ICT-Driven Smart HRM in Hospitals: A Scopus-Based Bibliometric Analysis of Trends and Themes

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ABSTRACT

The advancement of digital technologies such as artificial intelligence, big data analytics, and cloud computing has significantly transformed Human Resource Management (HRM) practices in hospitals. This transformation aims to enhance operational efficiency, service quality, and employee well-being. However, this study explores global trends by analyzing the impacts, challenges, and opportunities of HRM digitalization in hospital settings. Technology adoption also presents challenges, including digital stress, data privacy concerns, and organizational readiness. A qualitative bibliometric analysis was conducted using VOS viewer software. A total of 131 articles were published between 2019 and 2024, indexed in the Scopus database. The findings reveal five key themes: operational efficiency, decision support systems, employee engagement, adaptive leadership, and knowledge management. India, China, and Malaysia are the top contributing countries in this research domain. Nonetheless, challenges such as infrastructure readiness, workforce training, and psychosocial impacts of digitalization remain prominent. ICT integration in hospital HRM holds great potential in supporting healthcare transformation by enhancing efficiency, training, and data-driven performance evaluation. However, a balanced digitalization strategy is needed, one that considers employee well-being and ethical concerns. Future research should further explore the role of leadership in digital change and develop sustainable frameworks to support technology-based HRM.

Keywords: *Digital Transformation, Human Resource Management, Hospital, ICT.*

Submitted:
January 6, 2026

Revised:
February 13, 2026

Accepted:
March 28, 2026

Published Online:
March 31, 2026

INTRODUCTION

Human Resource Management (HRM) is a key element in hospitals' operational performance. Staff behavioral intention to use tools like telemedicine and Electronic Health Records (EHR) is influenced by achievement expectancy, effort expectancy, and social influence (Putri et al., 2024). Recent advancements in technologies, including AI, machine learning, big data analytics, and cloud computing, have modernized HR processes, enabling efficient, data-driven decision-making in recruitment, performance management, and employee engagement (Alaghbari et al., 2024). Effective HRM also aligns employee development with hospital growth strategies, enhancing operational efficiency (Wang et al., 2024). In smart hospitals, HRM integrates with Hospital Management Information Systems (HMIS), covering e-MR, HRIS, billing, and pharmacy systems (Hidayah et al., 2023). Technologies like 5G and AI further improve operational efficiency by enabling remote monitoring, predictive analytics, and personalized medical treatment (Elendu et al., 2024).

The integration of Human Resources (HR) and Information Technology (IT) can significantly improve hospital operations by supporting data management, decision-making, and more effective performance evaluation, thereby creating a more dynamic and efficient HR system (Sun & Su, 2017). Globally, hospitals are increasingly adopting technology in HRM to optimize healthcare management processes (Venugopal et al., 2019). Over the past three decades, research on HRM in healthcare has steadily increased,

JIMKES

Jurnal Ilmiah Manajemen Kesatuan
Vol. 14 No. 2, 2026
pp. 1813-1826
IBI Kesatuan
ISSN 2337 – 7860
E-ISSN 2721 – 169X
DOI: 10.37641/jimkes.v14i2.5103

with major contributions from countries such as the United States and Australia, focusing on performance, job satisfaction, and care quality, although gaps remain in studies related to compensation and employee relationship management (Qin et al., 2023).

The implementation of Health Information Systems (HIS) is increasingly widespread, particularly in developed countries, with the aim of improving care quality, safety, and efficiency. This process, through the utilization of e-HR and telemedicine, has been growing, driven by performance expectations, effort expectations, and social influence (Barbieri et al., 2023). In addition, AI and machine learning are starting to be incorporated into HMS to improve decision-making, predictive analysis, and operational efficiency (Destriani et al., 2024). This is expected to significantly advance smart hospitals with personalized care henceforth. The digital transformation towards healthcare 4.0 aims to automate administrative procedures and enhance clinical management through the use of advanced decision-support tools.

The integration of technology in HRM significantly improves healthcare services by enhancing operational efficiency, service quality, and cost management. Technology-supported HRM streamlines administrative processes, reduces human errors, and increases hospital efficiency, while improving nursing services and reducing waiting times through better data management and communication (Wang & Huang, 2010; Alaghbari et al., 2024). Despite high initial investment costs, long-term benefits include improved productivity and more effective hospital services through smart HRM and information technology implementation (Vahdat, 2022). The COVID-19 pandemic further accelerated HRM transformation through technologies such as cloud computing and teleworking, which helped organizations maintain performance and employee well-being. In addition, authentic leadership plays an important role in managing crises and supporting digital transformation, as innovative technologies can improve hospital care management, workflow coordination, and patient welfare when supported by adequate training, professional staff, and integrated systems (Vandresen et al., 2022). However, challenges remain, including equipment shortages, system inefficiencies, cultural adaptation difficulties, and fragmented Human Resource Health Information Systems (HRHIS), which limit coordination and operational effectiveness (Zhila et al., 2022).

Based on the studies outlined above, there are several interesting insights regarding the capacity of information technology in HRM effectiveness in the hospital area, particularly in the post-COVID-19 pandemic context. However, despite numerous studies addressing this topic, there are aspects that have not been extensively explored or still have potential for further development. Additionally, there has yet to be a bibliometric study specifically highlighting the shift in HRM paradigms in the hospital sector as a direct result of digitalization. Meanwhile, the advancement of digital technologies has substantially influenced various organizational processes, not only in administrative processes but also in organizational structures, HR professional roles, and strategic approaches to workforce management. Therefore, this research aims to explore the future of smart HRM in hospitals by analyzing insights obtained from a bibliometric study on the impact of technological transformation. Through a bibliometric analysis approach, this article identifies trends, patterns, and emerging relationships in the literature that focus on the implementation of technology within hospital-based HRM systems.

LITERATURE REVIEW

Conceptual Foundations of Smart HRM

Smart Human Resource Management (HRM) in hospitals is increasingly framed as a response to two hard realities: chronic workforce pressure (shortages, turnover, burnout) and the operational complexity of 24/7 care delivery that demands fast, data-informed decisions. In this context, "smart HRM" usually refers to ICT-enabled HR functions such as e-HRM platforms, HR information systems, HR analytics dashboards, and algorithmic decision-support that connect workforce data (skills, shifts, performance, training) with service needs (patient flow, acuity, unit demand) to improve staffing quality, employee experience, and organizational resilience. Conceptually, digital HRM is not just an

evolutionary shift in how HR work is designed, executed, and governed in digitally transforming organizations (Strohmeier, 2020). HRM is a core function for improving and managing employees' skills, knowledge, and work attitudes in public organizations. Within a strategic HRM perspective, employees are viewed as critical organizational assets that require continuous investment through effective HR practices to support long-term, sustainable organizational goals.

A key foundation in the literature is the clarification between earlier e-HRM (technology-enabled HR services and self-service) and the broader idea of digital HRM, which includes more pervasive digitization, integration, and transformation of HR processes and decision-making. Strohmeier (2020) argues that the field needs conceptual precision because terms like digitization, digitalization, transformation, and disruption are often used interchangeably, even though they imply different scopes and consequences for HR practice and research.

This matters for hospital settings because HR digitization can range from administrative automation (payroll, attendance, recruitment portals) to strategic transformation (workforce planning, predictive turnover models, competency mapping linked to clinical pathways). Without clear concepts, research outcomes become difficult to operationalize and compare, especially in bibliometric studies that depend on stable keyword structures and thematic boundaries (Strohmeier, 2020).

Challenges and Adoption of HR Analytics

However, moving from "data exists" to "data is used well" remains a persistent bottleneck. Evidence from Norwegian municipal healthcare services shows HR analytics adoption can be limited even where digital systems exist: the study found no extensive use of HR data to inform strategic workforce planning, identifying barriers such as weak data culture, insufficient HR analytics capability/IT support, and organizational "decoupling" between HR and the services where day-to-day staffing decisions happen (Anthun et al., 2024; Inayah et al., 2025). In hospital contexts, this aligns with a broader pattern where analytics investments prioritize clinical technology, while administrative/HR infrastructures receive comparatively less attention, creating a gap between the promise of "smart HR" and practical uptake.

Recent ICT trends also push "smart HRM" into optimization and AI-supported operations, particularly scheduling, rostering, and demand matching. A metanarrative review of real-world AI/ML patient scheduling applications reports promising but heterogeneous evidence: AI tools can improve scheduling efficiency and reduce missed appointments, yet studies vary widely in maturity, outcomes, and implementation readiness, with ongoing concerns about feasibility, generalizability, and bias (Knight et al., 2023). On the workforce side, operations research approaches such as integer programming have shown tangible benefits for nurse rostering by balancing legal constraints, qualifications, and preferences while improving efficiency and staff satisfaction in a clinical case setting (Mystakidis et al., 2024). Together, these streams suggest a convergence: "smart HRM" in hospitals increasingly intersects with smart operations where patient flow technologies, staffing algorithms, and HR data governance become entangled.

Technological Implementation and Employee Outcomes

At the policy level, the World Health Organization's Global Strategy on Digital Health emphasizes that digital transformation in health systems must be guided by governance, interoperability, workforce capacity, and responsible implementation, not merely adoption of tools (World Health Organization, 2021). For hospital HRM, this reinforces the need to treat HR technologies as part of the broader digital health ecosystem: workforce data standards, cybersecurity, ethical use of analytics/AI, and organizational change management are not "extra tasks," but enabling conditions for sustainable smart HRM. The strategy's focus on integrating human, financial, organizational, and technological resources is directly relevant to hospital HR digitization, because HR

systems that are not interoperable (or not trusted) will fail to support strategic workforce planning and quality-of-care goals.

Empirical work in hospital-adjacent settings also links e-HRM practices to employee outcomes. A study of hospital employees in Bandung reports that relational e-HRM practices positively influence employee performance, which in turn predicts productivity, suggesting that HR digitalization can matter beyond administrative efficiency, particularly when it improves HR service quality and employee experience (Muchsam et al., 2024, Handayani et al., 2025). While such findings require careful interpretation across contexts (e.g., different hospital types, governance, and digital maturity), they support a common theme in the ICT trend literature: value is more likely when e-HRM is designed as a service system that strengthens relationships, clarity, and support, not just a digitized bureaucracy.

RESEARCH METHODS

This study employs a qualitative approach with bibliometric analysis methods to examine the development and trends in the application of technology in HRM in hospitals. The bibliometric analysis method is chosen because it provides a comprehensive overview of publication patterns, relationships between concepts, and emerging research maps in this field. The analysis is conducted using the VOSviewer software to visualize networks of keywords, co-citation, and research trends over a specified period. The data sources used in this study are obtained from the Scopus database, with the main keywords: "Human Resource Management" AND "ICT" AND "Hospital." The selection of the Scopus database is based on its reputation as one of the internationally recognized scientific literature databases that includes high-quality journals.

This study uses data obtained from the Scopus database by applying the keywords "Human Resource Management," "ICT," and "Hospital." Scopus was selected due to its comprehensive coverage of reputable international scientific publications. The article selection followed specific inclusion criteria: publications between 2019 and 2024, studies focusing on HRM integrated with ICT in hospital contexts, and articles published in reputable international journals in English. Based on these criteria, a total of 131 articles were identified and included for further analysis.

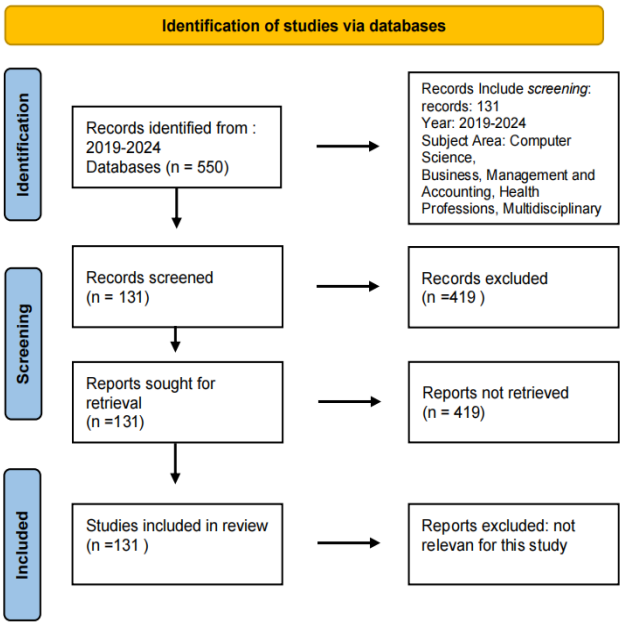

Figure 1. Stages of Data Collection

After selecting the articles, metadata, including titles, abstracts, keywords, author names and affiliations, publication years, and journal sources, were extracted and compiled in CSV format. The data were then analyzed using VOSviewer to conduct keyword classification based on co-occurrence analysis. Frequently appearing keywords were grouped into thematic clusters to identify research trends, relationships among topics, and the overall knowledge structure in the field. The classification results reveal several dominant research themes, including digital transformation in HRM, e-leadership, digital performance evaluation, digital learning, and AI-based operational efficiency. The analysis procedure is carried out in several stages, as shown in Figure 1.

Visualization analysis using VOS viewer maps the relationships between keywords and their frequency of occurrence, which forms the basis for interpreting the thematic discussion in this article. The visualization results are interpreted the objective is to map out prevailing patterns, critical obstacles, and prospective research avenues concerning the adoption of technology in hospital-based HRM. To ensure data validity, the Scopus database is used, which has high indexing standards. In addition, the interpretation of the results is conducted through triangulation by reviewing related literature and comparing it with the bibliometric results.

RESULTS

Trends of HRM and ICT Research Publication

This study presents an analysis of publication trends in the fields of Human Resource Management (HRM) and Information and Communication Technology (ICT) during the period 2019–2024. The data is presented systematically to provide an overview of research developments over time and to identify patterns of scientific contributions in these fields. Before entering into a more detailed discussion, Figure 2 summarizes the distribution of research data, which serves as the basis for subsequent analysis.

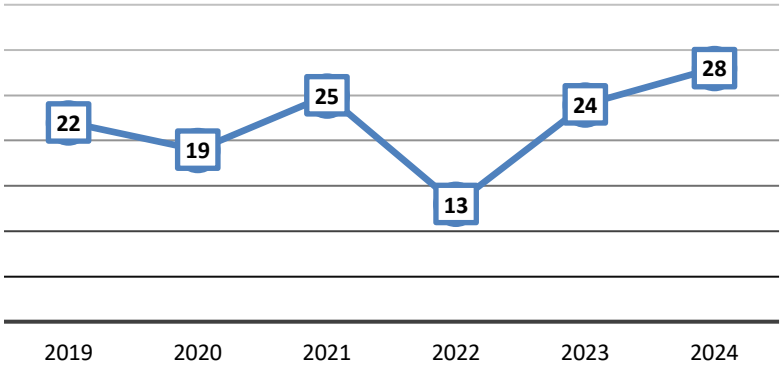

Figure 2. Annual Publication Distribution (2019-2024)

Figure 2 shows the trend of the number of publications by year related to HRM. This horizontal graph illustrates the fluctuation in the number of studies from 2019 to 2024, with a peak in publications occurring in 2024 (28 publications). Several other years show relatively small declines with numbers of 25, 24, 22, and 19 publications. Meanwhile, there was a decrease in publications in 2022, with only 13 publications. This trend provides an overview of how the development of information technology in HRM has evolved and become a global issue.

As information systems evolve in HRM, healthcare institutions increasingly adopt technology-driven frameworks to enhance efficiency and retain skilled personnel. Intelligent HRM systems go beyond administrative functions by supporting individualized and home-based care while aligning staff roles with dynamic patient needs (Strohmeier, 2020). Technology-based HRM improves workforce management, enabling medical staff to focus on patient care and enhancing service quality through streamlined processes, better communication, and reduced costs (Buchbinder et al., 2019). Effective leadership and teamwork are essential for successful implementation. However, fully

realizing the benefits of digital HRM requires addressing challenges related to data security, system compatibility, and ethical responsibility (Tiriteu et al., 2024).

In the study of HRM in the digital era, several works provide significant insights into how digital solutions, strategic leadership, and workforce engagement enhance institutional outcomes. Table 1 identifies Mazurchenko and Maršíková (2019) as among the most influential, with 36 citations for "Digitally powered HRM: Skills and roles in the digital era," emphasizing the urgent need for new competencies and roles in response to rapid digitalization.

Table 1. Ranking of Trending Articles

Rank	Title	Author	Journal	Cite
1	Digitally-powered human resource management: Skills and roles in the digital era.	Mazurchenko and Maršíková (2019)	Computers and Industrial Engineering	36
2.	Intelligent assistant system as a context-aware decision-making support for the workers of the future.	Belkadi et al. (2020)	Computers and Industrial Engineering	35
3	The effect of perceived transformational leadership style on employee engagement: the mediating effect of leader's emotional intelligence.	Milhem et al. (2019)	Foundations of Management	31
4	Linking knowledge management practices to organizational performance using the balanced scorecard approach.	Chopra and Gupta (2020)	Kybernetes	17
5	The study of knowledge employee voice among the knowledge-based companies: the case of an emerging economy.	Hosseini et al. (2022)	Revista de Gestão	16

The study by Belkadi et al. (2020) highlights how AI and data analytics are reshaping traditional HRM, requiring continuous workforce adaptation. Technological advancement is further supported by findings that AI-based intelligent assistant systems enhance dynamic decision-making in complex digital environments, improving effectiveness and adaptability. Moreover, digital workplaces demand adaptive leadership; transformational leadership supported by emotional intelligence strengthens leader–employee relationships, thereby increasing motivation and productivity during digital transformation (Milhem et al., 2019). Employee engagement and organizational transformation are closely linked to effective knowledge management, which enhances performance through improved efficiency, error reduction, and responsiveness to market changes (Chopra & Gupta, 2020). Furthermore, employee voice fosters innovation and performance in knowledge-based organizations, highlighting the combined role of engagement, leadership, and technology integration (Hosseini et al., 2022).

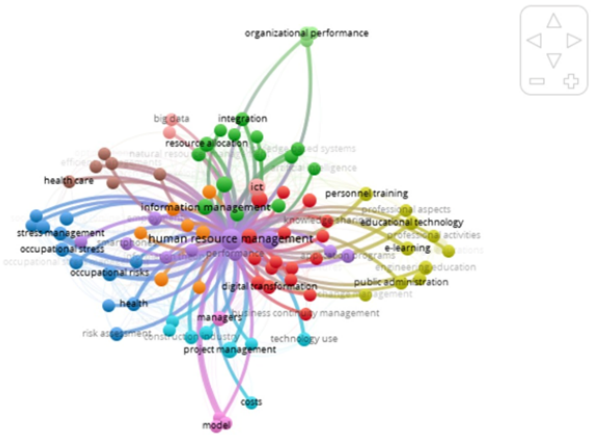

Figure 3. Knowledge Network and Research Trends in HRM and ICT for Hospitals

Based on Figure 3, color usage clearly illustrates relationships among HRM, technology, and employee well-being. Red represents HRM aspects such as instruction and competency development, which are essential for enhancing organizational performance (Shet et al., 2019). Blue denotes employee health and well-being, including stress management and work-related risk handling. Attention to these factors improves productivity and reduces absenteeism (Erickson et al., 2024). Green reflects the role of information technology and digitalization, including big data and digital transformation, in supporting HRM decision-making and planning (Fenech et al., 2019). Yellow signifies project management and resource allocation, while purple represents overall organizational performance through the integration of HR and technology, highlighting their combined contribution to organizational success.

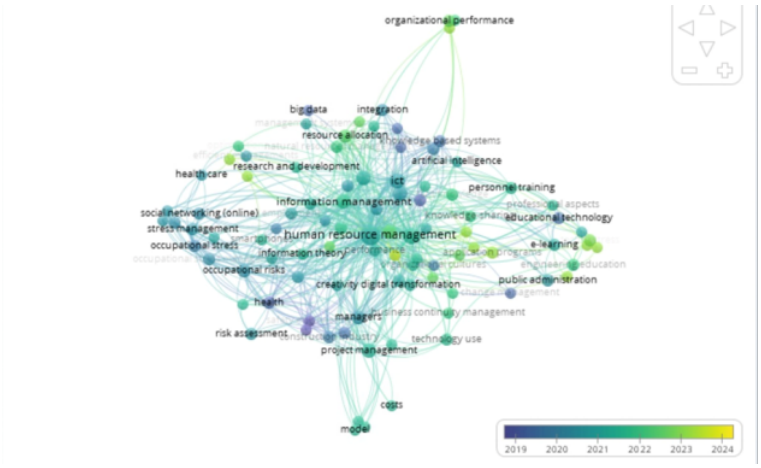

Figure 4. Trend Analysis of HRM and ICT in Hospitals: A Bibliometric Visualization from 2019 to 2024

Figure 4 illustrates the research trend network on HRM and ICT in hospitals, reflecting the relationships among various topics related to HRM, information technology, project management, and relevant aspects such as health, employee training, and organizational performance. Each node in the network represents interconnected concepts, with colors depicting the evolution of trends from 2019 to 2024, showing how these topics have developed over time.

Since 2019, ICT adoption in HRM has significantly enhanced organizational efficiency, employee information systems, and technology-based well-being initiatives, while also reshaping competency requirements toward digitally aligned skills (Mazurchenko & Maršíková, 2019). This transformation intensified in 2020 with cloud-based platforms enabling real-time data analysis, improving decision-making accuracy and talent management effectiveness (Polyakova et al., 2020; Chopra & Gupta, 2020). Furthermore, data analytics and knowledge management have strengthened employee engagement, productivity, and organizational competitiveness within the digital economy (Hammami & Zotto, 2020). By 2021, advanced technologies allowed HR professionals to transition from administrative to strategic roles, supporting organizational growth, although successful implementation requires strong organizational readiness and planning (Dávila & Dos Anjos, 2021; Alaghbari et al., 2024). However, technology integration also introduces challenges such as information overload and digital stress, potentially reducing productivity and increasing conflict (Kulshreshtha & Sharma, 2021). In 2022, studies emphasized ICT's dual impact, highlighting the need to balance efficiency gains with employee well-being (Camarena & Fusi, 2022).

Since 2023, the adoption of ICT in HRM has expanded beyond operational efficiency to include advanced data management and employee well-being improvement (Zhang et al., 2023). Technologies such as blockchain, biometrics, and AI have strengthened transparency, security, and integration in HR systems, enabling more efficient management of employee data and organizational processes (Vijh et al., 2023). This trend

continued in 2024, where digital transformation became a key driver of competency development, knowledge management, and productivity improvement (Lou et al., 2024). In sectors such as healthcare, information technology also plays an important role in improving operational efficiency and service quality, requiring organizations to continuously adapt to remain competitive in the digital era (Ercik & Kardaş, 2024).

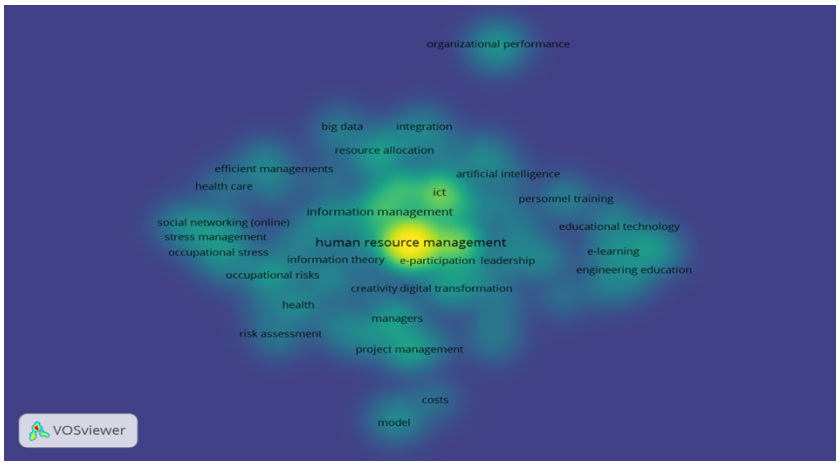

Figure 5. Identifying Research Focus Areas in HRM and ICT for Hospitals: A Bibliometric Heatmap

Figure 5 shows a bibliometric heatmap that detects research focuses in the areas of HRM and ICT in hospitals. Lighter colors indicate topics that appear more frequently in the literature, with human resource management, ICT, and e-participation being the most prominent keywords. Other topics such as information management, artificial intelligence, project management, and healthcare services also appear as important research areas, demonstrating the link between HRM, information technology, and organizational performance improvement in the hospital environment.

In today's digital era, HRM has undergone significant changes due to the integration of ICT. The merger of hi-tech, including AI and data analytics, has significantly enhanced the efficiency and effectiveness of HRM (Daya, 1996). In addition, the implementation of ICT in HRM allows organizations to function more strategically and generate added value. However, it is crucial to ensure that the adoption of this technology is balanced with improved system security and comprehensive human resource development, so that the human values in management remain preserved (Saputra, 2024).

Geographical Distribution of Publication

In the analysis of the geographical distribution of research publications related to HRM and ICT, India, China, and Malaysia emerge as the top three countries with the highest number of studies, making it simple for analysis. These three countries show significant developments in the application of digital technology in HRM, although with different challenges and approaches. Figure 6 shows the geographical distribution of research publications.

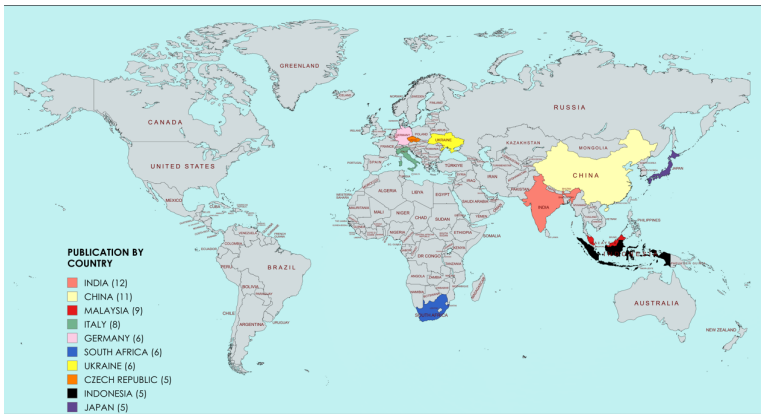

Figure 6. Geographical Distribution of Research Publications in HRM and ICT

In India, digital technologies such as AI, blockchain, IoT, and ICT have enhanced HRM efficiency through automation, improved data accuracy, and faster decision-making (Vijh et al., 2023). However, their implementation remains constrained by limited workforce skills, organizational resistance, and cultural and operational barriers (Indradevi et al., 2024). Similarly, China has advanced HRM transformation via e-HRM systems, improving efficiency, workforce management, and global competitiveness (Zhang et al., 2023). Nonetheless, successful digital HRM adoption requires organizational readiness, managerial support, and robust infrastructure. Furthermore, excessive use of Mobile ICT (MICT) may induce burnout, underscoring the importance of balanced technology utilization strategies (Monteagudo et al., 2022).

In China, HRM innovation increasingly leverages cloud-based technologies to enhance work flexibility, communication efficiency, and decision-making while fostering organizational innovation (Chen et al., 2022). Similarly, Malaysia has advanced technology-driven HRM to strengthen competitiveness, with ICT mediating the relationship between international HRM practices and multinational firm performance, particularly during the COVID-19 pandemic (Zhou et al., 2022). Moreover, technology facilitates value-based recruitment by aligning employee values with organizational culture, promoting integrity and work ethics (Goyal et al., 2024). The implementation of e-HRM supported by ICT further improves organizational performance by reducing costs, streamlining administrative processes, and enabling a more adaptive and innovative work environment (Cherif, 2020).

Distributions of Author, Keywords, and Journals of HRM and ICT Publication

The bibliometric analysis of 131 articles published between 2019 and 2024 provides important insights into the development of ICT-based HRM in hospital settings. The results show a consistent increase in publications each year, reaching a peak in 2024, which reflects growing academic interest in digital HR transformation in the healthcare sector, particularly after the pandemic. In terms of geographical contribution, India, China, and Malaysia emerge as the leading countries producing research in this field, indicating strong investment in digital healthcare systems and smart HRM initiatives. Additionally, Table 2 shows that several authors stand out as the most productive contributors during this period, highlighting key research centers that actively explore the integration of ICT in hospital human resource management.

Table 2. Top Contributing Authors (by Number of Publications)

Author	Affiliation	Publications
Zhang, J.	Tsinghua University, China	5
Alaghbari, M.A.	Universiti Malaysia Pahang, Malaysia	4
Vijh, G.	Indian Institute of Technology	3
Belkadi, F.	University of Bordeaux, France	3
Vandresen, L.	Federal University of Santa Catarina, Brazil	2

This bibliometric analysis identifies the main keywords to understand the primary research that directs attention to the integration of ICT in hospital HRM. The co-occurrence keyword analysis helps identify thematic relationships and the degree of connectivity between concepts in the analyzed literature. The ten most popular keywords, based on the frequency of occurrence and total link strength, are shown in Table 3, highlighting the most frequently studied research areas from 2019 to 2020.

Table 3. Top Keywords (Co-occurrence Analysis)

Keyword	Frequency	Total Link Strength (TLS)
Human Resource Management	108	852
ICT	92	810
Hospital	84	736
Artificial Intelligence	58	542
Digital Transformation	47	495
Big Data	36	434
Employee Engagement	28	362
Leadership	24	319
Cloud Computing	21	287
Knowledge Management	19	264

Table 4 shows the journals with the highest number of publications on ICT-based HRM from 2019 to 2024. Computers and Industrial Engineering (Elsevier) ranks first with nine articles, followed by Kybernetes (Emerald Publishing) with six articles. Journal of Information Systems Engineering & Business Intelligence and Sustainability each published five articles, while the International Journal of Innovation Management (World Scientific) contributed four. These journals serve as key outlets for research on digital transformation and ICT integration in HRM.

Table 4. Top Journals (by Publication Frequency)

Journal Title	Publisher	Number of Articles
Computers and Industrial Engineering	Elsevier	9
Kybernetes	Emerald Publishing	6
Journal of Information Systems Engineering & Business Intelligence	JISEBI	5
Sustainability	MDPI	5
International Journal of Innovation Management	World Scientific	4

Table 5 presents the main clusters identified in the visualization analysis of ICT-based HRM research in hospital settings. The results highlight three key themes: Smart HRM practices, which focus on digital transformation through AI, big data, and cloud-based HR systems. Health data management, which emphasizes integrated digital systems and data-driven performance evaluation, and workforce digital competence, which addresses the development of digital skills through e-learning and digital leadership. Each cluster also reveals important challenges, including data privacy and cybersecurity risks, regulatory requirements, digital skill gaps, technostress, and resistance to organizational change.

Table 5. Cluster Elaboration Table of Visualization Results

Cluster	Main Focus	Key topics	Challenges
Smart HRM practices	Digital transformation in hospital HRM practices	1. AI for recruitment and workforce prediction 2. Big data for performance analytics 3. Cloud-based HRM systems 4. Administrative Automation	1. Data privacy 2. Algorithmic bias 3. Organizational readiness
Health Data Management	Integrity and digital management of health and	1. Integrated EHR with HRM 2. Data-driven performance evaluation 3. Interoperability standardization 4. Privacy management	1. Cybersecurity 2. Data regulation requirements 3. Risk of data breaches

Cluster	Main Focus	Key topics	Challenges
	human resource data		
Workforce Digital Competence	Development of digital skills for healthcare workers	1. Implementation of e-learning and virtual simulation in clinical training 2. Utilization of Learning Management Systems (LMS) for workforce development 3. Organizational adaptation to digital transformation 4. Enhancing digital leadership (e-leadership) capabilities	1. Digital divide 2. Technostress 3. Organizational culture resistance

DISCUSSION

The integration of AI in HRM in hospitals shows substantial progress in digital transformation efforts. AI is used not only for automating recruitment processes but also to support predictive analytics that help management anticipate workforce needs and design strategic interventions. As revealed by Mazurchenko and Maršíková (2019), the presence of AI demands a shift in HRM skills, creating a need for adaptive digital capabilities. This transformation emphasizes the importance of continuous learning and development, ensuring that employees are equipped with the necessary skills to work effectively in an AI-driven environment. On the other hand, Belkadi et al. (2020) highlight the importance of context-aware intelligent assistant systems in supporting decision-making in complex work environments, which is highly relevant to the dynamics of hospitals. However, challenges such as digital stress, potential algorithmic biases, and employee data privacy issues are serious concerns in the use of AI. Therefore, the implementation of AI in HRM must be accompanied by strong ethical principles, robust data protection policies, and continuous training to ensure the workforce is prepared for this transformation.

Digital transformation also shows a strong impact on the training and learning aspects of healthcare personnel, which is a critical component of HR development strategies. Technologies such as Learning Management Systems (LMS), virtual simulations, and e-learning facilitate remote and adaptive learning that aligns with the individual needs of hospital staff (Vandresen et al., 2022). This shows that these technologies support the enhancement of nurses' managerial capacity, although challenges such as access disparities, limited devices, and cultural resistance still persist.

Digital training provides flexible and accessible HR development at a large scale, which is particularly important in the post-COVID-19 era. However, its effectiveness depends on strong system integration, institutional support, and the digital competencies of employees, making a blended learning approach that combines online and face-to-face training beneficial for maintaining clinical competency development. In addition, digital performance evaluation systems supported by big data and HR analytics enable more objective, real-time, and evidence-based assessments, allowing organizations to evaluate employee performance continuously and strengthen transparency and merit-based management (Zhang et al., 2023). However, e-performance evaluation also faces implementation challenges, particularly regarding system interoperability, the validity of digital performance indicators, and fairness perceptions among staff (Indradevi et al., 2024). This requires an approach that combines technology-based evaluations with human-centered performance reviews, so that the evaluation process is not purely quantitative but also considers qualitative aspects such as leadership, teamwork, and organizational values.

The bibliometric analysis shows regional disparities in research on ICT-based HRM in hospitals. Asian countries, particularly India, China, and Malaysia, dominate publications due to their strong adoption of digital technologies such as AI, cloud

computing, and e-HRM to modernize healthcare services. In contrast, Western countries like the United States, Canada, and the United Kingdom contribute fewer recent publications but tend to focus more on governance, data protection policies, and ethical considerations rather than purely technical development. This difference highlights an opportunity to integrate Asia's technological advancements with Western perspectives on regulation, sustainability, and employee rights (Saputra, 2024).

As hospitals adopt digital HRM systems, traditional manual processes have evolved into integrated platforms that manage employee data, behavioral analytics, and performance evaluation (Zhang et al., 2023). This digital transformation increases the importance of data privacy and security, as risks such as data breaches, unauthorized access, data misuse, and invasive monitoring practices may arise. In many Asian countries where regulations are not as strict as frameworks like GDPR or HIPAA, these risks create ethical concerns and may reduce employee trust in digital HR systems.

CONCLUSION

This study highlights the critical role of ICT integration in HRM as a driver of operational efficiency in hospitals, improving decision-support systems, employee engagement, and adaptive leadership amid digital transformation. Based on a bibliometric analysis, it identifies artificial intelligence, big data analytics, and cloud-based systems as key technologies shaping more data-driven HRM. The findings also show that India, China, and Malaysia are major contributors to this field, although challenges such as digital stress, uneven infrastructure, and organizational resistance persist. These results underscore the need to strengthen digital HRM frameworks in complex, human-centered hospital environments, with leadership and organizational culture playing vital roles in successful implementation. This study offers several recommendations for hospital HR managers to adopt hybrid approaches that integrate digital tools with human-centered practices while enhancing employees' digital competencies. Policymakers are encouraged to establish regulations ensuring data security and ethical AI use, alongside providing financial and policy support for hospital digitalization. Meanwhile, HRM system developers should focus on designing user-friendly, integrated platforms tailored to healthcare professionals' needs.

However, this study is limited to Scopus-indexed articles from 2019 to 2024, potentially excluding relevant research from other databases or earlier periods. The dominance of studies from India, China, and Malaysia may also limit generalizability to regions with differing technological readiness and healthcare systems. Future research should explore the psychosocial impacts of HRM digitalization, develop interoperable HRM systems across hospital units, and examine AI-based performance evaluation, digital leadership, and the long-term effects of digital HRM on productivity, job satisfaction, and workforce retention.

FUNDING STATEMENT: This research did not receive any specific grant from funding agencies in the public, commercial, or not - for - profit sectors.

CONFLICTS OF INTEREST: The author declares no conflict of interest.

DECLARATION OF GENERATIVE AI STATEMENT: During the preparation of this work, the author(s) used ChatGPT, Grammarly, and Turnitin to assist with language refinement, grammar checking, and originality verification. After using this tool/service, the author(s) reviewed and edited the content as needed and took full responsibility for the content of the publication.

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