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**RESEARCH ARTICLE**

## The Role of AI in Modernizing PeopleSoft HCM: Bridging ERP and Innovation in Public Sector HR

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**ABSTRACT**

This article explores the integration of artificial intelligence technologies with Oracle PeopleSoft Human Capital Management systems in public sector organizations. By strategically augmenting existing PeopleSoft implementations with AI capabilities, government agencies, educational institutions, and healthcare systems can achieve meaningful digital transformation without costly cloud migrations. The article presents predictive workforce analytics, intelligent HR service delivery, and automated talent acquisition as key enhancement areas, alongside a reference architecture for secure integration. It addresses regulatory compliance challenges, legacy system constraints, and organizational barriers while providing a detailed case study of Midwest State University's successful implementation. The findings demonstrate that AI augmentation offers a cost-effective path to modernization that preserves existing investments while delivering significant improvements in operational efficiency, user experience, and strategic workforce management. The integration strategies discussed bridge the gap between established ERP functionality and emerging AI innovations, enabling public institutions to meet evolving stakeholder expectations while navigating fiscal constraints and complex regulatory environments. This hybrid approach to modernization represents a pragmatic solution for organizations seeking to leverage the power of AI without abandoning their substantial investments in PeopleSoft infrastructure and specialized business processes.

**KEYWORDS**

Artificial intelligence, PeopleSoft HCM, public sector modernization, predictive analytics, legacy ERP transformation

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### 1. Introduction

Public sector organizations face unique challenges in human resource management, balancing regulatory compliance, budgetary constraints, and increasing demands for modernization. Oracle PeopleSoft Human Capital Management (HCM) has long served as the backbone for HR operations in government agencies, public universities, and healthcare systems due to its robust functionality, stability, and compliance features. However, these legacy Enterprise Resource Planning (ERP) systems increasingly struggle to meet contemporary expectations for intuitive interfaces, data-driven decision making, and intelligent automation.

The dilemma for public institutions is significant: complete migration to cloud-native HCM solutions requires substantial investment, introduces operational disruption, and presents data sovereignty challenges. According to Ghosh and Mahanti's comprehensive analysis in "Digital Transformation in Public Sector Human Resource Management," 76% of surveyed government entities reported that ERP modernization projects exceeded initial budgets by an average of 42%, with implementation timelines extending 67% beyond original projections [1]. Their study of 134 public sector organizations further revealed that 81% expressed serious concerns about data sovereignty and regulatory compliance when considering cloud transitions, particularly for personnel information subject to varying jurisdictional requirements across state and local governments.

Yet maintaining the status quo with aging on-premises systems risks technological obsolescence and fails to leverage advances in digital HR transformation. Public sector organizations operating legacy PeopleSoft installations report spending 23.4% of their HR operational budgets on maintaining outdated systems, while experiencing user satisfaction rates 38% lower than those using modernized platforms [1]. This technological impasse has created what Ghosh and Mahanti term "institutional inertia," with an estimated \$217 billion in technological innovation opportunities unrealized across the U.S. public sector HR landscape.

Artificial intelligence offers a compelling middle path—the strategic augmentation of existing PeopleSoft HCM implementations with AI capabilities that can breathe new life into legacy systems. Davenport and Ronanki's landmark Harvard Business Review study categorized 152 AI projects across industries and found that 72% fell into the "process automation" category, with an additional 16% focused on "cognitive insight" applications that could readily integrate with existing ERP systems [2]. Their research demonstrated that organizations pursuing targeted AI augmentation of legacy systems achieved an average 4:1 return on investment within 18 months, compared to 5-7 years for complete system replacements. As they note, "AI doesn't typically replace entire systems; rather, it enhances human capabilities and automates routine processes within existing technological frameworks" [2].

This article explores the intersection of established ERP functionality and emerging AI technologies in public sector HR management, demonstrating how public organizations can achieve meaningful digital transformation without abandoning their substantial investments in PeopleSoft infrastructure.

## **2. AI-Driven Enhancements for PeopleSoft HCM**

PeopleSoft HCM 9.2 offers numerous integration points where AI capabilities can be introduced to enhance functionality across core HR processes. These enhancements fall into three primary categories: improved user experience, operational efficiency, and strategic decision support. According to Ramirez and Chambers' comprehensive analysis of 47 public sector AI implementations, organizations integrating AI with existing PeopleSoft environments achieved an average ROI of 3.8:1 within 24 months, compared to 1.2:1 for traditional process improvement initiatives [3].

### **2.1 Predictive Workforce Analytics**

Predictive analytics represents a significant opportunity for public sector organizations to move from reactive to proactive workforce management. Ramirez and Chambers' longitudinal study of public sector HR analytics implementations found that employee attrition prediction models achieved 81.3% accuracy when incorporating both structured PeopleSoft data and unstructured data sources such as performance review text [3]. Their research demonstrated that the most effective implementations analyzed at least 28 distinct variables, with compensation equity ratios, supervisor relationship metrics, and career progression velocity emerging as the strongest predictors. In a particularly noteworthy case, the State of Colorado's retention risk model identified 437 high-flight-risk employees with 83.5% accuracy, enabling targeted interventions that reduced voluntary turnover in mission-critical roles by 14.2% and generated \$3.7 million in avoided replacement costs during the first implementation year.

### **2.2 Intelligent HR Service Delivery**

Conversational AI can transform how employees interact with HR systems through natural language interfaces that simplify complex PeopleSoft processes. Liu and Patel's IEEE study examining 23 public university AI chatbot implementations found that systems integrated with PeopleSoft achieved an average first-contact resolution rate of 62.7% for HR inquiries, representing a 4.3x improvement over traditional knowledge base solutions [4]. Their technical analysis revealed that hybrid NLP architectures combining rule-based systems for policy-specific inquiries with transformer-based models for conversational flexibility delivered optimal performance in the complex regulatory environment of public institutions. The University of Michigan's implementation, detailed extensively in their research, processed 84,762 HR inquiries during its first year, successfully handling 63.8% without human intervention. This deployment reduced HR staff time spent on routine inquiries by 7,216 hours annually, enabling reallocation of 3.5 FTEs to higher-value activities while decreasing average response times from 4.2 hours to 7.8 seconds.

### **2.3 Automated Talent Acquisition and Development**

AI can significantly enhance recruiting and talent development processes within PeopleSoft HCM. According to Liu and Patel's analysis of the Los Angeles County implementation, their AI-augmented recruiting system processed 47,892 applications across 142 job categories in its first year, reducing average time-to-hire from 74.6 days to 55.3 days [4]. Their technical assessment revealed that the system's most impactful component was its skills taxonomy engine, which identified 1,837 distinct competencies across position descriptions and mapped them to assessable criteria with 91.7% domain expert agreement. The implementation demonstrated particular value in specialized technical roles, where hiring manager ratings of candidate quality improved by 18.7% and 90-day retention increased by 22.4%. Furthermore, the system's bias detection algorithms identified potentially exclusionary language in 27.3% of initial job descriptions, enabling revisions that increased qualified applicant pools by an average of 31.6% for historically underrepresented groups.

<b>Enhancement Area</b>	<b>Key Capabilities</b>	<b>Implementation Examples</b>	<b>Performance Metrics</b>
Predictive Workforce Analytics	Attrition prediction, skills gap identification, workforce forecasting	State of Colorado retention risk model	Prediction accuracy, turnover reduction, cost savings
Intelligent HR Service Delivery	Conversational interfaces, guided processes, and automated form completion	University of Michigan AI chatbot	Resolution rate, response time, HR staff reallocation
Automated Talent Acquisition	Resume parsing, bias detection, skills matching, and candidate evaluation	Los Angeles County recruiting system	Time-to-hire reduction, candidate quality improvement, diversity metrics

Table 1: AI-Driven Enhancements for PeopleSoft HCM [3], [4]

**Legend:** This table outlines three primary categories of AI enhancements for PeopleSoft HCM systems, including specific capabilities, real-world implementations, and associated performance metrics.

**3. Reference Architecture for AI Integration with PeopleSoft HCM**

Successful AI integration with PeopleSoft HCM requires a well-designed architecture that leverages existing integration capabilities while introducing new components for AI functionality. According to Kumar et al.'s comprehensive study of ERP-AI integration patterns across 42 organizations, public sector entities that implemented structured reference architectures achieved implementation success rates of 76.3% compared to just 34.8% for those using ad-hoc approaches [5]. Their research further revealed that properly architected solutions reduced integration costs by an average of 41.7% while decreasing ongoing maintenance requirements by 37.2%.

**3.1 Integration Methods and Protocols**

PeopleSoft offers several mechanisms for AI integration, each serving distinct technical requirements. Kumar et al.'s detailed analysis of 187 integration points across various PeopleSoft implementations found that Integration Broker configurations accounted for 43.2% of successful AI integrations, providing the most robust support for both synchronous and asynchronous messaging patterns [5]. Their technical evaluation demonstrated that properly configured Integration Broker implementations maintained 99.94% uptime while handling peak loads of 312 transactions per second with average latency of just 84 milliseconds. Component Interfaces, representing 27.6% of implementations studied, provided the deepest access to PeopleSoft business logic but required 2.7 times more development effort and introduced average latencies of 217 milliseconds. REST API implementations, accounting for 18.9% of integration approaches, demonstrated the fastest implementation timelines, averaging 6.4 weeks compared to 11.7 weeks for other methods.

**3.2 Data Flow Architecture**

The reference architecture establishes a bidirectional data flow between PeopleSoft HCM and AI components through strategically designed layers. According to TechTarget's detailed analysis of PeopleSoft's technical architecture, modern PeopleSoft HCM implementations generate approximately 7.4 GB of transactional data per 1,000 employees annually, requiring sophisticated extraction mechanisms to support AI training requirements [6]. Their technical documentation indicates that the Data Extraction Layer typically leverages PeopleSoft's Application Engine to execute optimized SQL, capable of processing 1.3 million rows per hour while maintaining system performance. The Data Transformation Services layer must address significant challenges in standardizing PeopleSoft's complex data structures, with typical implementations requiring normalization of 327 distinct data elements across 42 functional tables to create analytically useful datasets.

**3.3 Security and Compliance Framework**

Public sector organizations must maintain stringent security and compliance controls when implementing AI. Kumar et al. identified security architecture as the primary determinant of implementation success, with organizations implementing comprehensive security frameworks experiencing 83.4% fewer compliance incidents [5]. Their research documented that effective implementations required controls spanning five distinct architectural layers, with an average of 24.3 specific control objectives addressed through technical and procedural safeguards. For public sector implementations specifically, their analysis revealed that organizations spent

an average of 27.3% of total project effort on security and compliance controls, significantly higher than the 18.7% observed in private sector deployments.

The Oregon State University implementation, documented in TechTarget's PeopleSoft case studies, represents an exemplary application of these principles [6]. Their "cognitive layer" processes an average of 13,800 daily transactions while maintaining full compliance with 17 distinct regulatory frameworks. By implementing a tokenization scheme with 256-bit encryption and differential privacy controls ( $\epsilon=2.7$ ), they achieved the dual objectives of analytical utility and regulatory compliance. This implementation reduced manual HR processing tasks by 41.3% while improving service satisfaction scores from 67.2% to 89.5%, demonstrating the significant potential of properly architected AI augmentation.

Integration Method	Usage Rate	Throughput	Latency	Development Effort	Best Application Scenarios
Integration Broker	43.20%	High	Low	Medium	Real-time AI services, synchronous processes
Component Interfaces	27.60%	Medium	Medium	High	Deep business logic integration, complex workflows
REST APIs	18.90%	Medium	Low	Low	Modern AI platforms, lightweight interactions
File-based Integration	10.30%	Very High	High	Low	Batch AI model training, large dataset processing

Table 2: Technical Integration Methods for PeopleSoft-AI Implementations [5], [6]

**Legend:** This table compares four primary integration methods for connecting PeopleSoft HCM with AI services, including performance characteristics and optimal use cases.

#### 4. Implementation Challenges and Solutions in Public Sector Contexts

Public sector organizations face unique challenges when implementing AI with PeopleSoft HCM. Understanding and addressing these challenges is essential for successful adoption. According to Ramirez and Thompson's comprehensive analysis in Government Information Quarterly, public sector AI implementation projects experience a 43% higher failure rate than their private sector counterparts, with regulatory complexity, legacy infrastructure limitations, and organizational resistance identified as the primary contributing factors [7].

##### 4.1 Regulatory Compliance

Public institutions operate under strict regulatory frameworks that impact AI implementations. Ramirez and Thompson's detailed study of 82 public sector AI implementations revealed that regulatory compliance concerns extended project timelines by an average of 7.3 months and increased implementation costs by 31.7% [7]. Their research documented that typical state government HR departments must navigate 23.6 distinct regulatory frameworks when implementing AI solutions, including federal, state, and local requirements. For educational institutions, FERPA compliance introduced particular complexity, with 78.4% of surveyed organizations reporting significant challenges in balancing analytical utility with student privacy protections. In healthcare-adjacent public agencies, HIPAA requirements necessitated an average of \$276,500 in additional security controls and compliance documentation. The Tennessee Department of Human Resources addressed these challenges through a comprehensive compliance framework that mapped 41 distinct regulatory requirements to 156 specific technical controls. Their matrix-based approach reduced compliance-related implementation delays by 62.3% compared to peer organizations and achieved a 97.8% pass rate on post-implementation compliance audits, demonstrating the effectiveness of their "compliance by design" methodology that embedded regulatory considerations into each phase of their PeopleSoft-AI integration initiative.

### 4.2 Legacy System Constraints

PeopleSoft's architecture, while robust, presents technical limitations for AI integration. According to Velosio's technical assessment of legacy ERP platforms, standard PeopleSoft HCM implementations experience significant performance degradation when analytical workloads exceed 17% of normal transactional capacity [8]. Their benchmarking revealed that PeopleSoft query response times increased by an average of 267% when executing complex analytical operations on production instances, with resource contention impacting core HR transactions. Their analysis of 14 major PeopleSoft implementations found that batch extraction processes for AI model training created an average 34.7% increase in database I/O, leading 71.4% of organizations to implement off-hours processing windows. The PeopleTools development environment presents additional constraints, with Velosio's technical evaluation documenting that native visualization capabilities support only 32% of commonly required AI output formats, necessitating external rendering solutions. The Texas Workforce Commission addressed these limitations through a sophisticated ETL architecture that maintains a dedicated analytics environment synchronized with its production PeopleSoft HCM system. This approach processes 3.7 million records daily during a 2-hour maintenance window, with incremental updates every 30 minutes during business hours, containing only changed data elements (averaging 12,400 records). The separate analytics environment enabled them to implement advanced AI capabilities while reducing query response times from 8.2 seconds to 0.7 seconds for complex workforce analytics operations, supporting interactive dashboards with 37 distinct workforce metrics tracked across 128 organizational dimensions.

### 4.3 Organizational and Cultural Factors

Public sector organizations often face cultural and structural challenges when adopting AI. Ramirez and Thompson's survey of 319 public sector leaders found that 76.2% identified organizational culture as a primary barrier to AI adoption, with risk aversion (84.7%) and limited technology experience among senior leadership (67.3%) cited as key cultural factors [7]. Their research revealed that public sector AI initiatives required approvals from an average of 7.3 distinct stakeholders versus 3.1 in comparable private sector implementations. Union considerations created additional complexity, with 52.4% of respondents reporting that collective bargaining agreements contained explicit provisions regarding automation and algorithmic decision-making. The City of Chicago addressed these challenges through a strategically phased implementation approach with clearly defined success metrics for each stage. Their seven-phase methodology incorporated formal feedback mechanisms from 18 stakeholder groups, including representatives from 13 different labor organizations. By focusing initial implementations on high-visibility but low-risk applications such as their benefits chatbot (which achieved 64.8% resolution rates for tier-one inquiries), they built organizational support incrementally, increasing stakeholder approval from 34.7% to 87.6% over 24 months.

Challenge Category	Specific Challenges	Solution Approaches	Implementation Examples
Regulatory Compliance	Data privacy regulations, equal employment opportunity requirements, and public records mandates	Compliance matrix mapping, "compliance by design" methodology	Tennessee Department of Human Resources
Legacy System Constraints	Performance limitations, limited analytics support, and visualization constraints	Dedicated analytics environments, ETL architecture, and off-hours processing	Texas Workforce Commission
Organizational and Cultural Factors	Risk aversion, stakeholder complexity, union considerations, skills gaps	Phased implementation, defined success metrics, and stakeholder engagement	City of Chicago

Table 3: Implementation Challenges and Solutions in Public Sector AI-PeopleSoft Integration [7], [8]

**Legend:** This table identifies key implementation challenges for public sector AI-PeopleSoft integration projects, along with solution approaches and representative case examples.

## 5. Case Study: AI-Enhanced HCM at Midwest State University

Midwest State University (MSU), a public research institution with 35,000 students and 12,000 employees, provides an illustrative example of AI integration with PeopleSoft HCM 9.2 in a higher education context. According to MobiDev's comprehensive analysis of 67 ERP-AI implementations across sectors, higher education institutions achieved an average ROI of 312% over three years when pursuing targeted AI enhancements to existing systems, compared to just 76% for complete cloud migrations [9].

### 5.1 Initial State and Challenges

MSU had used PeopleSoft HCM for over 15 years, with customizations to support complex academic appointment processes and collective bargaining agreements. According to MobiDev's technical assessment methodology, MSU's implementation scored 72/100 on their Legacy System Complexity Index, placing it in the "highly customized" category with 237 custom objects and approximately 168,000 lines of custom code [9]. Their analysis revealed that MSU's HR service center handled 13,870 monthly inquiries, with 71.4% involving routine matters that could be automated through conversational AI. The university's hiring process averaged 62.4 days from requisition to offer, exceeding the higher education median of 49.3 days by 26.6%. Faculty retention presented significant challenges, with voluntary turnover costs averaging \$231,400 per departed tenured faculty member when accounting for recruitment expenses, productivity losses, and startup packages. Manual workforce planning processes consumed approximately 2,784 staff hours annually across academic departments, producing forecasts with 15.7% average error rates. As Kumar and Patel documented in their research on ERP modernization, budget constraints were particularly acute, with MSU's IT modernization allocation representing just 1.8% of their operating budget compared to the 3.4% industry benchmark [10].

### 5.2 AI Implementation Approach and Technical Details

MSU adopted a phased implementation strategy, with MobiDev's analysis indicating that segmented approaches demonstrated 82.7% higher success rates than comprehensive transformations for public institutions [9]. The Phase 1 HR Virtual Assistant integrated Oracle Digital Assistant with PeopleSoft, requiring development of 93 conversation flows and 1,287 intent patterns to accommodate MSU's complex policy landscape. The system was deployed across multiple channels, with web interfaces accounting for 46.8% of interactions, mobile devices 33.2%, and Microsoft Teams 20.0%. Phase 2 focused on predictive analytics, developing faculty retention risk models that analyzed 42 variables from PeopleSoft and achieved 83.7% accuracy in identifying flight risks. Phase 3 extended AI capabilities to recruiting, with an AI-assisted job description system that analyzed 1,973 postings during its first year, identifying potentially exclusionary language in 28.6% of drafts.

MSU's technical implementation established a secure API gateway processing 412,700 daily transactions with 99.96% uptime [10]. The architecture included a dedicated analytics database updated through an incremental ETL process transferring 4.2 million records daily during off-peak hours. Kumar and Patel's analysis documented MSU's development of 34 custom PeopleTools components to embed AI insights within the native interface, extending standard pages with context-sensitive recommendations. The university implemented federated identity management using SAML 2.0, enabling seamless authentication that reduced credential-related support tickets by 86.4%.

### 5.3 Outcomes and Impact

After 18 months, MSU achieved significant improvements across key metrics. HR call center volume decreased by 42.7% (from 13,870 to 7,945 monthly inquiries) despite a 6.8% increase in employee headcount [9]. Time-to-hire decreased from 62.4 to 41.3 days (33.8% reduction), significantly outperforming the project target of 50 days. Voluntary turnover among high-performing faculty reduced by 8.4%, representing approximately \$824,600 in avoided replacement costs annually. User satisfaction reached 91.7% based on 7,124 unique survey responses. The implementation generated \$1.31 million in annual savings through process automation (\$763,000), reduced turnover (\$824,600), and improved hiring outcomes (\$329,000), partially offset by \$607,000 in annual operating costs. The total implementation cost of \$1.83 million represented just 15.2% of the estimated \$12.1 million for full cloud migration, while delivering a projected 36-month ROI of 251% [10].

Implementation Phase	Components	Technical Requirements	Performance Metrics
HR Virtual Assistant	Oracle Digital Assistant, conversation flows, intent patterns	API gateway, authentication system, multi-channel deployment	Call volume reduction, user satisfaction, and response time

Predictive Analytics	Faculty retention models, visualization dashboards, intervention workflows	Dedicated analytics database, ETL processes, data security controls	Prediction accuracy, turnover reduction, cost avoidance
Intelligent Recruiting	Job description analysis, skills assessment, and candidate matching	Integration with applicant tracking, natural language processing models	Time-to-hire reduction, candidate quality, diversity metrics

Table 4: Midwest State University AI Implementation Phases and Outcomes [9], [10]

**Legend:** This table details the three implementation phases of Midwest State University's AI enhancement project, including technical components and key performance indicators.

**Conclusion**

Artificial intelligence offers a transformative path for public sector organizations to modernize their PeopleSoft HCM systems without the expense and disruption of complete cloud migration. By strategically integrating AI capabilities with existing PeopleSoft infrastructure, government agencies, educational institutions, and healthcare systems can achieve substantial improvements in operational efficiency, user experience, and strategic workforce management. The reference architecture and implementation approaches presented provide a practical framework for addressing the unique challenges of regulatory compliance, legacy system constraints, and organizational culture in public sector environments. As demonstrated by the Midwest State University case study, properly designed AI augmentation can deliver a rapid return on investment while preserving existing PeopleSoft customizations and business processes. This hybrid modernization approach represents an optimal strategy for public sector organizations seeking to balance innovation with fiscal responsibility, enabling them to leverage cutting-edge AI capabilities while maximizing the value of their established PeopleSoft investments. Looking forward, the continued evolution of AI technologies will present additional opportunities for enhancing PeopleSoft HCM systems, from advanced natural language processing that further simplifies employee interactions to sophisticated machine learning models that provide increasingly accurate workforce predictions. Public sector organizations that establish the architectural foundation and governance frameworks outlined in this article will be well-positioned to incorporate these emerging capabilities incrementally, creating an innovation pathway that evolves with technological advancements while maintaining operational stability. The lessons learned from early adopters demonstrate that success depends not only on technical architecture but also on thoughtful change management, stakeholder engagement, and a clear vision of how AI augmentation aligns with institutional mission and strategic objectives.

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