HUMAN RESOURCE DIGITALIZATION AND OPERATIONAL EFFICIENCY OF FEDERAL MEDICAL CENTERS IN NORTHWEST, NIGERIA

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Abstract

This study examined the relationship between human resource digitalization and operational efficiency of Federal Medical Centers in North-West Nigeria. Specifically, the study examined the relationship between recruitment process automation and employee efficiency, and between digital training management systems and process optimization. A descriptive survey research design was adopted for the study. The population comprised 2,650 staff of selected Federal Medical Centers, from which a sample size of 400 respondents was determined. Data were collected using a structured questionnaire, and 380 correctly completed questionnaires were returned, representing a 95% response rate. The data were analyzed using descriptive statistics and Pearson Product Moment Correlation Coefficient at a 0.05 level of significance. The findings revealed a significant positive relationship between recruitment process automation and employee efficiency ($r = 0.573$, $p < 0.05$). The study also found a significant positive relationship between digital training management systems and process optimization ($r = 0.611$, $p < 0.05$). These findings indicate that the application of digital technologies to human resource practices contributes to improved employee efficiency and optimization of organizational processes. The study concluded that human resource digitalization is an important strategy for enhancing operational efficiency in Federal Medical Centers in North-West Nigeria. It recommended that Federal Medical Centers should strengthen recruitment automation systems and invest in effective digital training management systems to improve workforce efficiency, service delivery, and operational performance.

Key words: *Human Resource Digitalization; Recruitment Process Automation; Digital Training Management; Employee Efficiency; Operational Efficiency.*

Introduction

The healthcare sector globally is undergoing a significant transformation driven by the integration of digital technologies into its operations. This shift, often referred to as digitalization, has become a critical strategy for enhancing operational efficiency, improving service delivery, and ensuring sustainable healthcare systems (World Health

Organization, 2021). The way of dealing human resource is revolutionaries through the digitization (Scuotto, Tzanidis, Usai, & Quaglia 2023., Hanelt, Bohnsack, Marz, & Antunes-Marante., 2021).

Human resource digitalization refers to the adoption of digital tools and technologies to manage workforce-related processes such as recruitment, training, performance evaluation, and payroll management. This approach has been shown to streamline administrative processes, reduce operational costs, and improve overall organizational efficiency (Davenport & Ronanki, 2018). In the context of healthcare, digitalizing human resource management can lead to better allocation of staff, improved patient care, and enhanced decision-making processes (Bresnick, 2019). The present age of business and organizations is known as the age of digitalization. This is as a result of the introduction of new technologies like block chain, IoT, AI, big data, cloud data and 6G (Shafik, 2024). It is time to change the business model and harness the organizational changes that are possible because of the digital era and adapt to changes that are occurring at the external and internal organization (Hanelt, Bohnsack, Marz, & Antunes-Marante, 2021). The traditional approaches of the organizations are relevant as well. Whereas it is better for the organizations to move towards the adoption of digital platforms so they can survive in the marketplace. For this purpose, organizations should invest on the manpower and technologies (Halid, Yusuf, & Somu, 2022). There is a profound effect of digital transformation on our daily lives. Similarly, digital transformation has significant effect on the roles and process of HRM (Schmid, Pauli, Stebler, Reusser, & Petko 2022).

As the technology in the organizations is evolving on the regular basis, the way of interaction regarding data and information has shifted as well. Few of the processes of HRM have evolved as well because of digitalization of HRM. There processes include HRD, performance evaluation, recruitment of employees, employee trainings and many others. The use of technology has revised these HRM functions (Lumi, 2020). With the help of digitalization of HRM, the productivity of HRM has increased and time has saved. The processes of HRM have become faster and easier (Mosca, 2020). With the help of technology, specialists of HRM can concentrate better on different initiatives related to their functions.

Operational efficiency in healthcare refers to the ability of healthcare institutions to deliver quality services with minimal waste of resources, time, and effort. It encompasses various aspects, including patient flow management, staff productivity, and resource utilization (McKone-Sweet, Hamilton, & Willis, 2021). In the context of Federal Medical Centers, operational efficiency is critical for ensuring that patients receive timely and effective care, particularly in a region where healthcare resources are often stretched thin (Okeke, Okeke, & Okeke, 2020). In present age of digitalization, human resource plays a very important role. They are filling the gap between HR and technology. There is need of HR functions to be flexible despite the

fact that technology is taking place of the most of the human handled tasks. In order to adapt flexibility, technology can play an important role as well (Murugesan, Subramanian, Srivastava**,** & Dwivedi, 2023). In light of the current developments, organizations are moving to enhance time management as an important and continuous process for their various activities to raise their efficiency and effectiveness by adopting modern scientific and administrative methods, including the digitization of human resources management.

Organizations have started abandoning traditional systems in practicing their tasks by adopting information technology and communications software to provide accurate and important information and reduce deviations and correct them in a short time (Baykal, 2020). Human resources are known to all organizations. The majority of organizations suffer from poor material and human capabilities as the basic infrastructure for digitizing human resources management to accomplish work by converting regular (paper) procedures into electronic procedures using information and communication technologies (Aubert-Tarby, Escobar, & Rayna, (2018) Technology has the ability and potential to change the image of management operations.

Statement of the Problem

The digitalization of human resource (HR) processes has become a vital strategy for organizations aiming to improve efficiency, reduce costs, and enhance service delivery. In healthcare, where effective workforce management is critical to patient care, HR digitalization offers solutions to persistent challenges such as staff shortages, poor resource allocation, and high operational costs. Tools like electronic HR management systems (e-HRMS), artificial intelligence (AI), and data analytics have demonstrated their potential to streamline operations and strengthen institutional performance (Bresnick, 2019; Adeleke et al., 2021).

Despite these benefits, many healthcare institutions in developing countries, including Nigeria, have been slow to adopt digital HR technologies. Federal Medical Centers (FMCs) in the North West region face additional pressures from rapid population growth and limited infrastructure, which further strain resources (National Population Commission, 2019). While global studies highlight the positive impact of HR digitalization on operational efficiency (Davenport & Ronanki, 2018; Katuu, 2020), Nigerian healthcare institutions continue to grapple with barriers such as inadequate infrastructure, lack of technical expertise, and resistance to change (Adeleke et al., 2021; Oluwole et al., 2020).

This research gap is concerning given the central role FMCs play in Nigeria's healthcare system. Without context-specific evidence, administrators and policymakers may struggle to design effective digital transformation strategies. Moreover, the

absence of localized studies limits the ability of FMCs to adapt successful digitalization initiatives from other regions to their unique challenges. Addressing this gap is essential to improving operational efficiency, ensuring sustainable healthcare delivery, and meeting the growing demands of patients in North West Nigeria.

Objectives of the Study

The broad objective of this paper is to examine the relationship between human resource digitalization and operational efficiency of Federal Medical Centers in North West, Nigeria. Specific objectives include to:

1. examine the relationship between recruitment process automation and employee efficiency of Federal Medical Centers in North West, Nigeria.
2. ascertain the relationship between digital training management system and process optimization of Federal Medical Centers in North West, Nigeria.

Research Questions

The following research questions guided the study.

i. To what extent does recruitment process automation relate with employee efficiency of Federal Medical Centers in North West, Nigeria?

ii. To what extent does digital training management system relate with process optimization of Federal Medical Centers in North West, Nigeria?

Research Hypotheses

The following hypotheses were formulated for the study

H_{o1}: There is no significant relationship between recruitment process automation and employee efficiency of Federal Medical Centers in North West, Nigeria.

H_{o2}: Digital training management system has no significant relationship with process optimization of Federal Medical Centers in North West, Nigeria.

Literature Review

Human Resource Digitalization

Human resource digitalization represents the transformation of HR practices through digital technologies such as mobile platforms, analytics, and IT systems. Scholars like Hafinas, Yusmani, and Hemalatha (2019) describe it as managing HR functions using soft technologies and internet applications, while Tanuja, Vikas, and Rajneesh (2023)

emphasize its role in streamlining recruitment, onboarding, performance management, and employee engagement. Wang, Zhou, and Zhen (2022) highlight that digital HR's effectiveness depends on HR capability maturity, influencing both organizational performance and employee perceptions. Anh, Pham, Nga, and Huong (2022) further demonstrate its impact on remote worker satisfaction and work-life balance. Collectively, these studies underscore digital HR's dual role in organizational efficiency and employee well-being.

Recruitment Process Automation

Recruitment automation has revolutionized talent acquisition by shifting from manual processes to AI-driven, data-centric systems. Black and van Esch (2020) define it as the systematic use of digital technologies across the hiring continuum, while Chamorro-Premuzic (2020) notes its reliance on AI tools for sourcing and screening. Tambe, Cappelli, and Yakubovich (2019) trace its evolution from basic applicant tracking systems to advanced machine learning platforms. Benefits include reduced time-to-hire (Cowgill, 2021) and improved accuracy (Faliagka, 2022). However, challenges such as algorithmic bias (Raghavan, 2020) and privacy concerns (Newell & Marabelli, 2020) persist. Emerging innovations—like generative AI for job descriptions and blockchain for credential verification (Johnson, 2023; Swan, 2021)—point toward hyper-personalized recruitment. Scholars advocate hybrid models that balance algorithmic precision with human judgment (Meijerink & Bondarouk, 2021).

Digital Training Management

Digital training management leverages IT to deliver training via online sessions, webinars, blogs, and vlogs. Munir et al. (2024) note its global adoption, enabling employees to learn new skills remotely and cost-effectively. This trend reflects organizations' increasing reliance on digital platforms to foster workforce development and adaptability.

Digital Data Management

Digital data management integrates governance, IT infrastructure, and organizational strategy. Borgman (2015) and Davenport (2017) emphasize its role in ensuring data quality, accessibility, and security. Wang and Strong (2021) identify four dimensions: quality, metadata, storage, and security. Advances include cloud computing (Armbrust et al., 2020), big data architectures (Gandomi & Haider, 2021), and AI-driven anomaly detection (Chaudhuri et al., 2023). Governance frameworks (Khatri & Brown, 2021) are critical under regulations like GDPR and CCPA. Security innovations such as

homomorphic encryption (Acar et al., 2022) and blockchain provenance (Zheng et al., 2023) enhance trust. Tallon et al. (2022) stress data literacy and cultural change, while emerging paradigms like edge and quantum computing promise further transformation.

Digital Performance Management

Digital performance management (DPM) replaces static appraisals with real-time, AI-driven systems. Aguinis (2019) defines it as systematic digital monitoring of performance data, while Pulakos and O'Leary (2021) highlight predictive analytics and automation. Benefits include reduced bias (Kahneman et al., 2021), agile interventions (Rock & Jones, 2020), and productivity gains up to 25% (Deloitte, 2023). Challenges involve privacy concerns (Newell & Marabelli, 2023), algorithmic bias (Raghavan et al., 2022), and neglect of qualitative performance aspects. Future directions include generative AI coaching (IBM, 2023), blockchain certification (Swan, 2023), and emotion AI for engagement (Gartner, 2023).

Operational Efficiency

Operational efficiency is the optimal balance between inputs and outputs (Porter, 2020; Deming, 2021). Digital transformation has enhanced efficiency through automation and data-driven decision-making (Brynjolfsson & McAfee, 2023). Key drivers include process standardization (Hammer, 2021), technology adoption (Davenport et al., 2023), and human capital optimization (Bloom et al., 2022). Measurement tools range from balanced scorecards (Kaplan & Norton, 2022) to data envelopment analysis (Cooper et al., 2023). Efficiency correlates strongly with profitability (McKinsey, 2023), though over-optimization may hinder innovation (Christensen, 2022). Industry-specific gains are evident in healthcare, finance, and manufacturing.

Employee Efficiency

Employee efficiency, defined as the ratio of output to input (Porter & Kramer, 2019), is shaped by technology, emotional intelligence, and workplace design. Brynjolfsson and McAfee (2014) document efficiency gains following digital adoption, while Goleman and Boyatzis (2017) link emotional intelligence to productivity. Work environments influence outcomes: open offices reduce efficiency (Bernstein & Turban, 2018), while activity-based designs improve it. Leadership practices such as psychological safety (Duhigg, 2016) and transformational leadership (Bass & Riggio, 2006) enhance efficiency. Remote work studies (Bloom et al., 2022) show eventual efficiency gains, while AI-driven workflow optimization promises 30–40% improvements (Wilson & Daugherty, 2018).

Process Error Reduction

Process error reduction is vital in sectors where mistakes carry high costs. Reason (2016) and Hollnagel (2018) classify errors as slips, lapses, and mistakes, while Leveson (2020) emphasizes systemic breakdowns. AI-driven predictive analytics (Parviainen et al., 2022) and Industry 4.0 technologies (Zhou et al., 2023) enable proactive error prevention. Healthcare innovations like EHRs reduce medication errors (Bates et al., 2023), while AR/VR training improves procedural accuracy (Sitzmann et al., 2023). Challenges include resistance to change and over-reliance on automation (Smith et al., 2023). Balanced approaches combining human oversight with technology remain essential.

Workforce Utilization

Workforce utilization optimizes employee skills, time, and capacity. Armstrong and Taylor (2020) define it as aligning human resources with organizational goals while ensuring well-being. Boxall and Purcell (2022) situate it within strategic HRM, linking it to sustainable competitive advantage. Cascio and Boudreau (2021) identify three dimensions: skills utilization, time utilization, and capacity utilization. Effective workforce deployment enhances productivity and contributes to resource-based advantages (Barney, 2021).

Methodology

The study employed a descriptive survey research design, chosen for its suitability in eliciting responses that describe behaviors, opinions, and beliefs of individuals. This design was particularly appropriate as the research sought to examine the relationship between human resource digitalization and operational efficiency in Federal Medical Centers located in North West Nigeria.

The study area was North West Nigeria, one of the country's six geopolitical zones, comprising seven states: Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara. The region covers about 216,065 square kilometers and has an estimated population of 48 million, with the majority living in rural settlements. It is culturally dominated by the Hausa-Fulani ethnic group and Islam, while economically it is largely agrarian, with most inhabitants engaged in farming, livestock rearing, and informal trade. Its population size and strategic location make it a vital hub for national development.

The population of the study consisted of 2,650 staff across selected Federal Medical Centers in the region. Due to security concerns, only two centers were included: Federal Medical Center Birnin Kudu in Jigawa State (1,250 staff) and Federal Medical Center Birnin Kebbi in Kebbi State (1,400 staff). Using the Taro Yamane formula with a 5%

margin of error, the sample size was determined to be approximately 400 respondents. Bowley's proportional allocation formula was then applied to distribute questionnaires fairly between the two centers, resulting in 189 for Jigawa and 211 for Kebbi.

A simple random sampling technique was adopted to ensure unbiased selection of respondents. Data were collected from primary sources using a structured questionnaire designed on a five-point Likert scale ranging from "strongly agree" to "strongly disagree." The instrument was divided into two sections: Section A captured demographic information, while Section B focused on substantive issues related to the study.

Validity of the instrument was established through face and content validation by experts in Measurement and Evaluation at Nnamdi Azikiwe University, Awka, as well as input from the researcher's supervisor. Reliability was tested using the test-retest method with staff from Dutse General Hospital, who were not part of the main study. Cronbach Alpha analysis produced a coefficient of 0.815, exceeding the 0.50 benchmark, thereby confirming reliability.

Data analysis combined descriptive and inferential statistics. Descriptive statistics included frequency tables, percentages, and mean scores, while inferential analysis employed Pearson Product Moment Correlation Coefficient to test hypotheses at a 0.05 significance level using SPSS version 25. The decision rule stipulated that items with mean scores of 3.0 and above would be accepted, while those below were rejected. For hypothesis testing, the null hypothesis was rejected if the p-value was less than 0.05, thereby confirming significant relationships.

Results

Out of 400 questionnaires distributed, 380 were correctly completed and returned, representing a 95% response rate. This high return rate provided a reliable dataset for the study's analysis.

Research Question 1: To what extent does recruitment process automation relate with employee efficiency of Federal Medical Centers in North West, Nigeria?

Table 1 Responses of the respondents on the relationship between recruitment process automation and efficiency of Federal Medical Centers in North West, Nigeria

S/N	Statement	SA	A	U	D	SD	Mean	Remark
	Recruitment Process Automation							
1	Recruitment automation improves the efficiency of the hiring process and reduces the workload of the human resources manager	108	179	16	52	25	3.77	**Agree**
2	Recruitment automation leads to faster hiring decisions without compromising quality and enhances candidates experience	123	160	20	45	32	3.78	**Agree**
3	Automated tools (e.g., ATS, AI screening) help in reducing bias in candidate selection and makes the process more transparent	116	118	25	75	46	3.48	**Agree**
	Employee Efficiency							
1	The hospital provides adequate tools and equipment for employees to perform their duties efficiently.	128	123	37	58	34	3.67	**Agree**
2	The management provides regular training programs to improve employee skills and efficiency.	195	112	20	33	20	4.13	**Agree**
3	The use of automated tools for hiring has improved employee efficiency	179	136	17	28	20	4.12	**Agree**
	Grand Mean						3.82	**Agree**

The findings reveal that respondents strongly agreed that recruitment process automation enhances efficiency in Federal Medical Centers. With mean scores above 3.7, automation was seen to reduce HR workload, accelerate hiring decisions, improve candidate experience, and provide transparency in selection. Tools such as Applicant Tracking Systems and AI screening were acknowledged for reducing bias, though moderate agreement (3.48) suggests room for improvement in consistent application.

In terms of employee efficiency, respondents highlighted the positive impact of automation and organizational support. Adequate tools and equipment (mean 3.67), regular training programs (mean 4.13), and automated hiring tools (mean 4.12) were all seen as contributors to improved workforce productivity. Overall, the grand mean of 3.82 confirms that recruitment automation is perceived as a valuable strategy for boosting both recruitment outcomes and employee performance in Federal Medical Centers across North West Nigeria.

Research Question 2: What is the degree of relationship that exist between digital training management system and process optimization of Federal Medical Centers in North West, Nigeria?

Table 2: Responses of the respondents on the relationship between digital training management system and process optimization of Federal Medical Centers in North West, Nigeria

S/N	Items	SA	A	U	D	SD	Mean	Remark
	Digital Training Management System							
1	The digital training system helps me retain and apply knowledge better than traditional in-person training.	139	158	20	53	10	3.96	**Agree**
2	I can access training materials anytime, anywhere, without technical difficulties.	95	110	30	85	60	3.25	**Agree**
3	Managers/HR can effectively monitor employee training progress through the system.	120	135	25	55	45	3.60	**Agree**
	Process Optimization							
1	Technology is effectively used to automate repetitive	13	12	2	4	3	3.75	**Agree**

	tasks and eliminates redundant processes in my work	9	8	9	6	8		
2	Process optimization efforts have improved our service delivery times in the various department in our hospital	126	138	20	43	53	3.63	**Agree**
3	Process improvement initiatives have significantly reduced operational costs in the running of the hospital	158	154	13	30	25	4.02	**Agree**
	Grand Mean						3.70	**Agree**

The results indicate that respondents generally agreed that the digital training management system has positively influenced employee learning and institutional efficiency. With a mean score of 3.96, employees affirmed that digital platforms enhance knowledge retention and application compared to traditional training. Accessibility of training materials received moderate agreement (3.25), suggesting occasional challenges, while monitoring of training progress by managers scored 3.60, reflecting improved supervision and accountability.

On process optimization, respondents highlighted the role of technology in automating tasks (mean 3.75), improving service delivery times (3.63), and significantly reducing operational costs (4.02). The overall grand mean of 3.70 confirms that digital training management is strongly linked to process optimization, enhancing service delivery, productivity, and cost efficiency in Federal Medical Centers across North West Nigeria.

Test of Hypotheses

Hypothesis One

Ho_1: There is no significant relationship between recruitment process automation and employee efficiency of Federal Medical Centers in North West, Nigeria.

Table 3: Pearson's Correlation between Recruitment Process Automation and Employee Efficiency.

		Recruitment process automation	**Employee efficiency**
Recruitment Process Automation	Pearson's Correlation	1	.573**
	Sig. (2-tailed)		.000
	N	380	380
Employee efficiency	Pearson's Correlation	.573**	1
	Sig. (2-tailed)	.000	
	N	380	380
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Researcher's Computation 2025 /SPSS version 25

The correlation analysis revealed a significant positive relationship between recruitment process automation and employee efficiency in Federal Medical Centers across North West Nigeria. With a correlation coefficient of r = 0.573 (57.3%) and a p-value less than 0.05, the null hypothesis was rejected, confirming that recruitment automation meaningfully enhances workforce productivity and operational performance.

Hypothesis Two

Ho_2 Digital training management system has no significant relationship with process optimization of Federal Medical Centers in North West, Nigeria

Table 4: Pearson's Correlation between Digital training management system and Process Optimization

		Digital training management system	**Process optimization**
Digital training management system	Pearson's Correlation	1	.611**
	Sig. (2-tailed)		.000
	N	380	380
Process	Pearson's Correlation	.611**	1

		Digital training management system	**Process optimization**
optimization	Sig. (2-tailed)	.000	
	N	380	380
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Researcher's Computation 2025 /SPSS version 25

The correlation analysis revealed a significant positive relationship between the digital training management system and process optimization in Federal Medical Centers across North West Nigeria. With a correlation coefficient of r = 0.611 (61.1%) and a p-value less than 0.05, the null hypothesis was rejected, confirming that digital training systems enhance operational efficiency by improving service delivery, reducing costs, and streamlining hospital processes.

Summary of Findings

Based on the analysis of the study, the major findings are summarized as follows:

i. The study found a significant relationship between recruitment automation and employee efficiency in Federal Medical Centers in North West, Nigeria. The correlation coefficient between recruitment automation and employee efficiency recorded ($r = 0.573$, $p < 0.05$). This implies that the use of applicant tracking systems, digital screening tools, and automated scheduling enhances the efficiency of employees.

ii. There is a strong and significant relationship between digital training systems and process optimization in Federal Medical Centers in North West, Nigeria. The correlation coefficient between digital training systems and process optimization recorded ($r = 0.611$, $p < 0.05$). This indicates that digital training improves knowledge retention, enhances skill development, and contributes to better workflow, reduced delays, and lower operational costs.

Conclusion and Recommendations

The study concludes that digital transformation of HR practices significantly enhances organizational outcomes in Federal Medical Centers across North West Nigeria. Recruitment automation promotes efficient staff resourcing, digital training systems strengthen employee capabilities and hospital processes, digital data management reduces clinical and administrative errors, while digital performance management systems improve workforce utilization. Collectively, these digital HR tools substantially enhance healthcare service delivery, patient safety, and operational

efficiency. The empirical findings strongly support the adoption and expansion of digital HR systems within public healthcare institutions to meet modern performance and accountability demands.

Based on the study's findings, the following recommendations are made:

1. FMCs should upgrade and fully integrate recruitment automation systems to enhance candidate assessment, reduce bias, shorten hiring cycles, and ensure better job-fit for improved efficiency.
2. Government and hospital management should invest in robust Learning Management Systems (LMS), provide stable internet access, and ensure continuous digital training programs to promote staff development and process optimization.

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