

REVIEW

AI, HR Governance, and Human Capital Risk in Indonesia's Digital Banking: A Systematic Review

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ABSTRACT

While AI is set to make banking faster and better, discussions often overlook its significant impact on human capital and governance. The current literature is still fragmented, largely addressing AI adoption, human resource management (HRM), and sustainability as independent domains, ignoring the structural risks that develop where they can overlap. This study explicitly addresses this gap by examining how AI simultaneously reorganises HR competencies, creates human capital risks, and necessitates governance practices consistent with sustainability goals. This research employs a systematic literature review (SLR) of 68 peer-reviewed articles obtained from three distinct streams of literature: banking, HRM, and sustainability, using the PRISMA 2020 protocol. Results challenge dominant techno-centric perspectives, suggesting that AI is not simply a tool for boosting productivity but rather an underlying structural driver of both human capital risk—algorithmic bias, lack of transparency and accountability—and worker vulnerability. What is more relevant about the study is that it provides a key takeaway: that without sound HR governance development, AI implementation may undermine organisational legitimacy and have ethical and sustainability impacts. Positioning HR governance as an integrative and corrective mechanism, this study provides a framework linking AI capability, human capital risk, and sustainability. This research provides a different perspective on the literature by shifting the debate around AI-enabled HR transformation from

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a technological issue to a governance problem that carries multifaceted ramifications toward sustainable digital banking, especially in developing economies such as Indonesia.

Keywords: Artificial Intelligence; Human Capital Risk; HR Governance; Sustainability Strategy; Digital Transformation

1. Introduction

AI has become a strategic driver of digital transformation across the global banking industry, reshaping organisational processes, workforce structures, and governance systems. In parallel with the acceleration of digital banking, financial institutions are increasingly pressured to align technological innovation with sustainability objectives, particularly those associated with Environmental, Social, and Governance (ESG) principles and the United Nations Sustainable Development Goals (SDGs). Within highly regulated sectors, such as banking, AI adoption is no longer evaluated solely in terms of operational efficiency but also through its implications for ethical accountability, workforce sustainability, governance transparency, and long-term organisational legitimacy. Consequently, the growing intersection between AI capability, HR governance, and sustainability has emerged as a critical issue in both developed and emerging economies.

Over the last ten years, Indonesia's banking industry has witnessed accelerated digital transformation characterised by solid financial stability coupled with proactive regulatory interventions. The Indonesian Banking Book suggests that banks retain capital adequacy ratios above 25% and non-performing loans around 2–3%, allowing for a sustained period of digital investment. A resource-based view (RBV) lens indicates that advanced technologies like artificial intelligence (AI) serve as strategic organisational resources, the value of which hinges on complementary capabilities in human capital and governance mechanisms. At the same time, growing digital banking adoption from 33% in 2020 to nearly 39% in 2022 indicates a structural move to data-driven banking models.

Research evidence from Indonesia further reinforces the relevance of AI, HR governance, and sustainability in banking sectors, which substantiates the contextual grounding of this study. Although based on recent data up to October 2023 from Bank Indonesia, it was revealed that the value of digital banking transactions alone reached ±IDR 58.478

trillion in 2023 with a growth of 13.48% year-on-year and is forecasted to exceed IDR 71.000 trillion by the end of the year, showing rapid acceleration of innovation in financial services digitally. This is also backed by the growing use per active user, where digital banking transaction volumes grow more than 40% yearly to hit 1.93 billion transactions in the year 2024. Over 80% of banking transactions in Indonesia now occur digitally, a sign of structural change and an underlying transition to data-driven banking operations.

Indonesia represents one of the most promising emerging markets for AI-enabled banking transformation due to its rapidly expanding digital financial ecosystem, increasing financial inclusion, and accelerating adoption of digital banking services. OJK and BPS reported that Indonesia's Islamic financial inclusion rate has reflected on the number at 73.97% (2024), supported by the increasing digital economic access. Meanwhile, global estimates prepare for up to 75 million users engaged in the digital banking community (approximately 39% of its population) market by life part of the transaction expected. Similar transformation trends have also been observed across other emerging economies in Southeast Asia, the Middle East, and South Asia, where banks increasingly integrate AI-enabled systems while simultaneously facing governance, ethical, and sustainability challenges associated with workforce transformation and regulatory adaptation.

Despite the rapid growth of digital banking, OJK data shows that the average digital maturity of banks in Indonesia is still far from being a governor-ready bank or an institution whose technology-enabled risk management processes or institutional governance capacity meets regulatory requirements, especially in risk management and institutional governance functions, at below 50%.

These quantitative indicators suggest that Indonesian banks are undergoing an accelerated but uneven digital transformation in which the growth of AI-embedded systems hasn't necessarily been accompanied by commensurate advancement within governance institutions and human capital capabilities. This lopsidedness corroborates with the main

point of this research work that HR governance is an integrative mechanism to address the emerging human capital risks pertaining to AI adoption and prompt sustainability and regulatory responses in the Indonesian context.

The Theoretical Framework is based on Institutional Theory, since regulatory instruments such as the Digital Banking Transformation Blueprint and POJK No. 51/2017 regarding sustainable finance exert coercive pressure to force the integration of AI and ESG principles in organisational decision-making. These structural arrangements imply that AI-enabled HR governance has developed as a key competency driving sustainable banking performance amidst regulatory ESG pressures^[1].

The rate of digital transformation in Indonesia's banking sector has greatly accelerated over the past ten years, thanks to the rapid growth of digital service penetration, fintech growth, and a demand for increased efficiency and security in the financial system. Facilitating customer services, risk management, fraud detection, and optimising internal processes has become the task of a key enabling technology adopted by banks such as artificial intelligence (AI)^[2]. According to national reports, the current applications of AI mainly include customer service chatbots, data analytics-based credit scoring modalities, and predictive analysis for strategic decision-making^[3]. In the field of human resource management (HRM), AI is starting to be adopted across recruitment, selection, performance appraisal, and talent development^[4] through people analytics and data-driven HR systems to enhance efficiency as well as support evidence-based HR decision-making^[5]. Yet, the adoption is inconsistent, with digital and large commercial banks showing a greater readiness for technology than conventional banks, which continue to experience organisational inertia, lack of digital skills, and limited integration across systems.

According to the Resource-Based View (RBV) theory, AI capacities can be considered strategic resources^[6] whose value creation relies on complementary human capital in particular regards: digital, analytical and ethical competencies^[7]. While the transition from administrative to data-driven HR processes is underway, competency requirements in Indonesian banking have changed, but digital skill gaps can cause implementation deskilling in the workforce (the unequal capabilities became evident over time)^[8] and ultimately reduce the effectiveness of transformation. Con-

currently, institutional theory emphasises the influence of regulatory and normative pressures on AI adoption and governance^[9]. In particular, algorithmic decision-making poses risk to the governance and subsequent ethical frameworks of HRM in that it raises concerns about algorithmic bias^[10] and decreased transparency and accountability, each being heightened features in a heavily regulated industry focused on trust such as banking. In reaction, measures like the national AI governance framework are aimed at addressing the use of AI in ethically responsible ways with appropriate human oversight and risk management. Such perspectives imply that AI-enabled HR governance in Indonesian banking has become a strategic capability developed under the influence of both internal resource configurations and external institutional pressures, determining not only the sustainability but also the legitimacy of outcomes from digital transformation^[11].

In Indonesia's banking sector, however, digital transformation has emerged as a strategic imperative due to growing competition and the need for operational efficiency, with customers increasingly gravitating towards fast^[12], personalised and data-driven services^[13]. This transformation has seen AI being one of its most central enablers, increasingly deployed across banking functions, including risk management, customer services, and human resource management (HRM)^[14]. In HRM, AI can help improve data-driven recruitment and selection and automate performance evaluation, increasing talent development through people analytics (i.e., using data to inform more strategic decisions)^[15] that guides the implementation of all these processes without losing efficiency or consistency in a fast-paced environment. It also brings perceived objectivity^[16].

On the other hand, AI adoption invokes complex strategic consequences regarding human capital management^[17]. The reorganisation of work processes, increasing dependency on algorithmic systems and shifting balance between humans and machines have turned traditional HR risks into more comprehensive human capital risk^[18]. Such risks are competency mismatch, poor digital adaptation, algorithmic bias, and weak accountability in AI-enhanced decision-making^[19]. Such challenges are of particular significance in the banking sector, which is highly regulated, knowledge-based and reliant on public confidence in institutions^[20]. Empirical studies warn of indirect discrimination, reduced transparency and

the erosion of employment relationships from AI-based HR systems^[21] without healthy governance in place and a continuous upgrading of core competencies^[22]. As a result, it has moved the one to manage human capital risk at the heart of responsible and sustainable AI-enabled transformation in Indonesian banking.

In this regard, the transition of HR-related risks towards human capital risk stresses a more inclusive, dynamic and adaptive link between those responsible for bringing about high performance and strategic alignment in human resource governance (HR governance)^[23]. Instead of simply serving as an administrative compliance mechanism, HR governance has become a strategic system encompassing policies, structures and processes as well as ethical values that act to ensure AI-enabled HR implementation practices are conducted with the intent that they are responsible, fair and aligned with organisational sustainability objectives^[24]. Previous research points out the importance of ethical AI frameworks, algorithmic transparency, human-in-the-loop decision-making^[25], and incorporation of environmental, social, and governance (ESG) principles in technology-led HR practices^[26].

While research is growing in the area of AI and HRM and people analytics as well as digital transformation, little academic work to date has systematically initiated dialogue between theory on risk within human capital and theory on AI processes, capabilities, impacts or governance. Current studies primarily assess the technical and functional capabilities of AI in terms of recruitment opportunities or prediction precision, thereby neglecting the strategic long-term threats that can arise at a human capital level^[27, 28]. Alternatively, human capital risk is typically analysed as part of broader categories of risks associated with organisations or finances without taking into account the emergence of AI as a source of risk in HRM^[29].

The research is very limited, especially in a developing country like Indonesia, where the digital capability gap, along with changing AI regulations and organisational culture dynamics, plays a significant role in detecting the governance and ethical use of AI to support banking HRM. These conditions illuminate why a systematic synthesis of contemporary ideas on the impact of AI on HR competencies, ethics, and governance and how these risks can be strategically managed through effective HR governance, are urgently needed.

In light of the above background, this paper seeks to undertake a systematic literature review (SLR) on the relationship between AI, human capital risk and HR^[30] governance in line with digital transformation in the banking sector^[31]. We utilise the SLR approach^[32], as it allows for a thorough, transparent and replicable analysis of conceptual and empirical developments whilst systematically identifying prevailing themes, research voids and future research agendas^[33]. In particular, this paper draws upon three interrelated research dimensions: (1) human resource competencies evolved due to AI implications, (2) ethical concerns and algorithmic risks associated with AI-based HR practices, and (3) the role of HR governance in addressing human capital risk.

To serve these objectives, this article responds to the research questions:

- RQ1: What impact does artificial intelligence have on the configuration of humans' competencies and capability requirements in the banking sector?
- RQ2: What types of human capital risk are created by the use of AI in HR functions, especially focusing on ethics and accountability?
- RQ3: What is the role of HR governance in creating conditions for human capital risk management and mitigation as part of digital transformation in banking?
- RQ4: What are the conceptual and practical implications of AI-enabled human capital risk in banking governance for Indonesian banking?

This study positions AI not just as an efficiency-enhancing HR tool but also as a generator of human capital strategic risk^[34], which must be governed specifically^[35], and this is what makes the novelty of this research. Unlike previous SLRs that treat AI in HRM, AI ethics and risk management as distinct areas^[36], this article contributes a holistic conceptual framework which connects the adoption of AI with human capital risk and HR governance^[37]. This study additionally adds context-sensitive evidence from a developing economy, thereby contributing to literature that remains largely dominated by insights from advanced economies through the empirical focus on the Indonesian banking industry^[38]. The insights guide responsible HR governance and enable ethical, inclusive, and sustainable digital transformation banking.

2. Literature Review

2.1. Artificial Intelligence, HR Competencies and Capabilities in Banking

Broadly, Artificial Intelligence (AI) is understood to mean algorithmic systems that can learn, reason, predict, and facilitate data-driven decisions at scale^[39, 40]. AI is gradually integrated into human resource management (HRM) tasks like recruitment, performance appraisal and workforce planning in the banking industry through technologies that significantly alter job structures and their competencies^[41]. Human resource competencies refer to an individual's knowledge, skills, and attitudes that facilitate the successful execution of tasks, while human resource capabilities represent an organisation's unique capacity to renew and recreate its set of competencies in response to new challenges for continuous realisation of its strategic aims^[42].

For example, from a resource-based view (RBV) perspective, AI-related competencies are considered non-self-sufficient resources that have strategic value only in conjunction with complementary organisational capabilities^[43]. The dynamic capabilities theory builds upon this idea and recommends that banks continuously sense technological disruption, seize opportunities related to AI, and reconfigure their human capital in order to stay competitive^[44]. The literature highlights two primary mechanisms by which AI transforms work: automation and augmentation, refocusing human labour on judgement-heavy, interpretive, and ethically grounded activities^[45].

Thus, HR competencies are clustering increasingly around data-analytical, digital-operational, and strategic-ethical domains. A failure to develop these competences through systemic reskilling and upskilling raises human capital risk as it results in skills mismatch, automation bias, poor quality of decision-making and ethical vulnerabilities. Hence, competency development becomes an essential risk mitigation mechanism where human capital capabilities become the functions to drive responsible and sustainable AI-enabled transformation in banking.

2.2. Artificial Intelligence, Ethics, and Algorithmic Risk in Banking HRM

Algorithmic decision-making has been on the rise in recruitment, promotion, performance appraisal, and career

development, increasingly across bank environments. While several ethical implications remain to be addressed^[46], the issues of AI adoption in banking human resource management raise key questions. AI ethics can be defined as the principles governing such intelligent systems to work in a just, responsible, transparent and human-centric way^[47]. In banks, which are highly regulated and rely heavily on trust-based relationships with different stakeholders, AI and HR ethics failures in AI-enabled HR practices can directly translate into human capital risk that affects workforce morale, organisational legitimacy and regulatory compliance.

Algorithmic bias is one of the significant sources of human capital risk^[48], which can occur due to biased training data or non-inclusive design according to gender, age or socio-economic status^[49]. Such results run counter to equal employment principles and can diminish employee trust and engagement, weakening the quality of human capital. Moreover, the opacity of "black-box" AI systems does not allow transparency and accountability, thereby augmenting automation bias and diminishing managerial oversight^[41]. These dynamics make poor HR decisions, internal conflicts, and reputational harm more likely.

Ethical AI in HRM is increasingly considered more of a governance issue than a technical one, particularly from an ESG and regulatory perspective^[50]. At the same time, responsible AI frameworks have highlighted human-in-the-loop decision-making^[36], algorithmic auditing, mechanisms for data protection and being an ethical safeguard built into HR with AI-enabled HR governance structures. Hence, aligning AI-enabled HR practices with ESG principles and regulatory expectations is key to managing human capital risk and sustainable digital transformation in banking.

2.3. AI-Enabled HR Governance, ESG, and Human Capital Risk Mitigation in Banking

AI-enabled HR governance is an organisational governance level that incorporates environmental sustainability, social responsibility, and governance accountability^[51] into corporate policies, structures, and processes of decision-making. In Indonesian banks, AI-enabled HR governance is more pronounced and is reflected by the occurrence of both political policies through sustainable finance platforms and by the stack provided by OJK against digital banking and AI.

These regulatory regimes have inculcated the ESG principles in banks, which are required at strategic, operational, and HR management (HRM) levels.

AI-enabled HR governance as a human capital risk-mitigation mechanism: AI-enabled HR governance can be seen from a human capital perspective as a risk mitigation tool that prevents and mitigates new emerging human capital risks resulting from the adoption of AI in HRM, as well as stratification effects; these include competency gaps, algorithmic bias, data misuse, and weakened accountability^[52]. ESG HR governance extends the function of HRM beyond administrative compliance to sustainability-orientated human capital management, which includes transparency, ethical decision-making, employee well-being, and long-term value creation^[53]. AI-enabled HR governance offers normative and process guardrails to mitigate the risk of unfairness, exclusion, or irresponsible use of data in AI-enabled HR systems.

In conclusion, while the literature does offer some suggestions for positive developments through AI adoption in HR, it is likely that without robust AI-enabled HR governance, its implementation will exacerbate ethical and governance risk areas and undermine workforce trust or even organisational legitimacy^[50]. Such pressure coming from regulators and stakeholders in the highly regulated banking environment of Indonesia reinforces the need for AI-based HR practices that correspond with sustainability objectives. Thus, AI-enabled HR governance is an enabling framework that balances technological efficiency with social responsibility, reducing human capital risk and facilitating sustainable digital transformation in Indonesian banking.

3. Method

Using a Systematic Literature Review (SLR) method^[32], this study aims to synthesise and assess the existing body of literature in respect to how AI influences AI-enabled HR governance and serves sustainable human resource decision-making processes in the banking sector. The SLR method was selected because it would ensure a transparent, rigorous, and replicable review process that is able to synthesise both empirical and conceptual evidence across different domains^[33]. This is especially relevant for topics that are multidisciplinary (like AI, human resource

management or sustainability), where the literature often has to be sourced from multiple research areas.

For greater methodological transparency, screening criteria detailing inclusion and exclusion were set before the start of the screening exercise. Inclusion criteria included: (1) peer-reviewed journal articles in English published within the last ten years; (2) studies that explicitly focused on artificial intelligence in the context of HRM, governance, sustainability or human capital risk; and (3) research conducted in the banking/public financial services sectors. Examples include AI-enabled recruitment system analysis, algorithmic decisions in HR, purported ESG-based human resources governance research areas and banking sector AI-empowered workforce analytics. On the other hand, exclusion criteria consisted of (1) articles studying AI that delved deeper into technical elements of its development without connection to an organisation or their human resources implications (e.g., machine learning model optimisation that only touches on HR aspects in this context, for example); (2) journal studies addressing digital transformation which did not directly connect this topic between AI and a human capital dimension; (3) studies with no organisational format such as consumer behaviour studies that offered little connection to how organisations manage their human resources; and finally (4) non-peer-reviewed sources including abstracts from conference proceedings or practice papers that lack the theoretical rigour present in empirical research. For example, a purely technical study on AI-based fraud detection or research on fintech adoption more broadly without HR or governance considerations disqualified our inclusion. This study uses a systematic literature review (SLR) design in accordance with the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to promote transparency, methodological rigour, and reproducibility when drawing upon the literature^[54]. PRISMA 2020 prescribes four sequential stages: identification, screening, eligibility, and inclusion, which directed the systematic selection of studies that were analysed in this review^[55]. Relevant studies were retrieved from reputable academic databases with predefined keywords and Boolean operators^[56] to ensure comprehensive coverage and minimise omission bias^[57] for the identification stage. The screening phase consisted of reading titles and abstracts to discard duplicates and studies that did not fit the scope of the research^[58]. Then, the

eligibility stage involved screening the full text of articles to assess the theoretical relevance, methodological quality, and contribution of findings^[33]. Lastly, only studies that fulfilled all inclusion criteria were included in the detailed analysis. Considering the indexation of journals in management, information systems, human resource management, and sustainability research domains^[59, 60], the literature review strategy was implemented systematically using four internationally renowned academic databases: Scopus, Web of Science (WoS), ScienceDirect, and Emerald Insight. To ensure transparency and replicability, the search strategy was systematically developed using predefined keywords and Boolean operators tailored to each database. The search strings combined three core constructs: (1) artificial intelligence, (2) human resource management and governance, and (3) banking and sustainability context. The primary search string was constructed as follows: (“artificial intelligence” OR “AI capability” OR “machine learning”) AND (“human resource management” OR “HRM” OR “HR governance”

OR “human capital”) AND (“banking” OR “financial services”) AND (“sustainability” OR “ESG” OR “AI-enabled HR governance”). To improve search precision, database-specific syntax adjustments were applied. To maintain topicality and relevance, this search was limited to peer-reviewed articles published in the past ten years.

The process of study selection in **Figure 1** was carried out based on PRISMA 2020 guidelines, which ensures transparent literature identification. In the identification stage, 1,247 records were identified in four large academic databases (Scopus, Web of Science, ScienceDirect and Emerald Insight). With 312 duplicates removed, 935 unique articles were left for further screening. At the screening level, titles and abstracts were evaluated against predefined inclusion and exclusion criteria, which led to the elimination of 678 unrelated articles. Such excluded studies include those that focused on pure technical applications of AI, digital transformation that was not HR-related, or were in a context outside the banking and financial services sector.

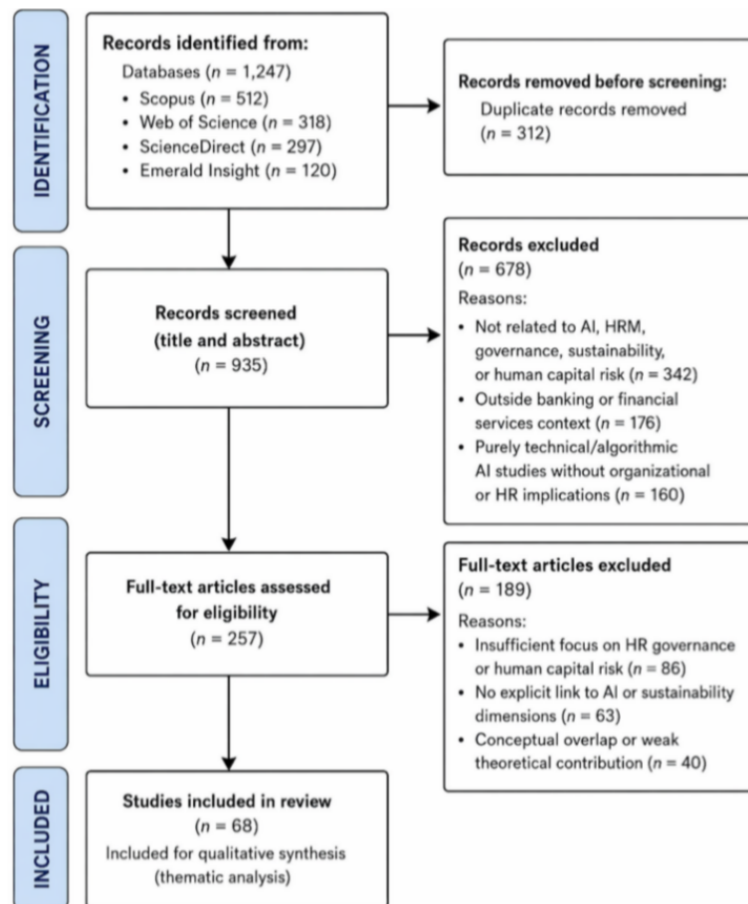


Figure 1. PRISMA 2020 Flow Diagram for SLR.

Note: The flow diagram is adapted from Page et al.^[54].

During eligibility, 257 full-text articles were further assessed for their theoretical significance, methodological robustness, and relevance to the intersection of artificial intelligence (AI), HR governance practices, and sustainability. Under this stage, there were a total of 189 articles that were excluded because they did not sufficiently align conceptually or discussed only limited human capital and governance dimensions. Finally, 68 peer-reviewed papers with thematic synthesis were included in the inclusion step. The systematic multi-stage filtering process provides a transparent, reproducible, and proof-of-concept version of the review, which also reduces selection bias in accordance with PRISMA 2020 guidelines^[32]. In line with PRISMA 2020 guidelines, this selection process ensured methodological rigour while minimising selection bias and provided a strong basis to synthesise relationships among AI capability, AI-enabled HR governance, sustainable HR decision-making, and sustainable organisational performance^[33].

The publication selection criteria were intentionally restricted to peer-reviewed journal articles to ensure conceptual reliability, methodological rigour, and academic quality. Conference papers, editorials, practitioner reports, and non-indexed publications were excluded to minimise methodological inconsistency and publication bias.

To enhance methodological rigour and reduce potential bias, a formal quality appraisal was conducted for all the included studies. Following prior management and systematic review studies, the quality assessment focused on five dimensions: (1) theoretical relevance, (2) methodological transparency, (3) empirical robustness, (4) contextual relevance to banking and financial services, and (5) integration of governance or sustainability perspectives. Each criterion was evaluated using a three-point scale ranging from (1) low to (2) moderate to (3) high quality. The appraisal process enabled the exclusion of conceptually weak studies and strengthened the reliability of the thematic synthesis.

4. Result

To provide a synthesis of the evidence base for this review, the characteristics of the 68 systematically described articles are content, ownership and publication year, methodology and conclusions, to present a neat overview of how AI/AI-enabled HR governance/sustainable HR decision-

making have been researched as contributing factors to firm sustainability. In line with sustainability-orientated management reviews, this summary captures dominant theoretical lenses and empirical trends across the corpus of literature to help cumulate fragmented findings on a cohesive conceptual base.

The 68 studies included in the final sample of this systematic literature review are listed in the references. Each study is organised, showcasing a timeline of how research has transitioned from earlier studies related to digitalisation and human capital risk in banking toward more recent ones focusing on artificial intelligence capability, AI-enabled HR governance, ESG integration, and sustainability-oriented HR decision-making. Due to space limitations, we were unable to fully report study-level characteristics; however, these are included in the references, along with aggregated patterns and theoretical insights discussed in the main text.

Based on the analysis of the 68 selected studies from this systematic literature review, we can clearly observe a trend in increasing research attention towards AI, governance and sustainable human resource management across the banking sector over time. The early spurt of publications (2019–2020) was dominated by studies related to digitalisation, human capital risk, and operational use of AI that largely discussed efficiency gains, risk management capabilities, and workforce restructuring. Starting in 2021, the field moved more towards a focus on AI capability and ethical frameworks/governance mechanisms, reflecting growing concern over algorithmic decision-making/accountability. More recent research (2023–2025) suggests a stronger orientation towards green governing, ESG, and sustainability-orientated HR decision-making, moving from technology adoption to strategic sustainability-driven digital transformation.

There is substantial methodological heterogeneity in the literature; however, conceptual and review-based articles still comprise the majority of studies published, especially at earlier time points (e.g., 2020). This dominance of key terms indicates both the nascent stage of AI governance and sustainable HR decision-making research. On the one hand, a growing number of quantitative empirical studies can be observed, including survey-based and SEM approaches, particularly in research connecting AI capability and ESG practices to organisational performance. Qualitative and case-based research is still rather scarce, indicating leeway for future

inquiry of micro-level decision processes and governance routines.

With regard to geography, the evidence we review is notably concentrated in developed economies across Europe, North America and parts of East Asia. Research from emerging markets is slowly growing, but studies that explore banking, ESG regulation and AI-enabled HRM in the context of economies such as Indonesia remain sparse. This imbalance exhibits a considerable contextual void in light of the mismatch between the regulatory, institutional, and sustainability challenges that banks in these regions encounter.

The literature highlights a few common findings. Relatedly, AI is always framed as a capability-enhancing resource whose value rests on the presence of complementary mechanisms (human and governance). AI-enabled HR governance structures, particularly when they align with principles of ESG and ethical AI, can significantly help mitigate algorithmic risks, ensuring that AI deployments are in line with sustainability aims. Moreover, HR decision-making is identified

as an effective strategic enabler through which AI and governance translate to sustainable organisational performance, thereby highlighting the need for integrative sustainability strategies in the banking sector.

4.1. Quality Appraisal

To enhance methodological rigour and ensure the credibility of the review process, a formal quality appraisal was conducted for all studies included in this systematic literature review. Examples can see in **Table 1**. The appraisal aimed to evaluate the relevance, methodological consistency, and analytical robustness of the selected literature while minimising potential selection bias. Considering the multidisciplinary nature of this study, which integrates artificial intelligence (AI), HR governance, human capital risk, and sustainability within the banking sector, the quality assessment framework was adapted from prior systematic review approaches commonly used in management and governance research.

Table 1. Quality Appraisal of Included Studies.

No.	Authors	Banking Context	Method	Main Focus	ESG/Governance Integration	Methodological Quality	Quality Score
1	Rahman et al. (2025) ^[11]	Sustainable Banking	Review Study	AI applications in sustainable banking	High	High	15/15
2	Aziz and Andriansyah (2023) ^[2]	Banking	Conceptual Review	AI for fraud prevention and compliance	Moderate	High	13/15
3	Thuda et al. (2024) ^[11]	Indonesian Regional Banks	Case Study	Business transformation and governance readiness	High	High	15/15
4	Bai et al. (2024) ^[12]	Banking Industry	Quantitative	Banking digital transformation	Moderate	High	13/15
5	Ali Alqararah et al. (2025) ^[13]	Commercial Banks	Quantitative Survey	Digital transformation capability and banking performance	Moderate	High	13/15
6	Buckley et al. (2021) ^[26]	Financial Services	Legal and Governance Review	Human-in-the-loop AI governance	High	High	15/15
7	Ashta and Herrmann (2021) ^[29]	Banking and Fintech	Conceptual Review	AI opportunities and risks in banking	High	High	14/15
8	Mughal et al. (2025) ^[41]	Pakistan Banking Sector	Qualitative	AI impact on HRM practices	Moderate	High	14/15

Table 1. *Cont.*

No.	Authors	Banking Context	Method	Main Focus	ESG/Governance Integration	Methodological Quality	Quality Score
9	Birindelli and Palea (2023) ^[51]	Banking Sector	Quantitative	Green governance and green banking strategy	High	High	14/15
10	Bonsu et al. (2025) ^[52]	Banking Sector	Quantitative	Fintech, governance, and sustainability performance	High	High	15/15
11	Wong et al. (2024) ^[61]	Non-Banking Sector	Quantitative	AI enhances supply chain agility through risk management	Low	High	14/15
12	Brey and van der Marel (2024) ^[62]	Non-Banking Sector	Quantitative	Human capital drives artificial intelligence adoption	Low	Moderate	11/15
13	Ali et al. (2022) ^[63]	Islamic Banking	Quantitative SEM	Green HRM and sustainable environment	High	High	14/15
14	Islam et al. (2025) ^[64]	Green Banking	Quantitative	Green HRM and sustainable business performance	High	High	14/15
15	Arif et al. (2025) ^[65]	Banking Sector	Quantitative	Green banking practices and sustainable performance	High	High	14/15
16	Dou et al. (2025) ^[66]	EU Banking Sector	Quantitative	ESG uncertainty and banking valuation	High	High	14/15
17	Citterio and King (2023) ^[67]	Banking Sector	Quantitative	ESG and bank financial distress	High	High	14/15
18	Moharrak and Mogaji (2025) ^[68]	Banking Industry	Empirical	Generative AI integration in regulated banking	High	High	15/15
19	Kuchciak and Warwas (2021) ^[69]	Banking 4.0	Conceptual	HRM transformation in Banking 4.0	Moderate	High	13/15
20	Bolognesi et al. (2025) ^[70]	Financial Services	Quantitative	Stakeholders and Regulatory Pressure on ESG Disclosure	Moderate	High	13/15
21	Cicchello et al. (2023) ^[71]	Financial Services	Quantitative	Assesses regulatory impacts on corporate ESG performance globally	Moderate	High	14/15
22	Karki et al. (2025) ^[72]	Sustainable Banking	MCDM Framework	ESG sustainable banking performance	High	High	15/15
23	Horobet et al. (2025) ^[73]	European Banking	Quantitative	ESG and financial performance nexus	High	High	14/15

Table 1. *Cont.*

No.	Authors	Banking Context	Method	Main Focus	ESG/Governance Integration	Methodological Quality	Quality Score
24	Wang and Yang (2025) ^[57]	Financial Risk Management	Quantitative	Digital intelligence and enterprise risk management	Moderate	High	13/15

The appraisal process employed five main evaluation criteria: (1) theoretical relevance to AI capability, HR governance, and sustainability issues; (2) methodological transparency regarding research design, data collection, and analytical procedures; (3) empirical or conceptual robustness of the study findings; and (4) integration of ESG, ethical governance, or sustainability perspectives. Each criterion was assessed using a three-point scale ranging from (1) low quality to (2) moderate quality to (3) high quality. The total quality scores ranged from 5 to 15 points. Scores between 13 and 15 points meant that the studies were of high quality, scores between 10 and 12 points meant that they were of moderate quality, and scores below 10 points meant that they were of lower methodological quality. Only studies demonstrating sufficient relevance and methodological adequacy were retained for thematic synthesis and conceptual analysis.

Table 1 presents the results of the quality appraisal conducted on 24 high-quality studies with strong relevance to the banking and financial services sector. The selected articles were evaluated based on their theoretical contribution, methodological rigour, contextual relevance to the banking transformation, and integration of governance and sustainability perspectives. The appraisal process shows that most of the studies included in this review had high methodological quality scores, between 13 and 15 points. This means that the final evidence base used in this review is both conceptually strong and analytically reliable.

The reviewed studies show a strong concentration on several dominant themes, including AI-enabled banking transformation, HR governance, ESG integration, sustainable banking performance, and human capital risk management. High-scoring studies such as Rahman et al.^[11], Rudko et al.^[8], Bonsu et al.^[52], Moharrak and Mogaji^[68], and Karki et al.^[72] demonstrated particularly strong integration between technological transformation, governance accountability, and sustainability-orientated banking practices. These studies also provided substantial conceptual and empirical insights regarding the role of AI-enabled HR governance

structures, ethical AI frameworks, and ESG-oriented strategies in supporting sustainable digital transformation within banking institutions.

Several studies specifically highlight the importance of governance readiness and institutional capability in managing AI-related organisational risks. For example, Thuda et al.^[11] contributed important contextual evidence from Indonesia by demonstrating that regional development banks continue to face substantial challenges related to governance maturity, digital readiness, and institutional transformation. Similarly, studies focusing on green banking, Islamic banking governance, and ESG-orientated financial performance reinforced the growing importance of sustainability considerations within banking AI-enabled HR governance structures.

Methodologically, the selected articles employed diverse research approaches, including quantitative surveys, conceptual reviews, case studies, legal-governance analyses, and multi-criteria decision-making frameworks. However, quantitative and governance-orientated empirical studies dominated the literature, reflecting an increasing academic interest in measuring the organisational and sustainability impacts of AI adoption within banking environments. Overall, the quality appraisal findings confirm that the included studies provide a strong and credible foundation for the thematic synthesis and conceptual framework developed in this research, particularly concerning the interaction between AI capability, human capital risk, HR governance, and sustainable banking transformation.

Table 2 presents the characteristics of the studies included in this systematic literature review, providing greater transparency and methodological clarity. The table summarises 20 high-quality articles selected based on their strong relevance to artificial intelligence (AI), HR governance, sustainability, and digital transformation within the banking and financial services sectors. The included studies were analysed across several dimensions, including the country or regional context, banking focus, research methodology, sample or data source, thematic emphasis, and principal find-

ings. Presenting these characteristics enables a clearer understanding of the dominant research trends, methodological approaches, and contextual orientations shaping the current literature. In addition, the table demonstrates the diversity

of perspectives and analytical approaches used to examine AI-enabled transformation, governance readiness, ESG integration and human capital risk management in banking environments across both developed and emerging economies.

Table 2. Characteristics of Included Studies.

No.	Authors	Country/ Region	Banking Context	Method	Sample/ Data Source	Main Focus	Key Findings
1	Rahman et al. (2025) ^[1]	South Asia	Sustainable Banking	Systematic Review	Banking and sustainability literature	AI applications in sustainable banking	AI improves banking sustainability, risk management, and operational efficiency when supported by governance mechanisms
2	Aziz and Andriansyah (2023) ^[2]	Indonesia	Banking	Conceptual Review	Secondary literature	AI in fraud prevention and compliance	AI strengthens fraud detection, risk management, and regulatory compliance in modern banking
3	Thuda et al. (2024) ^[11]	Indonesia	Regional Development Banks	Case Study	Indonesian regional banks	Business transformation and governance	Uneven governance readiness and digital capability remain major barriers in Indonesian banking transformation
4	Bai et al. (2024) ^[12]	China	Banking Industry	Quantitative	Banking industry dataset	Banking digital transformation	Digital transformation capability positively affects banking competitiveness and operational adaptation
5	Ali Alqararah et al. (2025) ^[13]	Jordan	Commercial Banking	Quantitative Survey	Commercial bank employees	Digital transformation capability	Banking performance improves through digital capability and technological integration
6	Mughal et al. (2025) ^[41]	Pakistan	Banking Sector	Qualitative	Interviews with banking professionals	AI impact on HRM practices	AI adoption reshapes HR competencies, workforce structure, and digital capability requirements
7	Ashta and Herrmann (2021) ^[29]	Global	Banking and Fintech	Conceptual Review	Banking and fintech studies	AI opportunities and risks	AI creates both operational opportunities and governance-related risks in banking
8	Buckley et al. (2021) ^[26]	Global	Financial Services	Legal-Governance Review	Financial regulation literature	Human-in-the-loop AI governance	Human oversight remains essential for accountability in AI-enabled financial decision-making
9	Moharrak and Mogaji (2025) ^[68]	Middle East	Banking Industry	Empirical	Banking institutions	Generative AI in regulated banking	AI integration requires governance safeguards to maintain regulatory compliance and trust

Table 2. *Cont.*

No.	Authors	Country/ Region	Banking Context	Method	Sample/ Data Source	Main Focus	Key Findings
10	Kuchciak and Warwas (2021) ^[69]	Europe	Banking 4.0	Conceptual	Banking transformation literature	HRM transformation in Banking 4.0	Digital banking transformation significantly alters workforce competencies and HR structures
11	Birindelli and Palea (2023) ^[51]	Europe	Banking Sector	Quantitative	European banking dataset	Green governance and banking strategy	ESG governance positively influences green banking strategies and sustainability orientation
12	Bonsu et al. (2025) ^[52]	Global	Banking Sector	Quantitative	Banking and fintech data	Fintech and sustainability governance	Governance quality moderates the relationship between fintech integration and sustainability performance
13	Ali et al. (2022) ^[63]	Islamic Banking Context	Islamic Banking	Quantitative SEM	Islamic banking institutions	Green HRM and sustainability	Green HRM strengthens sustainable organisational outcomes in Islamic banking
14	Islam et al. (2025) ^[64]	Bangladesh	Green Banking	Quantitative	Banking employees	Green HRM and business performance	Green HRM and green banking orientation improve sustainable business performance
15	Arif et al. (2025) ^[65]	Pakistan	Banking Sector	Quantitative	Banking institutions	Green banking practices	Green banking and HRM positively affect organisational sustainability
16	Dou et al. (2025) ^[66]	European Union	Banking Sector	Quantitative	EU banking data	ESG uncertainty and valuation	ESG uncertainty significantly affects banking valuation and governance decisions
17	Citterio and King (2023) ^[67]	EU and US	Banking Sector	Quantitative	Banking financial data	ESG and financial distress	Strong ESG performance reduces the likelihood of banking financial distress
18	Karki et al. (2025) ^[72]	Global	Sustainable Banking	MCDM Framework	Sustainable banking indicators	ESG sustainable banking performance	ESG governance serves as a strategic determinant of sustainable banking performance
19	Horobet et al. (2025) ^[73]	Europe	Banking Sector	Quantitative	European banking panel data	ESG and financial performance nexus	Strong ESG integration improves long-term banking financial performance
20	Wang and Yang (2025) ^[57]	China	Financial Risk Management	Quantitative	Enterprise and financial risk data	Digital intelligence transformation	AI-driven digital intelligence strengthens enterprise risk management effectiveness

Table 2 presents the characteristics of 20 selected studies included in this systematic literature review, all of which demonstrate strong relevance to the banking and financial

services sector and achieved high methodological quality scores during the appraisal process. The table provides a structured overview of the studies based on several dimen-

sions, including country or regional context, banking focus, research methodology, sample or data source, thematic focus, and key findings. This classification was conducted to improve transparency in the review process and to provide a clearer understanding of the dominant research patterns shaping the literature on artificial intelligence (AI), HR governance, sustainability, and banking transformation.

The reviewed studies reveal that research on AI-enabled banking transformation is geographically concentrated in both developed and emerging economies, including Indonesia, China, Pakistan, Bangladesh, the European Union, and the Middle East. Several studies specifically emphasised governance and sustainability challenges in emerging banking environments, particularly within Indonesia's regional development banking sector. For example, Thuda et al.^[11] highlighted uneven digital maturity and governance readiness among Indonesian banks, reinforcing concerns regarding institutional preparedness for AI-enabled transformation.

Methodologically, quantitative approaches dominate the literature, particularly survey-based studies, empirical banking analyses, and ESG-performance investigations. However, the review also includes conceptual papers, legal-governance analyses, systematic reviews, qualitative studies, and multi-criteria decision-making frameworks, reflecting

the multidisciplinary nature of AI governance and sustainable banking research. Most studies focused on themes related to AI capability, digital banking transformation, governance accountability, ESG integration, green HRM, sustainable performance, and human capital transformation.

The findings across these studies consistently indicate that AI adoption in banking creates both opportunities and governance-related risks. While AI enhances operational efficiency, decision-making quality, fraud detection, and sustainability-orientated banking performance, the studies also emphasise the importance of governance readiness, ethical oversight, human capital capabilities, and ESG-oriented AI-enabled HR governance structures. Several articles further demonstrate that sustainable digital transformation depends not only on technological capability but also on the integration of governance mechanisms capable of ensuring accountability, transparency, workforce adaptability, and long-term organisational legitimacy.

A summary of the characteristics of the 68 studies included in this systematic literature review is shown in **Table 3**, which is aggregated into four dominant thematic “labels.” This thematic classification underscores that previous literature has investigated the interconnections between artificial intelligence, human resource management, governance and sustainability through complementary but fragmented lenses.

Table 3. Thematic Overview of Selected Studies in AI-Enabled HR Governance and Sustainability.

Thematic Focus	Key Authors	Methods	Key Findings
AI Capability and Organizational Performance	Aziz and Andriansyah ^[2] ; Ali and Rafi ^[4] ; Ali Alqararah et al. ^[13] ; Yanamala ^[20] ; Brendel et al. ^[24] ; Buckley et al. ^[26] ; Ashta and Herrmann ^[29] ; Vrontis et al. ^[30] ; Stahl et al. ^[36] ; Qamar et al. ^[39] ; Mikalef and Gupta ^[44] ; Eswaran et al. ^[47] ; Birindelli and Palea ^[51] ; Macke and Genari ^[60] ; Wong et al. ^[61]	Quantitative (SEM, regression), empirical	AI capability enhances organizational performance when combined with complementary resources and dynamic capabilities, rather than functioning as a standalone technological asset.
AI in HRM and Decision-Making	Aziz and Andriansyah ^[2] ; Fenwick et al. ^[14] ; Venugopal et al. ^[23] ; Shetty et al. ^[28] ; Paul and Criado ^[33] ; Minbaeva ^[35] ; Malik ^[38] ; Mughal et al. ^[41] ; Macchi Silva and Ribeiro ^[42] ; Paraman and Anamalah ^[43] ; Mikalef and Gupta ^[44] ; Raisch and Krakowski ^[45] ; Sklavos et al. ^[50] ; Wang and Yang ^[57] ; Macke and Genari ^[60] ; Brey and van der Mare ^[62] ; Dou et al. ^[66]	Conceptual, qualitative, review	AI augments HR decision-making by supporting analytical capacity, but effective outcomes depend on human judgment, managerial interpretation, and organizational context.

Table 3. *Cont.*

Thematic Focus	Key Authors	Methods	Key Findings
Algorithmic Ethics and Bias in HR	Fenwick et al. ^[14] ; Qamar et al. ^[39] ; Albaroudi et al. ^[49] ; Sarkis-Onofre et al. ^[58] ; Ali et al. ^[63] ; Kumar et al. ^[74] ; Molavi et al. ^[75] ; Asante et al. ^[76] ; Filimowicz ^[77] ; Singh et al. ^[78]	Conceptual, empirical, review	Algorithmic bias, opacity, and fairness risks pose significant challenges in AI-enabled HR processes, necessitating ethical AI frameworks and governance safeguards.
Green HRM and Sustainable Decision-Making	Pillai ^[3] ; Stankevičiūtė ^[5] ; Thuda et al. ^[11] ; Bai et al. ^[12] ; Sony et al. ^[21] ; Radonjić et al. ^[27] ; Eswaran et al. ^[47] ; Kumar et al. ^[74] ; Molavi et al. ^[75]	Quantitative surveys, conceptual	Green HR practices and sustainability-oriented decision-making contribute to long-term organizational sustainability by integrating environmental and social considerations into HR processes.
AI-enabled HR governance and ESG	Bankins ^[10] ; Thuda et al. ^[11] ; Bai et al. ^[12] ; Margherita and Bua ^[15] ; Sharma and Sengupta ^[25] ; Macke and Genari ^[60] ; Citterio and King ^[67] ; Karki et al. ^[72] ; Horobet et al. ^[73]	Quantitative, conceptual	AI-enabled HR governance and ESG-oriented structures institutionalize sustainability principles, guiding AI deployment and aligning managerial decisions with long-term value creation.
ESG Regulatory Pressure	Rudko et al. ^[8] ; Bankins ^[10] ; Margherita and Bua ^[15] ; Ayanponle et al. ^[16] ; Sharma and Sengupta ^[25] ; Snyder ^[32] ; Bolognesi et al. ^[70] ; Cicchiello et al. ^[71]	Empirical, archival	ESG regulatory pressure moderates organizational behaviour by strengthening accountability and reinforcing sustainability-oriented strategies and performance outcomes.
Banking and Financial Services Context	Rahman et al. ^[1] ; Pillai ^[3] ; Stankevičiūtė ^[5] ; Rudko et al. ^[8] ; Anlesinya et al. ^[9] ; Bankins ^[10] ; Thuda et al. ^[11] ; Bai et al. ^[12] ; Ayanponle et al. ^[16] ; Rachid and Houda ^[17] ; Sony et al. ^[21] ; Buckley et al. ^[26] ; Snyder ^[32] ; Paul and Criado ^[33] ; Bonsu et al. ^[52] ; Kuchciak and Warwas ^[69]	Empirical, review, conceptual	In highly regulated banking environments, AI adoption requires robust governance and HR decision-making mechanisms to balance innovation, risk management, and sustainability objectives.

The first stream highlights artificial intelligence and the restructuring of HR competencies and capabilities in the banking sector. The second stream relates to the realm of human capital risk, ethics, and accountability in AI-enabled HR. A third strand focuses on HR governance and the management of human capital risk in digitally transforming banking. The fourth thematic area, integrating AI, human capital risk, and HR governance: conceptual and practical implications for the Indonesian banking sector.

4.2. Thematic

This section provides a thematic synthesis of the literature to illustrate how artificial intelligence transforms human capital, augments it, and changes governance mechanics within banking enterprises. Digital transformation is gaining momentum, and the AI-influenced restructuring

of competencies and capabilities continues to redefine skills needs, decision rights, and workforce composition in banks. The implementation of AI in HR functions also carries new types of human capital risk, especially regarding ethical issues, algorithmic biases, transparency, and accountability in the decision-making process. These emerging risks underscore the increasing relevance of HR governance as an operational mechanism that is increasingly strategic in mitigating human capital vulnerabilities in digitally transforming banking institutions. Hence, the literature underlines that suitable governance frameworks have a crucial role in aligning AI adoption with sustainability and risk management objectives. These insights link the final theme of AI, human capital risk, and HR governance to their conceptual and practical implications for the Indonesian banking sector, considering the influence of regulatory intensity, ESG pressures, and institutional contexts on pathways for sustainable digital

transformation.

4.2.1. Artificial Intelligence and the Restructuring of HR Competencies and Capabilities in the Banking Sector

Extant literature establishes a well-supported connection between the adoption of AI in banking and its impacts on reshaping the structure for human resource competencies and capability needs. Rather than merely automating repetitive tasks, AI alters decision-making processes, the required skill sets, and the strategic nature of HR functions. Therefore, Fenwick et al. suggest that the organisational knowledge needed for digital transformation will not only hinge on analytical skills but also more complex hybrid competencies involving technical literacy paired with strategic judgement and ethical awareness^[14]. With AI systems gaining broader roles in processes such as recruitment, performance assessment, workforce planning or risk procedures, it is expected HR professionals will need to interpret algorithm output critically and bring human input (human-in-the-loop) into decision-making^[45].

Some studies frame AI capability as an organisational-level dynamic capability that reconfigures rather than replaces individual and collective skills^[6]. This transformation within banking heightens the value of data-driven decision-making, digital fluency, and the cross-functional collaboration between HR, IT, and risk management units^[16]. Empirical studies also indicate that core employee competencies, including adaptability and problem-solving, remain critical predictors of performance across multiple environments and industries, even in highly digitised banking contexts^[28].

But, as found in the literature, insufficient reskilling and capability development also bear some risk for human capital due to the obsolescence of skills and excessive dependence on black-box algorithms^[61]. As a result, contemporary research highlights the strategic position of HRM in enabling ongoing learning, ethical capability-building, and governance-aligned capabilities to enhance AI adoption for sustainable value generation in banking^[31, 41].

In the Indonesian banking sector, the transformation of workforce competencies driven by artificial intelligence remains uneven across banking institutions. Large digital banks generally demonstrate stronger readiness in terms of digital literacy, AI integration capability, and governance infrastructure, enabling them to adopt data-driven HR and

operational systems more effectively. In contrast, many regional development banks and smaller conventional banks continue to experience substantial capability gaps related to technological readiness, employee digital competencies, and governance maturity. Existing studies on banking transformation in Indonesia suggest that AI interpretability, digital skill development, and institutional governance capacity are still heavily concentrated within larger banking organisations, creating disparities in the implementation of sustainable and governance-oriented digital transformation practices^[11].

4.2.2. Human Capital Risk, Ethics, and Accountability in AI-Enabled HR

The literature is also gradually capturing that the application of artificial intelligence (AI) in HR functions creates more human capital risk types related to ethics/accountability/decision transparency causes, particularly within the banking sector. Although artificial-intelligence-enabled human resources (AI-HR) systems can increase the efficiency of recruitment, performance appraisal, and workforce analytics, they may also contribute to algorithmic bias or black-box algorithms that treat employees differently^[61]. Several studies document that biased training data and poorly designed algorithms can systematically disadvantage certain demographic groups and thus expose banks to ethical, legal, and reputational risks^[20].

The literature has discussed one dimension of human capital risk: the erosion of accountability in AI-enabled decision-making. With HR decisions becoming increasingly data-driven, this responsibility may move from human managers to systematic algorithms; this shift creates a grey area of accountability concerning adverse outcomes^[26]. Such a “responsibility gap” can be especially unpleasant in tightly regulated banking environments, where HR decisions affect directly compliance, fairness and organisational legitimacy^[29].

Furthermore, research stresses that an overuse of AI could undermine employee trust and psychological safety when decision processes are believed to become opaque or unchallengeable^[24]. As a corrective, recent scholarship challenges the problem of AI-driven human capital risk and HI context by proposing various frameworks for human-centred and governance-orientated AI use case scenarios, including human-in-the-loop interventions, explainable or “transparent” AI, quasi-judicial due process protections or oversight

committees^[36]. In short, the literature reviewed converges on the idea that managing ethics and accountability in AI-enabled HR is better characterised as a human capital governance challenge than a technical one with implications for sustainable banking transformation.

In Indonesia, concerns regarding algorithmic accountability are becoming increasingly significant due to the uneven level of digital maturity across banking institutions, particularly between large digital banks and smaller regional or conventional banks. Although the Indonesian banking sector has experienced rapid acceleration in digital transformation and AI adoption, governance readiness has not progressed at the same pace. Reports from Otoritas Jasa Keuangan show that many banks still have low skills in digital governance, particularly in risk management, data governance, algorithmic transparency, cybersecurity, and oversight. This imbalance creates substantial vulnerabilities in AI-enabled HR decision-making processes, including recruitment, employee evaluation, workforce analytics, and talent management systems. Inadequate AI-enabled HR governance structures may increase the likelihood of algorithmic bias, opaque decision-making, reduced managerial accountability, and employee distrust toward automated systems. These challenges are particularly critical in Indonesia's highly regulated banking environment, where public trust, ethical accountability, and compliance with ESG-orientated governance standards remain central to sustainable digital transformation.

4.2.3. HR Governance and the Management of Human Capital Risk in Digitally Transforming Banking

The literature reviewed indicates that HR governance has a significant role in controlling and reducing human capital risk emerging from AI-enabled HR practices in the banking industry. With AI becoming progressively integrated into the processes of recruitment, performance management and evaluation, workforce planning, employee analytics, etc., which organisations are not particularly accountable, we need governance mechanisms that ensure these systems stay in line with the objectives of organisational accountability, fairness and sustainability into the future^[14]. This governance is inherent to compliance functions as well in heavily regulated banking environments, making HR initiatives a strategic function that contributes to AI's adoption, monitoring and correction when undesirable consequences happen^[68].

One common theme of the studies is that there needs to be accountability frameworks and human supervision over HR decisions supported by AI. The literature suggests the goal is best achieved through human-in-the-loop arrangements, formal decision rights, audit trails and escalation^[26] to avoid responsibility gaps and excessive dependence on automatic outputs. Furthermore, governance frameworks increasingly highlight ethical assurance mechanisms (e.g., bias testing, explainable requirements, and continuous model monitoring) and seek to ameliorate the risk of discrimination in AI model implementation as well as strengthen procedural justice for workers^[20, 24]. Such mechanisms are particularly well-suited for protecting employee trust and organisational legitimacy in banking, where *de facto* damages from perceived unfairness can be strategically costly.

In addition, many studies have established links between HR governance and larger sustainability/ESG-orientated frameworks. Governance arrangements embedding the principles of sustainability, cross-functional committees, standardised policies, and transparency routines serve to align AI-powered HR practices with social responsibility and long-term value creation^[50]. In conclusion, the findings indicate that best practices in human resource governance combine technical safeguards with ethical stewardship and strategic alignment to mitigate human capital risk while meeting the demands of AI-led transformation for banks^[53].

Regulatory, sustainability, and institutional governance pressures increasingly shape HR governance in AI-enabled transformation within the Indonesian banking sector. This development is strongly influenced by Otoritas Jasa Keuangan through the implementation of POJK No. 51/POJK.03/2017 concerning Sustainable Finance, which requires banking institutions to integrate environmental, social, and governance (ESG) principles into their strategic and operational activities. Within this regulatory framework, HR governance extends beyond administrative compliance and becomes a strategic mechanism for ensuring that AI-driven HR practices remain ethically accountable, transparent, and aligned with sustainability objectives.

4.2.4. Integrating AI, Human Capital Risk, and HR Governance: Conceptual and Practical Implications for the Banking Sector

In the Indonesian banking context, the integration of AI, human capital risk, and HR governance involves key concep-

tual and practical considerations, particularly due to its significantly regulated and institutionally complex sustainability-oriented environment. From a conceptual standpoint, the reviewed literature indicates that adopting AI should not be seen simply as an upgrade of technology but rather as an embedded governance transition of human capital systems. Together with this new modality of competency development and decision-making comes (much) greater risk: ethics, accountability, and workforce vulnerability^[44]. Consequently, HR governance serves as a vital integrative mechanism to align technological capability with risk management and sustainability goals^[36].

On a practical level, these insights are especially relevant to the Indonesian banking industry, as regulatory supervision and the expectations of environmental social governance (ESG) are critical while public trust becomes central. Research argues that AI-facilitated HR practices can inflate human capital risks, including skills polarisation, biased decision-making, and reduced accountability without strong HR governance in place^[34]. As a response, Indonesian banks are prompted to institutionalise governing modes ensuring human-led oversight, ethical assurance, and transparency in AI-supported HR decisions (e.g., recruitment applications, performance appraisals, and talent development)^[26].

On top of that, the integration of AI with HR governance can facilitate alignment with ESG-orientated banking reforms and sustainability agendas progressively emphasised in emerging markets. HR decision-making AI-enabled HR governance structures grounded on sustainability principles enable banks to strike a balance between innovation and social responsibility or regulatory compliance^[51]. In conclusion, the literature indicates that for sustainable digital transformation in Indonesian banking to occur, there must be a strategically embedded AI capability integrated with human capital risk management and HR governance, which enables banks to utilise AI as a tool for long-term value creation while ensuring fairness regarding workforce legitimacy and resilience.

4.3. Contribution Model

In this study, the authors present a conceptual model illustrating how artificial intelligence (AI) acts as a significant

catalyst for transformation in human resource management (**Figure 2**). While the adoption of AI alters HR competencies, it also introduces human capital risks, including algorithmic bias, a lack of transparency, and issues of accountability. The presence of these risks underscores the importance of HR governance as a key mediating mechanism. HR governance is operationalised through ethical frameworks, human-in-the-loop approaches to decision-making, and ESG-audited policies that interact with AI-enabled HR practices and align as closely as possible with sustainability objectives. Ultimately, this model suggests that sustainable digital transformation in banking results from the interplay between AI capabilities, human capital risk management, and governance.

This study contributes significantly to the literature on AI, HRM, and sustainability. Firstly, it builds on the Resource-Based View (RBV) literature by reconceptualising AI capabilities not as external value-generating technological resources but as contingent capabilities whose effectiveness depends on their alignment with human capital competencies and AI-enabled HR governance structures. Secondly, this research enhances the institutional theory literature by demonstrating how regulatory pressures, ESG frameworks, and sustainability expectations not only facilitate AI adoption but also shape AI-enabled HR governance structures that mitigate human capital risk. Thirdly, and most importantly, this study offers an integrative theoretical framework that connects AI capability, human capital risk, and HR governance within a sustainability-orientated context. By positioning HR governance as a theoretically grounded mediating and coordinating mechanism, the study integrates two previously disconnected research streams, reframing AI-driven HR transformation as a process predominantly influenced by governance.

The previous findings provide a simplified consolidation of literature references, highlighting the prevailing themes that emerged from the study regarding AI, human capital risk, and their interrelations with HR governance, particularly in the banking sector. The results presented here underscore significant empirical and conceptual patterns, albeit in a largely descriptive manner. To move beyond mere description and gain deeper theoretical insights, it is crucial to interpret these patterns through established theoretical lenses alongside broader sustainability considerations. The identified relationships among AI capability,

emerging human capital risks, and governance mechanisms necessitate a more integrative understanding of how these elements interact to shape sustainable digital transformation. This is followed by a discussion section, where the paper

interprets the findings through the lens of resource-based views (RBV) and institutional theory, considering their relevance to sustainability-oriented governance implications in the context of Indonesian banking.

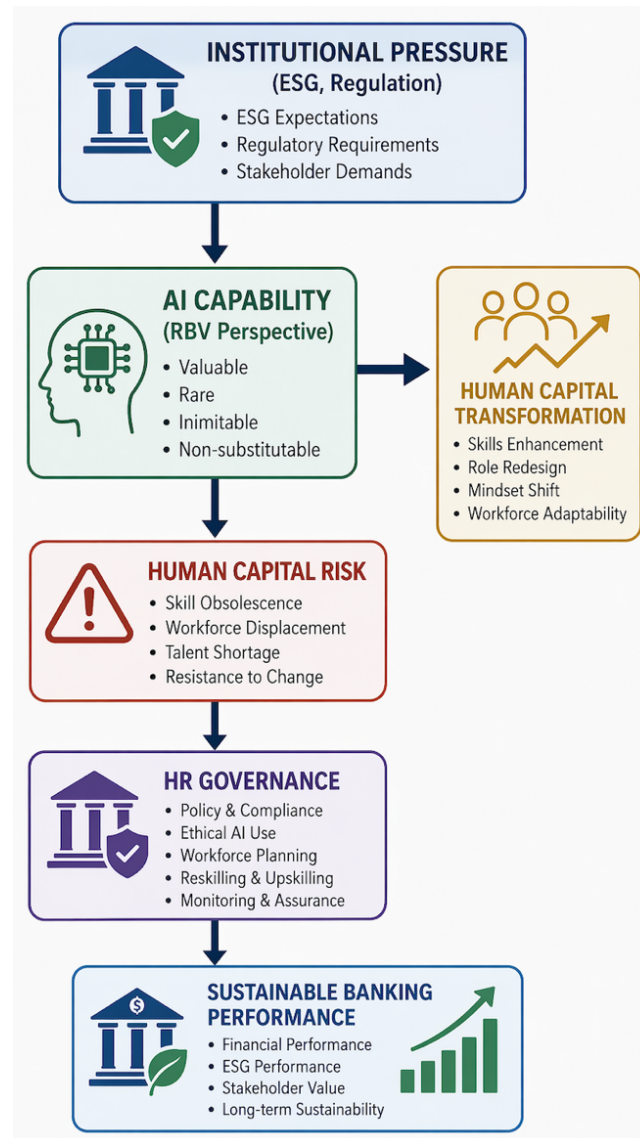


Figure 2. Conceptual Framework of AI-Driven Human Capital Risk and HR Governance for Sustainable Banking.

5. Discussion

This discussion moves beyond descriptive synthesis by providing a theoretically grounded interpretation of the relationship between artificial intelligence (AI), human capital risk, and HR governance in the banking sector. Rather than merely reiterating the thematic findings, this section advances three major theoretical extensions that collectively

reposition AI-enabled HR transformations as a governance-driven organisational phenomenon.

First, from the perspective of the resource-based view (RBV), the findings challenge the dominant assumption that AI capabilities automatically generate organisational value. Instead, AI should be understood as a contingent strategic resource whose effectiveness depends on the alignment between technological capability, human capital readiness, and

governance maturity. Therefore, this study extends RBV by introducing a risk-contingent capability perspective, demonstrating that inadequate AI-enabled HR governance structures may transform AI from a value-enhancing capability into a source of organisational vulnerability. Consequently, sustainable value creation is not determined solely by technological sophistication but also by the organization's ability to integrate AI capabilities with ethical oversight, workforce adaptability, and institutional governance mechanisms.

Second, viewed through the lens of institutional theory, AI adoption in banking is better interpreted as an institutional governance response rather than merely a technological efficiency initiative. The findings indicate that regulatory pressure, ESG expectations, and organisational legitimacy concerns significantly influence the development of HR AI-enabled HR governance structures in AI-enabled environments. In highly regulated sectors such as banking, governance mechanisms function as institutional instruments that translate external regulatory expectations into operational HR practices. This finding extends institutional theory by positioning HR governance as a mediating structure through which institutional pressures influence AI implementation, ethical accountability, and sustainability-orientated decision-making.

Third, this study identifies human capital risk as a central explanatory mechanism linking AI capability and HR governance. The literature demonstrates that AI-enabled HR systems may generate risks associated with algorithmic biases, opacity, accountability gaps, workforce polarisation, and diminished employee trust. These risks explain why governance mechanisms become strategically necessary rather than administratively optional. Consequently, the discussion shifts the debate from a purely technological perspective toward a broader risk-governance framework, in which governance is conceptualised as a structural requirement for sustainable digital transformation.

The findings also reveal that the Indonesian banking sector faces unique governance challenges associated with uneven digital maturity and institutional readiness. While large digital banks demonstrate stronger AI capability, governance infrastructure, and workforce adaptability, many regional and conventional banks continue to experience capability gaps related to digital literacy, AI interpretability, and governance preparedness. This imbalance intensifies con-

cerns regarding algorithmic accountability, ethical oversight, and sustainability compliance in AI-enabled HR practices. In this context, HR governance becomes increasingly important as a strategy for balancing technological innovation with organisational legitimacy, regulatory compliance, and workforce sustainability.

6. Conclusions

This study contributes to the growing literature on artificial intelligence, human capital risk, and HR governance by demonstrating that AI-driven transformation in the banking sector extends beyond operational efficiency and technological optimisation. The findings reveal that AI fundamentally changes organisational decision-making processes, workforce competencies, AI-enabled HR governance structures, and sustainability outcomes. Based on a systematic review of 68 peer-reviewed studies, this research identifies AI as a structural driver of emerging human capital risks, particularly those associated with algorithmic bias, reduced transparency, accountability gaps, workforce vulnerability, and ethical uncertainty in HR-related decision-making.

A major contribution to this study lies in the reconceptualisation of HR governance as a strategic integrative mechanism that aligns AI-enabled HR practices with sustainability objectives, ethical accountability, and institutional legitimacy. This perspective shifts the dominant discourse from a technology-centred understanding of AI adoption toward a governance-orientated framework for sustainable digital transformation. In doing so, the study offers a more comprehensive explanation of how AI capability, human capital risk management, and AI-enabled HR governance structures interact to shape long-term organisational sustainability, particularly within highly regulated sectors, such as banking.

The findings further suggest that AI capability alone is insufficient to generate sustainable organisational value. Instead, the effectiveness of AI implementation depends on the organisation's ability to develop complementary human capital competencies, ethical oversight mechanisms, and governance readiness. In the Indonesian banking context, these challenges become increasingly significant due to uneven levels of digital maturity, governance preparedness, and institutional capability across banking institutions. While large

digital banks demonstrate stronger readiness for AI-enabled transformation, many regional and conventional banks continue to experience substantial limitations related to digital literacy, governance infrastructure, and AI interpretability.

From a practical perspective, this study highlights the importance of governance-based AI implementation strategies. Banking institutions are encouraged to institutionalise human-in-the-loop decision-making, algorithmic audits, ethical AI oversight, and ESG-oriented governance mechanisms to minimise human capital risk while maintaining employee trust and organisational legitimacy. In addition, policymakers and regulators are expected to strengthen governance frameworks that support transparency, accountability, workforce sustainability, and responsible AI adoption within the banking industry.

6.1. Implication

This study provides several important theoretical, managerial, and policy implications regarding the relationship between artificial intelligence (AI), human capital risk, and HR governance in the banking sector. From a theoretical perspective, the findings strengthen and extend the literature on AI-enabled transformation by demonstrating that the value of AI does not arise solely from technological capability but from the organization's ability to align AI implementation with governance quality, human capital readiness, and sustainability objectives. The study, therefore, contributes to the Resource-Based View (RBV) by positioning AI capabilities as contingent strategic resources whose effectiveness depends on complementary organisational capabilities, particularly HR governance and ethical oversight mechanisms. In addition, the findings extend institutional theory by showing that regulatory pressure, ESG expectations, and legitimacy concerns significantly shape governance responses to AI adoption within banking institutions.

The study also contributes to the emerging literature on AI governance by conceptualising HR governance as a strategic integrative mechanism linking AI capability, human capital risk management, and sustainable organisational performance. Rather than functioning merely as an administrative control system, HR governance is reframed as a governance-based coordination structure that ensures fairness, transparency, accountability, and sustainability in AI-enabled HR decision-making processes. This perspective shifts the cur-

rent discourse from a predominantly technology-centred understanding of AI adoption to a governance-oriented interpretation of sustainable digital transformation.

From a managerial perspective, the findings suggest that banking institutions should move beyond efficiency-orientated AI adoption strategies and prioritise governance-focused implementation approaches. HR managers must ensure that AI-supported HR practices, including recruitment, workforce analytics, performance evaluation, and talent management, remain subject to human oversight and ethical accountability. The implementation of human-in-the-loop decision-making mechanisms, algorithmic auditing procedures, and explainable AI frameworks becomes increasingly important to minimise bias, reduce accountability gaps, and maintain employee trust. In addition, banks should continuously strengthen workforce competencies through reskilling and upskilling programmes focused on digital literacy, data interpretation, ethical reasoning, and AI-related governance capabilities.

These implications are particularly relevant in the Indonesian banking context, where digital transformation capability remains uneven across banking institutions. Large digital banks generally possess stronger governance infrastructure and technological readiness, whereas many regional and conventional banks continue to face limitations in digital capability, governance maturity, and AI interpretability. As a result, Indonesian banks are encouraged to institutionalise AI-enabled HR governance structures such as AI ethics committees, ESG-orientated HR policies, and cross-functional oversight mechanisms to ensure that technological innovation remains aligned with sustainability objectives and regulatory expectations.

From a policy perspective, the findings emphasise the important role of Otoritas Jasa Keuangan in strengthening governance frameworks related to ethical AI adoption in banking. Existing initiatives, including POJK No. 51/POJK.03/2017 on Sustainable Finance and the Indonesian Banking Digital Transformation Blueprint, provide an important institutional foundation for integrating ESG principles, governance accountability, and human capital sustainability into AI-enabled banking transformation. Future policy development should therefore focus on strengthening transparency standards, algorithmic accountability guidelines, workforce protection mechanisms, and governance readiness assess-

ment frameworks to support sustainable and inclusive digital transformation across the Indonesian banking industry.

6.2. Limitations and Future Research

This study, despite its theoretical and practical contributions, faces several limitations that warrant acknowledgement and may guide future research. First, this study employed a systematic literature review (SLR) approach, meaning that the findings depend heavily on the availability, quality, and scope of existing literature. Although the review followed the PRISMA 2020 protocol and incorporated 68 peer-reviewed studies, the synthesis remains influenced by the dominant concentration of studies originating from developed economies. Consequently, the contextual generalisation of the findings to emerging economies, including Indonesia, remains limited due to differences in institutional environments, regulatory maturity, technological readiness, and governance capacity.

Second, the analysis primarily concentrates on macro-level and organisational-level perspectives, neglecting the micro-level behavioural dimensions associated with AI-enabled HR practices. As a result, the study does not sufficiently capture how employees, managers, and other organisational actors perceive, interpret, negotiate, or respond to AI-driven HR decisions in ordinary organisational settings. Future research should therefore explore the behavioural and psychological implications of AI adoption, including employee trust, perceived fairness, technological acceptance, resistance to automation, and ethical concerns related to algorithmic decision-making.

Third, this review predominantly emphasises formal governance mechanisms, such as policies, regulatory frameworks, oversight structures, and institutional accountability systems. However, informal organisational dimensions, including leadership style, organisational culture, ethical climates, and social dynamics, may also significantly influence the effectiveness of AI-enabled HR governance and sustainability outcomes. Future studies are encouraged to investigate how formal and informal governance mechanisms interact to shape responsible AI implementation within banking organisations.

In addition, most studies included in this review remain conceptual or cross-sectional in nature, limiting the understanding of how AI capability, governance maturity, and hu-

man capital risk evolve. Longitudinal studies are therefore strongly recommended to examine the dynamic interaction between technological transformation, workforce adaptation, and governance development throughout different stages of digital transformation. Mixed-method approaches combining quantitative techniques, such as SEM-PLS, with qualitative interviews or case studies may also provide deeper insights into the organisational and behavioural mechanisms underlying AI-enabled HR governance.

Future research should also expand comparative investigations across countries and institutional contexts to better understand how regulatory systems, ESG pressures, cultural environments, and digital maturity influence AI governance practices in banking sectors across developed and emerging economies. Comparative studies involving Indonesia and other ASEAN countries may be particularly valuable for identifying region-specific governance challenges and sustainability strategies.

Finally, future studies should explore emerging governance mechanisms associated with responsible AI implementation, including explainable AI (XAI), algorithmic auditing systems, AI ethics committees, and governance-orientated digital capability frameworks. Additional research integrating AI governance with sustainable leadership, organisational learning, workforce resilience, and ESG-oriented transformation may further strengthen our understanding of how banking institutions can achieve sustainable, ethical, and governance-centered digital transformation in increasingly complex technological environments.

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All authors contributed equally to the conception, design, data collection, analysis, and writing of this study. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

AI Use Statement

During the development of this manuscript, artificial intelligence (AI) was employed solely to enhance linguistic quality and improve the clarity of methodological and analytical explanations. The use of AI was limited to editorial assistance and did not influence the intellectual contributions, research design, or interpretation of findings. The authors have thoroughly reviewed and edited all outputs and bears full responsibility for the final content of this work.

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