a central topic in management and organizational studies. Between 2022 and 2023, the number of studies continued to increase, reaching its peak in 2024. This surge can be attributed to several factors: first, the rapid progress of technologies such as artificial intelligence, automation, and advanced workforce analytics stimulated growing interest in how these innovations affect HR practices and organizational structures; second, the COVID-19 pandemic accelerated the transition to remote work and digital workforce management, creating new conditions for theoretical and empirical inquiry.

Citation activity followed a similar upward pattern, peaking in 2024. This indicates that the most influential and widely recognized studies in this field have emerged in recent years. The decrease in 2025 should be interpreted with caution, as it reflects the typical time lag in citation accumulation rather than a real decline in research interest.

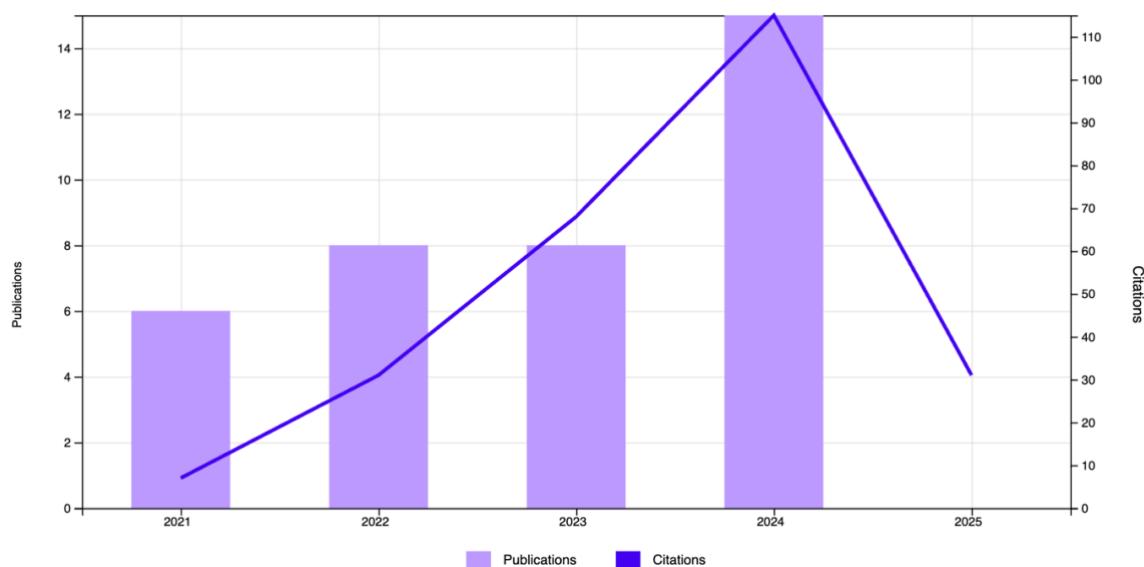


Figure 2. Annual publications and citations on digital HRM and HR analytics (2021–2025).

Source: Authors' processing based on Web of Science Core Collection data (2024).

Several seminal contributions have shaped this domain. Studies by Bondarouk and Brewster (2016), Vardarlier (2020) and Zhang and Chen (2024) highlight the evolution of HRM from an administrative function into a strategic, data-driven discipline. These authors emphasize that algorithmic and AI-supported HR systems can improve efficiency and transparency, but their success depends on the ethical and human-centred design of digital tools, including fairness, accountability, and employee trust as prerequisites for sustainable digital HRM.

Overall, the trend confirms that digital HRM has evolved into an established and rapidly developing research domain. The growing number of publications and citations demonstrates a shift from fragmented studies toward systematic research that links digital HRM with broader issues such as employment, job satisfaction, organizational behaviour, ethics, and data protection.

The bibliometric trajectory confirms that digital HRM is no longer a niche topic but a core component of management research, often intersecting with digital ethics, leadership, and organizational behaviour. Recent studies increasingly adopt frameworks such as socio-technical systems theory and the resource-based view, integrating technology adoption with human capital and organizational culture. This trend signals the consolidation of digital HRM as an independent yet interdisciplinary research domain.

(3) Technostress and well-being

Figure 3 shows a pronounced increase in publications addressing technostress and employee well-being. Although the topic appeared only occasionally before 2018, it expanded rapidly during the pandemic years, when mass remote work and digital overload became widespread. The number of studies nearly doubled between 2019 and 2021, and citation activity has remained high through 2024, reflecting the growing use of standardized instruments such as the Technostress Creators Scale and the Technostress Inhibitors Scale. Core contributions by Tarafdar, Cooper and Stich (2019) established the conceptual foundation of the field, linking technostress to both negative outcomes (fatigue, burnout) and positive effects such as learning and engagement. Subsequent research increasingly applies the Job Demands–Resources (JD-R) model to explain how organizational support, autonomy, and digital competence shape individual reactions to technological demands (Bakker and Demerouti, 2017; Saini and Phoolka, 2024). Recent studies also show that effective HRM practices—training, feedback, and empathetic leadership—can convert technological pressure into motivation and innovation (Aggarwal and Stanley, 2025).

This shift from a purely pathological toward a balanced and adaptive perspective represents a major conceptual turning point. Technostress is now viewed not only as a risk factor but as an analytical lens for understanding digital well-being and resilience. The continuous growth in citations demonstrates that technostress research has moved beyond psychology and information systems into mainstream HRM and organizational studies, confirming its interdisciplinary importance.

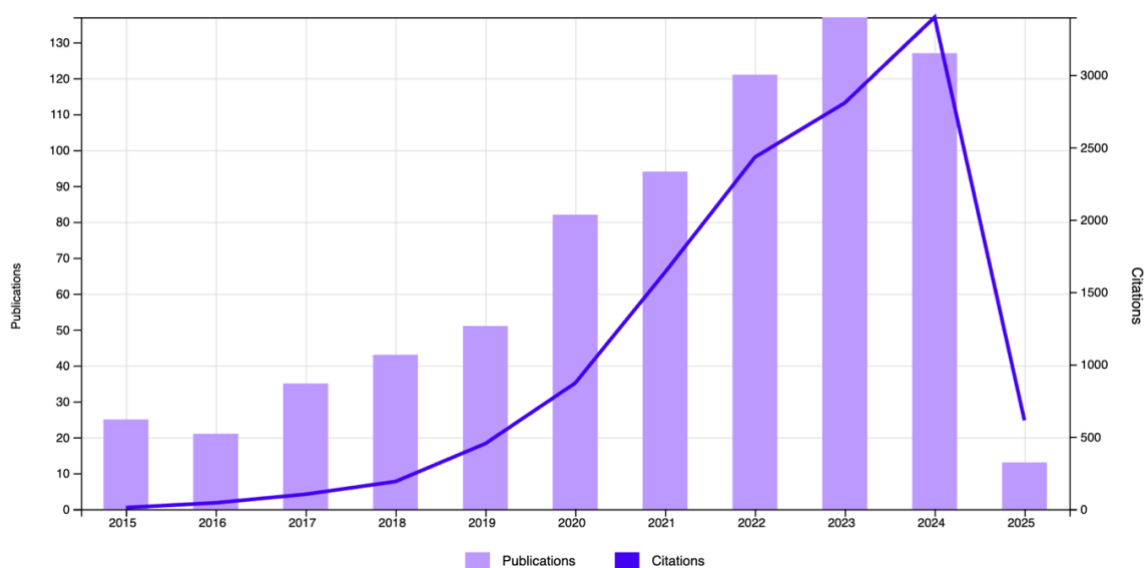


Figure 3. Annual publications and citations on technostress and employee well-being (2015–2025). Source: Authors' processing based on Web of Science Core Collection data (2024).

Across all three examined domains, two acceleration points are evident: the post-2018 period associated with *Industry 4.0* and the post-2020 phase triggered by the COVID-19 pandemic. These waves jointly redefined research priorities. While digital transformation and employment constitute the most established area, digital HRM shows the steepest recent growth, and technostress research provides the essential human-behavioural counterbalance. The parallel rise in publication and citation counts confirms the consolidation of digitalization as a multidimensional construct encompassing technological, organizational, and psychological dimensions. Collectively, these findings support the integrative aim of this article—to explore how digitalization reshapes work structures, HRM practices, and employee experience through the interlinked mechanisms of technological change, organizational adaptation, and human response.

Regional Comparison – Visegrad (V4) Countries

Data from the European Commission’s Digital Decade Country Reports (2024) reveal persistent disparities in digital maturity among V4 countries (Table 1).

Table 1 Summary of Digitalization Indicators in V4 Countries (2024)

Country	SME Digitalization	Cloud Adoption	Basic Digital Skills
Hungary	53.2%	37.1%	58.9%
Poland	50.0%	46.5%	44.3%
Czech Republic	49.0%	31.0%	~55.0%
Slovakia	42.2%	30.2%	51.3%

Source: Author according to European Commission’s Digital Decade Country Reports (2024).

Hungary and Poland demonstrate higher SME digital intensity and cloud use, while Slovakia and the Czech Republic lag behind. The gap of more than ten percentage points between leading and lagging countries indicates structural differences in innovation ecosystems and workforce digital readiness.

These disparities directly influence the ability of organizations to implement digital HRM practices effectively. In less digitally advanced contexts, HR departments often prioritize administrative automation over strategic analytics or employee experience, which limits the transformative potential of digitalization.

Qualitative Synthesis

The literature reviewed across the three thematic domains reveals several converging findings:

1. Digitalization and Employment:

Digitalization reshapes rather than reduces employment. Routine and manual tasks are replaced by knowledge-based activities requiring cognitive and digital skills. This transition necessitates lifelong learning and continuous reskilling supported by both public policy and corporate training.

2. Digital HRM:

AI-supported HR systems improve efficiency, transparency, and data-driven decision-making. Yet, their benefits depend on organizational culture and ethical implementation. Studies highlight that employees' perception of fairness, privacy, and autonomy determines the success of digital HR adoption.

3. Technostress and Well-being:

Technostress functions as a mediating mechanism linking digital demands and employee outcomes. When technological change is poorly managed, it generates overload and uncertainty; however, under supportive HRM conditions — such as training, communication, and managerial empathy — it can evolve into techno-eustress, enhancing motivation and innovation.

Collectively, the findings emphasize that human-centered HRM is a decisive factor in transforming digital disruption into digital resilience. The alignment of technology with human resources thus represents a key strategic challenge for organizations entering the digital age.

Discussion and conclusion

The integrated analysis of seventy peer-reviewed studies confirms that digitalization acts as a multidimensional driver of organizational transformation, reshaping structures, processes, and employee experiences across sectors. Whereas early research treated digital transformation primarily as a technological process, recent work frames it as a socio-technical phenomenon that interlinks technological innovation with human adaptation and cultural change (Ghobakhloo, 2019; Fukuda, 2020). Early theoretical discussions on the productivity implications of automation and artificial intelligence already anticipated such structural changes, marking what Brynjolfsson and McAfee (2014) described as the second machine age—an era in which technology complements rather than replaces human labour.

Across the literature, a consistent finding is that digitalization transforms rather than eliminates work. Routine and manual tasks are automated, while new occupations emerge that demand cognitive flexibility, digital literacy, and creative problem-solving (Christiaensen, Rutledge and Taylor, 2021; Cirillo et al., 2021; Aly, 2022). This evolution represents a structural transformation of labour markets whose impact depends on institutional capacity to ensure lifelong learning and reskilling (OECD, 2023; European Commission, 2024; Sousa and Rocha, 2019). Technology itself is not the source of disruption; the decisive factor is an organization's ability to integrate people and technology in a balanced and sustainable way through human-centred design and inclusive policies (Bondarouk and Brewster, 2016; Minbaeva, 2021). Within the HRM domain, digital transformation has shifted from automating administrative routines toward strategic, AI-enabled HRM systems that combine analytics, cloud-based solutions, and data-driven decision-making (Vardarlier, 2020; Zhang and Chen, 2024). These systems increase efficiency and transparency but also raise new ethical and psychological challenges. Employees' perceptions of fairness, privacy, and autonomy critically determine the success of digital HRM implementation (Florkowski, 2019; Nankervis and Cameron, 2023). Research by Ruiz et al. (2024) further demonstrates that a clearly articulated digital HR strategy significantly enhances organizational performance by aligning technological tools with strategic human-capital objectives. Consequently, digital HRM should be understood not as a technological tool but as a cultural and relational framework in which leadership, communication, and participation shape organizational outcomes (Bondarouk and Brewster, 2016; Vardarlier, 2020).

The review also confirms that HRM practices moderate the relationship between technological change and employee well-being. Organizational support, skill development, and transparent communication significantly reduce digital strain and enhance adaptability (Tarafdar, Cooper and Stich, 2019; Saini and Phoolka, 2024). Evidence shows that technostress is not inherently detrimental; when employees perceive adequate resources and autonomy, digital demands can stimulate learning, engagement, and innovation—a dynamic conceptualized as techno-eustress (Bakker and Demerouti, 2017; Aggarwal and Stanley, 2025). HRM thus functions as a stabilizing force that transforms technological pressure into growth and motivation, consistent with the Job Demands–Resources model (Bakker and Demerouti, 2017; Ragu-Nathan et al., 2008). Recent sectoral research confirms similar patterns in service industries, where technostress directly affects both employee experience and customer satisfaction (Christ-Brendemühl and Schaarschmidt, 2020; Wu, Chin and Liu, 2022).

Across all three thematic domains—employment, HRM, and technostress—the common pattern is the centrality of human-centred digital transformation. Empirical evidence confirms that technological and human dimensions must evolve in parallel to achieve sustainable outcomes (OECD, 2023; European Commission, 2024). Studies from the education sector also highlight the critical importance of digital competence and emotional regulation for reducing technostress in online environments (Berger et al., 2016; Dahabiyeh, Najjar and Wang, 2022). When HR systems and leadership align with employees' digital readiness and psychological needs, digitalization fosters resilience and innovation; when implementation focuses solely on technology, it often results in overload, alienation, and declining trust (Tarafdar, Cooper and Stich, 2019; Florkowski, 2019).

The findings further reveal regional disparities in digital maturity and research coverage. Economies with strong innovation ecosystems, such as Germany, the United Kingdom, and the United States, dominate empirical research on digital HRM and technostress, whereas Central and Eastern Europe, including the Visegrad region, remains under-represented (European Commission, 2024; OECD, 2023). This imbalance underscores the need for context-sensitive studies that account for institutional and cultural environments shaping workplace digitalization (Nankervis and Cameron, 2023).

Theoretically, this synthesis contributes to the integrative framework of digital work systems, linking three research streams that are often analysed separately: digital transformation as a structural driver, HRM as an organizational moderator, and technostress as a psychological mediator. Their interaction determines whether digitalization produces strain or resilience (Tarafdar, Cooper and Stich, 2019; Bakker and Demerouti, 2017). This aligns with the second generation of technostress research, which emphasizes adaptation, empowerment, and balance rather than pathology (Brod, 1984; Tarafdar, Cooper and Stich, 2019). From a practical perspective, the findings highlight that successful digital transformation depends as much on human capability as on technology. Organizations are advised to pursue holistic strategies that:

- support continuous digital upskilling and reskilling (Sousa and Rocha, 2019; OECD, 2023);
- promote transparent and participatory HRM processes (Bondarouk and Brewster, 2016);
- ensure ethical governance of AI and data (Vardarlier, 2020; Aggarwal and Stanley, 2025);
- and
- integrate well-being and resilience as strategic HR priorities (Bakker and Demerouti, 2017; Saini and Phoolka, 2024).

In conclusion, digitalization is reshaping employment and HRM in complex and deeply human ways. Its success depends on balancing technological efficiency with social responsibility. The evidence shows that digital HRM can transform technostress from a barrier into a catalyst for learning and innovation—provided that organizations deliberately cultivate trust, competence, and psychological safety (Tarafdar, Cooper and Stich, 2019; Aggarwal and Stanley, 2025). The human dimension of digital transformation is therefore not peripheral but decisive in determining whether the digital future will be sustainable, inclusive, and humane (Brynjolfsson and McAfee, 2014; European Commission, 2024).

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VV-MVP-24-0375 An ethical concept for the use of artificial intelligence in higher education

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