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HR Management Innovation and Employee Performance Improvement in SMEs Under the Background of Digital Transformation: A Cross - Industry Study

Amara Diop*
Faculty of Business Administration, University of Dakar, Dakar 10000, Senegal

ABSTRACT
This study explores HR management innovation's impact on SME employee performance across 4 industries (manufacturing, retail, IT, healthcare) and 3 digitalization levels (2021–2024). Using mixed methods—surveys of 6,000 employees, interviews with 120 HR managers, 30 SME case studies—it analyzes 3 core HR innovations: digital recruitment, AI-driven training, data-based performance management. Results show high-digitalization SMEs (UK, South Korea) with full-cycle digital HR see 32% higher task efficiency and 27% lower performance gaps. Low-digitalization ones (Senegal) focusing on basic digital recruitment/on-demand training have 18% efficiency gain but only 9% gap reduction. IT SMEs benefit most from AI training (29% efficiency), manufacturing from data-based performance management (25% efficiency). It offers insights for SMEs to align HR innovation with digitalization and industry traits.

Keywords: HR Management Innovation; SMEs; Digital Transformation; Employee Performance; Digital Recruitment; AI - Driven Training; Data - Based Performance Management; Cross - Industry Comparison

*CORRESPONDING AUTHOR:
Amara Diop, Faculty of Business Administration, University of Dakar; Email: amara.diop@ucad.sn

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1. Introduction

1.1 Background

Digital transformation has reshaped the global business landscape, with SMEs—accounting for 90% of enterprises worldwide (World Bank, 2023)—facing unique pressures to adapt. Unlike large corporations with abundant resources for digital overhauls, SMEs often struggle to integrate digital tools into HR management, despite evidence that HR innovation drives employee productivity (OECD, 2022). For example, a retail SME in China may lack budget for AI recruitment platforms, while an IT service SME in South Korea can leverage cloud - based HR systems to streamline training—highlighting how digitalization levels and industry needs shape HR practices.

In the post - 2020 era, SMEs' reliance on HR innovation has intensified: digital tools enable remote talent acquisition (critical amid global talent shortages) and personalized training (key to upskilling employees for digital tasks). However, most SMEs adopt fragmented digital HR practices (e.g., only digital recruitment) rather than holistic innovation, limiting performance gains (Deloitte, 2023). This gap underscores the need to understand how SMEs can align HR innovation with their digitalization capacity and industry context.

1.2 Significance of the Study

Existing research on digital HR management focuses primarily on large corporations (e.g., Microsoft's AI - powered performance systems) or single industries (e.g., manufacturing automation). Few studies address SMEs' unique constraints—limited budgets, small HR teams, industry - specific skill demands—or compare practices across digitalization levels. This study fills this void by:

Examining HR innovation in SMEs across three digitalization levels, identifying feasible practices for resource - constrained enterprises.

Uncovering industry - specific HR needs (e.g., healthcare SMEs' focus on compliance training vs. IT SMEs' focus on tech upskilling).

Quantifying the link between HR innovation scope (partial vs. full - cycle) and employee performance outcomes, providing evidence for prioritization.

Practically, the findings help SME HR managers avoid "digital overinvestment" (e.g., costly AI tools with low adoption) and focus on high - impact innovations. Theoretically, it extends the resource - based view of HR management by identifying digitalization capacity as a key resource shaping innovation effectiveness.

1.3 Research Objectives and Questions

The primary objective is to investigate HR management innovation in SMEs under digital transformation and its impact on employee performance, across digitalization levels and industries. To achieve this, we address three research questions:

What HR management innovations are SMEs adopting, and how do these vary by digitalization level and industry?

How do different HR innovation practices (digital recruitment, AI training, data - based performance management) influence employee performance metrics (task efficiency, performance consistency, skill development)?

What factors (resource constraints, digital literacy, industry regulations) moderate the relationship between HR innovation and employee performance in SMEs?

2. Literature Review

2.1 Digital Transformation and SME HR Challenges

SMEs face three core challenges in digital HR adoption. First, **resource constraints**: 65% of low - digitalization SMEs report budget limitations as the top barrier to digital HR tools, compared to 28% of high - digitalization SMEs (EU SME Policy Brief, 2022). For example, a Senegalese manufacturing SME may spend <5% of its HR budget on digital tools, while a UK IT SME allocates 25% (African Development Bank, 2023).

Second, **digital literacy gaps**: 72% of SME

HR managers in medium - digitalization countries lack skills to implement AI - driven training or data analytics (McKinsey, 2022). This leads to "tool underutilization"—e.g., a Chinese retail SME purchasing a digital recruitment platform but using only 30% of its features (China SME Development Report, 2023).

Third, **industry - specific regulatory barriers**: Healthcare SMEs must comply with strict data privacy laws (e.g., HIPAA in the US) when adopting digital performance management, while manufacturing SMEs face safety - related training mandates that limit flexibility in AI training design (ILO, 2023).

2.2 Core HR Innovation Practices in Digital Transformation

Three HR modules are most commonly digitized by SMEs:

Digital recruitment: Includes AI resume screening, video interviews, and talent pool analytics. High - digitalization SMEs use AI tools to reduce time - to - hire by 40% (LinkedIn, 2023)—e.g., a South Korean IT SME using resume parsing software to identify tech skills in 10 seconds per candidate. In low - digitalization countries, SMEs rely on basic digital platforms (e.g., LinkedIn job posts) but still reduce time - to - hire by 15% (Senegal SME Survey, 2022).

AI - driven training: Encompasses personalized learning paths, microlearning apps, and skill gap analytics. IT services SMEs prioritize AI training for technical skills (e.g., cloud computing), achieving a 28% increase in employee skill proficiency (Gartner, 2023). Manufacturing SMEs use AI - based simulation training for equipment operation, reducing on - site training time by 35% (Manufacturing SME Report, 2022).

Data - based performance management: Involves real - time performance tracking, predictive performance analytics, and feedback automation. Retail SMEs use POS data to link employee sales performance to training needs, increasing cross - selling rates by 22% (Deloitte, 2023). Healthcare SMEs use electronic health record (EHR) data to measure clinical staff efficiency, improving patient wait times by 18% (Healthcare SME Innovation Report, 2022).

2.3 HR Innovation and Employee Performance in SMEs

Studies show that HR innovation improves employee performance through three mechanisms. First, **efficiency gains**: Digital recruitment reduces administrative burdens for HR teams, freeing time for employee engagement—leading to a 20% increase in HR responsiveness (Society for Human Resource Management [SHRM], 2023). Second, **skill alignment**: AI training matches content to individual skill gaps, with SMEs reporting a 25% higher training transfer rate (application of skills to tasks) than traditional training (WEF, 2022). Third, **performance transparency**: Data - based management provides employees with real - time feedback, reducing performance gaps between top and bottom performers by 23% (HR Tech Alliance, 2023).

However, effectiveness varies by context. In low - digitalization countries, partial HR innovation (e.g., only digital recruitment) yields a 12% performance increase, while full - cycle innovation (all three modules) in high - digitalization countries yields 30% (OECD, 2023). Industry differences also exist: IT services SMEs see 29% performance gains from AI training, while healthcare SMEs gain 21% from data - based performance management (due to regulatory compliance needs) (SME Digital HR Benchmark, 2023).

2.4 Gaps in the Literature

Three critical gaps remain. First, most studies measure HR innovation as a binary variable (adopted vs. not adopted) rather than analyzing scope (partial vs. full - cycle) or industry - specific variations. Second, few studies explore moderating factors like SME size (micro vs. medium) or digital literacy, which influence innovation success. Third, research on low - digitalization countries is scarce, with 70% of studies focusing on high - income, high - digitalization contexts (African Development Bank, 2023). This

study addresses these gaps through a cross - level, mixed - methods design.

3. Methodology

3.1 Study Design

We use a sequential explanatory mixed - methods design:

Phase 1 (Quantitative): Survey of SME employees to measure HR innovation exposure and performance outcomes.

Phase 2 (Qualitative): Interviews with HR managers to explore innovation drivers, barriers, and industry - specific practices.

Phase 3 (Mixed): Case studies of SMEs to validate survey/interview findings and analyze cause - effect relationships.

The study period is 2021 - 2024, covering the post - pandemic digital acceleration phase, with data collected annually to capture longitudinal changes.

3.2 Selection of Study Samples

3.2.1 Country and Digitalization Level

We selected 9 countries representing three digitalization levels (based on UNCTAD's 2022 Digital Economy Report):

High - digitalization (digital readiness score ≥0.7): UK (0.82), South Korea (0.89), USA (0.85)

Medium - digitalization (0.5 - 0.69): China (0.68), Italy (0.62), Brazil (0.59)

Low - digitalization (<0.5): Senegal (0.42), Kenya (0.45), Ghana (0.48)

3.2.2 SME and Industry Selection

We sampled 30 SMEs (10 per digitalization level, 2 - 3 per country) across four industries:

Manufacturing (e.g., textile SMEs in Senegal, automotive parts SMEs in South Korea)

Retail services (e.g., grocery SMEs in Italy, e - commerce SMEs in China)

IT services (e.g., software development SMEs in UK, IT support SMEs in Kenya)

Healthcare (e.g., clinics in USA, diagnostic centers in Ghana)

SME selection criteria: (1) 10 - 250 employees (per EU SME definition); (2) implemented at least one digital HR practice since 2021; (3) willingness to share performance data (e.g., task completion rates).

3.2.3 Participant Selection

Survey participants: 6,000 employees (200 per SME, balanced by role: frontline, middle management, HR). Response rate: 83% (5,000 valid responses).

Interview participants: 120 HR managers (4 per SME, including 1 HR director and 3 module - specific managers: recruitment, training, performance).

Case study participants: 30 SME owners/CEOs (1 per SME) and 300 key employees (10 per SME) to gain organizational - level insights.

3.3 Data Collection

3.3.1 Phase 1: Employee Surveys (Quantitative)

Survey instrument (5 - point Likert scale: 1 = Strongly Disagree to 5 = Strongly Agree) included three core sections:

HR innovation exposure:

Digital recruitment: "My company uses AI tools to screen resumes" (R1); "I participated in a video interview for my current role" (R2)

AI - driven training: "I have a personalized digital learning path" (T1); "I use microlearning apps for skill development" (T2)

Data - based performance management: "My performance is tracked using real - time data" (P1); "I receive automated feedback on my performance" (P2)

Employee performance metrics:

Task efficiency: "I complete tasks faster than 6 months ago" (E1); "I use digital skills to reduce task errors" (E2)

Performance consistency: "My performance scores vary less than before" (C1); "I meet performance targets more frequently" (C2)

Skill development: "My technical skills have improved due to training" (S1); "I can handle new digital tasks" (S2)

Moderating factors:

Digital literacy: "I can use digital HR tools independently" (L1)

Resource constraints: "My company has enough budget for digital HR tools" (R3)

Industry regulations: "HR practices must comply with strict industry rules" (I1)

Surveys were distributed via SME internal platforms (e.g., email, intranets) and translated into local languages (e.g., Wolof for Senegal, Mandarin for China) by professional translators.

3.3.2 Phase 2: HR Manager Interviews (Qualitative)

Semi - structured interview guides focused on:

Drivers of HR innovation (e.g., "What motivated your SME to adopt digital recruitment?")

Implementation barriers (e.g., "What challenges did you face with AI training?")

Industry - specific adaptations (e.g., "How do healthcare regulations affect your performance management?")

Performance impact observations (e.g., "Have you noticed changes in employee efficiency since adopting data - based performance tools?")

Interviews were conducted via Zoom (45 - 60 minutes each), audio - recorded, and transcribed. Non - English interviews were translated to English with inter - translator reliability checks (Cohen's kappa = 0.89).

3.3.3 Phase 3: SME Case Studies (Mixed)

Case study data included:

Secondary data: SME annual reports, HR analytics dashboards, training records, and performance metrics (2021 - 2024).

Primary data: Follow - up interviews with CEOs (to understand strategic intent) and on - site observations (to assess tool adoption in practice).

For example, in a South Korean IT SME case study, we analyzed 2021 - 2024 training completion rates and task efficiency data, paired with interviews about AI training implementation.

3.4 Data Analysis

3.4.1 Quantitative Data Analysis

We used SPSS 26.0 and R 4.3.0 for analysis:

Descriptive statistics: Summarize HR innovation exposure and performance scores by digitalization level and industry.

Regression analysis: Multiple linear regression to test the effect of HR innovation (predictors: R1 - R2, T1 - T2, P1 - P2) on performance metrics (dependent variables: E1 - E2, C1 - C2, S1 - S2).

Moderation analysis: Hierarchical regression to test if digital literacy (L1) and resource constraints (R3) moderate the innovation - performance relationship (e.g., "innovation × literacy" interaction term).

ANOVA: Compare performance outcomes across industries and digitalization levels to identify significant differences.

3.4.2 Qualitative Data Analysis

Thematic analysis (Braun & Clarke, 2006) with NVivo 12 was used for interview and case study data:

Open coding: Assign codes to transcripts (e.g., "budget limitation as barrier", "AI training for tech skills")

Axial coding: Group codes into sub - themes (e.g., "digitalization level - driven barriers")

Selective coding: Integrate sub - themes into core themes (e.g., "industry - specific HR innovation priorities")

Inter - coder reliability was ensured by two researchers coding 25% of transcripts (Cohen's kappa = 0.86).

3.4.3 Mixed Data Integration

Joint display analysis (Guetterman et al., 2022) merged quantitative and qualitative findings. For example, survey data showing 32% efficiency gain in high - digitalization SMEs was paired with interview quotes from UK HR managers: "Our full - cycle digital HR tools let us hire faster,

train better, and track performance in real time—our employees now finish client projects 30% faster than before." This integration helped validate quantitative results with qualitative context, strengthening the study's rigor.

3.5 Ethical Considerations

The study was approved by the Institutional Review Board of the University of Manchester (IRB

Approval No. MAN - 2021 - 0067). All participants provided informed consent: survey respondents were assured of data anonymity (no personal identifiers linked to responses); interview and case study participants could request edits to transcriptions to protect confidentiality. SME performance data was aggregated to avoid identifying individual enterprises, and all data storage complied with GDPR (EU) and local data protection laws (e.g., China's Personal Information Protection Law).

4. Results

4.1 HR Management Innovation Practices by Digitalization Level and Industry

4.1.1 Digitalization Level Differences

Table 1 summarizes HR innovation adoption rates (percentage of SMEs implementing each practice) across digitalization levels:

Key trends emerge: High - digitalization SMEs prioritize **full - cycle, advanced digital practices**

HR Innovation Practice	High - Digitalization Countries (UK, SK, USA)	Medium - Digitalization Countries (China, Italy, Brazil)	Low - Digitalization Countries (Senegal, Kenya, Ghana)
Digital Recruitment			
- AI resume screening	85%	45%	12%
- Video interviews	92%	68%	35%
- Talent pool analytics	78%	32%	8%
AI - Driven Training			
- Personalized learning paths	80%	38%	10%
- Microlearning apps	90%	55%	22%
- Skill gap analytics	72%	28%	7%
Data - Based Performance Management			
- Real - time tracking	88%	42%	15%
- Predictive analytics	65%	20%	5%
- Automated feedback	82%	50%	20%
Full - cycle innovation (all 3 modules)	75%	25%	5%

(e.g., 85% use AI resume screening, 80% personalized training paths), while low - digitalization SMEs focus on **basic digital tools** (e.g., 35% video interviews, 22% microlearning apps) with minimal adoption of analytics or AI. Medium - digitalization SMEs show a "mixed adoption" pattern—higher than low - digitalization for most practices but far below high - digitalization, with 25% implementing full - cycle innovation (vs. 75% in high - digitalization).

Interview data from low - digitalization SMEs explained barriers: A Senegalese manufacturing HR manager noted, "We can't afford AI tools—our HR budget is $5,000/year, so we use free LinkedIn job posts and WhatsApp video interviews instead." In contrast, a UK IT SME HR director stated, "We allocate 30% of our HR budget to digital tools—full - cycle innovation helps us compete for tech talent."

4.1.2 Industry Differences

Table 2 shows industry - specific HR innovation priorities (top 2 practices by adoption rate per industry)

Industry needs drive differentiation: IT services SMEs prioritize **skill - focused innovation** (training, specialized recruitment) to address rapid tech change; manufacturing SMEs focus on **safety and efficiency tools** (simulation training, real - time tracking); healthcare SMEs emphasize **compliance and flexibility** (automated feedback, microlearning) to meet regulatory demands and staffing constraints.

Industry	Top 2 HR Innovation Practices (Adoption Rate)	Rationale (from Interviews)
Manufacturing	1. AI simulation training (62%)2. Real - time performance tracking (58%)	"Simulation training reduces on - site accidents; real - time tracking monitors production line efficiency."
Retail Services	1. Video interviews (70%)2. Automated performance feedback (65%)	"Video interviews let us hire across regions; automated feedback helps sales staff adjust in real time."
IT Services	1. Personalized learning paths (88%)2. AI resume screening (85%)	"Tech skills evolve fast—personalized training keeps employees updated; AI screening identifies niche skills."
Healthcare	1. Automated performance feedback (68%)2. Microlearning apps (60%)	"Automated feedback ensures compliance with clinical standards; microlearning fits busy staff schedules."

4.2 Impact of HR Innovation on Employee Performance

4.2.1 Overall Performance Effects

Regression analysis (Table 3) shows the relationship between HR innovation exposure (sum of adopted practices) and performance metrics (standardized beta coefficients, $p < 0.01$ for all):

Full - cycle innovation had the strongest impact: SMEs implementing all three modules saw a **32% average increase in task efficiency**, 27% improvement in performance consistency, and 35% gain in skill development—double the gains of SMEs with partial innovation (15% efficiency, 12% consistency, 18% skill development).

Performance Metric	Beta Coefficient (All SMEs)	Beta Coefficient (High - Digitalization)	Beta Coefficient (Low - Digitalization)
Task Efficiency	0.42	0.58	0.25
Performance Consistency	0.38	0.52	0.18
Skill Development	0.45	0.61	0.22

Case study evidence supported this: A South Korean IT SME (full - cycle innovation) reported 2021 - 2024 data showing task efficiency (measured by project completion time) decreased from 14 days to 9 days (36% reduction), while a Senegalese retail SME (partial innovation: only video interviews) saw efficiency improve from 8 hours to 6.8 hours per task (15% reduction).

4.2.2 Industry - Specific Performance Gains

ANOVA results (Table 4) reveal significant industry differences in performance outcomes from HR innovation:

Industry	Task Efficiency Increase	Performance Consistency Improvement	Skill Development Gain
IT Services	35%	30%	40%
Manufacturing	25%	28%	22%
Retail Services	22%	25%	20%
Healthcare	18%	27%	25%

IT services SMEs achieved the highest gains due to strong alignment between innovation and industry needs: AI - driven training (e.g., cloud computing courses) directly improved technical task efficiency, while AI recruitment attracted skilled employees who maintained consistent performance. Healthcare SMEs had lower efficiency gains due to regulatory constraints—e.g., a US clinic noted, "We can't fully automate performance feedback because we need manual reviews for clinical compliance, which slows down efficiency."

4.3 Moderating Factors Influencing Innovation - Performance Relationships

4.3.1 Digital Literacy

Digital literacy (L1 scale: 1 - 5) significantly moderated the impact of AI - driven training on skill development (interaction beta = 0.32, $p < 0.001$). For SMEs with high employee literacy (score ≥4), AI training increased skill development by 42%; for low literacy (score ≤2), the gain was only 15%.

Interview data explained this: A Chinese manufacturing SME HR manager said, "We rolled out microlearning apps, but 40% of our older employees couldn't use them independently—we had to add in - person tutorials, which reduced training impact." In contrast, a UK retail SME (high literacy) reported 90% of employees used microlearning apps daily, leading to 30% faster skill acquisition.

4.3.2 Resource Constraints

Budget availability (R3 scale: 1 - 5) moderated full - cycle innovation effectiveness: SMEs with high budgets (score ≥4) saw 35% efficiency gains from full - cycle innovation, while those with low budgets (score ≤2) saw only 12% gains—often due to "tool underutilization." For example, a Brazilian retail SME purchased a data - based performance system but lacked funds for training, so only 30% of managers used its analytics features, limiting efficiency improvements to 10%.

4.3.3 Industry Regulations

Regulatory stringency (I1 scale: 1 - 5) moderated data - based performance management impact: Highly regulated industries (healthcare, I1 score = 4.5) had 20% lower efficiency gains from real - time tracking than less regulated industries (IT services, I1 score = 2.0). A Ghanaian healthcare SME explained, "We track nurse performance in real time, but we have to store data in compliance with HIPAA, which adds delays—this reduces the speed of feedback and efficiency gains."

5. Discussion

5.1 Interpretation of Key Results

The findings confirm three core conclusions. First, **digitalization level determines HR innovation scope**: High - digitalization SMEs leverage full - cycle, advanced tools (AI screening, predictive analytics) due to stronger resources and infrastructure, while low - digitalization SMEs rely on basic practices (video interviews, microlearning) to balance needs and constraints. This aligns with the resource - based view—digitalization capacity (budget, infrastructure, literacy) acts as a critical resource enabling more impactful innovation (Barney, 2022).

Second, **industry context shapes innovation priorities**: IT services SMEs focus on skill - centered innovation to address rapid tech change, while healthcare SMEs prioritize compliance - friendly tools. This highlights the need for "industry - tailored" rather than generic HR strategies—e.g., a manufacturing SME would waste resources on AI recruitment for niche tech skills, while an IT SME needs such tools to compete for talent.

Third, **moderating factors explain performance gaps**: Digital literacy and budget availability amplify innovation effectiveness—without them, even advanced tools fail to deliver gains. For example, low literacy reduces AI training impact, while limited budgets lead to tool underutilization. This underscores that SMEs must invest in "complementary resources" (literacy training, budget for implementation) alongside digital HR tools.

5.2 Comparison with Previous Literature

This study advances existing research in three ways. First, it quantifies **digitalization level differences** in SME HR innovation—previous studies noted resource constraints (EU SME Policy Brief, 2022) but did not measure how they translate to adoption rates (e.g., 85% vs. 12% AI screening) or performance gaps (32% vs. 18% efficiency gains). This fills the gap in cross - digitalization comparative research.

Second, it uncovers **industry - specific innovation - performance links**: While prior work (SME Digital HR Benchmark, 2023) noted industry differences, this study shows IT services SMEs gain 35% efficiency from innovation—13% more than healthcare SMEs—due to regulatory and skill needs. This provides actionable insights for industry - specific prioritization.

Third, it validates the role of **complementary resources**: McKinsey (2022) highlighted digital literacy gaps, but this study quantifies their impact (42% vs. 15% skill gains) and links them to innovation success. This extends the resource - based view by identifying literacy and budget as essential complements to digital tools.

5.3 Limitations of the Study

Three limitations should be noted. First, the study focuses on 9 countries and 4 industries—results may not generalize to other regions (e.g., Eastern Europe, Southeast Asia) or industries (e.g., agriculture, education) with unique HR needs. Future research could expand to include these underrepresented contexts.

Second, performance metrics include self - reported data (e.g., employee - rated task efficiency), which may be subject to response bias (e.g., employees overestimating improvements). Objective metrics (e.g., manufacturing output volume, retail sales data) were used in case studies but not all surveys—future work could integrate more objective data to strengthen validity.

Third, the study uses a 2021 - 2024 timeframe, which includes post - pandemic recovery. Economic factors (e.g., inflation, recession) may have influenced SME budgets and employee performance, but these were not controlled for in analysis. Longitudinal studies beyond 2024 could isolate the long - term impact of HR innovation from economic fluctuations.

5.4 Implications for Policy and Practice

5.4.1 For SME HR Managers

Adopt a "Prioritization Framework" based on digitalization level:

High - digitalization SMEs: Invest in full - cycle innovation, with a focus on AI training (for skill development) and data - based performance management (for consistency). Example: A UK IT SME could allocate 30% of HR budget to personalized learning paths and real - time tracking.

Low - digitalization SMEs: Start with low - cost basic tools (video interviews, free microlearning apps) before scaling. Example: A Senegalese retail SME could use WhatsApp for video interviews and LinkedIn Learning's free courses to build digital literacy.

Medium - digitalization SMEs: Phase in innovation—first digital recruitment, then AI training—to align with budget and literacy gains. Example: A Chinese manufacturing SME could implement video interviews in Year 1, then add microlearning apps in Year 2.

Address complementary resources:

Provide digital literacy training (e.g., 1 - hour weekly workshops) before rolling out AI tools—this can double skill development gains.

Allocate 15 - 20% of digital tool budgets to implementation support (e.g., vendor training for managers) to avoid underutilization.

Tailor to industry needs:

IT services: Prioritize personalized training and AI recruitment to attract and retain tech talent.

Healthcare: Focus on compliance - friendly tools (automated feedback, microlearning) to balance regulation and efficiency.

5.4.2 For Governments and Policy Makers

Offer targeted subsidies for low - digitalization SMEs:

Provide 50% grants for basic digital HR tools (e.g., video interview platforms) to reduce budget barriers. For example, Senegal's government could partner with Zoom to offer discounted licenses for SMEs.

Fund digital literacy programs (e.g., free online courses) for SME employees—Kenya's "Digital Skills for Work" initiative could be expanded to include HR tool training.

Simplify regulatory compliance for healthcare/ manufacturing SMEs:

Develop industry - specific digital HR guidelines (e.g., HIPAA - compliant performance tracking templates) to reduce implementation delays. The US Department of Health could create a free toolkit for clinics using data - based performance management.

Create industry - academic partnerships:

Collaborate with universities to design tailored training programs (e.g., manufacturing - focused AI simulation courses) for SMEs. Italy's University of Milan could partner with local manufacturing SMEs to co - develop training modules.

5.4.3 For Academic Researchers

Explore long - term innovation impacts:

Track SMEs over 5 - 10 years to assess if performance gains from HR innovation persist or decline as digitalization evolves.

Investigate how SME size (micro vs. medium) influences innovation adoption—do micro - SMEs (10 - 50 employees) face unique barriers not captured in this study?

Study emerging technologies:

Research the impact of AI chatbots (for candidate screening) and virtual reality (VR) training on SME performance—these tools may be more accessible for low - digitalization SMEs than traditional AI platforms.

Focus on underrepresented regions:

Expand to Southeast Asia (e.g., Vietnam, Thailand) and Eastern Europe (e.g., Poland, Hungary) to test if digitalization - performance links vary in these contexts.

6. Conclusion and Recommendations

6.1 Conclusion

This study examines HR management innovation in 30 SMEs across 9 countries, 4 industries, and 3 digitalization levels (2021 - 2024). The results show that HR innovation effectiveness depends on three interrelated factors: **digitalization capacity**, **industry context**, and **complementary resources**.

High - digitalization SMEs implementing full - cycle innovation achieve 32% task efficiency gains—double those of low - digitalization SMEs with partial innovation—due to stronger budgets, infrastructure, and literacy. Industry differences also matter: IT services SMEs gain the most from skill - focused tools, while healthcare SMEs struggle with regulatory constraints. Critically, digital literacy and budget support are essential—without them, even advanced tools deliver minimal performance improvements.

The findings reject the "one - size - fits - all" approach to SME HR innovation. Instead, they highlight the need for **contextualized adaptation**: SMEs must align their innovation choices with their digitalization level, industry needs, and resource capacity. This not only maximizes performance gains but also avoids wasteful "digital overinvestment" in tools that cannot be implemented or utilized effectively.

6.2 Recommendations

Building on the conclusions, we offer actionable recommendations for three key stakeholders:

6.2.1 For SME HR Managers

Implement a "Digital HR Maturity Assessment" annually:

Evaluate your SME's digitalization capacity using three metrics: budget allocation to HR tech (target: ≥15% of HR budget for high - digitalization SMEs, ≥5% for low - digitalization), employee digital literacy (via 10 - question skills tests), and infrastructure readiness (e.g., internet speed, cloud storage access). Use the results to adjust innovation priorities—for example, if literacy scores are <3/5, delay AI training and invest in 4 - week basic digital skills workshops first.

Adopt "Phased Innovation Roadmaps" tailored to industry:

IT Services SMEs: Start with personalized learning paths (e.g., partner with Coursera for tech skill courses) and AI resume screening (e.g., use Greenhouse's AI tools) in Year 1; add data - based performance tracking (e.g., Monday.com) in Year 2. This aligns with rapid skill obsolescence and talent competition.

Manufacturing SMEs: Prioritize AI simulation training (e.g., Siemens' manufacturing simulators) and real - time performance tracking (e.g., Trello for production line tasks) in Year 1; phase in video interviews (e.g., Zoom) for remote hiring in Year 2 to address safety and efficiency needs.

Healthcare SMEs: Launch automated performance feedback (e.g., BambooHR) and microlearning apps (e.g., MedBridge for clinical skills) in Year 1—tools that comply with HIPAA and fit busy schedules—before adding more complex analytics.

Leverage "Low - Cost/Free Digital Tools" to reduce barriers:

Low - digitalization SMEs can use free tools like WhatsApp (video interviews), LinkedIn Learning (basic training), and Google Forms (simple performance surveys) to test innovation without high costs. For example, a Ghanaian retail SME could use Google Forms to send weekly performance feedback to sales staff, reducing administrative time by 20%.

6.2.2 For Governments and Policy Makers

Launch "Digital HR Ecosystems" for low - digitalization regions:

Create online platforms that aggregate free/low - cost resources for SMEs: (1) Tool libraries (e.g., discounted Zoom licenses, free microlearning apps); (2) Literacy training modules (e.g., YouTube tutorials for HR tool use); (3) Compliance guides (e.g., HIPAA - friendly tool checklists for healthcare). Senegal's government could partner with the African Development Bank to fund such a platform, reaching 5,000+ SMEs in Year 1.

1.**Offer "Innovation Matching Grants" for industry - academic collaboration**:

Provide 70% funding for SMEs that partner with universities to co - develop industry - specific HR tools. For example, Italy's Ministry of Economic Development could fund a partnership between the University of Milan and local manufacturing SMEs to create AI simulation training for textile production—addressing both skill gaps and tool accessibility.

Simplify "Regulatory Compliance Portals" for high - risk industries:

Develop one - stop portals for healthcare and manufacturing SMEs to access pre - approved digital HR tools (e.g., a list of HIPAA - compliant performance management software) and automated compliance checks (e.g., a tool that flags if your data tracking violates local labor laws). The US Department of Labor could launch this for healthcare SMEs, reducing compliance time by 30%.

6.2.3 For Academic Researchers

Conduct "Micro - SME Case Studies" (10 - 50 employees):

Most existing research focuses on medium - sized SMEs (51 - 250 employees), but micro - SMEs face unique barriers (e.g., no dedicated HR team). Study 20 micro - SMEs across 5 countries to explore how part - time HR managers (often the owner) implement digital innovation—do they rely on family members for tech support? Do they prioritize tools that require <5 hours/ week to manage?

Research "AI Chatbots and VR Training" for SME accessibility:

AI chatbots (e.g., ChatGPT for resume screening) and VR training (e.g., Oculus for safety simulations) are becoming more affordable—test their impact on low - digitalization SMEs. For example, a study could compare resume screening time between ChatGPT (free) and traditional methods (manual) in Kenyan SMEs, or measure skill retention from VR vs. in - person safety training in Brazilian manufacturing SMEs.

Lead "Cross - Country Digital HR Benchmarks":

Collect annual data from 100+ SMEs across 15 countries on HR innovation adoption and performance outcomes. Publish a public report ranking countries by SME digital HR maturity—this will pressure governments to invest in ecosystems and help SMEs compare their practices globally. For example, the OECD could launch this benchmark, with metrics like "percentage of SMEs using AI training" and "task efficiency gains from innovation."

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