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Article

Digital Transformation of Human Resource Management and Its Impact on Employee Efficiency: A Systematic Literature Review

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Abstract: This systematic literature review integrates findings from 39 empirical and theoretical studies published between 2022 and 2025 that investigate the digital transformation of Human Resource Management (HRM) and its effects on employee efficiency. Based on the interdisciplinary literature from HRM, organizational behavior, management, information systems, and Industry 4.0 studies, the review combines the findings from qualitative, quantitative, and review-based studies to explain the role of digital HR systems such as e-HRM, HRIS, AI-based HR practices, and analytics-based HR systems in influencing efficiency-related outcomes of employees. The review finds that digital HRM has a positive effect on employee efficiency, which is mediated by process automation, data-driven decision-making, performance management, and digital learning and development, but this is dependent on the alignment of socio-technical factors of technology design, work processes, leadership, and employee digital skills. The review also finds that engagement, organizational agility, digital leadership, and human-centered governance are important mediating and moderating variables that determine whether the digital transformation of HRM is successful in improving employee efficiency. However, the literature is still scattered, with a lack of consistency in the conceptualization of efficiency, a lack of longitudinal studies, and a lack of integration of ethical and governance perspectives in AI-based HRM models. By integrating the convergent and divergent findings from the literature, this review develops an integrative and socio-technical framework that links digital HRM practices to employee efficiency. The review makes a theoretical contribution to HRM by treating employee efficiency as a multi-level outcome of digital transformation and provides evidence-based recommendations to organizations for the effective, ethical, and sustainable digitalization of HRM.

Keywords: Digital Transformation, Digital Human Resource Management, e-HRM, Human Resource Information Systems, Artificial Intelligence in HRM, Employee Efficiency.

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1. Introduction

In recent years, the digital transformation of Human Resource Management (HRM) has gained momentum as a result of the increasing pace of technological development, increased competitive pressures, and the transformation of work in the digital economy. The growing use of digital technologies, such as Human Resource Information Systems (HRIS), artificial intelligence (AI), data analytics, cloud infrastructure, and e-HRM platforms, has significantly impacted the planning,

management, and assessment of human capital in organizations, with a direct impact on employee efficiency and organizational performance [1], [2], [3]. With the increasing shift of HR functions towards automated and data-driven approaches, employees are faced with new work patterns, monitoring systems, and performance requirements that can improve employee efficiency when designed in a coordinated manner, but may also create pressures for adjustment when implemented in a disintegrated or poorly managed manner [4], [5].

Employee efficiency, defined as the optimal use of skills, time, and effort to achieve organizational goals, is inextricably linked with the design and implementation of HRM systems. Digital HRM has been found to improve employee efficiency by simplifying administrative processes, increasing the accuracy and speed of decision-making, allowing for real-time performance analysis, and supporting continuous learning and engagement [6], [7]. However, the literature also warns that digital transformation poses serious challenges in terms of skill gaps, resistance to technology adoption, information overload, and the loss of human interaction, which could negatively affect employee efficiency if not mitigated by appropriate managerial and developmental interventions [8], [9]. Therefore, the effect of digital transformation of HRM on employee efficiency is not standardized or automatic but depends on various factors such as organizational readiness, managerial competence, and the quality of the implementation process.

In this context, HRM takes on a strategic role that extends beyond its role as an operational function, but also as a key mechanism through which the outcomes of digital transformation are mediated. By using digital-enabled training and development, analytics-driven talent management, technology-supported performance management, and digital leadership practices that are employee-centric, HRM can improve employees' ability to adapt to new technology, make effective use of digital tools, and maintain high levels of efficiency [10], [11]. In this way, digital HRM is a change process that affects the entire organization and seeks to transform work roles, competencies, and performance, rather than a mere technological change [12], [13].

However, despite the growing literature on digital transformation and HRM, there are still significant research gaps in the systematic explanation of the impact of digital HRM practices on employee efficiency. The current literature on digital HRM is often fragmented in terms of conceptual and empirical focus, with some studies tending to emphasize the technological capabilities and system-level efficiency of digital HRM, while others tend to focus more on the human-centered outcomes of digital HRM, such as engagement, agility, and performance [1], [14], [15], [16]. Moreover, the empirical findings on digital HRM are scattered across different industries and geographical locations, making it difficult to develop cumulative theoretical knowledge and generalizable practical insights [17], [18].

Accordingly, this systematic literature review integrates theoretical and empirical scholarship on the digital transformation of HRM and its effects on employee efficiency. By integrating empirical evidence on best digital HR practices, explaining the mechanisms underlying the effects of digital transformation on efficiency outcomes, and establishing limitations in the existing literature on contextual, methodological, and theoretical aspects, this systematic literature review aims to contribute to a coherent and theoretically informed understanding of the role of digital HRM in enhancing employee efficiency. In this regard, this systematic literature review aims to contribute to theoretical advancement in digital HRM studies and provide practical insights for organizations seeking to achieve effective, sustainable, and strategically aligned digital transformation of HRM practices [1], [19].

2. Materials and Methods

Main Research Question:

What are the effects of the digital transformation of Human Resource Management (HRM) on the efficiency of employees?

Sub-Research Questions

1. How have theoretical frameworks and empirical studies conceptualized digital transformation in Human Resource Management and its relationship with employee efficiency?
2. What are the specific digital HRM practices (such as HRIS, e-HRM, AI, data analytics, and digital performance management systems) that have been shown to be empirically effective in improving employee efficiency?
3. What organizational, technological, and human factors mediate or moderate the impact of digital HRM transformation on employee efficiency?
4. What are the methodological approaches, theoretical limitations, and contextual gaps that exist in the current literature on digital HRM and employee efficiency?
5. What future research directions are indicated to strengthen the theoretical integration and practical implementation of digital HRM for improving employee efficiency?

Systematic Screening

A systematic literature search was carried out on prominent academic databases, such as Scopus and Web of Science, and supported by backward and forward citation searches to ensure that the literature search covered the relevant literature. The search strategy used a structured combination of keywords and Boolean operators (AND, OR), such as "Digital Transformation," "Digital Human Resource Management," "e-HRM," "Human Resource Information Systems," "Artificial Intelligence in HRM," and "Employee Efficiency." These keywords were chosen to reflect the multidimensional nature of digital HRM and its implications for employee-level efficiency outcomes.

The first search retrieved 1,031 records, consisting of 612 articles from Scopus, 327 from Web of Science, and 92 additional records obtained by citation tracking. After removing the duplicates, 540 records were screened for the first stage of screening using the titles and abstracts to determine relevance and alignment with the purpose of the review. At this point, 223 records were removed as they were not relevant to digital HRM or did not include outcomes related to employee efficiency, leaving 317 records for screening.

In the second stage of screening, the criteria for inclusion were more rigorous and emphasized the methodology, theory, and analysis of digital HRM practices. This led to the exclusion of 147 studies, and 170 articles were considered for the next stage of screening. The articles were then screened using a relevance assessment matrix that

considered the clarity of concepts, empirical validity, and the role of digital HRM transformation in the efficiency of employees. This stage led to the exclusion of 120 studies, and 39 studies were identified that were relevant to the scope of the review.

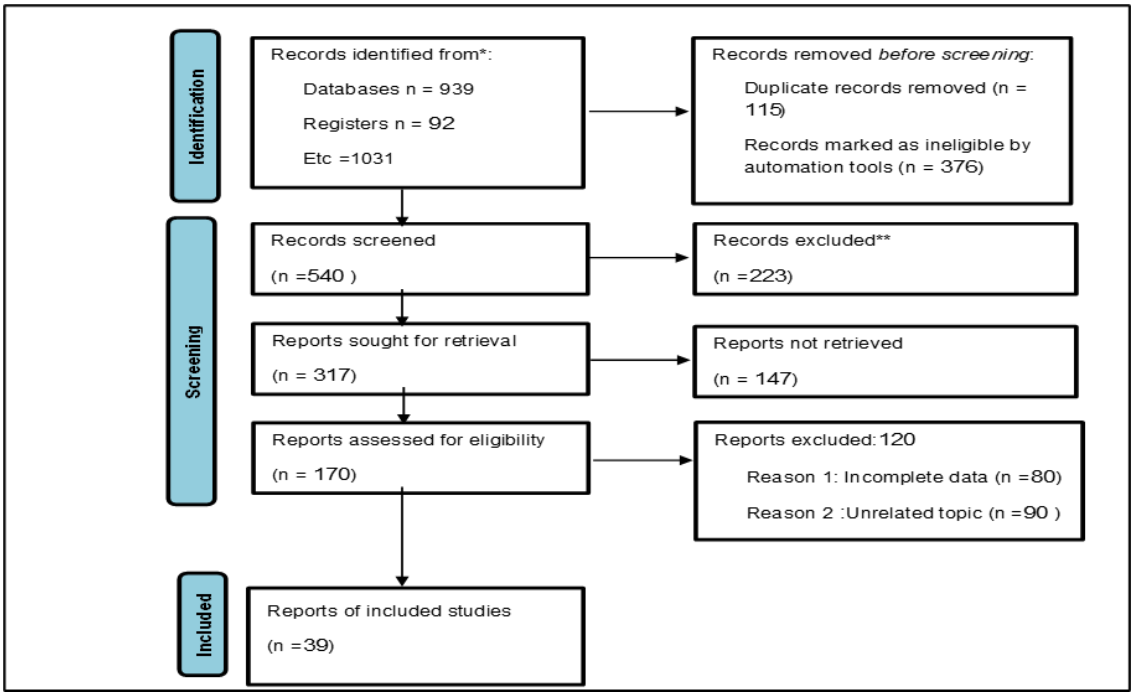

Figure 1. PRISMA diagram.

The final pool of 39 studies constituted the evidentiary basis for the synthesis and analysis. The multi-stage screening process follows PRISMA-compliant procedures and offers a transparent and replicable basis for the synthesis of existing knowledge on the impact of digital transformation in HRM on employee efficiency.

Table 1. Summarizes the criteria used to determine eligibility.

Criterion	Inclusion Criteria	Exclusion Criteria
Publication type	Peer-reviewed journal articles, systematic or narrative literature reviews, and well-established conceptual or theoretical studies	Conference proceedings, abstracts only, unpublished manuscripts, opinion pieces, editorials
Indexing & scholarly credibility	Articles published in journals indexed in Scopus or Web of Science, or in internationally recognized peer-reviewed HRM and management journals	Publications in non-peer-reviewed outlets or sources lacking academic rigor
Language	English-language publications to ensure accessibility and comparability	Publications in languages with limited academic accessibility
Temporal scope	Empirical and theoretical studies published between **2022 and 2025**, reflecting contemporary digital HRM transformation	Studies outside the specified period or unrelated to the current digital transformation discourse
Core phenomenon	Explicit focus on digital transformation of HRM, including e-HRM, HRIS, AI-enabled HR practices, and HRM 4.0	Studies addressing digitalization without a clear HRM focus
Outcome focus	Direct or indirect examination of employee efficiency, performance, productivity, engagement, or work effectiveness	Studies focusing exclusively on organizational-level outcomes without employee-level implications

Disciplinary domain	Human Resource Management, Organizational Behavior, Management, and Information Systems	Purely technical, macroeconomic, or policy-oriented studies without HRM relevance
Theoretical grounding	Studies employing or contributing to digital HRM, socio-technical systems, human-centered design, or organizational change frameworks	Studies lacking explicit conceptual or theoretical grounding
Methodological scope	Empirical studies (quantitative, qualitative, or mixed-methods) and systematic or narrative reviews	Studies with unclear methodology or insufficient methodological transparency
Context / population	Employees, HR professionals, managers, or organizations undergoing digital HR transformation	Student-only samples or non-workplace-related contexts
HRM relevance	Clear implications for HRM practices, systems, leadership, or workforce management	Studies without theoretical or practical relevance to HRM
Analytical contribution	Studies that enhance understanding of mechanisms, enablers, barriers, or outcomes linking digital HRM to employee efficiency	Studies offering only peripheral, descriptive, or anecdotal insights

3. Results and Discussion

Descriptive Summary of the Studies

This systematic review charts a heterogeneous literature on the digital transformation of Human Resource Management (HRM) and its implications for employee efficiency. The studies included in this systematic review are based on HRM, Management, Information Systems, and Industry 4.0 literature, including conceptual, review-based, and empirical studies on digital HR architecture (e-HRM/HRIS), AI-based HR practices, analytics-based decision-making, and digital HR-mediated employee experience. In terms of methodology, the literature is dominated by systematic literature reviews and narrative literature reviews that synthesize HRM 4.0, technology adoption, and implementation challenges, and empirical studies that investigate performance, engagement, agility, and efficiency outcomes in applied settings [1], [2], [8].

Throughout the body of scholarship included in this review, digital HRM is framed not simply as a technical improvement but as a socio-technical change that encompasses process change, capability development, and governance decisions that impact the translation of technology into efficiency [4], [17]. Employee efficiency is most commonly measured through proximal outcomes of employee performance, productivity, engagement, HR efficiency, organizational agility, and work effectiveness, which indicate a body of scholarship where efficiency is commonly framed as a multi-dimensional construct rather than a single outcome [7], [20], [21].

The cumulative evidence points towards the fact that efficiency gains are most likely to be linked to digital HRM technologies that combine automation of administrative processes, data analytics for HR decision-making, and digital-based performance and development management systems; however, the existing literature also points towards the fact that the achievement of efficiency gains is contingent upon the presence of contextual enablers such as leadership, digital literacy, organizational readiness, and human-centered approaches to implementation [10], [22], [9]. In general, the existing literature points towards the fact that the studies included in this review point towards a non-linear relationship between digital transformation and employee efficiency, where digital transformation can act as a catalyst for increased employee efficiency due to the simplification of workflows and improved capability alignment, but can also create friction due to

resistance, skills, and implementation barriers when technology adoption rates exceed change management and employee support [5], [23], [24].

Table 2. Descriptive Summary of Studies.

No.	Year	Author(s)	Article Title	Methodology	Sample / Context	Main Objective & Key Findings	Theory / Main Framework	Additional Analytical Fields
1	2022	Silva et al. [1]	Human Resources Management 4.0: Literature Review and Trends	Systematic Literature Review	93 articles / 75 journals	Identifies HRM 4.0 trends; digitalization enhances efficiency via automation and analytics	HRM 4.0 framework	Industry 4.0, strategic HR
2	2023	Bratamanggala [2]	Digital Transformation in HRM: A SLR	Systematic Literature Review	Multi-sector literature	Digital HR improves HR efficiency and service quality	Digital HRM adoption model	Governance, readiness
3	2023	Gunawan & Sopiah [15]	Impact of Digitalization System on Employee Performance	Literature Review	Multi-sector	Digital systems enhance productivity and performance	Performance Management Theory	Process automation
4	2023	Zhang & Chen [12]	Exploring HRM Digital Transformation in the Digital Age	Conceptual / Empirical	Organizations	Explores drivers and outcomes of HR digitalization	Digital transformation drivers	Strategy, capability
5	2023	Gadzali et al. [24]	HRM Strategy in Organisational Digital Transformation	Conceptual	Organizations	Strategic HR alignment enables efficiency in DT	Strategic HRM	Change management
6	2023	Abuhantash [14]	Impact of HRIS on Organizational Performance	Systematic Literature Review	Global literature	HRIS improves HR effectiveness and efficiency	HRIS value framework	Information systems

7	2024	S, R. [25]	Influence of Digital Technology on HRM Practice	Quantitative	Organizations	Digital tools improve HR practices and efficiency	Technology-based HRM	HR digitization
8	2024	Nurfadilah et al. [26]	Digitalization of Industry 4.0 Toward Improving HRM	SLR & Bibliometric	Global literature	Industry 4.0 digitalization boosts HR productivity	Bibliometric framework	Research trends
9	2024	Dyakiv et al. [4]	Digital Transformation in HRM: Challenges and Opportunities	Conceptual & Empirical	European organizations	Efficiency gains depend on skills and flexibility	Socio-technical systems theory	Ethics, risks
10	2024	Balabanova et al. [5]	Digital Transformation in HRM and Enterprise Performance	Quantitative	Enterprises	Digital HRM positively affects performance	Strategic HRM	Enterprise efficiency
11	2024	Umpain et al. [27]	Communication Strategies for Government Employees in Digital Era	Systematic Literature Review	Public sector	Digital communication supports employee performance	Communication theory	Public HR
12	2024	Handayani et al. [23]	HR Transformation to Technology in Industry 4.0	Systematic Literature Review	Global literature	HR technology improves efficiency if readiness exists	Industry 4.0 HR	Readiness
13	2024	Escribá-Carda et al. [17]	Firms' Digital Transformation and e-HRM	Qualitative (case studies)	SMEs	e-HRM enhances efficiency when aligned with strategy	Resource-Based View	HR analytics

14	2024	Kamalakannan [13]	Integration of DT with HRM: A Theoretical View	Conceptual	—	Conceptualizes DT–HRM integration for efficiency	Integrative HRM model	Theory building
15	2024	S. et al.	Strategic HR Planning in Digital Transformation Era	Conceptual / Empirical	Organizations	Strategic HR planning supports workforce efficiency	Strategic HR Planning	Workforce planning
16	2024	Makovoz & Lysenko [28]	Digital Technologies in Personnel Management	Conceptual	Organizations	Digital tools improve personnel efficiency	Digital HR tools	HR automation
17	2024	Amalia [29]	Impact of Digital Era 4.0 on HRM	Conceptual / Empirical	Organizations	Era 4.0 reshapes HRM and efficiency outcomes	Industry 4.0 HR	Digital readiness
18	2025	Zakaria et al. [6]	Impact of Digital Era Transformation on HRM	Quantitative	Employees	Digital HR practices improve efficiency	TAM	System usability
19	2025	J. [30]	Efficiency Enhancement of Hospital HRM under DT	Quantitative / Case-based	Hospitals	Digital HR improves HR efficiency in healthcare	Digital healthcare HR	Sectoral HR
20	2025	Haryadi [8]	Digital Transformation in HRM: Effectiveness & Challenges	Literature Review	Global literature	Highlights efficiency benefits and implementation barriers	Digital HR effectiveness	Barriers
21	2025	Sundari et al. [22]	Artificial Intelligence in HRM: SLR	Systematic Literature Review	Cross-industry	AI improves recruitment and decision efficiency	Human-centered AI	Ethics, bias

22	2025	Nusa & Medika [10]	Digital Transformational Leadership and Efficiency	Quantitative	Organizations	Leadership drives efficiency via engagement	Transformational leadership	Engagement
23	2025	Rahman [31]	HRM in Transport Sector: SLR	Systematic Literature Review	Transport sector	Strategic HR improves sectoral efficiency	Sectoral HRM	Transport
24	2025	Amany [3]	Review of Digital HRM	Literature Review	Global literature	Digital HR transforms HR efficiency and practices	Digital HRM framework	HR innovation
25	2025	Chrusciak et al. [32]	Human-Centric Process Improvement via DT	Mixed-methods	Industrial firms	Human-centered DT maximizes efficiency	Human-centered design	Process improvement
26	2025	Zhang [11]	Mechanism of Digital HRM on Employee Performance	Quantitative	Employees	Efficiency mediated by engagement and commitment	Social Exchange Theory	Commitment
27	2025	Mahmoud et al. [7]	Digital HRM, DT, and HR Efficiency	Quantitative (SEM)	385 employees	Digital HRM improves efficiency; agility moderates	Dynamic Capabilities	Agility
28	2025	Musaigwa & Swanepoel [33]	DT, Workforce Agility & Intangible Resources	Systematic Literature Review	Global literature	Agility mediates DT–efficiency relationship	Resource-based logic	Intangibles
29	2025	Thu et al. [20]	Digital HRM and Performance in Vietnam	Quantitative (PLS-SEM)	Vietnamese firms	Digital HRM improves efficiency via engagement	RBV & Digital capability	Emerging economy
30	2025	Riesnandar et al. [34]	HRM Influence on Employee Performance in	Quantitative	Employees	Digital HRM improves efficiency and performance	HRM–performance linkage	Digital era

			Digital Era					
31	2025	Ferian dy & Hartin i [16]	HRM Role in Improvin g Engagem ent in Digital Era	Quanti tative	Banking /Finance	Engagement mediates HRM–efficiency	Engagemen t theory	Financial sector
32	2025	Djunae di [35]	Digital Transfor mation and Strategic HR Role	Conce ptual / Empiri cal	Organiz ations	Strategic HR enhances efficiency in DT	Strategic HRM	Performan ce
33	2025	Alrous an et al. [36]	Enhancin g Organizat ional Effectiven ess Through Digital HR	Conce ptual	Organiz ations	Digital HR drives sustainable efficiency	Posthuman ist HR	Sustainabi lity
34	2025	Damnj anović et al. [37]	AI & Data Analytics in HRM	Conce ptual / Empiri cal	Enterpri ses	AI-driven HRM enhances competitive efficiency	AI-enabled HR	Analytics
35	2025	Sarkisi an & Garafo nova [18]	Impact of Smart HRM on HR System Efficiency	Quanti tative	Enterpri ses	Smart HRM improves HR efficiency	Smart HRM	Digital economy
36	2025	Bhatti et al. [9]	Future of HR: Benefits & Challenge s of DT	Conce ptual	Organiz ations	DT improves efficiency but raises challenges	Future HR perspective	Risks
37	2025	Setiaw an et al. [38]	Transfor ming HR Practices in the Digital Age	Quanti tative	Workfor ce	Digital HR supports resilience and efficiency	Workforce resilience	Innovatio n
38	2025	Pradip to et al. [19]	Revolutio nizing HRM: DT and	Quanti tative	Organiz ations	Digital HR improves efficiency	Strategic HRM	Sustainabi lity

							and sustainability		
39	2025	Sarkisian & Garafonova [18]	Sustainability Smart HRM in the Digital Economy	Quantitative	Enterprises	Smart HRM increases HR efficiency	Smart HRM framework	HR analytics

Thematic Review of Literature

Digital Transformation of Human Resource Management and Employee Efficiency

Analysis of the 39 studies included in this synthesis reveals that the relationship between digital transformation in human resource management (DHRM/e-HRM/HRM 4.0) and employee efficiency can be conceptualized as a multi-dimensional socio-technical phenomenon where HR technology, process redesign, employee capabilities, leadership, and organizational flexibility are interwoven in a self-reinforcing manner. Thus, the literature suggests a consensus on the notion that efficiency gains are not achieved by technology implementation but by the level of socio-technical fit between digital HR technology, work system design, and human-centric governance in different organizational settings [1], [2], [4].

First, the evidence reviewed has been consistent in identifying process digitalization and HR automation as the underlying routes to efficiency gains. Trend mapping and systematic review studies have found that HRM 4.0, especially when integrated into Industry 4.0 systems, leads to a decrease in HR-related administrative work, shortens HR-related cycle times (e.g., recruitment, selection, and appraisal), and enhances decision-making quality by allowing for the coordination of data flows [1], [26], [23]. Empirical and review studies on HR technology adoption have also found that the adoption of e-HRM and HRIS leads to smoother HR-related workflows, decreased friction in HR-related operations, and improved performance management, often using employee performance and productivity as a proxy for efficiency gains at the individual level [14], [15], [25]. Industry-level evidence has further supported this line of reasoning by finding that, in high-demand settings such as hospitals, HR digital transformation can lead to increased efficiency gains through better staffing coordination, service continuity, and more responsive HR process execution [30].

Second, a specific line of research highlights AI, HR analytics, and "smart HRM" as the mechanisms that can further enhance efficiency gains as HR work transforms from transactional processing to predictive and decision-supporting activities. Literature reviews on AI in HRM indicate that algorithmic screening, talent analytics, and technology-aided monitoring can enhance the speed and internal consistency of HR decisions, as well as facilitate near-real-time feedback that could potentially enhance productivity and minimize performance variability [22], [37]. Contemporaneous research on smart HRM contends that analytics-driven HR systems can improve the efficiency of enterprise HR systems by promoting greater measurement accuracy, resource optimization, and strategic workforce planning in a more technologically sophisticated context [18]. Nevertheless, these studies also stress that efficiency gains are contingent upon the presence of appropriate ethical and governance frameworks, especially those that emphasize transparency, accountability, and bias correction, since perceptions of algorithmic lack of transparency and fairness can potentially impair employee trust and adoption, thus limiting efficiency gains [22], [37].

Third, employee efficiency is often defined and conceptualized as a function of capability- and context-contingent enablers, such as digital competencies, employee engagement, leadership, and organizational agility/resilience. Some research models engagement and efficiency as mediating mechanisms that help digital HR initiatives achieve efficiency gains, suggesting that technology impacts efficiency by influencing motivation, commitment, and the nature of employee-organization exchange in digital work systems [10], [16], [11]. Further empirical evidence suggests that organizational agility positively moderates the relationship between digital HR systems and HR efficiency, suggesting that adaptive structures and reconfiguration capabilities play the role of

amplifiers of the value created through digital HR initiatives [7]. Related research on workforce resilience and innovation also suggests that efficiency gains are more likely to be maintained when digital HR transformation is supported by learning, adaptation, and improvement-oriented climates [38].

Fourth, implementation-scholarship research points to a consensus that efficiency effects are context-dependent and contingent upon organizational readiness, sectoral limitations, and the degree to which transformation is human-centered. Qualitative and human-centered approaches highlight the importance of recognizing digital HR transformation for its superior efficiency effects when viewed as process improvement informed by user experience and usability, rather than purely technical implementation [17], [32]. In effectiveness and difficulty studies, common inhibitors include resistance to change, a lack of digital skills, system fragmentation and integration issues, privacy and cybersecurity concerns, and a mismatch between technology solutions and HR strategy, which can transform potential efficiency benefits into additional coordination costs and implementation difficulties [8], [4], [9]. Findings from government-related literature reviews also suggest that communication practices facilitating adoption, collaboration, and role understanding during transformation efforts are crucial to digital-era performance and efficiency, underscoring the organizational aspects of technology-driven efficiency [27].

Critical Analysis and Synthesis

The literature reviewed shows an increasing theoretical scope in accounting for digital HR transformation and its impact on efficiency, with a tendency to fall back, explicitly or implicitly, on socio-technical, resource, and dynamic capability logic [4], [17], [7]. However, most of the literature reviewed tends to be more descriptive, with a focus on general "benefits and challenges" rather than attempting to specify causal mechanisms, boundary conditions, or precise definitions of efficiency at the individual level [2], [8], [9]. When quantitative modeling is done, the preponderance of cross-sectional survey research designs allows for association inference (including mediation and moderation analyses) but does not allow for stronger statements about causality and the sustainability of efficiency gains past the initial stages of adoption [7], [20], [6].

Methodologically, the body of evidence is heavily influenced by systematic reviews, narrative reviews, and bibliometric studies that trace the development of HRM 4.0, e-HRM, and AI-based HR practices, but tend to lack detail on objective employee-level efficiency gains in terms of time usage, throughput, error rates, or task-cycle time reduction [1], [26], [23]. Furthermore, empirical research that refers to "efficiency" may conceptualize it at the level of HR function performance instead of employee performance, leading to a construct discontinuity between HR function effectiveness and employee-level productivity performance. This trend indicates a meso-level explanatory gap regarding the role of HR digital transformation in work design, coordination mechanisms, and performance control systems, which indirectly affect employee efficiency through job demands/resources, role ambiguity, and monitoring systems [32], [38].

Substantively, the literature exhibits convergence that digital HR transformation can improve efficiency through faster processes, improved matching, and data-informed decision-making, while simultaneously revealing divergence regarding net outcomes once implementation costs, ethical risks, and adoption frictions are considered. Some studies portray digital transformation as predominantly efficiency enhancing, whereas others emphasize that gains may be delayed, fragile, or unevenly distributed particularly where digital skill disparities are pronounced or algorithmic governance is perceived as unfair or insufficiently transparent [22], [8], [4]. Sectoral constraints especially in healthcare and public administration may intensify both the upside potential (coordination and continuity) and downside risks (compliance pressures and resistance) of digital HR transformation [30], [27]. Finally, although agility, engagement, and leadership repeatedly appear as amplifying conditions, longitudinal evidence explaining how organizations develop these enabling capacities over time remains limited. Consequently, the accumulated evidence while positioning digital HR transformation as strategically consequential for employee efficiency remains fragmented across technology types (HRIS, e-HRM, AI), levels of analysis (employee versus HR

function), and contextual settings, reinforcing the need for more integrated and temporally sensitive research designs [7], [10], [38].

Agreement and Divergence Across Studies

Across the reviewed studies, there is consistent agreement that DHRM, e-HRM, HRIS, and HRM 4.0 practices contribute to efficiency by simplifying HR processes, improving decision quality, and enabling analytics-supported workforce management [1], [14], [2], [26]. A further point of convergence is that AI and HR analytics can accelerate HR decision cycles and enhance performance monitoring, provided that these technologies are accompanied by safeguards for transparency, accountability, and ethical assurance [22], [37], [18]. The literature also converges on organizational enablers, particularly engagement, performance, agility, and digital leadership, which are frequently theorized as mediating or moderating conditions that strengthen the digital HR efficiency relationship [10], [7], [16].

Divergence is most evident in three areas. First, efficiency is not uniformly conceptualized, with studies alternating between employee-level productivity, HR function efficiency, and organization-wide performance, reducing comparability and complicating synthesis [7], [20], [34]. Second, while some contributions highlight rapid efficiency gains, others foreground implementation frictions, skills gaps, resistance, governance deficits, and cybersecurity risks, implying that efficiency outcomes are conditional and may fail to materialize without deliberate change management and capability development [4], [8], [9]. Third, although human-centered design perspectives argue that efficiency is maximized when digital HR supports autonomy, usability, and fairness, many empirical studies treat user experience and perceived justice as secondary factors rather than as core mechanisms shaping efficiency outcomes [17], [32], [22]. Overall, the synthesis indicates conceptual consensus on the efficiency relevance of digital HR transformation, alongside uneven empirical development in measurement standardization, causal validation, and the integration of governance and employee experience into explanatory models.

Theoretical and Practical Implications

Theoretical Implications

The synthesis supports the conclusion that digital transformation in HRM (DHRM/e-HRM/HRM 4.0) influences employee efficiency through a dynamic socio-technical configuration in which technology-enabled HR practices interact with human capabilities and organizational conditions rather than producing linear or automatic effects [1], [2], [4]. Integrating HRM 4.0 and Industry 4.0 perspectives with socio-technical reasoning clarifies how automation, analytics, and system integration can reduce cycle time and enhance decision accuracy, while simultaneously emphasizing that efficiency remains contingent on adoption quality and governance robustness [1], [26], [23]. The evidence also indicates that efficiency operates across interdependent levels, micro (employee productivity and engagement), meso (HR process efficiency and agility), and macro (sectoral digitalization and institutional constraints), suggesting that theory should explicitly model cross-level linkages rather than treating efficiency as an isolated employee outcome [7], [20], [31]. Furthermore, AI- and analytics-driven HRM extends the theoretical domain toward algorithmic decision-making, where efficiency claims are inseparable from normative considerations of fairness, transparency, and bias, implying that "efficient HR" should be theorized as simultaneously technical and ethical [22], [37], [18]. Finally, the repeated identification of agility, leadership, and engagement as amplifiers supports capability-oriented interpretations in which efficiency is strengthened when organizations can sense, adapt, and reconfigure HR and work systems under digital change [10], [7], [38].

Practical Implications

From a practice perspective, the literature suggests that organizations should pursue integrated, end-to-end digital HR architectures that connect workforce planning, recruitment, onboarding, performance management, and learning systems, thereby reducing fragmentation and minimizing integration overhead that can erode efficiency gains [1], [39], [28]. Emphasis is also placed on building employee digital readiness through training, communication, and adoption

support, because implementation quality consistently appears as a boundary condition for whether digital HR tools translate into faster workflows, higher decision accuracy, and improved productivity [2], [8], [4]. In sectors characterized by high workload intensity and strong regulatory constraints, such as healthcare and public administration, effective digital HR transformation should be grounded in context-specific process redesign and supported by communication practices that maintain role clarity and coordination during transition [30], [27]. Where AI-enabled HR functions are deployed, the evidence underscores the necessity of human-centered governance (accountability, transparency, explainability, and bias mitigation) to sustain trust and prevent resistance-driven efficiency losses [22], [37]. Finally, leadership and engagement should be treated as efficiency-relevant intervention points because digital transformational leadership and engagement-focused HR strategies frequently strengthen the pathways linking digital HR transformation to employee efficiency outcomes [10], [16], [38].

Gaps and Future Research Directions

Despite the rapid expansion of scholarship on digital transformation in human resource management, several substantive gaps persist that constrain cumulative theory building and empirical generalization. A prominent limitation concerns the scarcity of longitudinal and implementation-sensitive research designs capable of examining whether efficiency gains are sustained beyond the initial adoption phase and how employee efficiency evolves across different stages of digital HR implementation and stabilization [8], [9]. Although a substantial proportion of studies document perceived benefits and implementation challenges, relatively few provide explicit, measurable employee-level mechanisms such as reductions in task cycle time, improvements in coordination efficiency, error minimization, or systematic workload redistribution, thereby limiting the translational precision of findings for both theory and practice [1], [4].

A further gap relates to the underdeveloped integration of human-centered governance within AI-enabled HRM research. While ethical concerns surrounding algorithmic bias, transparency, and accountability are frequently acknowledged, these dimensions are rarely incorporated as central explanatory constructs in empirical models assessing efficiency outcomes, resulting in an incomplete understanding of how governance conditions shape the efficiency effects of AI-driven HR practices [22], [37]. In addition, sectoral coverage remains uneven: although digital HR transformation has been examined in contexts such as transportation, healthcare, banking, and public administration, comparative multi-sector investigations that systematically analyze boundary conditions such as regulatory intensity, unionization levels, service criticality, and data sensitivity remain limited [31], [21], [27], [30].

Looking ahead, future research would benefit from multi-level and integrative modeling approaches that explicitly test indirect pathways through which digital HR systems influence employee efficiency via engagement, commitment, organizational agility, and workforce resilience, while simultaneously accounting for the distribution of digital skills and leadership capability as key structural enablers [7], [10], [38], [11]. Advancing such research agendas would substantially enhance theoretical coherence and provide more robust, context-sensitive evidence on when and how digital HR transformation generates sustainable efficiency outcomes.

4. Conclusion

Taken together, the evidence indicates that digital transformation in HRM is a strategically consequential, multi-level phenomenon that can enhance employee efficiency by streamlining HR processes, enabling data-driven decisions, accelerating performance feedback, and strengthening workforce allocation and capability development. The literature positions HRM 4.0, e-HRM/HRIS, and analytics/AI-enabled HR as key efficiency levers, while emphasizing that realized gains depend on adoption quality, workforce digital readiness, and governance conditions. Efficiency effects are frequently reinforced by organizational agility, engagement, and digital leadership, suggesting that digital HR transformation is most effective when implemented as a socio-technical change

programme rather than a standalone technology initiative. However, the evidence base remains uneven in causal validation, metric consistency, and longitudinal assessment, limiting strong conclusions about sustainability and distribution of efficiency gains across roles, sectors, and employee groups. Future research should therefore advance standardized efficiency measures, robust longitudinal and quasi-experimental designs, and human-centered governance frameworks that integrate ethics, skills development, and change management into coherent models of digital HR transformation and employee efficiency outcomes.

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