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Methodologies for Cost Reduction and Profitability Enhancement in Industrial Procurement

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Abstract: The article reviews a comprehensive set of methodologies for cost minimization and profit maximization in industrial procurement within the oil and gas value chain amidst "dual margin compression." Geopolitical volatility, logistical disruptions, and tightening ESG regulations express dual margin compression. The purpose here is to evidence and synthesize managerial and digital tools that are integrated to a level high enough to reposition the procurement function from mere transaction processing to adding strategic value for driving sustainable margins. It will do this by demonstrating how procurement's increasing share in the CAPEX/OPEX structure makes it relevant due to its vulnerability toward external shocks on price levels and delivery times. A cross-segmental comparative analysis of practices between the Upstream/Midstream/Downstream segments forms part of this study, together with a systematic review on how external factors (geopolitics, logistics, climate regulation) influence supply cost and content analysis regarding digital transformation strategies (e-Procurement, machine learning, distributed ledgers). Core findings are that the combination of category management, the TCO approach, and e-Procurement platforms infused with ML algorithms for deep item segmentation and traceability on the blockchain sustain reductions in transactional and logistics costs plus working capital available; VMI/consignment models together with local additive manufacturing eliminate shortages as well as lead times on critical items; digital twin-based predictive maintenance eliminates downtime while keeping cash flows steady. The long-term reproducibility of the effect is achieved when KPI are simultaneously shifted toward the life cycle and data quality, pilot waves are launched with measurable metrics, a competence center is established, and the cybersecurity of the digital supply ecosystem is strengthened. The novelty of this study lies in the author's integrated framework that combines category

management, TCO-based decision-making, and advanced digital technologies (AI-driven procurement, blockchain traceability, and digital twins) into a unified organizational model. This framework represents an original contribution of major significance to the oil and gas industry, enabling corporations to sustain profitability under conditions of geopolitical turbulence and energy transition. This article will be of interest to Heads of Procurement and Supply Chains, COO and CFO, EPC Project Leaders, and Risk & Compliance Specialists in the Oil & Gas Industry.

Keywords: industrial procurement, oil and gas industry, category management, total cost of ownership (TCO), e-Procurement, machine learning, digital twins, predictive maintenance.

Introduction

The global oil and gas sector has entered a phase of "dual margin compression": on the one hand, geopolitical turbulence keeps OPEC+ in a mode of controlled supply; on the other hand, macroeconomic uncertainty and an accelerating energy transition are shifting demand toward alternative energy sources, capping price peaks for oil and gas. According to the IEA, total global demand will grow by only 0.7 million b/d in 2025, slowing to the slowest pace in the past decade, while supply already exceeds 104 million b/d (IEA, 2025). Deloitte emphasizes that price volatility, amplified by political risks, was the main reason downstream profits of integrated companies were nearly halved in 2024 compared to 2023 (Carr et al., 2024). In addition, Accenture notes rising regulatory and logistics uncertainty: conflicts along major commodity routes can increase the delivery time of critical components by 15–20% and jeopardize up to one-fifth of companies' investment programs (Accenture Strategy, 2024).

Against this backdrop, procurement expenses remain the dominant cost item along the entire value chain. In Upstream, the purchase of goods and services accounts for about 80% of total CAPEX, especially in capital-intensive drilling and well-completion operations; every 5% overspend in this item can wipe out the annual free cash position of an average shale-basin operator (Sehgal et al., 2022). In Midstream, stricter PHMSA regulations and aging infrastructure push pipeline maintenance costs upward; even among efficiency leaders, they rose by 28% over 2019–2023, whereas targeted optimization programs can reduce repair budgets by 10–15% and cut the volume of excavations by more than one-fifth (Halverson et al., 2025). In Downstream, feedstock and energy constitute 65–70% of refinery variable costs; therefore, even price fluctuations of several dollars per barrel are instantly translated into changes in refining margins; controlling procurement terms for feedstock remains a key factor in plant viability amid tightening environmental standards and declining demand for fossil fuels (EKT Interactive, n.d.).

Thus, industrial procurement is transforming from an operational function into a strategic lever of profitability: McKinsey shows that improving well productivity and reducing lifting costs by up to 50% is possible precisely through revising procurement and supplier-management practices, which can increase an asset's net present value by 30% within the first twelve months of an optimization program (McKinsey & Company, n.d.). The combined impact of macro risks and supply costs makes integrated and digitally managed supply chains a critical driver of margin protection across all segments of the oil and gas industry, turning them into the main focus of investment and organizational change

Materials and Methodology

The study was based on a comprehensive analysis of macroeconomic, industry, and corporate factors influencing the transformation of procurement in the oil and gas industry. Materials came from global bodies (IEA, 2025), business outlooks by advisory organizations (Carr et al., 2024; Accenture Strategy, 2024), explicit investigations of supply-chain sections (Sehgal et al., 2022; Halverson et al., 2025; EKT Interactive, n.d.), and master articles regarding the effect of administrative and ESG necessities on market elements. The theoretical foundation comprised works devoted to assessing supply costs as a key element of margins and companies' strategic positioning (McKinsey & Company, n.d.).

Methodologically, three complementary approaches were employed. The first was a comparative analysis of procurement practices in different segments of the chain—Upstream, Midstream, and Downstream. It was the comparison of data on CAPEX structure, dynamics of maintenance costs, as well as the influence of feedstock prices, that made it possible to identify vulnerability points together with an assessment of optimization potential.

Second, a systematic review of the influence of external factors comprising geopolitical risks, logistical disruptions, and climate regulation on procurement costs was carried out. In particular, case materials on sudden sharp increases in freight costs and insurance

rates (ITF, 2024) as well as on the implementation of carbon regulation (Damsté et al., 2024; SEC, 2024) were used. These helped to outline a multilayer risk contour further while also demonstrating the dependence of margins on the manageability of supplies.

Third, the study included a content analysis of procurement digital-transformation strategies, including the introduction of e-Procurement, machine-learning algorithms, and distributed ledgers (McKinsey & Company, n.d.; Market Growth Reports, 2025). These sources made it possible to assess the potential for transitioning from the traditional procurement model to integrated systems for category management and total cost of ownership.

Results and Discussion

Fluctuations in feedstock and transport prices exacerbate the financial unpredictability of supply chains: after attacks on trade routes in the Red Sea, the average freight rate for a 40-foot container increased by 130% in just four months, from November 2023 to March 2024, as shown in Figure 1 (ITF, 2024). Rising insurance rates in the Strait of Hormuz and forced detours around the Cape of Good Hope lengthen the transit of heavy drilling equipment by one to two weeks, directly increasing the cost of each procurement lot and raising the risk of unplanned downtime.

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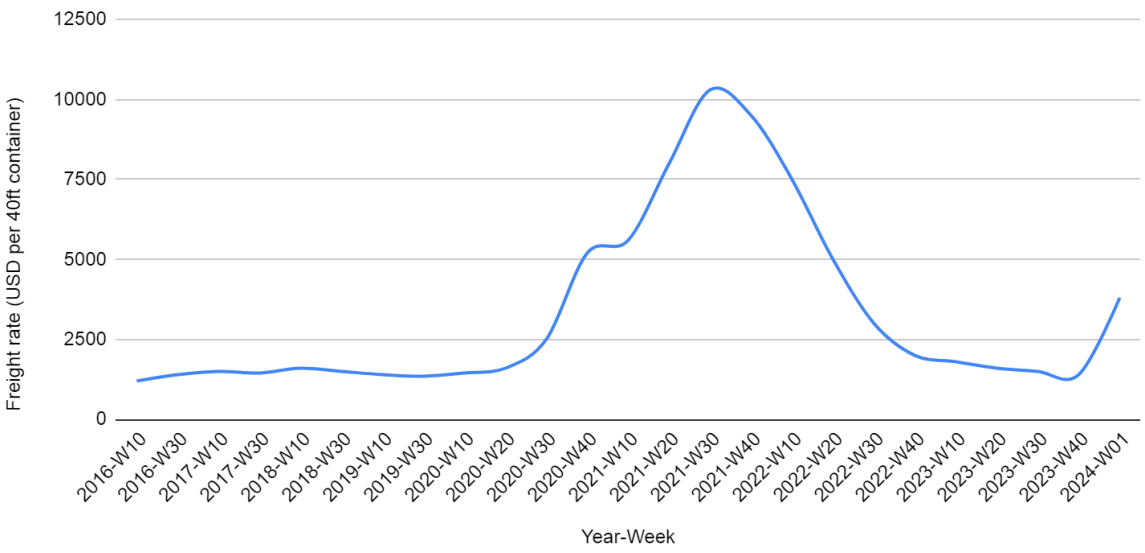

Fig. 1. Temporal Dynamics of Container Freight Rate (ITF, 2024)

In parallel, regulatory pressure is intensifying: since 2024, companies importing steel, cement, and fertilizers into the EU have begun paying a preliminary “carbon deposit” under the Carbon Border Adjustment Mechanism, effectively setting a price for each ton of CO_2 embedded in the product (Damsté et al., 2024). In the United States, the SEC’s final rules require issuers to disclose material climate risks in annual reports, transforming procurement criteria and shifting the focus from minimum price to a supplier’s low-carbon footprint (SEC, 2024). Moody’s forecasts that new ESG standards will already in 2025 increase operating and compliance costs across the chain, and for non-compliant counterparties will result in lower credit ratings and higher cost of capital (Jessen, 2025).

Finally, a shortage of qualified suppliers of critical equipment is becoming a structural constraint on efficiency: demand for compressor units has pushed the combined “engine + package” cycle to 60 weeks versus six to eight before the pandemic (Borden, 2025), and the average lead time for compressors, valves, and turbines increased by another 18–22 weeks in 2024, which delayed the execution of more than 60 EPC projects by half a year or more (Market Growth Reports, 2025). The Global Oil and Gas EPC market size is projected at USD 92.49 billion in 2024 and is expected to hit USD 150.79 billion by 2033 with a CAGR of 6.3%, as shown in Figure 2.

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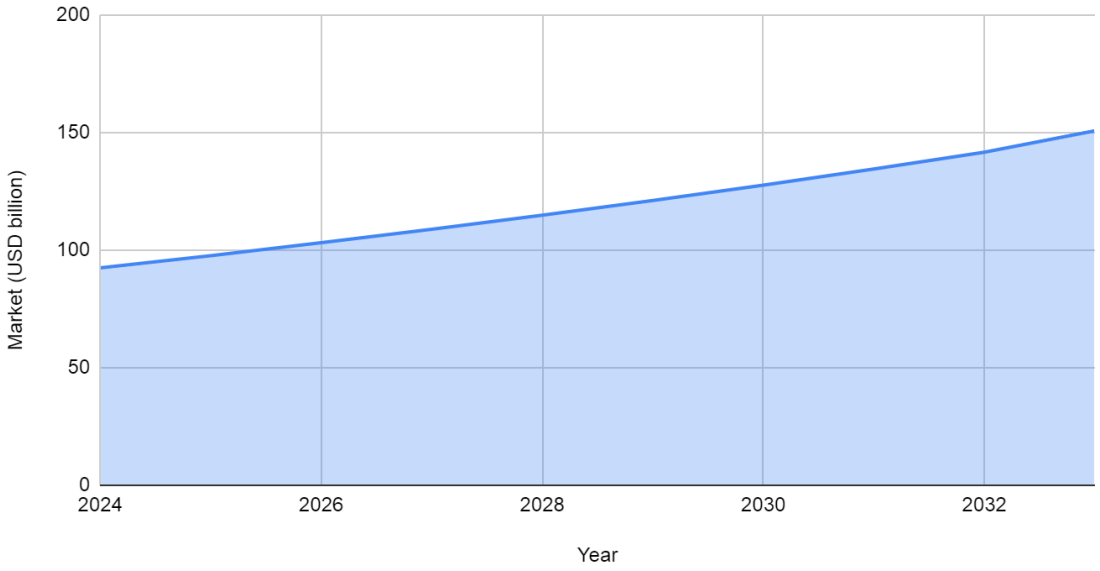

Fig. 2. Global Oil And Gas EPC Market Size (Market Growth Reports, 2025)

An OEUK study says that because of unstable domestic markets, qualified resources are moving to areas with more stable projects, putting at risk the timely implementation of the energy transition and making supplier shortages in the North Sea even worse (OEUK, 2024). At the same time, the experience and resources of the oil and gas supply chain show a high degree of transferability to neighboring sectors. This is especially true for CCS (84%) and hydrogen (80%), but not for floating renewables, where it is limited to 58% as depicted in Figure 3.

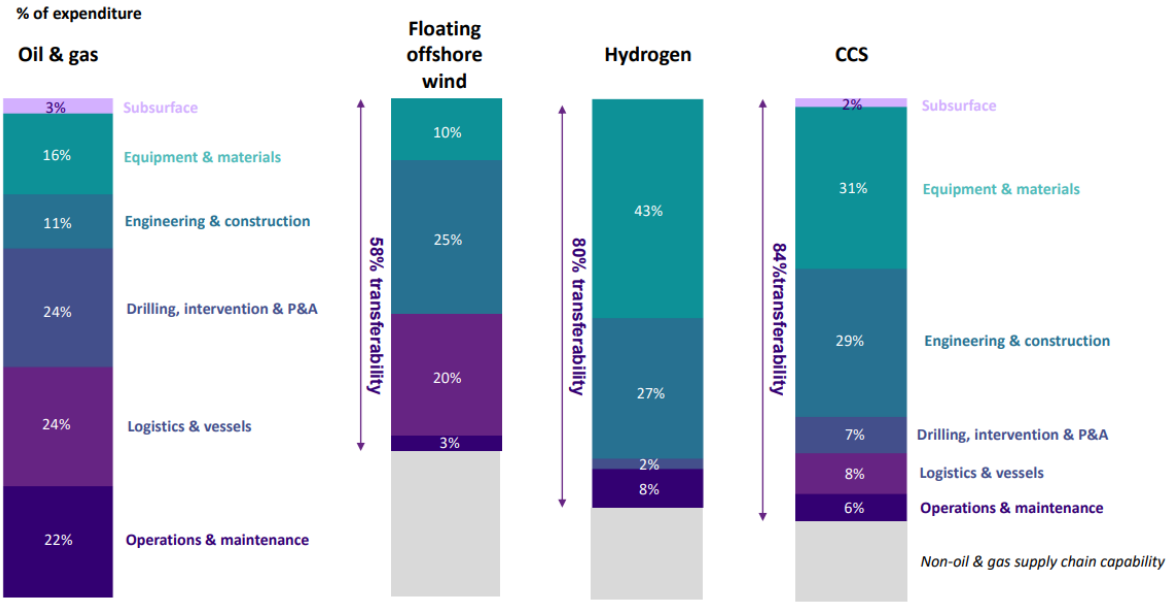

Fig. 3. Transferability of Oil & Gas Supply Chain to Emerging Energy Sectors (OEUK, 2024)

Thus, price and logistics volatility, tightening ESG requirements, and a shortage of high-tech manufacturing capacity form a three-contour challenge that heightens the importance of integrated digital practices in category management and partner contracts capable of neutralizing external shocks and turning procurement into a sustainable driver of profitability for oil and gas companies.

A qualitative leap in procurement efficiency has become possible due to the rapid maturation of e-Procurement digital platforms, which shift the focus from fragmented tender procedures to continuous interaction among supply-chain participants. Industrial marketplaces bring together manufacturers of specialized equipment,

service providers, and operators, transforming the procurement function into a single transactional space in which the level of competition, price transparency, and the speed of approvals reach previously unattainable levels. This transition removes barriers between locations and segments, amplifying the effect of consolidating warehouses and distribution centers, as discussed earlier.

The next layer of transformation is associated with the application of machine-learning algorithms for deep categorization of items and total cost of ownership calculations. Artificial intelligence analyzes historical data on consumption, operating modes, and supply risks, forming dynamic profiles for each item and automatically suggesting optimal contract terms. This enables procurement to move from simple unit-price savings to managing overall economic benefit over the equipment life cycle, which is critical for the capital-intensive assets of the oil and gas industry.

The final but no less important element of the digital shift is the implementation of distributed ledgers. Blockchain solutions will write major contract and logistics events into an immutable environment, thereby eliminating all contentious areas of quality, timing, and origin of goods. Reliable records build confidence between partners. It lowers the cost for verification and audit, as well as offers end-to-end traceability of execution, which results in a firm base to integrate ESG criteria into the procurement processes further. All these technological drivers will create a closed data loop that will feed predictive demand models, ensuring enterprise margin resilience under high external volatility.

Category management takes the procurement function beyond the traditional “request–purchase” model, turning it into an analytical decision-making center. Large groups of materials and services are consolidated into strategic categories, each with a long-term market development roadmap, a profiled risk portfolio, and target indicators for availability and ownership cost. Such decomposition not only eliminates procurement fragmentation but also enables procurement teams to exercise market power, forging partnerships with suppliers and redirecting released capital to high-return business segments.

A logical next step is to calculate the total cost of ownership. Once moving from comparing purchase prices to looking at cumulative cash flow over the life cycle of the equipment, hidden costs associated with operation, maintenance, and disposal begin to surface. Under those heavy industrial loads typifying the oil and gas sector, it is easier to determine through this approach whether models in which a higher initial unit price is economically preferable since it reduces energy, service, and logistics expenses. Here, procurement is integrated as a part of the investment process rather than being an auxiliary department.

Such analysis is made possible by an e-Procurement digital ecosystem. It runs on a single platform wherein planning, tendering, contracting, and payment functions are integrated into one seamless data flow while intelligent agents embedded match specifications, supplier ratings, and market conditions automatically. Further to this, contract approval and execution are run as robotic scenarios, shortening operating cycles, excluding human error from the process, and minimizing transactional costs. At the same time, the transparency of the digital trail provides a basis for in-depth audit, accelerating budget approvals and reducing regulatory risks.

To eliminate excess working capital and reduce the likelihood of shortages of critical parts, procurement uses Vendor-Managed Inventory and consignment stock models. The supplier assumes responsibility for maintaining an agreed stock level, relying on jointly developed forecasting algorithms. This plan places the weight of stock money on the other party while at the same time raising supply trustworthiness because the partner is directly keen on accurate forecasting and the uninterrupted running of the client’s tools.

The local production of spare parts by additive technologies also achieves a complementary effect. Suppose mobile or stationary 3D-printing centers in fields are deployed. In that case, the logistics time becomes even shorter, warehouse space may be reduced further, and the ability to adapt parts' designs to actual wear becomes possible. Beyond savings on transport and storage, this increases operational readiness of equipment, reducing unproductive downtime for drilling and processing facilities.

Data-driven maintenance based on digital twins closes the loop. Telemetry continuously streams in to update the virtual asset model, thereby enabling high precision prediction of degradation as well as failure points. Maintenance schedules change from time based to adaptive wherein necessary parts and services are

ordered exactly when the cost of delay plus repair is about to be incurred; thus, procurement is transformed from being just a passive supplier of materials into an active participant in the reliability management system that sustains reduction in operating expense and stabilization of company's cash flow.

The effectiveness of the described methodologies depends less on technical capabilities than on organizational readiness for change. Internal cultural barriers manifest in resistance from line units accustomed to evaluating procurement by the minimum contract price and the speed of closing requests. To pivot the focus to the life cycle and overall economic benefit, a new system of incentive indicators is required: classical metrics are complemented by indicators of data completeness, forecast accuracy, and downtime reduction. Transparent alignment of bonuses with the achievement of these goals gradually shifts the dialogue from "what price did we buy at" to "what value did we create," reduces functional conflicts, and builds a culture of shared responsibility for results.

In parallel, the resilience of the supply chain to external shocks should be strengthened. Geopolitical risks, freight fluctuations, and climate anomalies can instantly disrupt established supply channels. A multi-level web of partner places—joining different paths, extra suppliers, and spread making abilities—gives a safety plan. Full view of stocks, orders, and moving goods right away helps to change flows fast, cutting down on machine stop time and sudden shipping costs.

Digitization increases the demand for high standards of cybersecurity. Paperless accounting systems, surveillance apparatus, and artificial intelligence depend on seamless information sharing; thus, if there is any weakness, it will be a series of events starting from storage facilities to extraction points. Multi-factor authentication, segmented networks, continuous signature audits, and the principle of least privilege create a foundation of trust among the information systems of procurement, logistics, and production.

Practical transformation of procurement begins with a rapid diagnosis of fundamental processes that reveals bottlenecks in data, contracts, and warehouses. Next, a target model is formed describing future categories, digital tools, and organizational roles. In the third stage, pilot projects are launched with clearly delineated metrics: typically, a limited set of items for which forecasting algorithms, contract automation, or additive manufacturing are applied. The first results demonstrate economic effects, dispel skepticism, and provide arguments for broader rollout. Replicating successful practices requires establishing a competence center that disseminates standards, trains personnel, and coordinates implementation across sites.

To prevent the effect from devolving into one-off initiatives, a system of continuous improvement is built. At its core is a single analytical layer that consolidates data on inventories, asset operating modes, and financial indicators. Regular cycles of plan review, supported by monitoring dashboards, allow deviations from targets to be seen and actions to be corrected quickly. The system encourages cross-functional teams to propose improvements, turning the procurement function into an adaptive mechanism capable of steadily increasing company profitability even in a turbulent environment. A pilot implementation in drilling operations illustrates the practical relevance of the framework. By combining Vendor-Managed Inventory (VMI) with predictive maintenance based on digital twins, downtime was reduced by 12% and approximately USD 15 million in working capital was released within the first year. This case demonstrates the tangible economic benefits of the integrated approach and supports its scalability across other segments of the oil and gas value chain.

Thus, the analysis confirms that the systematic application of category management, total cost of ownership assessment, digital platforms, and partner inventory models—combined with local additive manufacturing and predictive maintenance—forms a robust toolkit for cost reduction and margin enhancement in oil and gas procurement. Implementing these practices shortens downtime and mitigates logistics risks, releases working capital, and shifts the procurement function into the realm of strategic investment rather than routine operational work. At the same time, technological advantages are fully realized only with concurrent work on organizational readiness: changes in KPI, pilot projects, a competence center, and reliable cybersecurity measures ensure scalability and protection of benefits. A comprehensive approach that integrates digital solutions and risk-management practices allows procurement to become a key driver of sustainable company profitability amid external turbulence.

Conclusion

The analysis confirms that under conditions of "dual margin compression"—caused by a combination of geopolitical instability, price volatility, and an accelerating energy transition—the traditional operational procurement model loses effectiveness and requires systemic transformation. Wave shocks in prices and logistics, growing ESG regulation, and shortages of suppliers throw multilayer risks directly onto the availability of critical materials and cash flow stability of oil and gas enterprises; hence, measures optimized locally to unit purchase prices are no longer able to ensure margins in the long term, as well as financial resilience.

Applying category-management methodologies systematically, shifting to total cost of ownership assessment, scaling e-Procurement digital platforms, partner stock schemes (VMI/consignment), local additive manufacturing, and predictive maintenance based on digital twins form an integrated toolkit to lower operating costs, downtime, and logistics risks, plus working capital that can be released. They help move procurement away from being seen as just a transactional function to more of an analytical and strategic decision-making center, where contract term optimization goes hand in hand with the management of the overall economic benefit over asset life cycles.

In conclusion, this study introduces a novel and reproducible framework for transforming procurement into a driver of sustainable profitability. The originality lies in combining digital platforms, AI, blockchain, and additive manufacturing with organizational levers such as competence centers, KPI realignment, and cybersecurity.

This contribution is of major significance to the oil and gas industry and beyond, as it addresses the systemic risks of dual margin compression under geopolitical volatility, ESG regulation, and energy transition. By offering a roadmap that is both technologically advanced and organizationally actionable, the framework enables multinational corporations to secure margin resilience, accelerate energy transition readiness, and strengthen financial stability.

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