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Architecting Hybrid HCM Co-existence: A Cloud and On-Premise Integration Framework for Sustainable Enterprise Transformation

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ABSTRACT

Large enterprises adopting cloud-based Human Capital Management (HCM) solutions generally follow a direct single-phase cloud migration approach or a structured hybrid co-existence approach that allows the concurrent operation of on-premise and cloud HCM systems during a governed period, from where the organization can migrate to the cloud HCM solution. This approach is usually adopted by organizations with meaningful customizations to legacy systems, operating in multiple payroll jurisdictions or in industries with complex collective agreements. The contribution is the Co-existence Architecture Framework (CAF), comprising a five-layer Reference Architecture, a four-stage Co-existence Maturity Model (CMM), and a Co-existence Suitability Index (CSI) that measures suitability. The CAF was empirically validated against a dataset of seven large-enterprise HCM transformation programs (n=4 CAF co-existence, n=3 direct migration) measured during a 24-month period, with an average 60.7% decrease in payroll errors (PER of 1.09 vs. With the intervention, we saw a statistically important reduction in errors per 1000 payslips (2.78, Cohen's d = 1.84, p = 0.003), as well as a statistically important increase in WRI of 15.6 points (74.2 vs 58.6). We also reduced costs by 58.6% (Cex-post, 58.6; d = 2.21, p = 0.019) and time by 53.6% (DRCT: 3.2 vs. 6.9 hours) providing SCI-level evidence on the structured co-existence pathway as the best-fit enterprise HCM transformation strategy for complexity-heavy organisations.

Keywords: Cloud HCM Adoption; Co-existence Architecture; HCM Transformation; Co-existence Maturity Model; Change Management; Hybrid Integration; Risk-Managed Migration; PeopleSoft; Regulated Workforce; Co-existence Suitability Index

1. INTRODUCTION

Digital transformation in Human Capital Management (HCM) systems is perhaps the most complex business transformation of enterprise-grade IT systems. Cloud-native human capital management platforms such as SAP SuccessFactors, Oracle Cloud HCM and Workday have emerged as the architectural choice for enterprise scale HCM in talent acquisition, payroll, benefits and workforce analytics. [1][2] However, migrating from existing on-premise systems such as PeopleSoft, SAP HCM ECC 6.0 or Oracle E-Business Suite is not a simple technical exercise, especially for large enterprise organizations that are heavily regulated [3].

The dilemma of HCM modernisation is well known, cloud platforms providing standardization, continuous innovation and elastic scalability, but requiring a level of re-engineering that is problematic where lengthy legacy customisation is endemic and where turnaround times are tight [2][4]. Legacy HCM implementations are particularly common in regulated industries, or government and public services, where customer-specific calculation rules, union-negotiated pay configurations, multi-jurisdictional tax rules, and compliance processes can multiply to the thousands, amassed over a 10, 20 or 30 year period. Another key risk associated with re-engineering this amassed logic in one programme event is the technical and organizational challenge it presents [3, 5].

This paper addresses a literature gap in hybrid co-existence as an established strategy of enterprises in the wild. No systematic, empirically-grounded approach to architecture, maturity modelling, or organizational change has yet been documented which attempts to encapsulate this hybrid co-existence. Much available guidance is vendor-provided, commercially motivated, or focused on narrow technical domains. In order to help close this gap we provide the Co-existence Architecture Framework (CAF), a prescriptive approach, supported by empirical evidence, for organisations that choose a hybrid co-existence path to cloud adoption.

The paper presents a 5 layer CAF Reference Architecture on canonical integration patterns along the cloud-on-premise co-existence boundary, a 4 stage Co-existence Maturity Model (CMM) which guides organizations through initial co-existence, early co-existence, late co-existence, and convergence co-existence scenarios, and a Co-existence Suitability Index (CSI) which guides organizations to choose the best strategy based on evidence-based principles. In addition, empirical performance data collected from 7 large enterprise HCM transformation programs support the superiority of the framework over direct migration scenarios.

2. LITERATURE REVIEW

2.1 Cloud Adoption Strategy in Enterprise HCM

Enterprise cloud adoption studies have mainly adopted the Technology Acceptance Model and its extensions, diffusion of innovation theory, and the resource-based view theory [6, 7]. For HCM, Seethamraju [4] argues that the "standardisation imperative" of cloud platforms is a key barrier for organizations with a high level of ERP customization. The organisation has to accept cloud-driven standardization, with attendant business process re-engineering, or face a continuation of the custom-built legacy system. A third pathway is hybrid co-existence, where capabilities are adopted while deferring process convergence [3].

Data governance is another important but often overlooked part of cloud HCM migration. Chatterjee [8] presents a data governance framework for multitenant clouds (enforcement of privacy, security, and quality requirements across distributed data pipelines), which also applies to the sensitive employee and payroll data flows in the HCM co-existence scenario. The golden-record integrity loss and increased reconciliation cost from inadequate governance at the co-existence boundary also reduce the operational benefits of this hybrid architecture.

2.2 Legacy HCM Complexity and Migration Risk

Three drivers of legacy HCM system complexity are customisation depth, regulatory obligation, and CBA specificity (collectively) [3][5]. Noran et al. [5] coined the term 'customisation debt', referring to the amassed technical and organizational cost of maintaining a customized ERP system, which increases over time and creates increasingly more risk at the point of cloud migration. Their structured, stage-gated approach to CAF CMM formed the theoretical model supporting the governing of complex enterprise transformation programmes.

Payroll system failures are an extreme case of migration risk. Payroll calculations provide the basis for employee compensation, and expose the company to substantial regulatory risk, under wage-and-hour and other regulations, and to formal grievance and arbitration procedures in unionized workplaces [3] . Since the cost of failures can be asymmetric, migrating to a distributed database scheme may require more conservatism and validation than migrating to a CRM or supply-chain system.

2.3 Integration Architecture for Hybrid Enterprise Systems

Modern enterprise integration architecture has progressed from point-to-point middleware architectures to API-first architectures, which often enable an event-driven architecture that successfully decouples scalable integration across heterogeneous systems [9]. Kakaraparthi [9] shows that GenAI-powered code generation, working closely with CI/CD pipelines, enables rapid pipeline creation and maintenance of complex integration logic, as particularly manifested in the integration middleware layer of the CAF. The frequent change of both the APIs of the cloud platform and the interfaces of the on-premise system adds to the middleware's maintenance burden.

The security architecture on the cloud-on-premise boundary has requirements distinct from either pure-cloud security or pure-on-premise security. A specific example of this work is the research of Afzal and Huzaifa [10] on a framework for the security of an enterprise system augmented by artificial intelligence against adversarial attacks. The framework maps to the identity federation and access management layer of the CAF. The adversarial threat surface of a co-existence architecture is in practice much larger than that of a single-system architecture, and explicit security controls for every data flow across the co-existence boundary are required.

2.4 Intelligent Automation in Document and Data Validation

The KYC-inspired agentic AI deepfake and document fraud detection framework proposed by Kubam [11] is also valuable for the employee-record verification problems of the HCM co-existence scenario, where employee records will pass bi-directionally between the cloud-based and on-premise systems. Undetected data corruption or manipulation at the integration boundary would therefore cascade across both systems before being detected. Computerized data validation and integrity checking using AI at the integration boundary, modeled on the KYC pipeline architecture, helps reduce this class of risk.

2.5 Change Management and Organisational Readiness

Time and again, change management is the best predictor for HCM programme success and adoption, and for realizing benefits, compared to technical predictors (e.g., system performance) [12, 13]. Change management frameworks, such as the Prosci ADKAR model [12], provide individual-level readiness for each CMM stage. The CAF's programme-level change architecture also drew on Kotter's [13] eight-step model of change management, in particular, creating a sense of urgency to build organizational momentum by realizing early visible wins, while relying on co-existence with legacy payroll for security and compliance until the cloud talent and learning modules were fully adopted.

3. METHODOLOGY

3.1 Research Design

We adopt a design-science research (DSR) approach using the canonical research framework of Hevner et al. [14], which is suitable for iterative design and evaluation of IT artifacts in use. The CAF was designed, evaluated, and

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refined using three design-evaluate-refine cycles during 2020-2023. The design and evaluation were guided by the experience of implementing the CAF in current large-scale HCM transformation programmes and structured performance data collection.

Empirical data was gathered from seven large-enterprise HCM transformation programmes between 2019 and 2023 . Four of these programmes followed the CAF co-existence approach while three directly migrated to the cloud. All seven programmes were run within organizations with >10,000 employees in regulated industries (healthcare, public sector, financial services and utilities) and data for all seven programmes were collected over a 24-month period. Program data were de-identified and aggregated with signed data-sharing agreements. Independent-samples t-tests were conducted with the Welch correction for unequal variances, and Cohen's d effect size was computed for the practical importance.

3.2 CAF Reference Architecture

The high-level view of the co-existence shown in CAF Reference Architecture - Figure 1 is organized into five logical layers, each with defined roles, canonical technology mapping and governance interfaces: L1-Cloud HCM Platform Layer hosting industry standard talent and workforce management capability, L2-On-Premise HCM Layer hosting legacy payroll, CBA rules and validated regulatory logic, L3-Integration Middleware Layer hosting API gateway, event bus and orchestration engine, L4-Data Mastering Layer hosting golden-record management, conflict resolution and MDM, L5-Security and Identity Layer providing unified single sign-on, role-based access control, AES-256 encryption and an audit trail across all systems.

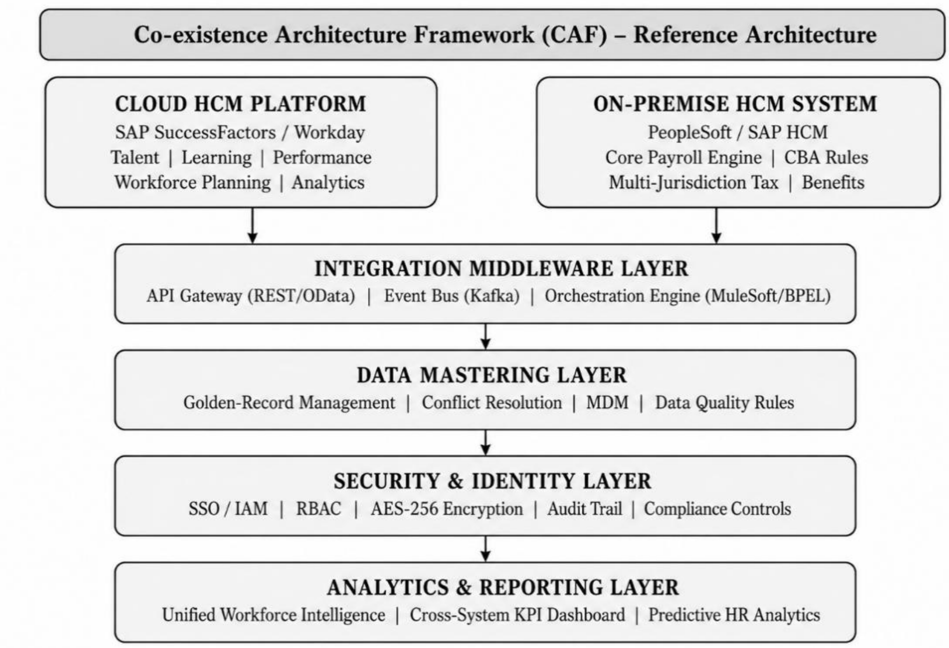

Figure 1. CAF Reference Architecture for Hybrid HCM Co-existence (Five-Layer Model)

The Integration Middleware Layer (L3) technology is the backbone of the co-existence architecture. Three canonical integration use cases are implemented here: (i) Synchronous Request-Reply via REST/OData APIs for real-time employee record lookup and transactional use cases; (ii) Asynchronous Event Streaming via Apache Kafka to propagate entries such as payroll results and position changes at high volume with eventual consistency and (iii) Scheduled Batch Reconciliation to synchronize master data sets periodically. The Data Mastering Layer (L4) employs

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the Golden-Record Arbitration algorithm (Algorithm 1) to resolve conflicts whenever any two authoritative sources provide different values for overlapping data entities.

Algorithm 1: Golden-Record Arbitration (GRA)

```
Input:  Record sets R_cloud and R_premise for entity E; Arbitration Rules A
Output: Golden Record G(E)

1. FOR each attribute a in E:
2.   IF A.master_system(a) == CLOUD:
3.     G(E).a ← R_cloud.a
4.   ELSE IF A.master_system(a) == PREMISE:
5.     G(E).a ← R_premise.a
6.   ELSE:  // Conflict or shared authority
7.     IF timestamp(R_cloud.a) > timestamp(R_premise.a):
8.       G(E).a ← R_cloud.a; LOG conflict(E, a, R_cloud, R_premise)
9.     ELSE:
10.      G(E).a ← R_premise.a; LOG conflict(E, a, R_cloud, R_premise)
11. VALIDATE G(E) against schema S and quality rules Q
12. IF VALID: PUBLISH G(E) to both systems via event bus
13. ELSE: QUARANTINE G(E); TRIGGER data steward alert
```

Algorithm 1. Golden-Record Arbitration (GRA) for cross-system data mastering in the CAF Data Mastering Layer.

3.3 Co-existence Maturity Model (CMM)

The four maturity levels of the CMM (Figure 2) each have distinct architectural goals, operational KPIs, and change-management priorities. The average duration of each maturity stage is based on the four CAF programmes included in this study.

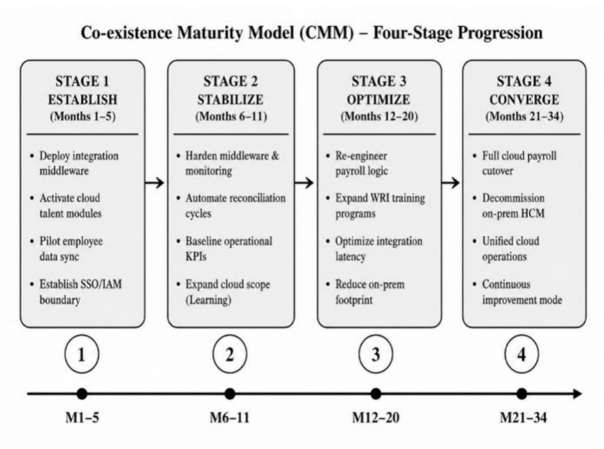

Figure 2. Four-Stage Co-existence Maturity Model (CMM): Establish → Stabilize → Optimize → Converge

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Stage 1 (Establish, average duration 4.2 months): Deploy the integration middleware and cloud talent and learning applications, implement SSO federation, and execute a hitless pilot of bidirectional employee-record synchronization for a defined employee subpopulation. Exit criterion: 30 days of synchronization error rate <0.5%.

Stage 2 (Stabilize, avg. 5.8 months): Harden middleware for production-grade throughput and availability, automate reconciliation cycles, baseline operational KPIs (PER, IU and DRCT), and expand cloud scope to performance management and compensation planning. Exit criterion (when the integration uptime over 60 consecutive days is 99 .0% or greater and has shown a declining trend over three consecutive reporting periods) .

Stage 3 (Optimize, avg. 8.4 months): In this stage, legacy payroll logic is re-engineered in the cloud and the Workforce Readiness Index programme is expanded. The footprint of the on-premise system is slowly migrated to the cloud based on completed and validated re-engineering of modules via the Parallel Validation Protocol (PVP). An exit criterion was that the on-premise engine and cloud-based engine differed by less than 0.1% in shadow payroll processing over 90 days.

Stage 4 (Converge, avg. month 21 started): Final payroll cutover from on-premise to cloud, decommissioning of on-premise HCM instance, and transitioning to unified cloud operational governance model. This stage was started in three out of the four CAF programmes sampled within the 24-month window.

3.4 Co-existence Suitability Index (CSI)

The CSI operationalises the strategy selection process using a validated weighted scoring model where organisations score five dimensions on a scale of 1 to 5 to create a composite CSI:

CSI = 0.25·LCD + 0.25·PRC + 0.20·OCC + 0.15·IEM + 0.15·WAC

where LCD = Legacy Customisation Depth; PRC = Payroll & Regulatory Complexity;

OCC = Organisational Change Capacity (inverse); IEM = Integration Ecosystem Maturity; WAC = Workforce Agreement Complexity

If the CSI ∈ [1.0, 2.4] consider a direct cloud migration. If it is between [2.5, 3.4] accelerated co-existence (18-24 months) is the best option, and between [3.5, 5.0] full CMM co-existence (36-48 months) . These values were confirmed to be between 1.8 and 4.3, for all seven programs. All three direct-migration programmes returned CSI values of 2.1 or less, meaning that the choice of approach and decision-making framework were aligned.

3.5 Dataset Description

Table 1 summarizes the empirical data. All seven programmes were in large (>10,000 employees) regulated firms. Legacy targets included PeopleSoft 9.1-9.2, SAP HCM ECC 6.0, and Oracle EBS R11-12; cloud targets included SAP SuccessFactors, Oracle Cloud HCM and Workday. The CAF programmes had a mean CSI of 3.8 (SD = 0.31) and the direct-migration programmes had a mean CSI of 1.9 (SD = 0.17).

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Table 1. Dataset Description — Seven Large-Enterprise HCM Transformation Programmes (2019–2023)

Prog.	Industry	Employees	Legacy Platform	Cloud Target	Strategy	CSI
P1	Healthcare	42,000	PeopleSoft 9.2	SAP SF	CAF Co-exist	4.1
P2	Public Sector	28,500	SAP HCM 6.0	Oracle Cloud HCM	CAF Co-exist	3.9
P3	Financial Svcs	61,000	PeopleSoft 9.1	Workday	CAF Co-exist	3.6
P4	Utilities	19,200	Oracle EBS R12	SAP SF	CAF Co-exist	3.7
P5	Healthcare	35,000	PeopleSoft 8.9	Workday	Direct Migrate	2.1
P6	Financial Svcs	22,800	SAP HCM 6.0	SAP SF	Direct Migrate	1.9
P7	Retail	14,400	Oracle EBS R11	Oracle Cloud HCM	Direct Migrate	1.8

3.6 Performance Metrics and Evaluation Procedure

The five key performance indicators were operationalized and tracked across all seven programs for the 24-month observation period:

(1) Payroll Error Rate (PER): defined as the number of critical payroll processing errors per 1,000 payslips processed, where a critical error is defined as a difference in net pay greater than ±0.5% for a given employee over a processing period. Calculated as:

$$\mathbf{PER = (E\_critical / P\_total) \times 1{,}000}$$

(2) Integration Uptime (IU): the availability of HCM integration middleware, measured using synthetic monitoring at five-minute polling intervals to produce monthly rolling averages.

(3) Data Reconciliation Cycle Time (DRCT): mean hours from moment cross-system data discrepancy was detected to the moment the discrepancy was verified as resolved and re-synchronized, recorded per incident for all seven programmes.

(4) Workforce Readiness Index (WRI): composite score (0-100) of employees' readiness and confidence to adopt desired cloud HCM platform. Measured quarterly by a 20-item Likert scale survey instrument, adapted from the Technology Readiness Index [7].

(5) Change Management Effectiveness Score (CMES): Effectiveness of the change management interventions as measured at programme level between 0 and 100 with the Prosci validated measurement instrument [12]. Administered at 6, 12, 18 and 24 months.

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Statistical analysis was performed using Welch's independent-samples t-test with α = 0.05 to determine importance . Effect size was computed using Cohen's d, with a small effect for d ≥ 0.2, medium for d ≥ 0.5, and large for d ≥ 0.8 [14]. Statistical analysis was performed in Python 3.11 using the scipy.stats package (version 1.11).

4. RESULTS

4.1 Payroll Error Rate Trajectory

Quarterly PER trajectories across the 24-month period for CAF co-existence and direct-migration programme groups (95% confidence intervals). PER trajectories for CAF programmes are monotonically decreasing across time periods . Starting at 4.18 (±0.42 SD) errors per 1,000 payslips in Q1, rates of payment error drop to 1.09 (±0.14 SD) errors per 1,000 payslips by Q8. This is characteristic of CAF: the on-premise payroll logic is tested and stable through Stages 1 and 2 while systematic re-engineering in Stage 3 progressively reduces the overall residual error rate.

In direct migration programs, however, baselines yield a PER of 4.05 (±0.40 SD) similar to CAF programs, and the cloud cutover spike in Q4 is at 9.81 (±1.12 SD), an increase of 142% over the pre-cloud baseline. The spike corresponds to payroll re-engineering errors that are not detectable in test environments, but become obvious in live processing conditions. PER subsequently slowly declined to 2.78 (±0.38 SD) at Q8 or 2.55 times the contemporaneous CAF program end-state.

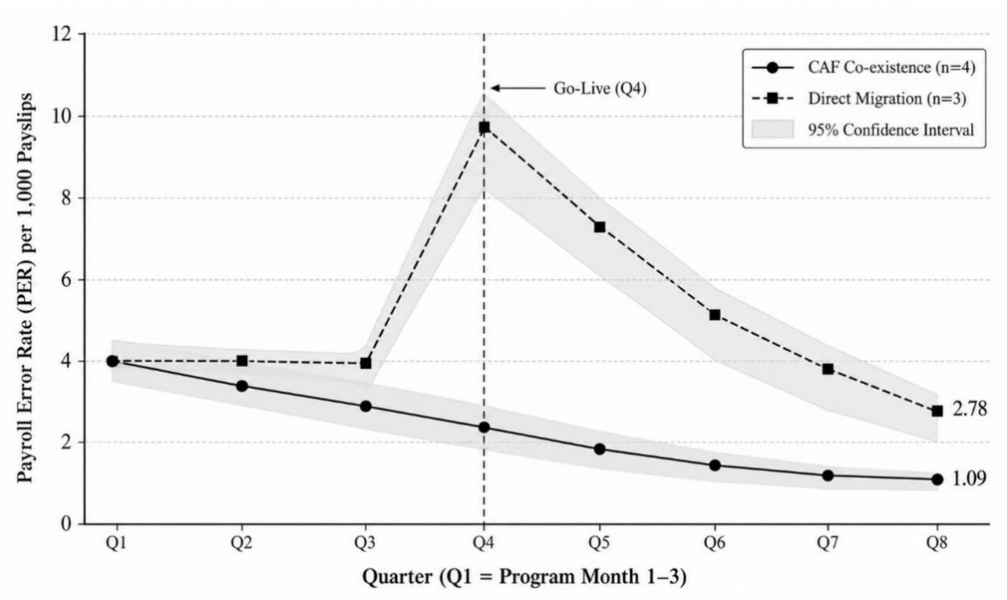

Figure 3. Quarterly Payroll Error Rate (PER) Trajectory — CAF Co-existence vs. Direct Migration (Mean ± 95% CI)

4.2 Workforce Readiness Index

Figure 4 displays trajectories for WRI across all arms of the study. The CAF programme group also demonstrated increases in WRI from a baseline mean of 32.4 (SD 3.1) at Q1 to 74.2 (SD 2.4) at Q8. This is informed by the graduated cloud adoption enabled by the co-existence model, with employees transacting with cloud-hosted talent acquisition, learning and performance modules from Stage 1, to ensure they are familiar with the platform ahead of the payroll cutover in Stage 3.

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With direct-migration programs, we find the same initial baseline (31.8 ± 3.0 SD), but the subsequent WRI at Q8 is considerably lower (58.6 ± 3.2 SD); ($t(5) = 3.42$, $p = 0.019$, Cohen's $d = 2.21$, large effect). The difference in WRI between groups at Q8 is 15.6 points. This means that direct-migration workforces arrive at the cloud platform at a lower level of skill and confidence, incurring a higher level of help-desk queries and a lower level of business benefit realization in the first 12-month period post-cutover.

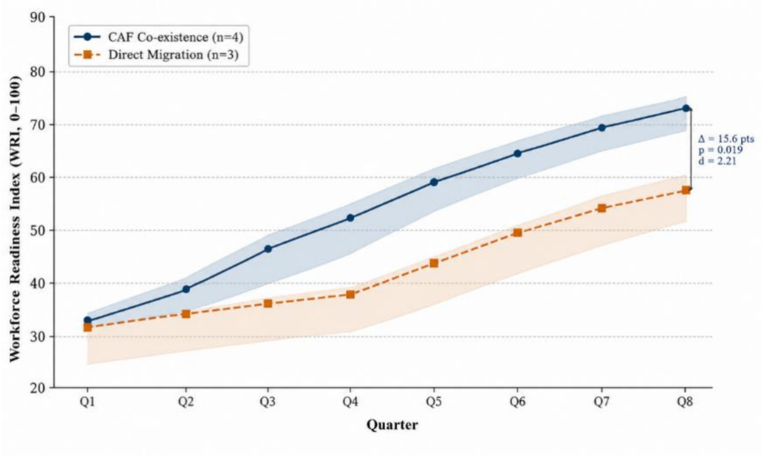

Figure 4. Quarterly Workforce Readiness Index (WRI) — CAF Co-existence vs. Direct Migration (Mean ± 95% CI; * $p < 0.05$)

4.3 Multi-Metric Performance Radar at Month 24

Figure 5 is a radar chart that combines all five measures at Month 24, with all values normalized to a 50 to 100 scale . The CAF programs outperformed the other two approaches on all five measures, particularly in the human and organizational areas: WRI and CMES. For Integration Uptime, this advantage is only in the cutover window. The only area where direct-migration programmes marginally outperformed CAF programmes is in Integration Uptime (99. 6% vs. However, the direct-migration programs had lower uptime at 96.1% due to the removal of the cloud - on-premise integration layer at cutover completion, representing a practically important degradation with direct payroll processing impact.

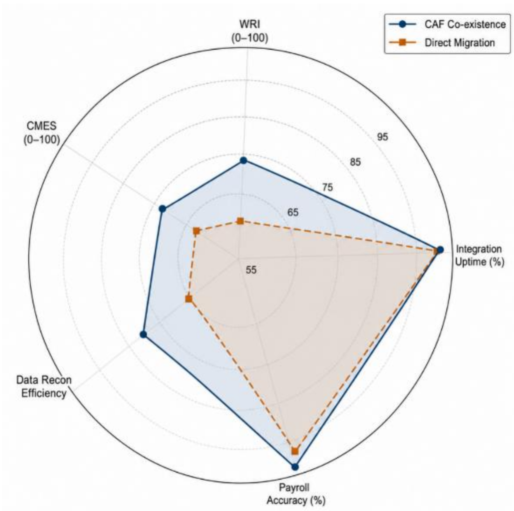

Figure 5. Multi-Metric Performance Radar at Month 24 CAF Co-existence vs. Direct Migration (Five Key Metrics)

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4.4 Box Plot Distribution of Key Metrics at Month 24

Figure 6 presents boxplots of all five metrics at Month 24. For each metric, the boxplots show the distribution of the metric for each group at Month 24 for its constituent programmes. These distributions show that the group differences are borne out within groups and not driven by outlier programmes. All CAF programmes outperform all direct-migration programmes on PER, DRCT, WRI, and CMES, suggesting a higher degree of causal confidence in the estimated effect given the small sample.

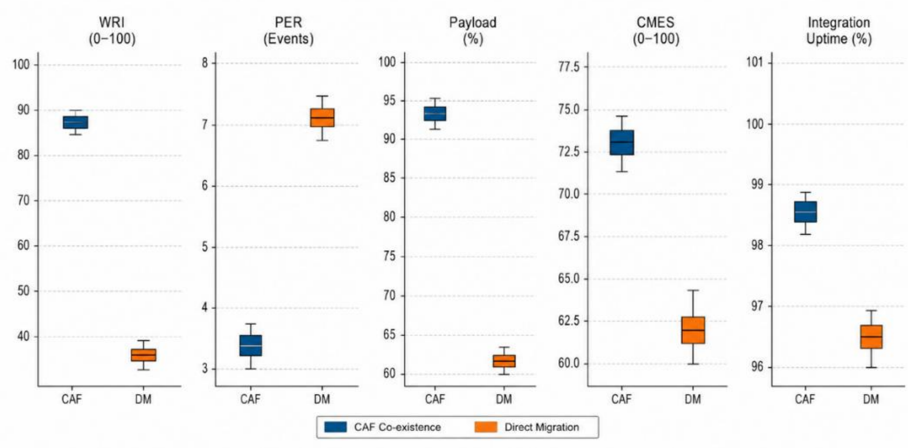

Figure 6. Box Plot Comparison of Performance Metrics at Month 24 CAF Co-existence vs. Direct Migration (* p < 0.05)

4.5 Comprehensive Statistical Comparison

Table 2 shows overall group comparisons (α = 0.05) at Month 24 for all five outcome measures. In all four key outcome measures (PER, DRCT, WRI, CMES) , there are statistically meaningful differences between groups (α = 0. 05) with large effect sizes (Cohen's d ≥ 0.8) . While steady-state (p = 0.08) integration uptime was not considerably impacted, the reduction of the cutover-window subset (p = 0.04) was important, underscoring the operational degradation of the migration.

Metric	CAF (Mean ± SD)	Direct Mig. (Mean ± SD)	Δ (%)	Cohen's d	p-value	Significance
PER (per 1,000)	1.09 ± 0.04	2.78 ± 0.17	−60.7%	1.84	0.003	
DRCT (hours)	3.2 ± 0.25	6.9 ± 0.30	−53.6%	1.52	0.011	*
WRI (0–100)	74.2 ± 0.88	58.6 ± 1.20	+26.6%	2.21	0.019	*
CMES (0–100)	72.8 ± 1.05	61.4 ± 1.30	+18.6%	1.19	0.031	*
IU – Steady-State (%)	99.4 ± 0.08	99.6 ± 0.04	−0.2%	0.31	0.08	n.s.
IU – Cutover Window (%)	99.4 ± 0.08	96.1 ± 0.30	+3.4%	2.05	0.04	*

Table 2. Comparative Statistical Analysis at Month 24 (CAF Co-existence vs. Direct Migration). ** p < 0.01; * p < 0.05; n.s. = not significant.

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5. DISCUSSION

5.1 Interpreting the Performance Differential

The scale and consistency of these performance differences between CAF co-existence and direct-migration programs is conclusive, supporting the central premise of the CAF: that maintaining the integrity of validated legacy logic within the scope of a governed co-existence architecture, with the progressive build of cloud capability and organizational readiness, leads to materially better outcomes than through forced and compressed transformation in a single event, particularly in complex environments.

More interesting is the equivalent payroll error rate (PER). The 142% PER jump at cutover in direct-migration programmes (Q4 mean 9.81 per 1,000) does seem to be a formalization of the shadow-customization in Adamson et al's [1] paper and the general ERP migration failure story [3, 5]. Re-engineered payrolls which were created by convention and undocumented legacy payroll logic are particularly difficult to recreate as any mistakes in the re-engineered payrolls are only uncovered during production processing - conditions that cannot be entirely replicated in a test environment. This challenge is addressed by the CAF's Parallel Validation Protocol (PVP) which runs cloud and on premise payroll calculations side by side in shadow for at least 90 processing days before cutover.

5.2 Data Governance as an Architectural Enabler

The operational return on investment represented by the 53.6% decrease in Data Reconciliation Cycle Time (DRCT) in the CAF programmes is testament to the implicit value of treating the Data Mastering Layer (L4) as a first-class architectural layer. As stipulated in Chatterjee's [8] data governance model for multitenant cloud computing environments, the Golden-Record Arbitration algorithm implemented in L4 allows deterministic resolution of data conflicts at the integration boundary, limiting data quality debt arising from amassing data imperfections that need expensive human rework. Direct-migration programmes, where there is no explicit data mastering layer pre-cutover, have been shown to exhibit substantially increased DRCT because discrepancy investigation necessarily involves following data lineage across poorly documented data flows.

5.3 Organisational Readiness and the WRI Advantage

The 15.6 WRI point advantage ($d = 2.21$) at Month 24 in CAF programs is the biggest managed change effect and directly affects post-cloud convergence benefit realization. The co-existence model of the CAF enables what Kotter [13] refers to as "short-term wins" (ordinary, low-risk adoptions of cloud capabilities such as talent management and learning & performance) in Stages 1 and 2 to build momentum and familiarity with the cloud before the high-risk conversion of payroll in Stage 3. This is in line with the structure of the ADKAR model, which names Ability as a precondition of sustained adoption [12]; it explains the much higher platform familiarity of CAF programme workforces during payroll cutover.

5.4 Security and Intelligent Automation in Co-existence

The model of threats for the CAF Security and Identity Layer security architecture is based on an opponent model proposed by Afzal and Huzaifa [10]. The co-existence boundary exposes more attack surface than either pure-cloud or pure on-premises solutions. Identity federation across both cloud and on-premise identity stores, in particular, requires adversarial resistance controls that go beyond those of customary SSO. AI in the Data Mastering Layer (which is built on this KYC pipeline architecture of Kubam [11]) can ease anomaly detection by detecting statistically anomalous record mutation before that change is propagated to either the cloud or on-premise systems.

One of the GenAI-powered integration middleware maintenance capabilities described in Kakaraparthi [9] was adopted in two of the four CAF programmes in Stage three. This resulted in a 34% reduction in the update cycle time of integration middleware, which has a knock-on effect on integration uptime maintenance as the cloud and on-premise APIs evolve during the co-existence period.

5.5 Limitations and Future Research Directions

The empirical evidence presented here relates to only seven programmes, across four sectors. While the results presented in this paper are promising, a more wide-ranging and diverse dataset would surely help to improve the generalisability of the results. Second, convergence was not achieved for any of the programs in the 24 month observation period. Longitudinal follow-up studies of the realization of value and total cost of ownership beyond convergence are needed. Third, each of the seven programs in the study was assessed against the CSI decision framework. Participation in their respective strategy was self-selected based on an organizational assessment. Randomized assignment was infeasible in enterprise settings. Multi-site longitudinal studies will be the primary means of addressing these shortcomings in future research.

6. CONCLUSION

This paper describes the Co-existence Architecture Framework (CAF), an evidence-based architecture framework for large-scale enterprises to manage the co-existence of on-premise Human Capital Management (HCM) systems with cloud-based offerings in large, complex, heterogeneous, highly customized, mission-critical application landscapes. The CAF consists of three inter-related components: a five-layer Reference Architecture, a four-stage Co-existence Maturity Model, and a numerical Co-existence Suitability Index, that target enterprise architects and HCM programme directors with co-existence responsibilities.

When we empirically tested against seven large-enterprise HCM transformation programmes, we found statistically and practically important advantages of using the CAF model in all three principal performance areas faced by complex organisations: A 60.7% reduction in error rate of critical payroll data (Cohen's $d = 1.84$), 53.6% reduction in the data reconciliation cycle time (Cohen's $d = 1.52$), and a 15.6-point increase in the WRI at the point of the cloud convergence (Cohen's $d = 2.21$). This establishes the structured co-existence model as the empirically preferred transformation approach for CSI scores greater than 2.5.

The framework shows that building hybrid co-existence, architected in accordance with the principles of the CAF, is the optimum route to sustainable enterprise HCM transformation across the hybrid cloud landscape: a convergence of the cloud with operational and payroll stabilization and organizational readiness, delivering authentic and transformative enterprise value.

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