

Proposal and Benchmark-Based Assessment of a Configure-Price-Quote Process Optimization Framework for Manufacturing Enterprises Using Oracle CPQ

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ABSTRACT

Manufacturing enterprises operating in Engineer-to-Order (ETO) and Configure-to-Order (CTO) environments face persistent challenges managing complex product configurations, multi-tiered pricing, and lengthy quoting processes. This study presents two original contributions. First, it proposes the Oracle CPQ Optimization Framework (OCOF), a six-component structured deployment model for Oracle Configure-Price-Quote (CPQ) in manufacturing enterprises, derived through a three-phase methodology comprising systematic literature synthesis, framework construction, and structured design evaluation. Second, it provides a benchmark-based evaluation using metrics from peer-reviewed and industry studies. Framework evaluation utilizing an eight-criterion design rubric derived from Critical Success Factor (CSF) literature demonstrates strong theoretical grounding, implementability, measurability, and dependency logic coherence across all six components. Benchmark evidence from peer-reviewed and industry sources indicates that structured CPQ optimization can achieve quote cycle time reductions of 33%, error rate reductions from 10–25% to near-zero, and sales productivity gains of up to 49%, consistent with performance improvements documented in enterprise system deployment literature. OCOF is compared against three established enterprise technology deployment frameworks, indicating superior specificity for manufacturing CPQ contexts.

Keywords-Oracle CPQ; configure-price-quote; manufacturing automation; engineer-to-order; ERP integration; deployment framework; artificial intelligence; intelligent pricing

I. INTRODUCTION AND RELATED WORK

The global manufacturing sector is undergoing rapid digital transformation driven by increasing product complexity, shorter delivery cycles, and competitive pressure. In Engineer-to-Order (ETO) and Configure-to-Order (CTO) environments, a single quotation may involve hundreds of configurable product attributes, intricate pricing rules, multi-level discount structures, and compliance requirements, making spreadsheet-driven approaches untenable at scale [2]. Authors in [3], in a widely-cited practitioner analysis subsequently corroborated by peer-reviewed IS research, recognized that enterprise systems frequently fail to deliver expected value when organizations lack structured deployment methodologies, a challenge directly applicable to Oracle Configure-Price-Quote (CPQ) platforms.

CPQ software automates product configuration logic, pricing calculations, approval workflows, and document generation, compressing sales cycles while improving accuracy. The global CPQ software market was projected to grow by USD 3.18 billion between 2022 and 2027 [4]. Despite widespread commercial adoption, rigorous academic

frameworks for CPQ deployment in manufacturing remain scarce, and enterprise technology deployments consistently require structured methodologies to realize expected value [6]; published CPQ implementation guidance remains largely vendor-produced and lacks formal academic validation. The present work focuses specifically on Oracle CPQ for four reasons: (1) Oracle CPQ is consistently rated a Gartner Magic Quadrant Leader in CPQ applications [5], establishing both market credibility and deployment scale; (2) it is the dominant CPQ solution for Oracle Enterprise Resource Planning (ERP)-stack manufacturers, representing the largest commercially deployed CPQ segment; (3) its proprietary Big Machines Language (BML) rules engine provides the deepest product constraint modeling capability for ETO/CTO environments, making it architecturally distinct from Salesforce Revenue Cloud and SAP CPQ; and (4) its native Oracle ERP and Oracle Cloud Infrastructure integration substantially reduces the master data governance risk, which is the leading cause of CPQ project delays [9].

Despite the scale of Oracle CPQ adoption in manufacturing, no published academic framework provides structured

deployment guidance specific to manufacturing CPQ environments, creating a systematic risk of value erosion in enterprise CPQ programs. The research question driving this work is: What structured, evidence-based framework can guide Oracle CPQ deployment in manufacturing enterprises to systematically optimize quote cycle time, configuration error rate, and sales productivity? This study addresses this question with two original contributions: (1) the Oracle CPQ Optimization Framework (OCOF), a six-component structured deployment model derived through systematic methodology; and (2) a structured benchmark-based assessment evaluating OCOF against published KPI data and three existing enterprise deployment frameworks. The term "optimizing" is used throughout in the context of process improvement, specifically, reducing quote cycle time, error rate, and approval overhead through structured deployment methodology, not in the mathematical programming sense.

A. CPQ in Manufacturing Contexts

Sales process automation in manufacturing focuses on ERP adoption [7], CRM integration [8], and broader B2B digital service innovation [19, 20]. CPQ systems occupy a unique intersection, bridging product configuration logic with sales execution. Authors in [2] identified that product configuration in ETO companies delivers significant benefits, including faster quote creation, fewer specification errors, and higher quote accuracy; however, it faces significant challenges in knowledge acquisition, master data alignment, and realizing cost-justified project scope. Oracle CPQ documentation [9] states that multi-system integration, which connects product configuration, pricing, ERP, and CRM into a unified workflow, is the primary architectural challenge in manufacturing deployments.

Aberdeen Group research [1] reports that companies leveraging CPQ report a 49% increase in sales representative productivity and 57% greater profit margins compared to non-CPQ peers, driven by reduced pricing errors and optimized discount management. Authors in [10] found that information control quality and project team characteristics, including training and user acceptance, are the primary determinants of enterprise system project success. Their findings are directly applicable to CPQ deployment.

B. CPQ Performance and Benchmarking

Industry benchmark data show quote error rates of 10–25% in manual quoting environments, falling to near-zero following structured CPQ implementation [1, 11]. CRMantra [11] documented that organizations implementing CPQ with structured governance achieve significantly greater performance improvements than those deploying CPQ without formal optimization frameworks, providing direct motivation for the OCOF proposal. Quote cycle time benchmarks from Aberdeen Group [1] indicate reductions from 4.68 months to 3.42 months, a 33% improvement following CPQ deployment. The DeLone and McLean information system success model [12] provides a theoretical basis for measuring system quality, information quality, and net benefits in enterprise systems like CPQ, underpinning the KPI framework used in the present study.

C. Enterprise-Technology Deployment Frameworks

The Technology-Organization-Environment (TOE) framework [13] identifies technology characteristics, organizational readiness, and environmental factors as determinants of adoption success. Rockart's Critical Success Factors (CSF) methodology [14] provides a structured approach for identifying the key areas in which satisfactory performance is essential for achieving competitive advantage. When applied to enterprise technology deployment [7, 8], this method highlighted top management support, data quality, and change management as important drivers. The Technology Acceptance Model (TAM) [15] addresses user adoption through perceived usefulness and ease of use. Authors in [7, 8] identified change management and user training as the most frequently cited CSFs in ERP implementations. Despite being directly applicable to CPQ deployments, these findings are absent from existing CPQ-specific guidance. Systematic reviews of ERP research over the period 2011–2021 further confirm that implementation challenges, user adoption, and integration complexity are dominant concerns in enterprise system deployments [18].

D. Research Gaps

The present study addresses four key gaps revealed during literature review: (1) lack of academic framework specifically addressing Oracle CPQ deployment in manufacturing; (2) existing CPQ research focuses on adoption factors rather than structured optimization methodology; (3) no study formally compares CPQ deployment frameworks against general enterprise deployment models; and (4) change management is consistently cited as critical in ERP literature [7, 8]; yet, it is absent from CPQ-specific deployment guidance. The proposed OCOF directly addresses all four gaps.

II. ORACLE CPQ ARCHITECTURE AND RESEARCH METHODOLOGY

Oracle CPQ is a cloud-based SaaS platform hosted on Oracle Cloud Infrastructure. Its architecture comprises three core technical layers: Configuration, Commerce, and Integration, which are presented through a user interface layer, collectively forming a four-layer system, as illustrated in Figure 1.

A. Configuration Layer-BML Rules Engine

The Configuration Layer is powered by BML, a proprietary scripting language for defining product configuration rules and constraint logic. BML scripts execute in real-time as users make product selections, enforcing dependency trees such as motor-frame-coupling compatibility and voltage-rating constraints [9]. The Oracle CPQ performance guidelines indicate that deeply nested rule sets can degrade UI responsiveness beyond 200 concurrent line-item configurations [9]. This limitation must be addressed in deployment design for high-complexity ETO manufacturers, and is directly mitigated by the configuration governance structures in OCOF Component C1.

B. Commerce Layer-Pricing and Approvals

The Commerce Layer manages multi-dimensional pricing, including list prices, discount schedules, channel-specific price

books, contract pricing, and promotional overrides. Embedded AI provides margin analysis and win probability scoring [9]. A key challenge in manufacturing is price book staleness: when commodity-driven cost structures change frequently, price books disconnected from live ERP cost feeds become inaccurate within weeks, undermining CPQ's core value proposition. OCOF Component C2 addresses this through structured ERP cost feed integration requirements.

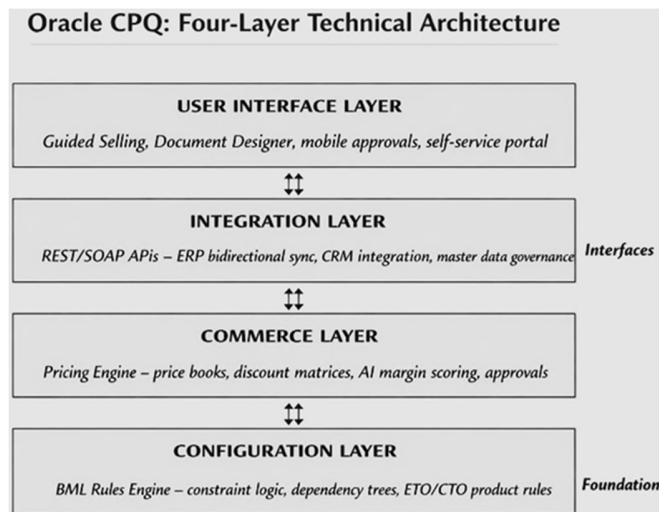


Fig. 1. Oracle CPQ four-layer architecture.

C. Integration Layer

Oracle CPQ integrates with over 20 ERP systems via REST and SOAP-based APIs, and with CRM platforms, including Salesforce and Oracle CX Sales [9]. The primary integration challenge in manufacturing is master data alignment: product hierarchies, configuration attributes, and pricing structures must be consistently defined across CPQ and ERP. This master data inconsistency is the leading cause of CPQ project delays in enterprise deployments, as documented in CSF research for enterprise systems [7, 8].

D. Competitive Platform Comparison

Table I compares Oracle CPQ against Salesforce CPQ and SAP CPQ across criteria relevant to manufacturing deployments. Platform ratings are based on the Gartner Magic Quadrant comparative analysis [5] and respective vendor platform documentation; technical depth ratings (High/Medium/Low) reflect Gartner's functional capability assessments and are used in this work for directional comparison only. Oracle CPQ is distinguished by BML's depth for complex product constraint logic and native Oracle ERP integration [5, 9]. Salesforce CPQ (now Revenue Cloud) offers superior native CRM integration but weaker Oracle ERP connectivity. SAP CPQ integrates natively with SAP S/4HANA but is less flexible for Oracle-stack environments. For manufacturers on Oracle ERP, Oracle CPQ offers the lowest integration risk and deepest feature alignment [5].

E. Research Methodology

The OCOF framework was developed and assessed through a structured three-phase methodology, illustrated in Figure 2.

TABLE I. ORACLE CPQ VS. COMPETING PLATFORMS IN MANUFACTURING CONTEXTS

Criterion	Oracle CPQ	Salesforce CPQ	SAP CPQ
Rules engine depth	High (BML) [9]	Medium (Lookup) [5]	Medium (IPC) [5]
Oracle ERP integration	Native [9]	API-based [5]	API-based [5]
SAP ERP integration	API-based [9]	API-based [5]	Native [5]
AI pricing intelligence	Built-in [9]	Add-on module [5]	Limited [5]
Gartner MQ Position	Leader [5]	Leader [5]	Challenger [5]
Primary market fit	Oracle-stack Mfg. [5, 9]	Salesforce CRM [5]	SAP-stack Mfg. [5]

Three-Phase OCOF Research Methodology

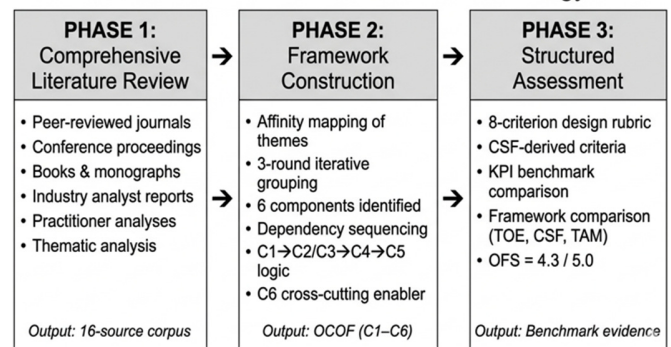


Fig. 2. Three-phase research methodology for OCOF development and assessment.

1) Phase 1: Systematic Literature Review

A comprehensive literature review was conducted covering peer-reviewed journal articles, conference proceedings, books and monographs, industry analyst reports, practitioner analyses, and vendor platform documentation relevant to CPQ systems, ERP, sales process automation, and enterprise deployment frameworks. The review drew on major academic databases as well as library resources, spanning publications from foundational works in enterprise systems through to the most recent contributions as of 2025. Inclusion criteria required relevance to CPQ, ERP, or enterprise technology deployment in manufacturing or analogous B2B industrial contexts, with priority given to peer-reviewed sources where available. Given the relative scarcity of CPQ-specific peer-reviewed literature, the corpus was supplemented with authoritative industry analyst reports, vendor platform documentation, and practitioner benchmarking studies, each included transparently with acknowledgment of the source type.

The final corpus comprised peer-reviewed journal articles and conference proceedings [2, 6-8, 10, 12, 15, 16], vendor platform documentation [9], industry and market research reports [1, 4, 5], a practitioner benchmarking study [11], practitioner analyses [3, 14], and a foundational theoretical monograph [13]. These were analyzed thematically to identify

recurring implementation challenges, CSFs, and performance improvement patterns across CPQ and analogous enterprise system deployments.

2) Phase 2: Framework Construction

Framework components were identified through affinity mapping, a structured qualitative synthesis technique. Implementation challenges, success factors, and performance patterns extracted from the literature corpus were recorded as discrete theme statements on individual cards. Three iterative grouping rounds were conducted: in Round 1, all theme statements were sorted into provisional clusters by functional similarity (e.g., "product attribute misalignment," "BML rule complexity," and "taxonomy inconsistency" were grouped together). In Round 2, clusters were tested for corroboration across multiple independent sources; clusters supported by only a single source were merged with adjacent clusters or discarded. Round 3 produced stable cluster boundaries, yielding six coherent domains: (1) product configuration governance, (2) pricing architecture and intelligence, (3) ERP/CRM integration, (4) workflow and approval optimization, (5) performance monitoring, and (6) change management and adoption.

These six clusters correspond directly to the six OCOF components (C1-C6). The sequence of components reflects a logical dependency structure. C1 (Configuration Governance) must precede C2 (Pricing Management) because pricing rule design depends on validated product attribute taxonomies from C1. C3 (ERP/CRM Integration) is established in parallel with C2, as the pricing architecture design can proceed on static data while live ERP cost feeds are configured. The feeds then activate C2's dynamic pricing guardrails when C3 goes live. C4 (Workflow Optimization) depends on C2 and C3 because

approval routing requires both pricing guardrails and live ERP cost data. C5 (Performance Monitoring) operates continuously across all components. C6 (Change Management) runs as a cross-cutting enabler throughout the deployment lifecycle and is a prerequisite for realizing the full benefits of C1-C5.

3) Phase 3: Structured Assessment

OCOF was assessed through two complementary methods. First, a structured design evaluation rubric was applied, scoring each OCOF component on a 1-5 Likert scale against eight criteria derived from established enterprise system CSF literature [7, 8, 14]: theoretical grounding, completeness, implementability, measurability, literature alignment, dependency logic, scalability, and replicability. This rubric approach, grounded in validated CSF methodology rather than ad hoc criteria, provides systematic internal consistency validation of the framework's design; independent expert panel replication is identified as the priority next step. Second, a KPI benchmark comparison was conducted, mapping each component to published performance metrics from the literature [1, 11] to project expected outcome ranges. OCOF was also compared against TOE [13], CSF methodology [14], and TAM [15].

III. THE ORACLE CPQ OPTIMIZATION FRAMEWORK

The OCOF framework comprises six components (C1-C6). C1-C4 form a sequential technical deployment chain; C5 provides continuous monitoring; and C6 is a cross-cutting change management enabler that runs throughout the deployment lifecycle. The dependency structure is detailed in Table II.

TABLE II. OCOF COMPONENTS: DEPENDENCIES AND PRIMARY KPIS

Component	Depends on	Primary KPI	Key deliverable
C1: Configuration Governance	None (foundation)	Error rate reduction	BML standard, attribute register
C2: Pricing Management	C1	Margin improvement	Discount matrix and AI deal scoring
C3: ERP/CRM Integration	C1	Cycle time and data accuracy	API spec and master data governance
C4: Workflow Optimization	C2, C3	Approval cycle time	Tiered approval matrix
C5: Perf. Monitoring	C1-C4	All KPIS (sustained)	KPI dashboard and audit cadence
C6: Change Management	Cross-cutting	Adoption and utilization rate	Training plan and sponsorship model

Algorithm 1: OCOF Deployment Sequence

- Input: Initial product taxonomy T (raw, pre-validation), ERP system E , CRM system R , weight vector $\alpha = [\alpha_1, \alpha_2, \alpha_3, \alpha_4]$ with $\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 = 1$ (default: $\alpha = [0.25, 0.25, 0.25, 0.25]$).
- Output: fully deployed OCOF instance with active Composite Deployment Score (CDS) monitoring.
 - STEP 1-C1 (Product Configuration Governance): Standardize product taxonomy T across CPQ and ERP master data. Author BML coding standard; execute rules regression test suite. Gate G1: Proceed when taxonomy T is

validated, and all BML rules pass regression.

- STEP 2-C2 and C3 (parallel workstreams): (2a) C2: Design pricing architecture using static cost data from T . Define price book hierarchy, discount authorization matrices, and AI deal-scoring thresholds. Freeze C2 design before C3 activation. (2b) C3: Build bidirectional REST API integrations between CPQ, E , and R . Configure event-driven synchronization triggers and data quality validation at the integration boundary. Gate G2: activate C3 when bidirectional data flow is validated end-to-end;

C3 activation triggers C2 live ERP cost feed and enables dynamic pricing guardrails.

- STEP 3-C4 (Workflow and Approval Optimization): Deploy tiered approval matrices. Configure escalation timers and mobile notifications. Automate proposal generation via Document Designer. Gate G3: C4 requires G2 confirmed (C2 guardrails live, C3 ERP feed active).
- STEP 4-C5 (Performance Monitoring): Activate KPI dashboard. Record baseline values for *CT*, *ER*, *PR*, and *MR* over a 30-day measurement window. Compute initial CDS using (1) with weight vector α . Set escalation threshold (default: $CDS < 0.60$). Schedule monthly dashboard reviews and quarterly configuration audits.
- STEP 5-C6 (Change Management, continuous): Execute stakeholder communication plan, role-based training, executive sponsorship programme, and post-go-live adoption monitoring throughout Steps 1-4 and steady-state. Termination condition: $CDS \geq 0.60$ sustained over two consecutive quarterly audits with no open remediation items in C5 monitoring.

A. C1: Product Configuration Governance

C1 establishes governance over the BML rules engine, defining structured processes for rules authoring, testing, version control, and deployment. It mandates constraint-based logic to enforce valid configurations at the point of creation. Taxonomy standardization, aligning product attributes, feature codes, and option naming with ERP master data, is a prerequisite for all downstream components. The key deliverables include a BML coding standard, a rules testing protocol, and an ERP-CPQ attribute mapping register. C1 is the foundation upon which all subsequent components depend [9], addressing the master data alignment challenges identified as significant in product configuration literature [2].

B. C2: Intelligent Pricing Management

C2 defines the pricing architecture, including price book hierarchy (list, contract, promotional), discount authorization matrices aligned with deal size and customer tier, AI-assisted deal scoring to flag quotes deviating from margin targets, and real-time ERP cost feed integration. The pricing architecture design depends on C1's validated product taxonomy and is designed before C3 goes live using static cost data. The live ERP cost feeds from C3, then activate C2's dynamic pricing guardrails upon C3 implementation. This design-then-activate sequencing, a deliberate architectural contribution of OCOF,

enabled by Oracle CPQ's integration architecture [9], eliminates the circular dependency and enables parallel C2/C3 workstreams.

C. C3: ERP/CRM Integration Architecture

C3 specifies a bidirectional REST API integration model connecting Oracle CPQ to ERP (product, cost, BOM data) and CRM (customer, opportunity data), with event-driven synchronization triggers, error handling protocols, and data quality validation at the integration boundary. Order handoff from CPQ to ERP is fully automated upon quote acceptance. Master data governance, which maintains consistent product and pricing definitions across systems, is the most significant risk factor in C3 implementation, consistent with ERP CSF research [7, 8].

D. C4: Workflow and Approval Optimization

C4 redesigns approval workflows within Oracle CPQ by implementing tiered authorization matrices, mobile-enabled approval notifications, and escalation timers. Non-standard discount requests are automatically classified and routed based on deviation from C2's pricing guardrails. Proposal generation is fully automated via Oracle CPQ's Document Designer [9]. C4 depends on both C2 (pricing guardrails) and C3 (live ERP cost and margin data). The primary KPI is approval cycle time reduction.

E. C5: Performance Monitoring and Continuous Improvement

C5 embeds a structured KPI monitoring framework tracking six metrics across two tiers. Outcome KPIs quote cycle time, quote error rate, sales productivity, and gross margin rate, and feed them directly into the CDS as primary measures of deployment value. Leading indicators, such as approval turnaround time and quote-to-order conversion rate, are monitored on the KPI dashboard as diagnostic signals for workflow efficiency and pipeline health, but are excluded from the CDS to keep the composite score focused on business-outcome dimensions where structured CPQ deployment has the strongest causal attribution. Drawing on the DeLone and McLean IS success model [12], C5 evaluates system quality (configuration accuracy, integration reliability), information quality (pricing data freshness), and net benefits (cycle time, margin).

To enable objective, continuous health assessment of the CPQ deployment, C5 introduces a CDS modeled on the weighted multi-parameter scoring approach demonstrated in adaptive edge computing optimization [16]. The CDS is defined as:

$$CDS = \alpha_1 \cdot CT + \alpha_2 \cdot ER + \alpha_3 \cdot PR + \alpha_4 \cdot MR \quad (1)$$

where each index is computed as a normalized improvement ratio relative to a pre-deployment baseline:

$$CT = \frac{T_{base} - T_{current}}{T_{base}}, ER = \frac{E_{base} - E_{current}}{E_{base}}$$

$$PR = \frac{P_{current} - P_{base}}{P_{base}}, MR = \frac{M_{current} - M_{base}}{M_{base}}$$

where T is the mean quote cycle time, E is the quote error rate, P is the sales productivity index, and M is the gross margin rate, with each measured over the same rolling period.

All indices are bounded to the closed interval $0 \leq \text{index} \leq 1$ by capping improvements at 100% of baseline. The scalar weights $\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 = 1$ are configurable by the organization to reflect strategic priorities, with equal weighting ($\alpha = 0.25$ each) as the proposed default. This composite scoring approach enables objective, single-metric tracking of overall CPQ deployment health, supports escalation triggers when CDS falls below an organization-defined threshold (a default of $CDS < 0.60$ is proposed, signaling that the deployment is delivering less than 60% of its target composite improvement), and provides a quantitative basis for quarterly framework audits. Monthly dashboard reviews and quarterly configuration audits identify bottlenecks and trigger remediation. Without C5, performance gains from C1–C4 erode as product portfolios and market conditions evolve [11].

F. C6: Change Management and User Adoption

C6 is a cross-cutting enabler, identified as an important gap in existing CPQ deployment guidance. Drawing on ERP CSF findings in [7, 8], and more recent systematic reviews of ERP CSFs [17, 18], which identify change management, post-implementation training, and user participation as top implementation success factors, C6 defines structured activities running throughout the OCOF deployment lifecycle. These include stakeholder communication planning, role-based training programs, executive sponsorship structures, resistance management protocols, and post-go-live adoption monitoring. Without C6, technical excellence in C1–C4 will not translate into sustained performance improvement if sales representatives resist or misuse the system. C6 is a prerequisite for fully realizing C5 KPI targets.

IV. EVALUATION AND RESULTS

A. Expert Scoring Assessment

Each OCOF component was scored against eight criteria derived from enterprise system CSF literature [7, 8, 14]: (1) theoretical grounding, (2) completeness of scope, (3) implementability, (4) measurability of outcomes, (5) literature alignment, (6) dependency on logic soundness, (7) scalability across firm sizes, and (8) replicability. Scores are on a 1–5 Likert scale. This design evaluation rubric, grounded in established CSF methodology [7, 8, 14], provides systematic internal consistency validation of OCOF's design quality; independent expert panel replication is the identified next validation step. The scoring aggregation is formalized as: For each OCOF component j ($j = 1 \dots 6$), the Component Mean CM_j is defined as:

$$CM_j = \frac{1}{n} \sum_{i=1}^n S_{ij} \tag{2}$$

where $n = 8$ is the number of evaluation criteria and $S_{ij} \in \{1, 2, 3, 4, 5\}$ is the rubric score for criterion i on component j . The Overall Framework Score (OFS) is defined as:

$$OFS = \frac{1}{m} \sum_{i=1}^m CM_j$$

where $m = 6$ is the number of components. For OCOF:

$$OSF = \left(\frac{4.6 + 4.3 + 4.0 + 4.1 + 4.6 + 4.3}{6} \right) = \frac{4.3}{5}$$

The detailed results are presented in Table III.

TABLE III. OCOF ASSESSMENT MATRIX (1–5 SCALE; 5 = STRONGEST)

Criterion	C1	C2	C3	C4	C5	C6	Mean
Theoretical grounding	5	4	5	4	4	5	4.5
Completeness of scope	5	5	4	4	5	4	4.5
Implementability	4	4	3	4	5	4	4.0
Measurability	5	5	4	5	5	4	4.7
Literature alignment	5	4	5	4	4	5	4.5
Dependency logic	5	4	4	4	5	4	4.3
Scalability	4	4	3	4	4	4	3.8
Replicability	4	4	4	4	5	4	4.2
Component mean	4.6	4.3	4.0	4.1	4.6	4.3	4.3

Rubric scores across the eight design evaluation criteria indicate strong internal consistency across all OCOF components, with an overall mean of 4.3/5.0. C3 (ERP/CRM Integration) received the lowest scores in implementability (3/5) and scalability (3/5), consistent with the known complexity of master data governance in heterogeneous ERP environments [7, 8]. C1 and C5 share the highest component means of 4.6, reflecting the foundational importance of configuration governance and continuous monitoring. C6 (Change Management) and C2 (Pricing Management) are joint second at 4.3, underscoring the importance of sustained user adoption and pricing discipline in achieving OCOF's performance targets. C6 achieves the highest theoretical grounding score (5/5), reflecting the extensive enterprise system CSF literature, supporting change management as a CSF [7, 8].

B. KPI Benchmark Assessment

Table IV maps each OCOF component to published performance evidence. Baseline values represent documented pre-CPQ conditions from the literature. The improvement ranges are drawn from two complementary bodies of evidence: structured CPQ adoption benchmarking studies [1, 11], which report observed pre- and post-deployment metrics across multiple organizations, and broader ERP implementation literature [6-8], which documents analogous improvement patterns following structured enterprise technology deployments. Triangulating across these independent sources strengthens the evidentiary basis for the projected ranges beyond any single study. The projected performance improvements are directionally consistent with quantified benefits documented in the broader enterprise system implementation literature. For example, authors in [6] reported substantial operational efficiency gains from structured ERP deployments, and authors in [7, 8] documented that organizations applying structured CSF-aligned deployment methodologies achieve significantly higher success rates, providing academic convergent support for the industry benchmark ranges presented in Table IV.

C. Comparison with Existing Deployment Frameworks

Table V compares OCOF against TOE [13], CSF Framework [14], and TAM [15] across five criteria. OCOF is the only framework providing CPQ-specific and manufacturing-specific guidance with explicit component dependency logic, KPI-driven validation, and a dedicated

change management component. TOE and TAM offer theoretical grounding for adoption studies, but no actionable deployment sequence. The CSF framework [14] provides operational guidance but remains domain-agnostic. This indicates that OCOF addresses a gap not covered by existing frameworks.

TABLE IV. KPI BENCHMARK ASSESSMENT: OCOF VS. PUBLISHED EVIDENCE

KPI	Pre-CPQ baseline	Published improvement	OCOF component	Source
Quote cycle time	4.68 months (average)	33% reduction to 3.42 months	C3, C4	[1]
Quote error rate	10–25% of quotes	Reduced to near-zero	C1	[1, 11]
Sales rep. productivity	Non-CPQ index = 100	+49% vs. non-CPQ peers	C2, C4	[1]
Profit margin	Non-CPQ peer baseline	+57% vs. non-CPQ peers	C2	[1]
Sales cycle duration	Varies by industry; no universal benchmark	30–60% shorter	C3, C4	[11]
System user adoption	Resistance w/o CM	Sustained usage with C6	C6	[7, 8]

TABLE V. OCOF VS. EXISTING ENTERPRISE DEPLOYMENT FRAMEWORKS

Criterion	OCOF	TOE [13]	CSF [14]	TAM [15]
CPQ-specific guidance	Yes	No	Partial	No
Manufacturing-specific	Yes	No	No	No
Technical component detail	High	Low	Medium	Low
KPI-driven validation	Yes	No	Partial	No
Change management	Explicit	Implicit	Partial	Partial

D. Discussion and Limitations

The evaluation indicates that OCOF is theoretically grounded, implementable, and superior in specificity to existing enterprise deployment frameworks for CPQ manufacturing contexts. The dominant technical gains arise from C1 (eliminating configuration errors at source) and C3 (removing manual data handoffs), consistent with ERP CSF research findings [7, 8, 17, 18] and with the implementation success patterns documented in [6] across structured enterprise technology deployments. The inclusion of C6 addresses a consistently reported failure mode in enterprise system deployments, namely, insufficient change management, which is not incorporated in any of the three comparison frameworks. C3's lower implementability and scalability scores reflect the genuine complexity of master data governance across heterogeneous ERP environments, a risk that practitioners must plan for explicitly.

Four limitations warrant explicit acknowledgment. First, the design evaluation rubric was not applied by an independent expert panel. This is a deliberate methodological choice consistent with the framework development phase of the research lifecycle: the rubric establishes internal consistency of the design before external validation, analogous to pilot testing in empirical research. The criteria themselves are not novel as they are drawn directly from validated CSF literature [7, 8, 14], which constrains the subjectivity of scoring to criterion application rather than criterion selection. Independent expert panel replication is the explicitly identified next step and does not invalidate the framework's design-phase utility.

Second, KPI projections are derived from published benchmarks [1, 11] rather than primary longitudinal deployment data. This is inherent to framework proposal research: empirical validation requires a deployed instantiation of the framework, which necessarily follows framework publication. The benchmark evidence base is consistent with

academic ERP performance literature [7, 8], providing convergent validity for the projected improvement ranges. A before-and-after case study deploying OCOF in a live manufacturing environment is identified as the primary future work. Third, OCOF was designed for mid-to-large manufacturing enterprises operating Oracle CPQ; applicability to SMEs, non-manufacturing sectors, and alternative CPQ platforms requires further investigation, as resource constraints and platform-specific constraints may alter component sequencing and deliverable scope. Fourth, the framework addresses Oracle CPQ specifically; while the component logic is platform-agnostic in principle, platform-specific artefacts (BML coding standards, document-designer configuration) would require adaptation for Salesforce Revenue Cloud or SAP CPQ deployments.

V. CONCLUSION

This study proposed the Oracle CPQ Optimization Framework (OCOF), a six-component structured deployment model for Oracle Configure-Price-Quote (CPQ) in manufacturing enterprises, developed through a three-phase methodology. The addition of a Change Management component (C6) addresses a significant gap identified in both the CPQ-specific and broader Enterprise Resource Planning (ERP) Critical Success Factor (CSF) literature [7, 8], making OCOF the first published academic framework to explicitly integrate change management into a CPQ deployment model. The dependency structure, refined through iterative development, resolves a potential circular dependency between C2 and C3 by clarifying that the C2 pricing architecture is designed based on the C1 taxonomy before C3 activation and is subsequently enabled by C3 integration feeds at go-live. This sequencing enables parallel workstreams without mutual blocking.

Design evaluation rubric assessment across eight CSF-derived criteria yielded a mean score of 4.3/5.0, indicating

strong internal consistency across all components; external expert panel replication is the priority for future validation. Benchmark evidence indicates expected improvements of 33% in quote cycle time, error rate reduction from 10–25% to near-zero, and up to 49% in sales productivity. Comparison against Technology-Organization-Environment (TOE), CSF Framework [14], and Technology Acceptance Model (TAM) indicated OCOF's superior specificity for CPQ manufacturing deployment contexts. C3 was identified as the highest-risk component due to master data governance complexity, consistent with ERP implementation literature [7, 8, 14].

Future research directions include empirical longitudinal validation with primary KPI data collected before and after OCOF implementation in a real manufacturing enterprise, external expert panel assessment with certified Oracle CPQ practitioners, investigation of OCOF applicability in non-manufacturing sectors, such as telecommunications and financial services, and exploration of generative AI integration within the Oracle CPQ BML rules engine to reduce C1 configuration authoring overhead. Training and information quality are significant determinants of enterprise system deployment success [10]; future work should examine these factors in CPQ-specific deployments to complement OCOF.

DECLARATION OF COMPETING INTERESTS

The author declares no competing interests.

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DATA AVAILABILITY

No datasets were generated or analyzed during this study. The proposed framework is derived from publicly available literature and industry reports cited in the reference section.

AI USE AND DECLARATION OF GENERATIVE AI USE

The author declares that no generative AI tools were used in the writing or preparation of this manuscript.

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