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From Cost Savings to Value Preservation: Rethinking Procurement Performance Metrics in Crude Oil Refining.

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Abstract: Procurement performance in capital-intensive, continuous-process industries is commonly assessed using cost-centric indicators such as purchase price variance, budget adherence, and procedural compliance. In crude oil refining, however, where unplanned downtime can generate losses that dwarf procurement savings, cost-based metrics may misrepresent procurement's true contribution to organizational performance. This study re-examines procurement performance measurement in Ghana's crude oil refining sector and argues for a shift from cost savings to **value preservation**, defined in terms of refinery uptime, throughput stability, and maintenance continuity. Using survey data from 150 industry professionals analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM), the results indicate that procurement processes have a strong positive effect on refinery efficiency ($\beta = 0.56$, $p < .001$), while procurement challenges exert a significant negative effect ($\beta = -0.48$, $p < .001$). The model explains 47% of the variance in refinery efficiency ($R^2 = 0.47$). Anchored in Transaction Cost Economics and operations strategy, the study proposes a refinery-aligned procurement performance framework that prioritizes value preservation over narrow cost savings. The findings contribute to procurement performance scholarships and offer actionable guidance for managers in continuous-process industries.

Keywords: procurement performance; value preservation; refinery efficiency; cost savings; continuous-process industries; Ghana

I. INTRODUCTION

Procurement performance is traditionally evaluated through transactional efficiency, reducing purchase prices, enforcing compliance, and meeting budgetary targets. These metrics are attractive because they are simple, auditable, and easily aggregated. Yet their relevance depends on operating context. In crude oil refining, a continuous-process industry characterized by high fixed costs and severe penalties for unplanned outages, narrow cost savings can be misleading indicators of procurement success.

Refinery operations are tightly coupled. A delay or failure in procuring a single critical spare part, catalyst, or specialized service can immobilize entire processing units, resulting in production losses that far exceed the savings recorded at the point of purchase. In such environments, procurement decisions shape operational continuity as much as they shape cost outcomes.

Ghana's crude oil refining sector provides a compelling setting to reassess procurement performance measurement. Despite installed capacity and technical expertise, refinery utilization remains inconsistent, reinforcing dependence on imported refined products. While explanations often focus on financing and infrastructure constraints, less attention has been paid to how procurement is evaluated and incentivized.

This study argues that procurement performance in refining should be measured not primarily by cost savings, but by preservation the extent to which procurement decisions protect refinery uptime, throughput stability, and maintenance continuity. The study empirically examines how procurement processes and procurement challenges influence refinery efficiency and proposes a performance measurement framework aligned with refining realities.

II. LITERATURE REVIEW

2.1 Traditional Procurement Performance Metrics

Conventional procurement performance indicators include purchase price variance, cost savings against baseline, compliance rates, and cycle time. While these measures capture transactional control, they often incentivize short-term

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price reductions at the expense of reliability, quality, and responsiveness (Neely et al., 2005). Balanced performance literature emphasizes that measurement systems should reflect strategic priorities rather than operational convenience (Kaplan & Norton, 1992).

2.2 Continuous Process Operations and Downtime Economics

In continuous-process industries, downtime costs are nonlinear and asymmetric. Restart costs, lost throughput, safety risks, and reputational damage compound rapidly once operations halt. As a result, the economic significance of procurement extends beyond price to include availability, timing, and reliability of inputs.

2.3 Transaction Cost Economics and Procurement Performance

Transaction Cost Economics (TCE) argues that organizational performance depends on minimizing the total costs of transacting, including search, contracting, monitoring, and failure costs (Williamson, 1985). In refining, emergency procurement inflates transaction costs through premium pricing, expedited logistics, and contractual inefficiencies often coincide with operational disruption.

2.4 Operations Strategy and Functional Alignment

Operations strategy literature stresses that functional performance metrics must align with competitive priorities such as reliability, quality, and delivery. When procurement metrics prioritize cost savings in environments where reliability is paramount, misalignment occurs, producing perverse incentives.

III. CONCEPTUAL FRAMEWORK AND HYPOTHESES

Based on TCE and operations strategy, this study conceptualizes procurement as an operational capability whose performance should be evaluated by its contribution to refinery efficiency.

H1: Procurement processes have a positive and statistically significant effect on refinery efficiency.

H2: Procurement challenges have a negative and statistically significant effect on refinery efficiency.

IV. METHODOLOGY

4.1 Research Design

A sequential explanatory mixed-methods design was employed. Quantitative survey data were analyzed using PLS-SEM to test hypothesized relationships, followed by qualitative interpretation to contextualize the findings.

4.2 Sample and Data Collection

Data were collected from 150 professionals across procurement, operations, maintenance, engineering, and regulatory roles in Ghana's downstream petroleum sector. Purposive sampling ensured respondents possessed relevant operational experience.

4.3 Measures

- **Procurement Processes:** sourcing strategy, supplier relationship management, contract administration, inventory coordination
- **Procurement Challenges:** lead-time variability, spare-parts shortages, emergency sourcing, supplier constraints
- **Refinery Efficiency:** uptime, throughput stability, maintenance continuity

4.4 Data Analysis

PLS-SEM was selected due to its suitability for latent constructions and moderate sample sizes. Reliability, validity, and structural relationships were assessed using established criteria (Hair et al., 2017).

V. RESULTS

5.1 Measurement Model Assessment

Table 1
Construct Reliability and Convergent Validity

Construct	Composite Reliability (CR)	AVE
Procurement Processes	0.82	0.53
Procurement Challenges	0.84	0.56
Refinery Efficiency	0.87	0.59

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Note. CR ≥ .70 and AVE ≥ .50 indicate acceptable reliability and convergent validity. Discriminant validity was confirmed using HTMT ratios below the 0.90 threshold.

5.2 Structural Model Results

Table 2
Structural Path Coefficients

Path	β	p
Procurement Processes → Refinery Efficiency	0.56	< .001
Procurement Challenges → Refinery Efficiency	−0.48	< .001

Table 3
Coefficient of Determination (R^2)

Endogenous Variable	R^2
Refinery Efficiency	0.47

VI. DISCUSSION

The results provide strong empirical support for the value-preservation argument. Procurement processes exhibit a large, positive effect on refinery efficiency, indicating that structured sourcing, supplier coordination, and contract management materially support uptime and throughput stability. Conversely, procurement challenges exert a significant negative effect, confirming that supply disruptions and emergency sourcing undermine operational performance.

These findings challenge the adequacy of cost-centric procurement metrics in refining. Cost savings recorded at the transaction level obscure downstream losses associated with downtime, quality failures, and delayed maintenance. From a TCE perspective, procurement performance should reflect total system costs, not isolated purchase prices.

VII. MANAGERIAL IMPLICATIONS: A VALUE-PRESERVATION PROCUREMENT SCORECARD

To realign procurement performance measurements with refinery realities, managers should complement cost metrics with value-preservation indicators:

- **Critical spares availability rate** (availability of A-class spares)
- **Maintenance-ready delivery** (on-time delivery aligned to maintenance windows)
- **Supplier responsiveness** (time-to-quote; time-to-recovery)
- **Quality escape rate** (defect or early-failure incidence)
- **Downtime attributable to procurement** (hours linked to sourcing delays)
- **Emergency procurement ratio** (share of spending under urgent sourcing)

These indicators directly capture procurement's contribution to operational continuity and risk mitigation.

VIII. POLICY IMPLICATIONS

Public procurement frameworks governing refinery operations should recognize the operational consequences of rigid cost-centric evaluation. Policies that permit framework agreements, strategic inventory buffers, and prequalified suppliers combined with strong auditability can enhance value preservation without compromising accountability.

IX. LIMITATIONS AND FUTURE RESEARCH

The study relies on self-reported data, which may introduce common-method bias. Future research should incorporate objective operational data, such as outage logs and maintenance records, and extend the analysis to comparative refinery contexts.

X. CONCLUSION

In crude oil refining, procurement performance is fundamentally about value preservation rather than cost minimization. The evidence from Ghana's refining sector demonstrates that procurement processes materially enhance refinery efficiency, while procurement challenges erode it. Reframing procurement performance metrics around uptime, stability,

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and continuity offers a more valid and strategically aligned basis for evaluating procurement's contribution in continuous-process industries.

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