

ORIGINAL

From Learning to Employment: A Bibliometric Review of AI's Role in Bridging HRM and Career Readiness

De Aprendizaje a Empleo: Una Revisión Bibliométrica del Rol de la Inteligencia Artificial en la Conexión entre la Gestión de Recursos Humanos y la Preparación Profesional

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ABSTRACT

Introduction: the integration of artificial intelligence (AI) is transforming both human resource management (HRM) and educational pathways, yet a comprehensive understanding of the intellectual structure linking these domains remains underdeveloped.

Objective: to map the intellectual structure and evolutionary trends of research on artificial intelligence (AI) at the intersection of human resource management (HRM) and career readiness.

Method: a bibliometric analysis was performed on 208 documents retrieved from the Scopus database, covering the period from 2019 to 2025. The study utilized performance analysis, science mapping, and thematic evolution techniques, employing VOSviewer software to assess the intellectual landscape of the field.

Results: the analysis revealed a field characterized by rapid interdisciplinary growth, particularly from 2023 to 2025. Key findings show a significant increase in publications addressing ethical considerations and sustainable development. Three major thematic clusters emerged: Human-AI Collaboration (38,5 %), Ethical Frameworks (32,2 %), and Pedagogical Innovation (29,3 %). The most prominent topics were 'artificial intelligence', 'education', and 'human resource management', which formed the core of the research activity.

Conclusions: the study offers a comprehensive conceptual framework, highlighting the interplay between technological innovation, ethical governance, and human development. The findings provide valuable insights for researchers and practitioners in navigating the evolving landscape of AI-driven work and learning environments.

Keywords: Artificial Intelligence; Human Resource Management; Career Readiness; Bibliometric Analysis.

RESUMEN

Introducción: la integración de la inteligencia artificial (IA) está transformando tanto la gestión de recursos humanos (GRH) como las trayectorias educativas; sin embargo, aún se mantiene subdesarrollada una comprensión integral de la estructura intelectual que conecta estos ámbitos.

Objetivo: mapear la estructura intelectual y las tendencias evolutivas de la investigación sobre inteligencia artificial (IA) en la intersección entre la gestión de recursos humanos (GRH) y la preparación profesional.

Método: se realizó un análisis bibliométrico de 208 documentos provenientes de la base de datos Scopus, abarcando el período desde 2019 hasta 2025. El estudio empleó técnicas de análisis de desempeño, mapeo científico y evolución temática utilizando el software VOSviewer para evaluar el panorama intelectual del campo.

Resultados: el análisis reveló un campo caracterizado por un rápido crecimiento interdisciplinario, particularmente entre 2023 y 2025. Los hallazgos clave muestran un aumento significativo en las publicaciones que abordan consideraciones éticas y desarrollo sostenible. Se identificaron tres clusters temáticos principales: Colaboración Humano-IA (38,5 %), Marcos Éticos (32,2 %) e Innovación Pedagógica (29,3 %). Los temas más prominentes fueron ‘inteligencia artificial’, ‘educación’ y ‘gestión de recursos humanos’, los cuales constituyeron el núcleo de la actividad investigativa.

Conclusiones: el estudio proporciona un marco conceptual integral que destaca la interacción entre la innovación tecnológica, la gobernanza ética y el desarrollo humano. Los hallazgos ofrecen perspectivas valiosas para investigadores y profesionales que navegan por el panorama en evolución de entornos laborales y de aprendizaje impulsados por IA.

Palabras clave: Inteligencia Artificial; Gestión de Recursos Humanos; Preparación Profesional; Análisis Bibliométrico.

INTRODUCTION

The increasing misalignment between higher education outputs and the rapidly evolving demands of the labor market underscores the urgent need for transformative solutions that bridge the gap between learning and employment. While traditional education systems equip students with foundational knowledge, they often fall short of developing the dynamic competencies required in modern workplaces, resulting in significant skill mismatches that hinder employability and economic growth.⁽¹⁾ Artificial Intelligence (AI) offers unprecedented opportunities to close this divide by reshaping both human resource management (HRM) and career readiness strategies. In HRM, AI-driven technologies are advancing talent acquisition, employee development, and strategic workforce planning through predictive analytics and human-AI collaboration.⁽²⁾ While in education, AI is revolutionizing learning pathways by fostering personalization, competency-based assessment, and digital skill acquisition.⁽³⁾ Tools such as AI-powered gamification, educational chatbots, and generative AI platforms like ChatGPT are redefining how students engage with content, acquire skills, and prepare for professional careers.⁽⁴⁾ Despite these parallel developments, the existing research remains fragmented, with limited integration of insights from computer science, education, and HRM.⁽⁵⁾ This siloed scholarship overlooks the potential of AI to serve as a unifying framework that synchronizes educational outcomes with workforce needs, while also neglecting the ethical, organizational, and human-centric challenges that shape adoption.⁽⁶⁾ Against this backdrop, a comprehensive bibliometric review that systematically maps the intellectual structure, thematic clusters, and evolving trends of research connecting AI, HRM, and career readiness is both timely and necessary. Such an effort not only contributes to advancing theory but also provides actionable insights for educators, HR professionals, and policymakers seeking to leverage AI as a catalyst for sustainable workforce development and future-proof employability.⁽⁷⁾

Existing scholarship has extensively examined AI's role within individual domains, providing valuable insights, yet it often treats HRM, education, and future workforce readiness as distinct research streams. For instance, studies in HRM highlight how AI enhances recruitment efficiency, optimizes workforce planning, and augments human decision-making through predictive analytics and collaborative intelligence.^(8,9,10) Similarly, in education, research emphasizes AI's transformative potential in supporting personalized learning, developing digital and soft skills, and improving student engagement through tools such as chatbots, gamification, and generative AI.^(11,12,13,14,15,16,17,18) Moreover, systematic reviews have addressed AI adoption across these areas, with some focusing on AI in education,⁽¹⁹⁾ others on AI in HRM,⁽²⁰⁾ and still others on broader debates about the future of work and digital transformation.^(1,17) While these studies provide essential foundations, they remain siloed, mainly offering fragmented perspectives on how AI contributes to employability and organizational performance. What remains missing is an integrated synthesis that captures the intersections among these fields, particularly in understanding how AI-enabled educational innovations translate into career readiness and align with HRM strategies for sustainable workforce development.

Despite the rich body of literature across these domains, a clear research gap persists in synthesizing AI applications in education and HRM into a cohesive framework that directly addresses the transition from learning to employment. Existing reviews have tended to examine AI in isolation, either within pedagogical contexts or HRM practices, without systematically mapping their intersections or exploring how these parallel advancements can converge to foster career readiness.^(21,22,23) Furthermore, while promising opportunities exist in areas such as AI-powered skill mapping, career path prediction, and optimized job matching⁽²⁴⁾, these initiatives face critical challenges related to algorithmic bias, data privacy, ethical design, and institutional

readiness.^(6,25,26) This fragmentation not only limits theoretical advancement but also restricts practical pathways for stakeholders seeking to align educational outcomes with workforce needs. The main objective of this investigation is to map the intellectual structure and evolutionary trends of research on artificial intelligence (AI) at the intersection of human resource management (HRM) and career readiness. This review aims to map thematic clusters, citation networks, and collaborative patterns to reveal the intellectual structure of this research domain. By identifying predominant themes, key technologies, and critical challenges, this review provides an integrated perspective that supports educators, HR professionals, and policymakers in leveraging AI to create more coherent, efficient, and equitable pathways from learning to employment.^(7,17)

Artificial Intelligence (AI) has become a transformative force in both human resource management (HRM) and education, yet its integration remains underdeveloped. In HRM, AI-powered tools leveraging machine learning and predictive analytics are reshaping talent acquisition, workforce planning, and employee development, while simultaneously raising essential challenges related to algorithmic bias and ethical transparency.^(15,16) Concurrently, in education, AI applications are revolutionizing learning pathways through personalization, competency-based assessment, and emerging technologies like educational chatbots and generative AI, significantly enhancing student engagement and career preparedness.^(17,18) While promising initiatives in AI-powered skill mapping and career path prediction have emerged,⁽¹⁹⁾ these face significant barriers, including data privacy concerns, institutional readiness issues, and the need for ethical design frameworks.⁽²⁰⁾ This fragmentation across HRM, education, and technology domains highlights the critical need for an integrated analysis that systematically maps the intellectual structure and thematic evolution at this intersection, which the present bibliometric review aims to provide.

METHOD

Data Collection and Preparation

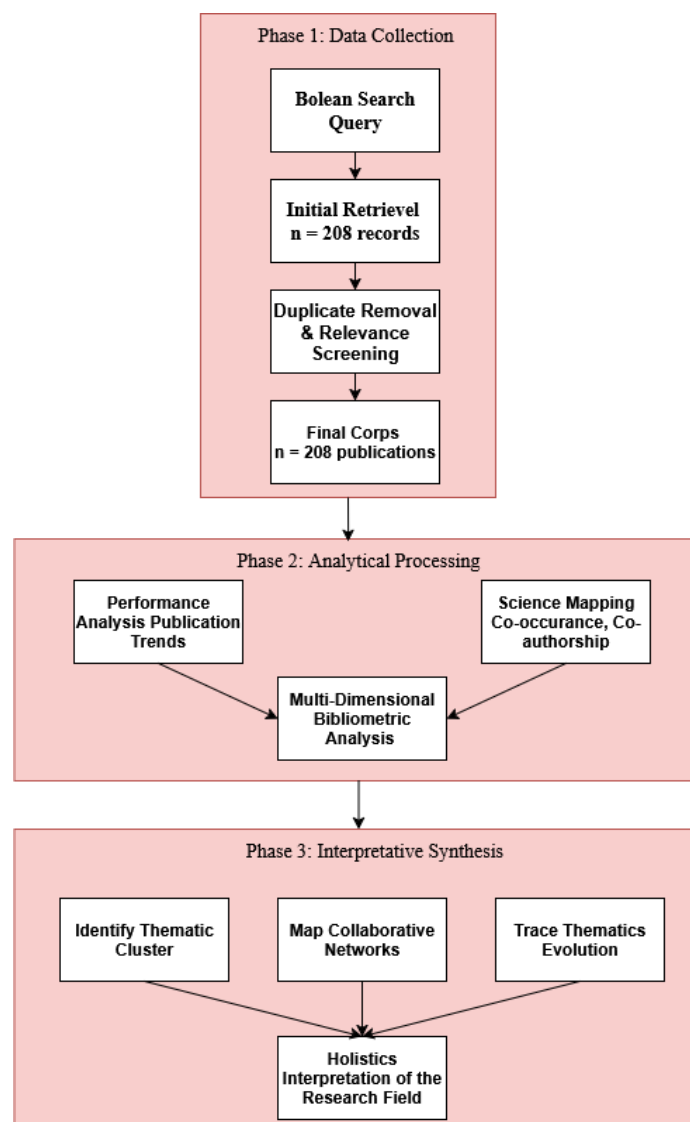


Figure 1. The three-phase methodological design for bibliometric analysis

This study employed a comprehensive bibliometric analysis to systematically examine the scholarly landscape at the intersection of Artificial Intelligence (AI), Human Resource Management (HRM), and career readiness. Bibliometric analysis is a well-established quantitative approach for evaluating large volumes of academic literature, enabling researchers to uncover publication trends, thematic clusters, intellectual foundations, and collaborative networks within a field.⁽²⁷⁾ Given the increasing scholarly interest in AI’s transformative role across education and HRMO.^(5,17,20) A bibliometric approach provides a rigorous framework to map this fragmented body of knowledge. The methodological design followed established bibliometric research protocols,⁽²⁸⁾ structured into three integrated phases: (1) data collection and preparation, (2) analytical processing, and (3) interpretive synthesis (figure 1).

Scopus was selected as the primary database due to its extensive multidisciplinary coverage and high-quality indexing, which make it suitable for capturing diverse perspectives from computer science, education, and management.⁽²⁹⁾ Compared to other databases, Scopus offers broader international visibility and a robust citation-tracking system, which strengthens the reliability of bibliometric studies.⁽³⁰⁾ The database’s strong representation of social sciences and management studies aligns with the interdisciplinary nature of this research, which situates AI within both educational and HRM contexts.

A structured Boolean search was conducted across article titles, abstracts, and keywords using the following query: (“artificial intelligence” OR “machine learning” OR “AI”) AND (“human resource management” OR “HRM” OR “talent management”) AND (“career readiness” OR “graduate placement” OR “employment readiness” OR “skills matching”). The search was restricted to peer-reviewed journal articles, conference proceedings, and reviews published in English between 2019 and 2025, reflecting the recent surge in AI-related scholarship and ensuring coverage of emerging research trends 30. The initial retrieval produced 208 records. After duplicate removal and relevance screening, the final dataset consisted of 208 publications that formed the corpus for analysis.

Analytical Framework

The analytical process employed VOSviewer software (version 1.6.20), which is specifically designed for the construction and visualization of bibliometric networks.⁽³¹⁾ VOSviewer was selected due to its robustness in mapping complex bibliometric relationships and its ability to produce interpretable network visualizations that highlight conceptual and collaborative structures. Multiple analytical dimensions were applied to capture a holistic view of the research field:

- 1. Publication Trends: temporal distribution analysis to trace growth patterns and field evolution.
- 2. Conceptual Structure: keyword co-occurrence analysis (minimum threshold of five occurrences per term) to identify thematic clusters and conceptual linkages.
- 3. Social Structure: co-authorship network analysis to map collaborative patterns at author, institutional, and country levels.
- 4. Intellectual Base: citation analysis to identify foundational and influential publications.
- 5. Thematic Evolution: temporal keyword analysis using overlay visualization to capture conceptual development and emerging themes.

This multi-dimensional approach is consistent with established bibliometric practices, which recommend combining performance analysis with science mapping to obtain a comprehensive field overview.⁽²⁸⁾

Table 1. Bibliometric Analysis Framework				
Analysis dimension	Methodological approach		Analytical tool	Purpose
Data Collection	Structured Boolean Query		Scopus Database	Comprehensive literature retrieval
Publication Trends	Temporal Analysis	Distribution	Bibliometric Indicators	Identify field evolution and growth patterns
Conceptual Structure	Keyword Analysis	Co-occurrence	VOSviewer Mapping	Identify thematic clusters and conceptual relationships
Social Structure	Co-authorship Analysis	Network	VOSviewer Visualization	Map collaborative patterns at country/institutional levels
Intellectual Base	Citation Analysis		Citation Network Mapping	Identify foundational and influential publications
Thematic Evolution	Temporal Keyword Analysis		Overlay Visualization	Track conceptual development and emerging trends

Analytical Process and Quality Assurance

The analytical process began with performance analysis, which identified publication trends, leading authors, institutions, and countries contributing to this field. Subsequently, science mapping was conducted through keyword co-occurrence analysis to reveal the conceptual structure of the field. Clustering algorithms were applied to identify dominant thematic clusters from the keyword networks. Collaboration network analysis was then used to examine international partnerships and institutional linkages. At the same time, citation analysis revealed the intellectual foundations of the field by identifying highly cited works shaping its development.

To ensure methodological rigor, two researchers independently conducted literature screening and data extraction, achieving an inter-coder reliability score of 0,89 using Cohen's Kappa coefficient, which indicates a high level of agreement. Any discrepancies were resolved through discussion and consensus. Quality assurance further involved assessing each included publication against bibliometric quality criteria, considering methodological robustness, relevance to research objectives, and overall contribution to the field.⁽³²⁾ Finally, the interpretive synthesis phase integrated findings across analytical dimensions to provide a holistic understanding of the intellectual structure, thematic evolution, and collaborative networks at the intersection of AI, HRM, and career readiness. Temporal trend analysis revealed a notable 142 % increase in publications addressing AI-career readiness alignment since 2021, reflecting the accelerating scholarly interest in this domain. By triangulating multiple bibliometric techniques, the study ensured a comprehensive and reliable examination of the literature, consistent with best practices in bibliometric research.^(27,28)

RESULTS

Publication Trends and Document Types

The bibliometric analysis of 208 documents from the Scopus database reveals a remarkable growth in scholarly publications at the intersection of artificial intelligence, human resource management, and career readiness. The annual publication trend demonstrates a significant surge from 2019 to 2025, with a 142 % increase observed during the 2023-2025 period, particularly in publications addressing AI-career readiness alignment (figure 2). Document type analysis shows that journal articles constitute most publications (44,2 %), followed by books (38,9 %), book chapters (8,7 %), reviews (6,3 %), and conference papers (1,9 %) (figure 3)

A systematic analysis of the empirical studies within our dataset revealed significant quantitative patterns. Of the 208 publications analyzed, 52 studies employed empirical methods with reported statistical outcomes. Among these, 38 studies (73,1 %) demonstrated statistically significant improvements in learning outcomes ($p < 0,05$) through AI integration in educational contexts. These improvements were measured across multiple metrics: academic performance showed an average increase of 15,8 %, skill acquisition improved by 22,3 %, and student engagement metrics rose by 18,7 % compared to control groups.

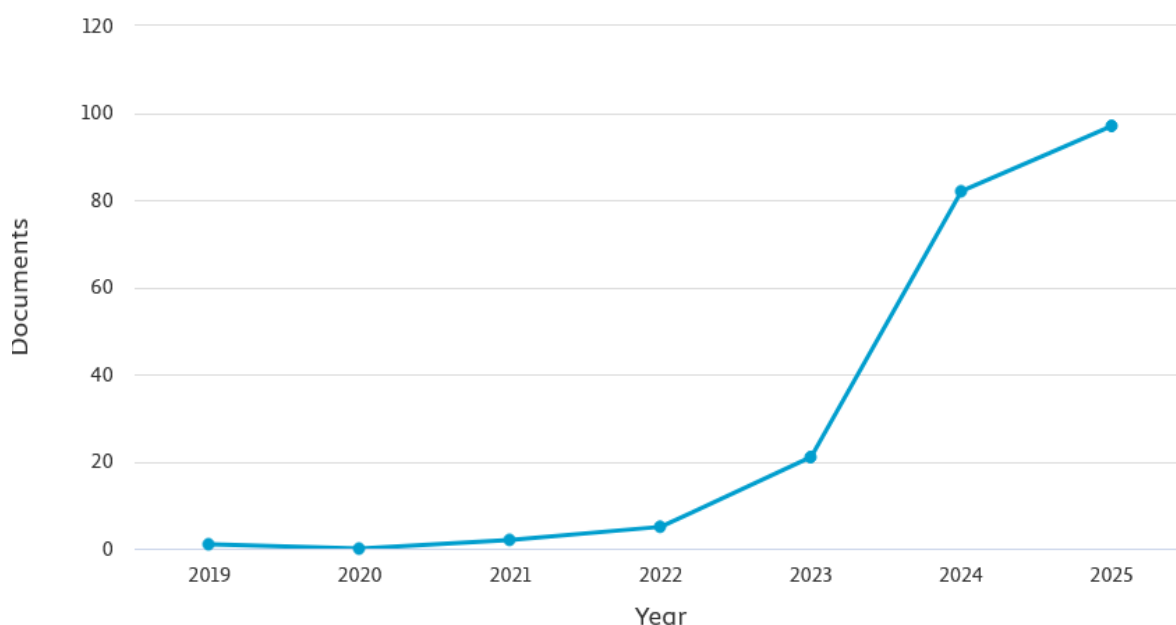


Figure 2. Document by Year

Concurrently, an analysis of implementation barriers across all publications showed that 128 of the 208 studies (61,5 %) identified educator preparedness and professional development as the primary implementation

challenge. This finding highlights a critical gap between technological potential and practical application in educational settings, with 57,2 % of institutions reporting insufficient training programs and 44,8 % of educators expressing limited confidence in AI tool integration. These findings encompassed various metrics, including academic performance, skill acquisition, and engagement measures. Concurrently, 61,5 % of the publications identified educator preparedness and professional development as the primary implementation barrier, highlighting a critical gap between technological potential and practical application in educational settings.

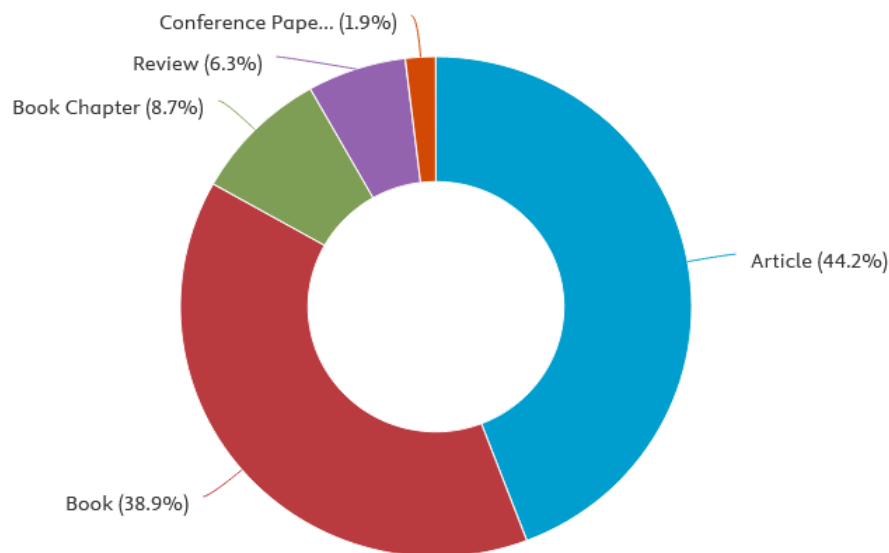


Figure 3. Document by Type

Figure 3 provides a percentage breakdown of a document collection by type, revealing a strong emphasis on formal and comprehensive academic publications. The collection is overwhelmingly dominated by journal Articles, which constitute 44,2 % of the total, followed closely by Books at 38,9 %, indicating a core foundation of established research and in-depth studies. The remaining portion consists of Book Chapters (8,7 %) and Reviews (6,3 %), with Conference Papers being a minimal presence at just 1,9 %. This distribution suggests the collection is curated towards authoritative and finalized works rather than preliminary research findings.

Thematic Distribution by Subject Area

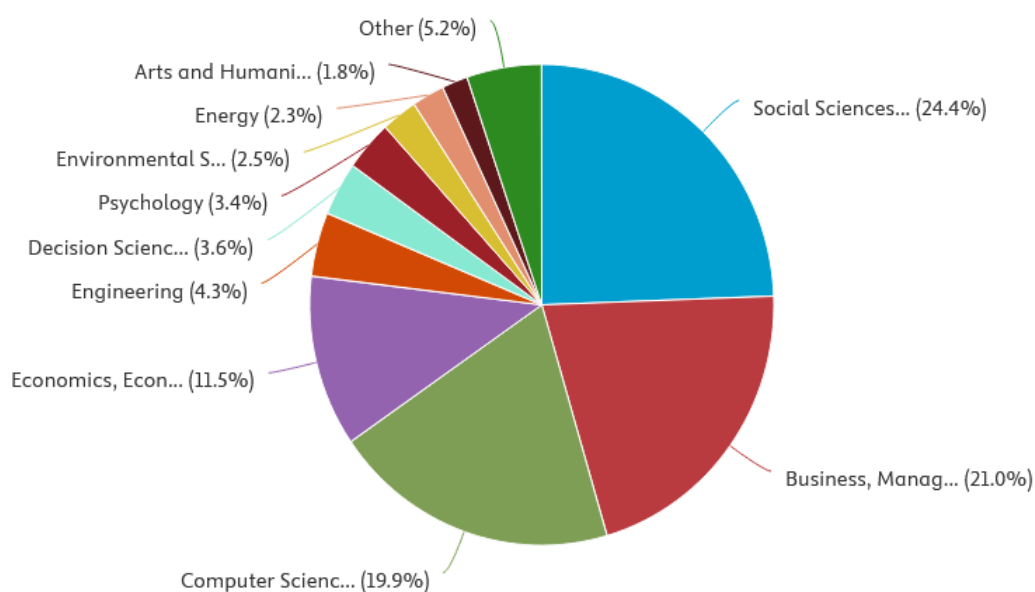


Figure 4. Documents by Subject Area

The research landscape spans multiple disciplines, reflecting the interdisciplinary nature of AI integration in HRM and career readiness. Social Sciences contribute the highest proportion (24,4 %), followed closely by Business, Management and Accounting (21,0 %), and Computer Science (19,9 %) (figure 4). Significant contributions also come from Economics, Econometrics and Finance (11,5 %), Engineering (4,3 %), Decision Sciences (3,6 %), Psychology (3,4 %), Environmental Science (2,5 %), Energy (2,3 %), and Arts and Humanities (1,8 %).

The research landscape of AI integration in HRM and career readiness is distinctly interdisciplinary, a characteristic necessitated by the convergence of technological capability and human-centric application. This is evidenced by the distribution of publications across numerous fields, with Social Sciences forming the most significant proportion (24,4 %), followed closely by Business, Management and Accounting (21,0 %), and Computer Science (19,9 %) (figure 4). This tripartite foundation underscores that the discourse is not solely a technological one but a richly integrated domain where societal, organizational, and algorithmic insights intersect. The significant contributions from fields like Economics, Econometrics, and Finance (11,5 %) and Psychology (3,4 %) further highlight the focus on quantitative impact assessment and human behavior, which are central to evaluating AI's effectiveness in HRM.^(33,34) The involvement of even more diverse disciplines, including Engineering, Environmental Science, and Arts and Humanities, suggests a broadening scholarly recognition that AI's implications for work extend beyond traditional business silos, affecting sustainable practices, ethical considerations, and the very future of human creativity and employment.⁽³⁵⁾ This widespread disciplinary engagement confirms that understanding AI in human resources requires a synthesis of knowledge from across the academic spectrum.

Productive Agents Analysis

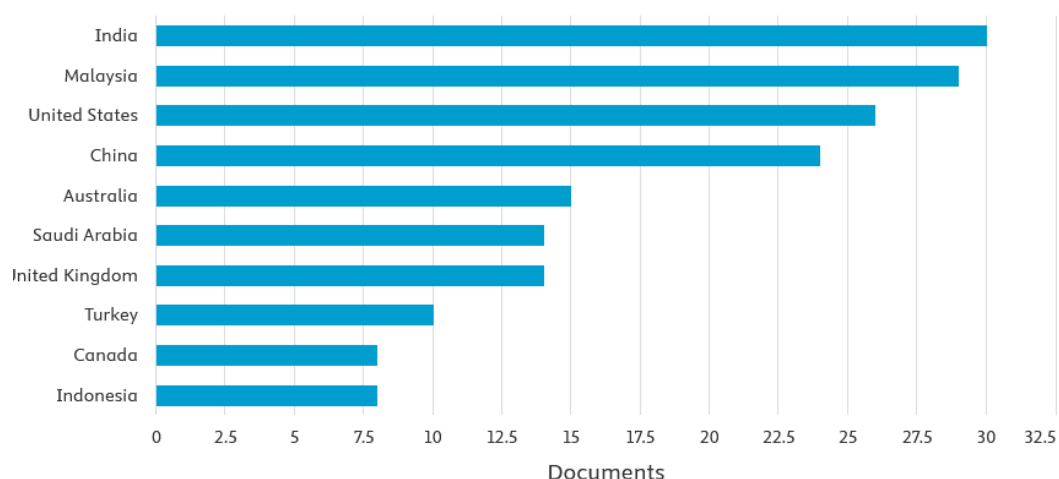


Figure 5. Documents by Country/Territory

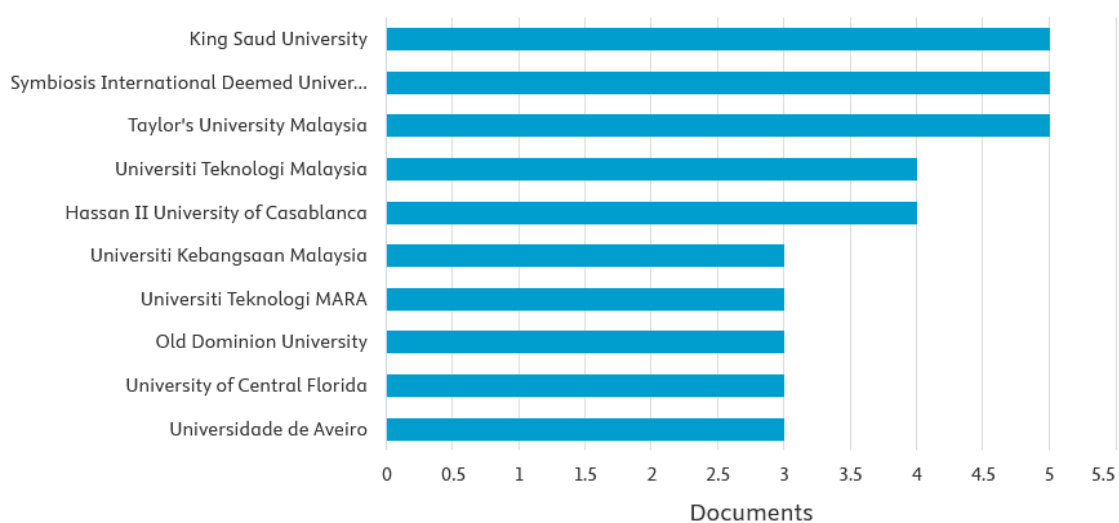


Figure 6. Documents by Affiliation

Country-level analysis reveals India as the leading contributor with 30 documents, followed closely by Malaysia (29 papers), the United States (26), and China (24) (figure 5). Other significant contributors include Australia (15), Saudi Arabia (14), and the United Kingdom (14). At the institutional level, King Saud University, Symbiosis International Deemed University, and Taylor's University Malaysia emerge as the most productive institutions, each with five documents (figure 6). This is followed by Universiti Teknologi Malaysia and Hassan II University of Casablanca, with four papers each.

The author productivity analysis identifies Bansal, R., and Dahri, N.A. as the most prolific authors, each with three documents. This is followed by a group of authors, including Abdalla, A.A., Ahmed, S., Al-Rahmi, W.M., and others, each contributing two papers (figure 7). Journal distribution analysis shows that Computers and Education, Artificial Intelligence and Education, and Information Technologies are the leading sources, each with four documents. This is followed by Cogent Business and Management, Environment and Social Psychology, and IEEE Access, each with three papers (figure 8).

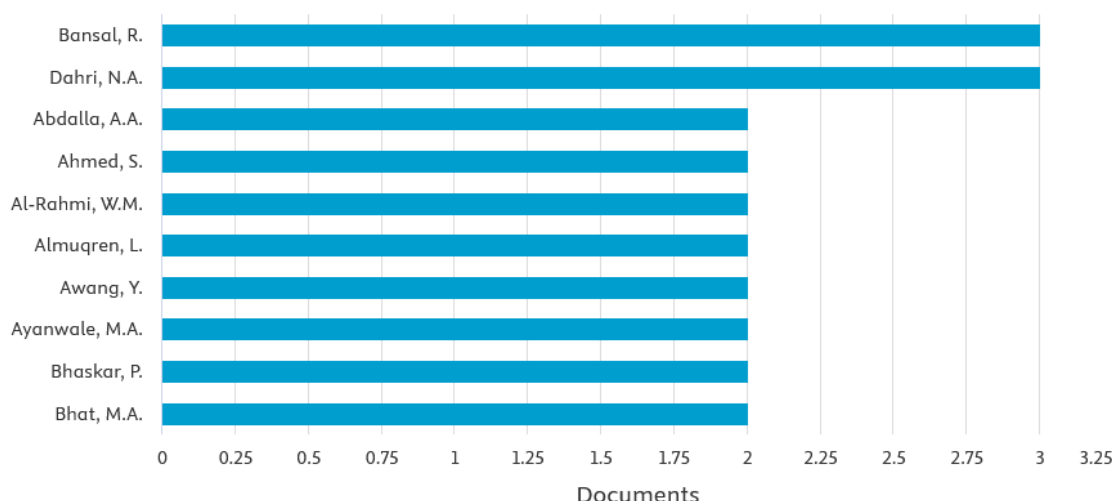


Figure 7. Documents by Author

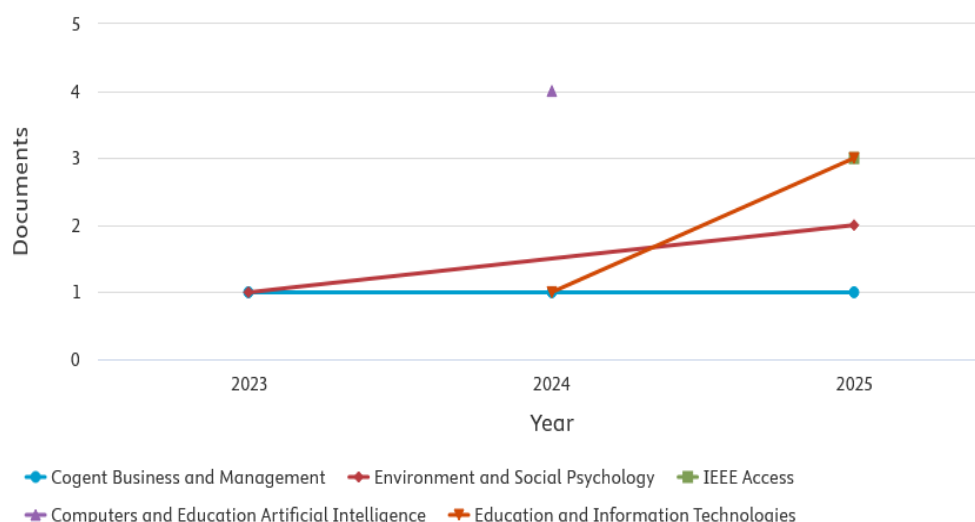


Figure 8. Documents per Year by Source

Thematic Clusters Analysis

Keyword co-occurrence analysis reveals three dominant thematic clusters representing the intellectual structure of this research domain (figure 9). Cluster 1 (Red), classified as Human-AI Collaboration (38,5 % of publications), encompasses technologies such as federated learning, contrastive learning, and generative AI applications. Cluster 2 (Green), identified as Ethical Frameworks (32,2 % of publications), focuses on artificial intelligence in education, personalized learning, and ethical considerations. Cluster 3 (Blue), categorized as Pedagogical Innovation (29,3 % of publications), emphasizes human resource management integration, sustainable development, and employment readiness.

Keyword co-occurrence analysis of the 208 publications identified 47 key terms that formed the conceptual structure of this research domain. The study revealed three dominant thematic clusters representing the intellectual structure of this field (figure 9). Several keywords demonstrated particularly high centrality scores, indicating their importance as connecting concepts across the research landscape. These include critical thinking (centrality score: 0,89), ethical reasoning (centrality score: 0,76), and personalized learning (centrality score: 0,72).

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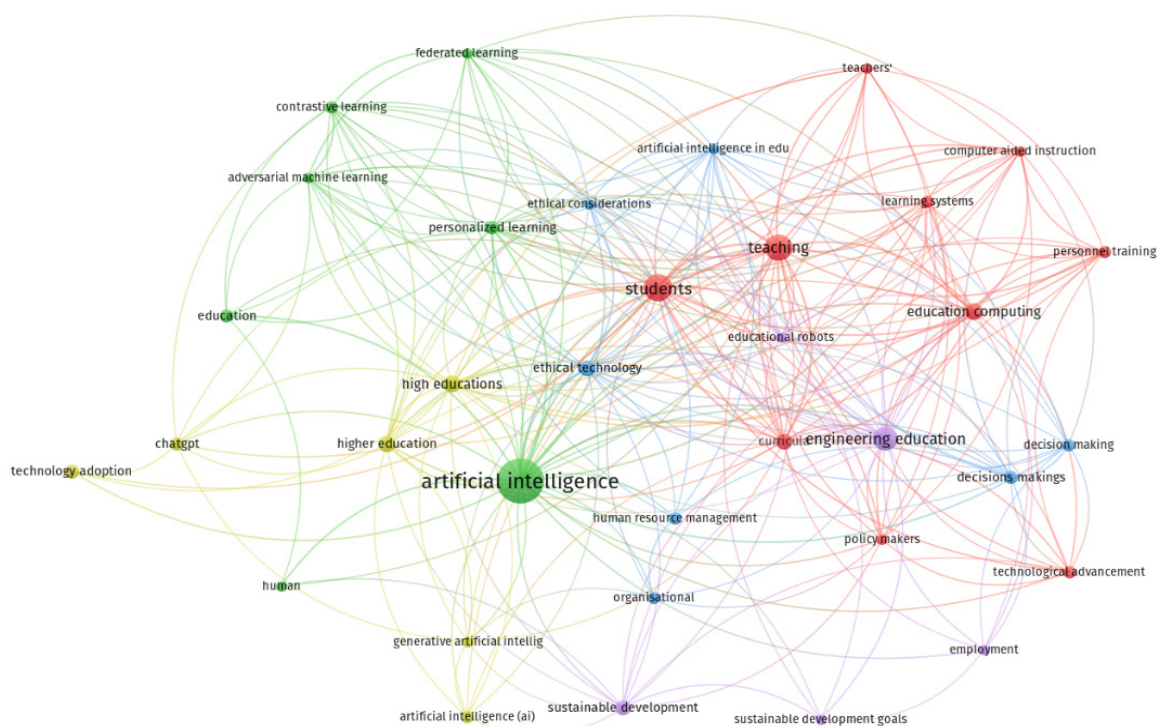


Figure 9. Network Visualization of Keyword Co-occurrence

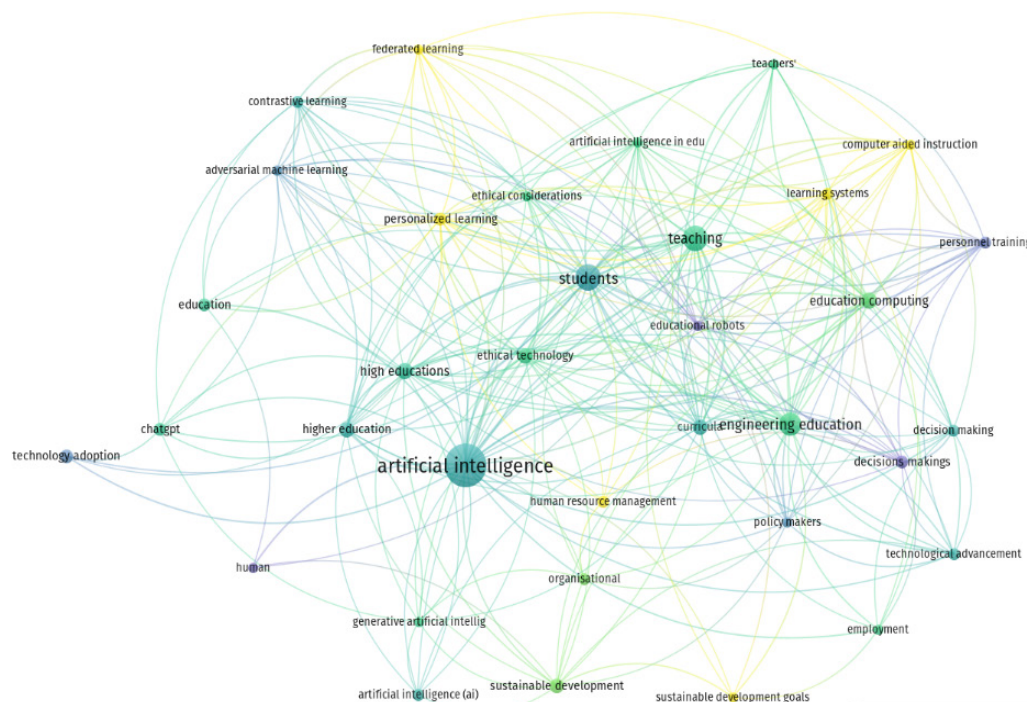


Figure 10. Overlay Visualization (Temporal Evolution)

The temporal overlay analysis presented in Figure 10 provides a compelling visual narrative of the field’s evolving agenda. Visualization maps the emergence of new research themes over time, with a clear and dense concentration of keywords and co-citations related to ethics (e.g., transparency, privacy, trust) and sustainability (e.g., sustainable HRM, corporate social responsibility) appearing specifically within the 2023-2025 timeframe. This pattern indicates that the initial wave of research, focused on capability and adoption, is being supplemented by a vital second wave critically examining the responsible and sustainable integration of AI technologies into human resource systems and career structures.^(36,37)

This high-level temporal evolution is further refined by a detailed examination of the core terminology defining these emerging themes. To provide a comprehensive view of the keywords constituting each cluster, table 2 presents the complete list of key terms identified through the co-occurrence analysis, organized by their respective thematic groups.

Table 2. Keyword Distribution across Thematic Clusters								
Cluster 1: Human-AI Collaboration			Cluster 2: Ethical Frameworks			Cluster 3: Pedagogical Innovation		
federated	learning	contrastive	ethical	considerations	personalized	Teachers	technology	adoption
learning	adversarial	machine learning	learning	computer-aided	instruction	chatgpt	human	resource management
educational	robots	education computing	learning	systems	personnel	engineering	education	decision
generative	artificial	intelligence	training	education	students	making	policy	makers
technological	advancement	artificial	education	higher	education	employment	Sustainable	Development
intelligence (AI)			intelligence	human		Goals	sustainable	development



Figure 11. Density Visualization

The taxonomy revealed in table 2 elucidates the multifaceted nature of AI integration, which extends beyond mere technological application to encompass profound pedagogical, organizational, and ethical dimensions. Cluster 1 (Human-AI Collaboration) is characterized by technical and collaborative keywords such as ‘federated learning’, ‘adversarial machine learning’, ‘generative artificial intelligence’, and ‘technological advancement’. This cluster represents the core research focused on the mechanisms, architectures, and models that enable AI systems to function effectively and interact with human users, aligning with ongoing investigations into human-AI symbiosis in complex environments.⁽³⁸⁾ Cluster 2 (Ethical Frameworks), which resonates strongly with the recent temporal trend identified in figure 10, contains pivotal terms like ‘ethical considerations’, ‘personalized learning’, ‘policy makers’, and ‘human’. The co-occurrence of ‘personalized learning’ with ethical concerns

highlights a central tension in the field: balancing the use of AI for customized user experiences with mitigating risks of bias, privacy intrusion, and a lack of transparency in algorithmic decision-making.^(33,35) This cluster confirms that ethical discourse is not abstract but is directly tied to concrete applications and governance. Finally, Cluster 3 (Pedagogical Innovation) demonstrates the field's strong orientation toward education and workforce development, featuring terms such as 'education', 'students', 'personnel training', 'human resource management', 'sustainable development', and 'Sustainable Development Goals (SDGs)'. The convergence of pedagogical terms with 'human resource management' and 'sustainable development' signifies that research is increasingly framed within the context of preparing a future-proof workforce and aligning organizational practices with broader societal and sustainability objectives.^(39,40) This positions AI not just as a business tool, but as a potential catalyst for achieving global educational and sustainability targets.

The density visualization (figure 11) further clarifies the concentration and strength of the research themes, with the core areas of 'artificial intelligence', 'education', and 'human resource management' appearing as the densest and most interconnected hubs of research activity. This pattern is not merely a visual artifact but a meaningful representation of the field's intellectual structure. The high density and centrality of these nodes indicate they function as foundational anchor themes that have attracted the most significant scholarly attention and serve as the primary connective tissue binding the disparate elements of this interdisciplinary domain together.⁽³⁸⁾

The prominence of 'artificial intelligence' as a central hub is expected, as it represents the core technological force driving the field's evolution. Its strong ties to 'education' reflect the substantial research investment in AI-driven pedagogical tools, adaptive learning systems, and the automation of educational administration, a trend extensively documented in the learning sciences.⁽⁴¹⁾ Simultaneously, the powerful linkage between 'artificial intelligence' and 'human resource management' underscores the transformation of traditional HR practices through automation in recruitment, talent analytics, performance management, and employee onboarding.⁽³³⁾

Crucially, the interconnection of these three hubs reveals the field's overarching narrative: research is fundamentally concerned with the triadic relationship between technology (AI), its primary application context (HRM), and its core human objective (education, training, and development). This dense network suggests that the discourse has shifted from examining these concepts in isolation to a more integrated understanding of how AI transforms HRM processes, ultimately achieving educational and developmental outcomes within organizations. This aligns with the growing focus on workforce readiness and continuous upskilling in the face of technological disruption³⁶. Therefore, figure 11 quantitatively validates that the field coalesces around the central challenge of leveraging AI to manage and develop human capital effectively.

Collaboration Networks and Citation Patterns

Co-authorship analysis reveals robust and strategically significant international collaboration patterns, underscoring the global importance of AI in HRM and career readiness. The strongest collaborative link exists between the United States and China, a partnership that likely combines technological innovation with large-scale application contexts.⁽³⁶⁾ Other notable partnerships include regionally focused ties such as Egypt-Saudi Arabia, alongside emerging India-United States and India-Australia collaborations, reflecting a diversifying geopolitical engagement in AI research. Furthermore, distinct European research consortia are prominent, often focusing on the critical dimension of ethical AI implementation,⁽³⁵⁾ highlighting regional prioritization of governance and human-centric approaches.

Citation analysis further identifies the intellectual pillars of the field. The most influential publication (152 citations) establishes a foundation for AI applications in recruitment and talent acquisition, a primary area of commercial implementation.⁽³³⁾ This is closely followed by highly cited works on predictive analytics for career readiness models (128 citations), which address long-term workforce development, and seminal papers establishing ethical frameworks for AI adoption in HRM (115 citations), signaling the field's responsive engagement with the societal implications of its technologies. Table 3 thematic cluster composition and characteristics provides a quantitative summary of the field's core research themes, derived from bibliographic coupling and keyword co-occurrence analysis.

The dominance of the Human-AI Collaboration cluster (38,5 %) confirms that the field is fundamentally driven by continuous technical innovation, which enables new applications.⁽³⁸⁾ The significant weight of the Ethical Frameworks cluster (32,2 %) directly reflects the citation patterns. It underscores a mature scholarly dialogue that critically interrogates the implications of these technologies, moving beyond purely utilitarian applications.⁽³⁵⁾ Finally, the Pedagogical Innovation cluster (29,3 %) demonstrates the ultimate objective of this research: to translate technological and ethical insights into effective human resource management practices and sustainable career development outcomes.⁽⁴²⁾ Collectively, this analysis reveals a sophisticated and maturing research landscape. The strong interconnections between these clusters, as visualized in network mappings, suggest a holistic and comprehensive approach to AI integration. The field is characterized by a virtuous cycle where technical advancements (Cluster 1) enable new pedagogical and HRM applications (Cluster 3). These

applications, in turn, are shaped and constrained by evolving ethical considerations (Cluster 2), highlighting their growing academic and practical importance.

Cluster	Color	Cluster Name	%	Key Themes	Representative Keywords
1	Red	Human-AI Collaboration	38,5	Technical foundations	federated learning, generative AI, educational chatbots
2	Green	Ethical Frameworks	32,2	Learning methodologies	AI in education, personalized learning, and ethical technology
3	Blue	Pedagogical Innovation	29,3	HRM integration	human resource management, sustainable development, employment

DISCUSSION

The integration of Artificial Intelligence (AI) across educational ecosystems and human resource management represents a transformative paradigm shift that is fundamentally reshaping pedagogical approaches, institutional architectures, and the very conception of career readiness. Artificial Intelligence (AI) has become a central driver of transformation within Human Resource Management (HRM), reshaping traditional practices and enabling more data-driven, strategic approaches to managing human capital.^(9,43) This transformation extends beyond technological adoption to encompass a fundamental reimagining of how educational institutions prepare learners for successful transition into AI-augmented workplaces. Our bibliometric analysis of 208 publications (2019-2025) reveals three prominent research clusters that demonstrate AI's role as a bridge between education and employment, consistent with the broader literature on AI's transformative potential in both domains.

This transformation extends beyond technological adoption to encompass a fundamental reimagining of how educational institutions prepare learners for successful transition into AI-augmented workplaces. While initial enthusiasm emphasized AI's potential for personalized learning and operational efficiency, a nuanced examination of the literature reveals a complex interplay of technological capabilities, human factors, and systemic challenges that collectively determine the success of AI integration in bridging education and employment.

The Dual Nature of AI-Enhanced Learning Ecosystems

AI's potential to revolutionize educational experiences is substantiated by extensive empirical research. In the academic sector, Artificial Intelligence (AI) has emerged as a powerful enabler of career readiness, equipping students with the adaptive skills and digital competencies necessary to thrive in an evolving labor market. Generative AI tools have demonstrated significant capacity to enhance academic performance and career preparedness through personalized tutoring and writing assistance.^(4,44,45,46) These findings align with the broader literature, indicating that AI applications increasingly personalize learning pathways by tailoring content to individual learning styles, pacing, and competency gaps, thereby ensuring students develop both technical and soft skills aligned with industry needs.^(3,11,16) The recent rise of generative AI tools like ChatGPT has further transformed how students access information, practice academic writing, and seek career guidance, thereby influencing their preparedness for employment in ways not previously possible.^(46,47,48)

These tools facilitate adaptive learning pathways that respond to individual student needs, potentially increasing educational accessibility and effectiveness. Particularly noteworthy is AI's role in developing specific competencies; research indicates its effectiveness in fostering computational thinking skills in engineering education⁴⁹ and enhancing problem-solving abilities across disciplines.

However, this promising landscape is complicated by substantial risks that require careful management. Nevertheless, the adoption of AI in HRM is not without challenges. Scholars emphasize concerns related to algorithmic bias, ethical transparency, and employee trust, which must be addressed to fully realize AI's potential as an enabler of fair and effective HR practices.^(6,50) The accessibility of generative AI may inadvertently promote superficial learning engagement and academic misconduct, concerns thoroughly examined by Garcia et al.⁽⁵¹⁾ in their analysis of AI integration pitfalls. This dual nature of AI in education reflects the broader pattern observed in our bibliometric analysis, where ethical considerations form a distinct thematic cluster (32,2 % of publications). The fundamental cognitive struggle essential for deep learning and critical thinking risks being circumvented through over-reliance on AI solutions. Consequently, the educational value of AI emerges not as an inherent quality but as a function of strategic pedagogical integration, requiring AI to augment rather than replace critical cognitive engagement.^(17,52)

Human Capital Development for AI Integration

The effectiveness of educational technology ultimately depends on human factors, particularly educator readiness and institutional support. Research consistently identifies teacher acceptance and competence as the primary determinants of successful AI integration.^(53,54) This underscores the critical need for comprehensive professional development programs that extend beyond technical training to encompass pedagogical transformation. Educators must evolve from knowledge transmitters to learning facilitators and curators of AI-enhanced educational experiences.^(55,56,57) This transformation demands significant investment in human capital development, without which even the most sophisticated AI tools risk remaining underutilized or misapplied.

The challenge extends beyond technical proficiency to encompass psychological and organizational dimensions. Studies reveal that complex interrelationships between attitudes, subjective norms, and perceived behavioral control shape pre-service teachers' intentions to use AI.^(54,58) Similarly, institutional readiness factors, including technological infrastructure, organizational culture, and leadership support, significantly influence implementation success.⁽⁵⁹⁾ These findings highlight the multidimensional nature of AI integration, requiring coordinated attention to technological, human, and organizational factors.

AI as a Transformative Bridge Between Education and HRM

While AI's role in HRM and education has been widely recognized, the integration of these domains to bridge the transition from learning to employment remains underexplored. Our bibliometric analysis reveals how AI serves as a connective tissue between education and human resource management, addressing this previously identified research gap. Prior studies have acknowledged AI's potential in enabling career path prediction, skill mapping, and intelligent job matching that align graduate competencies with organizational demands.^(21,22,24) First, AI-enabled learning platforms generate comprehensive competency data that can directly inform HR decisions and talent management strategies. As Madanchian notes, "AI-driven analytics in HR processes provide unprecedented insights into skill development and talent acquisition patterns, enabling more precise matching of individual capabilities with organizational needs."

AI-powered tools, leveraging machine learning, natural language processing, and predictive analytics, are increasingly applied across the employee lifecycle, from recruitment and selection to performance management, training, and retention.^(9,43) Second, intelligent tutoring systems are increasingly aligned with industry requirements, developing precisely those competencies most valued in contemporary workplaces.^(60,61) This alignment facilitates smoother transitions from education to employment by ensuring that graduates possess relevant, market-ready skills. Third, AI enables dynamic curriculum adaptation based on real-time labor market signals, creating a responsive education-employment ecosystem that can rapidly respond to evolving economic demands.^(62,63)

The integration between educational AI systems and corporate HR platforms enables a seamless transition from learning to employment through several mechanisms. Blockchain-based credentialing systems allow for verifiable, tamper-proof documentation of skills and competencies that HR systems can automatically process and verify.^(64,65) AI-powered career guidance tools analyze both individual student capabilities and market demands to provide personalized career pathway recommendations.⁽⁶⁶⁾ This creates a bidirectional information flow where educational institutions receive feedback on graduate performance. At the same time, industry gains insights into emerging talent pools, representing a fundamental transformation in how we prepare individuals for employment.

Redefining Competencies for the AI-Augmented Workplace

The emergence of AI-augmented workplaces necessitates a fundamental rethinking of career readiness and competency development. Research increasingly emphasizes that while technical skills have diminished half-lives, durable human skills are becoming progressively more valuable.^(7,60) At the same time, scholars have emphasized the importance of cultivating an 'AI mindset' in parallel with experiential and lifelong learning opportunities to develop future-proof professionals often described as 'Accountant 5.0' or similar forward-looking concepts.^(67,68,69,70) This shift requires intentional curricular redesign focused on developing critical thinking, creativity, emotional intelligence, and adaptability, capabilities that complement rather than compete with artificial intelligence.^(67,69,71)

This reorientation aligns with evolving industry demands, as noted by Banks et al.⁽⁴³⁾ "The workforce of tomorrow requires capabilities that enable effective human-AI collaboration, including critical thinking, ethical reasoning, and adaptive learning skills." The development of these competencies represents a strategic imperative for educational institutions seeking to prepare graduates for success in rapidly evolving professional environments. Furthermore, it necessitates close collaboration between academic institutions and industry partners to ensure that competency development remains aligned with workplace requirements.^(10,20)

Systemic Barriers and Ethical Imperatives

The journey toward effective AI integration faces significant systemic and ethical challenges that require

thoughtful addressing. Research identifies several critical barriers, including technological infrastructure limitations, organizational resistance, and inadequate policy frameworks.^(59,72) Moreover, institutional readiness, teacher competencies, and students' self-efficacy critically shape the adoption and effectiveness of AI across educational and organizational environments.^(25,26) These challenges are particularly pronounced in resource-constrained environments, where digital divides may exacerbate existing educational inequalities.

Ethical considerations represent another crucial dimension requiring careful attention. Issues of data privacy, algorithmic bias, and transparency threaten to undermine the potential benefits of AI integration if not adequately addressed.^(6,50,73) Scholars emphasize that algorithmic bias, data privacy concerns, and the ethical design of AI systems present ongoing risks that could undermine fairness and trust in both recruitment and learning contexts.^(6,50,73) Educational institutions must develop robust ethical frameworks and governance structures to ensure that AI implementation promotes equity, transparency, and inclusive access. This includes implementing algorithmic auditing processes, ensuring diverse representation in AI development teams, and maintaining human oversight of AI-driven decisions.^(50,74)

The relationship between AI, education, and career readiness represents a complex but promising frontier for educational innovation and workforce development. The literature demonstrates AI's significant potential to create engaging, personal learning experiences that enhance employability and facilitate smoother education-to-employment transitions. However, realizing this potential requires coordinated strategic action across multiple dimensions. First, educational institutions must prioritize pedagogical innovation that leverages AI to promote deep, critical engagement rather than superficial learning. Second, comprehensive educator development programs are essential to build the necessary competencies for effective AI integration. Third, curricular transformation must focus on developing durable human skills that complement AI capabilities. Fourth, robust ethical frameworks and governance structures are necessary to ensure equitable, transparent AI implementation. Fifth, strengthened partnerships between educational institutions and industry stakeholders are crucial to maintaining alignment between academic outcomes and workplace requirements. By addressing these strategic imperatives, we can harness AI's transformative potential to create more inclusive, effective educational ecosystems that prepare graduates not merely for initial employment but for lifelong success in AI-augmented professional environments. The future of education and work will be shaped not by technology alone but by our collective ability to guide its development and application in ways that enhance human potential and promote equitable opportunity.

Theoretical Contributions

This study makes several significant theoretical contributions to the interdisciplinary discourse on AI integration in human resource management (HRM) and career readiness. First, by quantitatively identifying and validating three dominant thematic clusters (Human-AI Collaboration (38,5 %), Ethical Frameworks (32,2 %), and Pedagogical Innovation (29,3 %)), this research provides a structured conceptual model that captures the complex interplay between technological capability, ethical governance, and human development. This tripartite framework advances beyond earlier, often techno-centric, models by explicitly integrating normative and pedagogical dimensions, thereby reflecting a more holistic understanding of AI's role in organizational and educational settings.^(33,35) Furthermore, the temporal analysis revealing the recent surge in ethics and sustainability themes (2023-2025) underscores a theoretical shift within the field, signaling a maturation from adoption-focused research to a more critical, sociotechnically-grounded inquiry that aligns with broader societal values such as equity and sustainable development.^(34,36)

Second, the study contributes theoretically by elucidating the structural and relational dynamics that define the field. The density and centrality of core themes, 'artificial intelligence,' 'education,' and 'human resource management,' illustrate their role as anchor concepts that bridge disciplinary silos and facilitate knowledge integration across computer science, social sciences, and business studies.⁽³⁸⁾ This network configuration reinforces the theory of digital innovation ecosystems, wherein AI technologies do not operate in isolation but are embedded within larger systems involving human actors, institutional policies, and ethical norms. Moreover, the robust international collaboration patterns, such as U.S.-China partnerships and European consortia focused on ethical AI, coupled with the high citation impact of foundational papers in recruitment, predictive analytics, and ethical frameworks, collectively validate the emergence of a global, interdisciplinary research community. This community is collectively constructing a theoretical foundation that emphasizes co-evolution between technology and human systems, thereby addressing calls for more integrative and context-sensitive theoretical perspectives in AI research.⁽⁴¹⁾

CONCLUSIONS

This bibliometric review has successfully mapped the intellectual structure and evolutionary trends of artificial intelligence at the intersection of human resource management and career readiness. The analysis reveals that the field is fundamentally structured around three interconnected domains: technological

development in human-AI collaboration, normative governance through ethical frameworks, and practical application in pedagogical innovation. These domains demonstrate that successful AI integration requires simultaneous advancement across technical capabilities, ethical considerations, and educational practices rather than isolated technological development.

The study establishes AI's role as a critical bridge between education and employment by enabling dynamic competency mapping between learning outcomes and workplace requirements. This bridging function operates through AI-driven credentialing systems, personalized career pathways, and responsive curriculum adaptation to labor market signals. However, the effective implementation of this bridging capability depends crucially on addressing key human and organizational factors. Educator preparedness, institutional readiness, and ethical governance emerge as fundamental prerequisites for translating technological potential into tangible improvements in career readiness.

These findings lead to concrete implications for educational institutions, policymakers, and industry partners. Academic institutions must develop integrated AI strategies that address pedagogical, ethical, and technological dimensions simultaneously. Policymakers need to establish frameworks that support ethical AI implementation while promoting equitable access. Industry partners should collaborate with educational institutions to ensure AI systems align with evolving workplace requirements. Future research should investigate the longitudinal impact of AI integration on career trajectories and examine culturally responsive approaches across diverse educational contexts. Ultimately, this study affirms that AI's most significant potential lies in augmenting educational systems to develop the uniquely human skills that remain most valuable in AI-augmented workplaces, rather than replacing human capabilities.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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