The Role of Artificial Intelligence in e-HRM, e-Marketing and Fintech Practices in the Medicine, Healthcare, and Life Sciences Sector of Bangladesh: Opportunities, Difficulties, Functions and Strategic Implications

Md. Azmir Hossain[1], Sohag Datta[2], Bushra Ferdousi[3], Nazma Akhter[4]

[1]Associate Professor, Department of Business Administration, Dhaka International University, Badda, Dhaka-1212, Bangladesh & PhD Scholar, Guru Kashi University, Talwandi Sabo, Bathinda, India, e-mail: azmir.bba@diu.ac
[2]Associate Professor, Department of Business Administration, Faculty of Business Studies, Dhaka International University, Dhaka, Bangladesh, e-mail: sohag.bba@diu.ac
[3]Associate Professor, Department of Business Administration, Faculty of Business Studies, Dhaka International University, Dhaka, Bangladesh, e-mail: bushra.bba@diu.ac
[4]Assistant Professor, Department of Business Administration, Notre Dame University Bangladesh, Dhaka, Bangladesh, e-mail: nazma@ndub.edu.bd

Abstract: Bangladesh's healthcare and life sciences sector is undergoing a rapid digital shift under the Smart Bangladesh vision in 21st century. This article presents a practice-oriented synthesis based on secondary data from 2022–2024 to examine how Artificial Intelligence (AI) is transforming three intertwined domains: electronic Human Resource Management (e-HRM), e-Marketing, and Fintech. This study outlines opportunities (efficiency, personalization, inclusion), difficulties (data quality, bias, interoperability, regulatory gaps), core functions being deployed (predictive HR analytics, marketing automation, risk scoring for digital payments), and strategic implications for health system resilience, equity, and competitiveness. This paper concludes with an actionable roadmap for payers, providers, regulators, and innovators in Bangladesh.

Keywords: AI, e-HRM, e-Marketing, Fintech, Medicine, Healthcare, and Life Sciences.

1. Introduction

The rapid digital transformation of Bangladesh has positioned Artificial Intelligence (AI) as a critical driver of innovation across sectors, particularly in healthcare and life sciences. AI is no longer viewed as a futuristic technology but as an operational necessity embedded in workforce management, patient engagement, and financial transactions. The healthcare system of Bangladesh, while showing progress in service expansion, continues to face pressing challenges such as workforce shortages, unequal distribution of skilled personnel, limited interoperability of health data systems, and a lack of robust governance mechanisms. These challenges, coupled with the growing demand for efficient, equitable, and financially sustainable healthcare, have created fertile ground for the integration of AI-powered solutions in three interlinked domains: electronic Human Resource Management (e-HRM), e-Marketing, and Fintech.

In e-HRM, AI is transforming workforce planning, recruitment, credential verification, and retention strategies. Predictive analytics enables hospitals and clinics to anticipate staffing needs during seasonal outbreaks, while natural language processing (NLP) supports recruitment triage and certificate verification. Similarly, AI-enabled e-Marketing facilitates personalized patient engagement through audience segmentation, localized content generation in Bangla and English, and omnichannel campaign optimization. Fintech innovations, including

mobile financial services (MFS) platforms such as bKash and Nagad, have reshaped healthcare payments by reducing cash dependency, improving traceability, and expanding financial inclusion. AI-driven fraud detection, risk scoring, and incentive design further strengthen the reliability of these digital payment ecosystems.

Against this backdrop, this study aims to synthesize existing evidence on AI integration into e-HRM, e-Marketing, and Fintech within the healthcare and life sciences sector of Bangladesh. By mapping opportunities, difficulties, and strategic implications, it provides actionable insights for policymakers, healthcare providers, regulators, and technology innovators.

2. Background and Literature Review of the Study

Artificial Intelligence has become increasingly central to healthcare delivery and management in both developed and developing economies. Globally, AI is being applied in predictive workforce analytics, marketing automation, and financial inclusion mechanisms to enhance system efficiency and resilience (Sarker & Al-Zoubi, 2022). Within the South Asian context, researchers emphasize that AI offers transformative opportunities, but adoption is often constrained by infrastructural limitations, data fragmentation, and weak governance frameworks (Hoque & Islam, 2024).

The application of AI in human resource management has gained traction in healthcare due to persistent workforce shortages and distribution imbalances. Bhuiyan and Rahman (2023) argue that predictive analytics can optimize staff deployment and reduce workforce burnout, particularly in high-pressure environments such as intensive care units. Similarly, Ferdousi and Datta (2023) highlight the role of ICT-based HRM practices in Bangladesh, stressing that AI-enabled HRIS platforms can improve data completeness, streamline credential verification, and enhance compliance monitoring. However, Rahman and Khatun (2022) caution that data quality and interoperability issues continue to limit the scalability of such initiatives.

Marketing strategies in healthcare have also been reshaped by AI. In Bangladesh, providers such as Praava Health and AmarLab employ digital-first marketing models to engage patients through multiple channels. Jahan and Uddin (2022) emphasize the effectiveness of AI-driven omnichannel campaigns in improving patient adherence to appointments and diagnostics. Moreover, Hasan and Alam (2022) demonstrate that generative AI tools enhance the localization of patient education materials, making them more accessible in both Bangla and English. Despite these opportunities, ethical concerns remain, particularly regarding patient consent, data privacy, and the potential exclusion of offline populations.

Fintech solutions, particularly mobile financial services, have revolutionized healthcare payments in Bangladesh. Chowdhury and Rahman (2024) observe that AI-driven fraud detection and risk scoring mechanisms are strengthening the reliability of digital payments, reducing leakage, and expanding financial inclusion. Kabir and Mahmud (2024) further argue that fintech adoption facilitates traceable, cash-light healthcare operations, which became especially relevant during the COVID-19 pandemic. Yet, as Saha and Das (2024) highlight, cybersecurity threats, regulatory uncertainties, and algorithmic bias pose significant barriers to sustainable scaling.

Taken together, the literature underscores that AI has the potential to simultaneously address structural weaknesses and unlock new growth pathways for Bangladesh's healthcare sector. However, successful implementation will depend on strengthening governance, ensuring data interoperability, enforcing fairness audits, and investing in capacity-building programs. The synthesis of global best practices and local realities highlights the need for a holistic

roadmap that aligns with Bangladesh's National AI Policy (2024) and the broader Smart Bangladesh agenda.

Bangladesh articulated a National AI Policy (2024, draft/finalization underway) and continued the Smart Bangladesh agenda to meet the global competitions. In health, the Ministry of Health and Family Welfare (MOHFW) and Directorate General of Health Services (DGHS) scaled digital platforms, including a central Human Resource Information System (HRIS) and national health data exchanges. WHO's 2024 country profile and HRH updates continue to flag significant workforce gaps, unequal distribution, and a need for better HRH data governance. Mobile financial services (MFS) such as bKash and Nagad deepened their presence in healthcare payments (e.g., hospital/diagnostic payments, health campaigns). Private digital-first providers (e.g., Praava Health, Doctorola, AmarLab) strengthened tech-enabled services, omnichannel marketing, and patient engagement.

AI is no longer peripheral: it sits inside HR workflows (recruitment, rostering), marketing stacks (segmentation, creative optimization), and fintech rails (fraud/risk, pricing, financial inclusion). For Bangladesh, these capabilities are directly linked to SDG progress and the Smart Bangladesh pillars (Smart Government, Economy, Society, Citizen).

3. Objectives of the Study

- To analyze the role of Artificial Intelligence (AI) in transforming e-HRM, e-Marketing, and Fintech practices in Bangladesh's healthcare and life sciences sector under the Smart Bangladesh vision.
- To investigate how AI-driven e-HRM improves workforce planning, recruitment, credential verification, and retention in the healthcare system.
- To evaluate the effectiveness of AI-enabled e-Marketing in enhancing patient engagement, localized communication, and ethical promotional practices.
- To assess the impact of AI-powered Fintech on healthcare financing, fraud prevention, payment traceability, financial inclusion, and propose a strategic roadmap for sustainable adoption.

4. Methodology of the Study

This is a secondary analysis of policy documents, regulator notices, multilateral reports, peer-reviewed, grey literature, and reputable industry sources (2022–2024). Sources were screened for recency, relevance to health or life sciences, and specificity to AI, e-HRM, e-marketing and fintech in the context of Bangladesh and the global perspective. Findings were synthesized into opportunities, difficulties, functions, and strategic implications.

5. Opportunities

5.1 eHRM (Health Workforce)

- **Predictive staffing & deployment**: AI models forecast demand surges (e.g., seasonal outbreaks), enabling proactive roster optimization in public hospitals and large private networks.
- **Skill-mix optimization**: Linking competency taxonomies with facility service footprints highlights gaps (ICU nurses, lab technologists) and informs targeted training.
- **Retention & wellbeing**: Passive analytics (leave patterns, shift volatility) and active signals (pulse surveys, chatbot triage) surface burnout risk and trigger early interventions.
- **Credentialing & compliance**: NLP assists in verifying certificates, tracking CPD, and flagging expiries across HRIS.

5.2 e-Marketing (Providers, Pharma, Diagnostics)

- **Audience segmentation & personalization**: ML-driven

micro-segments support ethical, consented outreach for vaccination, NCD screening, and specialty clinics.
- **Marketing channels**: AI optimizes cadence across SMS, WhatsApp, in-app, and web, improving appointment adherence and test-prep compliance.
- **Content intelligence**: Generative tools help localize patient education (Bangla/English), A/B test creatives, and improve accessibility (readability, voice).

5.3 Fintech (Payments, Lending, Inclusion)
- **Instant, traceable payments**: MFS rails reduce cash handling in hospitals/diagnostics, shrink leakage, and improve reconciliation.
- **Risk scoring for health financing**: Alternative-data models (transactional history) inform micro-credit for procedures or diagnostics, subject to guardrails.
- **Incentive design**: Targeted health-payment campaigns nudge preventive behaviors (e.g., check-up discounts) and reduce missed follow-ups.

6. Difficulties
- **Data quality & interoperability**: Fragmented facility systems, incomplete HRIS fields, and limited interoperability with health records constrain AI.
- **Algorithmic fairness & bias**: Risk of disadvantaging rural/low-income or women health workers in recruitment/rostering; marketing exclusion of offline populations.
- **Regulatory incompleteness**: E-pharmacy standards, consent frameworks, and AI accountability mechanisms are evolving; uncertainty deters investment.
- **Cybersecurity & privacy**: PHI and HR data are high-value targets; MFS fraud vectors (SIM swap, social engineering) require continuous model updates.
- **Change management**: Limited analytics capacity, procurement hurdles, and vendor lock-in slow enterprise-scale adoption.

7. Core Functions
7.1 e-HRM
- **Recruitment triage** using NLP on CVs, structured forms; **shortlisting** aligned to standard job families.
- **Demand forecasting & rostering** at facility/district level; integration with attendance/biometric systems.
- **Learning & development**: Adaptive e-learning (clinical protocols, antimicrobial stewardship), credential tracking.
- **HR data governance**: Master data management across HRIS, facility dashboards, and regulator reporting.

7.2 e-Marketing
- **Patient journey analytics**: From ad impression to appointment to lab result pickup; drop-off analysis and reminder optimization.
- **Consent & preference centers**: Capture lawful basis for outreach; auto-honor opt-outs across channels.
- **Local language generation**: Bangla patient leaflets, clinic FAQs, and post-procedure instructions.

7.3 Fintech
- **Payment acceptance** at hospitals/diagnostics via QR/USSD; automated receipts into HIS/ERP.
- **Health campaign engines** (cashback, vouchers) for screenings and check-ups.
- **Fraud & AML**: Device fingerprinting, behavioral biometrics, and graph models for mule account detection.

8. Strategic Implications for Bangladesh Context
a. **System Resilience**: AI-enabled eHRM and fintech improve preparedness (rapid surge staffing, cash-light operations) during outbreaks or climate events.

b. **Equity by Design**: Mandate fairness audits, rural weighting, and Bangla/low-literacy UX to avoid digital divides.
c. **Trust & Safety**: National consent standards, e-pharmacy accreditation, and incident disclosure norms build public confidence.
d. **Economic Competitiveness**: Data-driven pharma/biotech marketing and clinical trial readiness can attract FDI and partnerships.
e. **Governance**: Align AI implementations with the National AI Policy, Digital Health Strategy, and DGDA oversight—codify model risk management and procurement standards.

9. Implementation in Bangladesh

9.1 Executing Blueprint

a. Governance & Policy – Finalization,
b. AI governance (model documentation, risk classification, bias testing); align e-pharmacy marketing/dispensing.
c. Operationalize a National Health Data Interoperability Profile covering HRIS↔HIS↔payments.
d. Data & Platforms – Improvement.
e. HRIS completeness (mandatory fields, validation rules, incentives to update) and link to facility dashboards.
f. Establish a Consent & Preference Service shared across providers, MFS, and e-pharmacy.
g. Create a Health Data & AI Capacity Program for HR managers, marketers, and finance teams (practical modules on RAG/NLP, uplift modeling, fraud analytics).
h. Run regulatory sandboxes for AI in recruitment, digital promotions, and health loans with privacy-by-design.

9.2 Prototype Programs

a. **NCD screening uptake** via AI-targeted messages and MFS incentives; measure incremental screenings.
b. **Roster optimization** at two public hospitals; track overtime reduction and patient wait times.
c. **E-pharmacy accreditation and antimicrobial stewardship**: NLP prescription checks; curb inappropriate antibiotic sales.

9.3 KPIs

a. **HR**: Vacancy fill time (days), burnout risk alerts acted upon, rural posting stability.
b. **Marketing:** Cost per kept appointment, informed consent rate, readability scores.
c. **Fintech:** Cash-to-digital share of payments, chargeback/fraud rate, time-to-settlement.

10. Ethics, Privacy, and Safety

- **Fairness**: Periodic disparate-impact testing by gender, region, cadre; publish plain-language summaries.
- **Privacy**: Data minimization; encryption in transit/at rest; role-based access; lawful bases for processing.
- **Clinical safety**: Keep AI decision support advisory; preserve clinician/hospital accountability.
- **Marketing integrity**: Prohibit DTC promotion of prescription drugs; prioritize education and service access over promotion.

11. Limitations of the Study

Secondary data may contain reporting lags, selection bias, and heterogeneous definitions across sources. Private sector metrics (conversion, churn) are often undisclosed. Despite these constraints, converging evidence supports the directionality of findings.

12. Findings

a. **AI in e-HRM**: Predictive staffing, skill-mix optimization, and burnout detection are actively supporting health workforce management in Bangladesh. However, data fragmentation and incomplete HRIS records limit the accuracy of forecasts.

b. **AI in e-Marketing**: Machine learning enhances patient segmentation, localized health messaging in Bangla, and omnichannel orchestration. Still, risks of excluding rural or offline populations remain.
c. **AI in Fintech**: Mobile financial services like bKash and Nagad facilitate traceable hospital/diagnostic payments and health financing. Yet, fraud and cybersecurity threats (SIM swap, social engineering) persist.
d. **Strategic Implications**: AI-enabled eHRM and fintech are boosting system resilience during outbreaks, while e-marketing strengthens patient engagement. Alignment with Bangladesh's National AI Policy and Smart Bangladesh 2041 agenda is critical.

13. Recommendations

a. **Data Governance**: Strengthen interoperability between HRIS, HIS, and fintech platforms by adopting standardized protocols (e.g., FHIR).
b. **Bias Mitigation**: Mandate fairness audits in recruitment and marketing models to ensure inclusivity for rural and female health workers.
c. **Regulatory Frameworks**: Accelerate e-pharmacy accreditation, digital consent laws, and AI accountability standards to build trust.
d. **Capacity Building**: Develop AI literacy programs for HR managers, marketing officers, and fintech operators in healthcare.
e. **Prototype Pilots**: Scale up AI-driven pilots (e.g., NCD screening incentives via MFS, roster optimization in public hospitals) into national programs with robust KPIs.

14. Conclusion

AI is already embedded in Bangladesh's digital health stack across e-HRM, e-marketing, and Fintech. With targeted governance, interoperable data, and capacity-building, Bangladesh can translate pilots into system-level gains—improving access, quality, trust, and financial protection while advancing the Smart Bangladesh vision. Artificial Intelligence (AI) has moved beyond being a peripheral innovation and has become an integral component of Bangladesh's digital health ecosystem. Across e-HRM, e-Marketing, and Fintech, AI applications are already demonstrating their potential to optimize health workforce management, personalize patient engagement, and enhance financial inclusion. While notable challenges remain—particularly around data quality, interoperability, governance, and ethical safeguards—the strategic opportunities are significant. By prioritizing robust governance frameworks, ensuring fairness and inclusivity, investing in capacity-building, and aligning implementation with the National AI Policy and Smart Bangladesh vision, can accelerate the transition from pilot projects to system-wide transformation. Ultimately, AI has the potential to strengthen health system resilience, improve access and equity, and reinforce trust in digital healthcare services, thereby positioning Bangladesh as a regional leader in leveraging technology for sustainable health and life sciences innovation.

References

1. Ahmed, S., & Hossain, M. I. (2023). Artificial intelligence adoption in healthcare management: A review of opportunities and challenges in developing countries. *Journal of Health Informatics in Developing Countries, 17*(2), 45–61.
2. Alam, M. N., & Khan, M. A. A. (2022). Digital transformation in Bangladesh's healthcare: HRM and Fintech perspectives. *Asian Journal of Information Systems, 14*(1), 77–93.
3. Bhuiyan, T., & Rahman, M. S. (2023). Predictive analytics in e-HRM: Lessons for Bangladesh's public health sector.

International Journal of Human Resource Studies, 13(3), 89–104.

4. Chowdhury, F., & Rahman, M. (2024). Fintech innovations and mobile payments in Bangladesh: Implications for health financing. *South Asian Journal of Economics, 12*(4), 211–229.
5. Dwivedi, Y. K., et al. (2023). *Artificial intelligence (AI) in health care and life sciences: Opportunities, challenges, and future research directions*. International Journal of Information Management, 67, 102–114.
6. Ferdousi, B., & Datta, S. (2023). ICT-enabled HRM practices in Bangladesh's health workforce: An implementation study. *International Journal of Business and Management, 18*(2), 55–72.
7. Hasan, M. K., & Alam, R. (2022). AI in digital marketing: Evidence from healthcare and pharmaceutical industries. *Journal of Marketing Analytics, 10*(2), 133–148.
8. Hoque, R., & Islam, M. R. (2024). Governance of AI in healthcare: Policy, ethics, and practice in South Asia. *Global Health Governance Journal, 18*(1), 25–39.
9. Hossain, M. A., & Jahan, T. (2023). Machine learning applications for HR analytics in Bangladesh hospitals. *Human Resource Development International, 26*(3), 301–320.
10. Jahan, S., & Uddin, M. N. (2022). Omnichannel marketing strategies in Bangladesh's healthcare sector: The role of AI. *International Journal of Healthcare Management, 15*(4), 190–202.
11. Kabir, H., & Mahmud, S. (2024). Fintech-driven inclusion in Bangladesh: Lessons for digital health. *Journal of Financial Innovation, 9*(1), 55–70.
12. Karim, A., & Sultana, N. (2023). E-pharmacy and AI integration: Prospects for safe medicine use in Bangladesh. *Bangladesh Journal of Medical Informatics, 11*(2), 77–89.
13. Khan, S., & Akter, S. (2022). Artificial intelligence and marketing automation in emerging markets: A case study approach. *Journal of Marketing Technology, 8*(3), 101–116.
14. Mahmud, K., & Chowdhury, R. (2024). Workforce optimization using AI: The case of Bangladesh's health sector. *Asian Journal of Human Resource Management, 12*(2), 145–160.
15. Rahman, A., & Khatun, F. (2022). Data quality and interoperability challenges for AI-enabled HRIS in Bangladesh. *Journal of Health Information Systems, 15*(1), 41–57.
16. Rahman, M. M., & Akhter, J. (2023). AI adoption in healthcare marketing: Consumer perceptions in Bangladesh. *Journal of Consumer Research in Emerging Economies, 6*(2), 89–105.
17. Saha, P., & Das, R. (2024). Mobile financial services for healthcare payments: Risks and opportunities. *Journal of Fintech and Development Studies, 5*(1), 22–38.
18. Sarker, I. H., & Al-Zoubi, A. (2022). Explainable AI for healthcare applications: Opportunities and challenges. *Computers in Biology and Medicine, 148*, 105950.
19. WHO. *Bangladesh Country Profile 2024–2025: Digital Health Strategy 2023–2027 highlights*. 2024.
20. WHO SEARO. *Bangladesh Health Workforce Country Profile* (HRH, NHWA portal, Sept 2024).
21. World Bank. *Path to Transform Bangladesh's Health System for Better Results*. 2024.
22. UN Bangladesh/WHO. *Developing the first National Medical Education Strategy: HRH context*. 2024.