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Assessing the impact of Digital HR tools on managerial efficiency in India's oil public sector undertakings

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Abstract

This study examines how the integration of digital human resource (HR) tools influences managerial efficiency within India's Oil Public Sector Undertakings (PSUs). Employing a mixed-methods research design, data were collected through structured questionnaires and secondary sources to analyze key digital HR applications-such as e-recruitment platforms, digital performance dashboards, and e-learning systems-and their effects on HR practices and overall efficiency. Statistical techniques including Pearson correlations, ANOVA, and descriptive analyses were used to test hypotheses derived from established HRM frameworks. Findings reveal that the use of digital HR tools is significantly and positively associated with enhanced managerial efficiency. The study not only validates theoretical models such as the Harvard Framework and the Michigan Model but also highlights practical implications for policy makers and organizational leaders. By providing recommendations for digital transformation and continuous benchmarking, the research offers a roadmap for Oil PSUs to remain competitive in a rapidly evolving technological landscape.

Keywords: Digital HR, managerial efficiency, Oil PSUs, e-recruitment, e-learning, performance dashboards, HR transformation

Introduction

The oil and gas industry in India is characterized by high capital intensity, operational complexity, and a rapidly evolving competitive environment. In this sector, efficient managerial practices are essential for sustaining productivity and achieving strategic goals. Digital transformation in human resource management (HRM) has emerged as a critical enabler of organizational performance, as advanced digital HR tools offer the potential to enhance data-driven decision-making, streamline recruitment, and foster continuous employee development. Despite the increasing adoption of digital HR solutions in many industries, the extent to which these tools impact managerial efficiency in India's Oil Public Sector Undertakings (PSUs) remains underexplored. This study seeks to address this gap by investigating the relationship between digital HR tools and managerial efficiency in key Oil PSUs such as GAIL, IOCL, BPCL, and ONGC. The research is guided by established HRM theories, including the Harvard Framework (Beer *et al.*, 1984) [3] and the Michigan Model, while also incorporating contemporary insights on digital transformation (Chen *et al.*, 2019; Lee, 2019) [6, 14, 16]. By

integrating quantitative survey data with qualitative insights from secondary sources, this study aims to provide both theoretical contributions and practical recommendations for leveraging digital HR technologies to enhance managerial performance in a competitive industry.

Literature Review

Existing literature on HRM has long emphasized that strategic HR practices are integral to organizational performance. Foundational models such as the Harvard Framework (Beer *et al.*, 1984) [3] posit that HR policies must be aligned with organizational goals to drive efficiency, while the Michigan Model highlights the role of systematic HR processes in performance improvement. Recent studies have extended these models by focusing on the digital transformation of HR functions. Researchers like Chen *et al.* (2019) [6] and Brown and Green (2018) [4] have argued that digital HR tools-such as e-recruitment platforms, digital performance dashboards, and e-learning systems-can streamline HR processes, reduce time-to-hire, and enhance employee development. In the context of India's oil and gas sector, where operational demands are high and competition

is intensifying, digital transformation offers a pathway for public sector organizations to achieve greater managerial efficiency (Desai & Verma, 2018; Nair & Gupta, 2018) [9, 21]. Furthermore, employee engagement, a critical driver of efficiency, is positively influenced by digital communication and feedback systems (Mamari *et al.*, 2019;

Williams & Smith, 2019) [18, 29]. Despite these promising insights, there is limited empirical research focused specifically on how digital HR tools impact managerial efficiency within Oil PSUs. Table 1 summarizes key themes and the theoretical underpinnings that inform this study.

Table 1: Key Themes and Theoretical Underpinnings

Theme	Key Findings	Theoretical Framework
Digital Recruitment	E-recruitment tools enhance candidate quality and reduce hiring cycles	Harvard Framework; digital transformation (Chen <i>et al.</i> , 2019) [6]
Digital Performance Dashboards	Real-time data improves decision-making and performance monitoring	Michigan Model; agile HR practices (Lee, 2019) [14, 16]
E-Learning and Training	Online training platforms facilitate continuous learning and skill development	Continuous improvement theory (Brown & Green, 2018) [4]
Employee Engagement	Digital feedback systems boost engagement and productivity	Engagement theory (Mamari <i>et al.</i> , 2019) [18]

Table 1 highlights that digital HR tools are positioned as key drivers of managerial efficiency, aligning with established theoretical models and emerging trends in digital transformation.

Materials and Methods

This study adopts a mixed-methods design to assess the impact of digital HR tools on managerial efficiency in India’s Oil PSUs. Primary quantitative data were collected using a structured questionnaire administered to employees across four major Oil PSUs. The questionnaire employed a five-point Likert scale to measure perceptions regarding the effectiveness of digital HR applications across several dimensions: digital recruitment, performance dashboards, and e-learning systems. A purposive sampling technique was used to target employees directly involved in HR functions or managerial processes. Out of 400 distributed

questionnaires, 315 valid responses were obtained, yielding a response rate of approximately 78.75%. Additionally, secondary data were sourced from government reports, industry publications, and academic journals to triangulate the findings and provide context.

Data were analyzed using statistical techniques including descriptive statistics, Pearson correlation, ANOVA, and Data Envelopment Analysis (DEA) to benchmark efficiency. Reliability of the instrument was ensured through pilot testing, yielding Cronbach’s alpha coefficients exceeding 0.80 across all constructs (Creswell, 2018; Saunders *et al.*, 2019) [7, 24]. The methodology ensures both internal and external validity while maintaining ethical standards through informed consent and data confidentiality. Table 2 provides an overview of the research design and data collection procedures.

Table 2: Research Design Overview

Component	Description	Purpose
Sampling	Purposive sampling; 400 initial respondents, 315 valid responses	Target employees with relevant digital HR experience
Data Collection	Structured questionnaire (online and face-to-face); secondary sources	Gather quantitative and qualitative data on digital HR practices
Analytical Techniques	Descriptive statistics, Pearson correlations, ANOVA, DEA	Test hypotheses and benchmark managerial efficiency
Reliability & Validity	Pilot testing, Cronbach’s alpha > 0.80	Ensure instrument accuracy and consistency
Ethical Considerations	Informed consent, confidentiality, data security	Maintain ethical integrity and data reliability

Table 2 summarizes the research design and data collection methodology used to investigate the impact of digital HR tools on managerial efficiency.

Results and Analysis

The quantitative analysis of the survey responses revealed significant positive relationships between the use of digital HR tools and managerial efficiency. Digital recruitment processes exhibited a Pearson correlation of $r = 0.50$ ($p < 0.01$) with managerial efficiency, while digital performance dashboards and e-learning systems showed correlations of $r = 0.53$ ($p < 0.01$) and $r = 0.48$ ($p < 0.01$), respectively. Descriptive statistics indicated that the mean scores for digital HR practices were generally high, with respondents rating the effectiveness of digital recruitment at 3.7 (SD = 0.68), digital performance dashboards at 3.8 (SD = 0.65), and e-learning systems at 3.6 (SD = 0.70). ANOVA

results demonstrated significant differences among the four Oil PSUs, particularly in the adoption of digital recruitment platforms ($F(3,311) = 4.25, p < 0.01$). DEA further supported these findings by benchmarking the efficiency with which each PSU transformed digital HR inputs into improved managerial outcomes.

These results substantiate the hypothesis that digital HR tools significantly enhance managerial efficiency. The statistical evidence aligns with previous studies (Chen *et al.*, 2019; Lee, 2019) [6, 14, 16] and underscores the importance of digital transformation in modern HR practices.

Findings and Discussion

The findings indicate that digital HR tools contribute substantially to improving managerial efficiency in Oil PSUs. The use of e-recruitment platforms accelerates the hiring process and enhances candidate quality, which is

critical for ensuring a skilled workforce. Digital performance dashboards facilitate real-time monitoring and data-driven decision-making, thereby enabling managers to respond promptly to operational challenges. E-learning systems support continuous employee development and help bridge skill gaps, especially among non-managerial staff. These findings are consistent with the theoretical propositions of the Harvard and Michigan models, and they

extend previous research by demonstrating the practical benefits of digital HR integration in a public sector context. Comparative analyses among the four Oil PSUs revealed that organizations with higher levels of digital HR adoption, such as IOCL, exhibited superior managerial efficiency compared to those with lower digital integration. Table 3 provides a comparative summary of digital HR practices across the PSUs.

Table 3: Comparative Summary of Digital HR Practices

PSU	Digital Recruitment (Mean ± SD)	Digital Performance Dashboards (Mean ± SD)	E-Learning Systems (Mean ± SD)	Managerial Efficiency Score (Mean ± SD)
GAIL	3.6 ± 0.70	3.7 ± 0.68	3.5 ± 0.69	3.8 ± 0.65
IOCL	3.8 ± 0.68	3.9 ± 0.65	3.7 ± 0.70	3.9 ± 0.62
BPCL	3.5 ± 0.72	3.6 ± 0.70	3.5 ± 0.71	3.7 ± 0.66
ONGC	3.6 ± 0.70	3.8 ± 0.67	3.6 ± 0.69	3.8 ± 0.67

Table 3 shows that IOCL consistently outperforms the other organizations in digital HR practices, which correlates with higher managerial efficiency.

The discussion integrates these empirical findings with the existing literature, confirming that digital HR tools not only streamline HR processes but also enhance overall organizational performance. The robust correlations and significant differences observed suggest that investments in digital HR solutions can yield substantial benefits, thereby providing strong support for the study’s hypotheses.

Findings and Discussion (Continued)

Furthermore, the findings underscore the importance of continuous benchmarking. Oil PSUs that regularly compare their HR practices against global standards are better positioned to identify performance gaps and implement innovative solutions. The study’s use of DEA provides an objective measure of how effectively each organization converts digital HR inputs into managerial outcomes. These insights are critical for both practitioners and policymakers, highlighting that the strategic adoption of digital tools is essential for maintaining competitiveness in a volatile market.

The overall significance of the results is twofold. First, they confirm that digital HR tools have a direct, positive impact on managerial efficiency, thereby validating the integration of digital transformation into HR practices. Second, they offer practical guidance for Oil PSUs on where to focus their HR investments. By prioritizing digital recruitment, performance management, and e-learning, organizations can not only improve efficiency but also foster a culture of continuous improvement. These recommendations are aligned with current research emphasizing the role of digital innovation in HRM (Brown & Green, 2018; Chen *et al.*, 2019) [4, 6].

Conclusion

The study concludes that digital HR tools play a crucial role in enhancing managerial efficiency in India’s Oil PSUs. The positive correlations between digital recruitment, performance dashboards, e-learning systems, and managerial efficiency underscore the transformative potential of digital HR practices. Organizations such as IOCL, which demonstrate higher levels of digital integration, serve as benchmarks for best practices in the

sector. The empirical evidence supports the hypothesis that investments in digital HR technologies result in significant performance improvements, reinforcing the theoretical frameworks of strategic HRM. The study’s findings provide actionable insights for Oil PSU leaders and policymakers, suggesting that a holistic digital HR strategy-incorporating agile methodologies and continuous benchmarking-is essential for sustaining competitive advantage in a rapidly evolving industry. Future research should extend these findings by incorporating longitudinal data and comparative analyses with private sector organizations to further validate the benefits of digital HR tools.

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