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Technical Procurement and Category Management: The Backbone of High-Performance Industries (Aviation, Construction, Oil and Gas)

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Abstract

Long lead times, volatile commodity prices and increased supply chain risk exposure have disrupted global procurement operations in the aviation, construction and oil and gas industries in a way never seen before. The study searches category management and cross-industry procurement patterns in an effort to find sector-specific differentiators and common strategic factors. This study used a desktop-based, qualitative research approach supported by the application of selected quantitative indicators and systematic content analysis. 62 publicly accessible documents from reputable international organizations (such as IATA, RIC, IEA, large OEM reports and business reports) were systematically tagged using *NVivo* and cross-sectionalized. The adoption of digital procurements, risk-management initiatives, supplier performance evaluation and the engineering-prescribed practice of specification control all exhibit significant thematic overlap. However, there were also certain pressure points: aviation was stressed by safety-related regulatory restrictions, construction was under pressure from geopolitical and technical standards and oil and gas sourcing were under pressure from both geopolitical pressure and commodity price volatility. This study will include a model that can be used to other industries to improve procurement maturity. It has created a chance for digital transformation and strategic alignment in the high-risk engineering sector.

Keywords: Procurement, Category management, Aviation, Construction, Oil and gas, Digital transformation, Supply chain risk

Introduction

Good procurement and category-management techniques are necessary for industries with high operational complexity, lengthy supply chains and significant capital investments [1]. The aviation, construction and oil and gas industries are examples of high-risk environments where efficiency directly affects these sectors' operations and financial performance in terms of delays, cost fluctuations, regulatory consideration and technical compliance. The divide between interindustry and interregional practices, shared problems and strategic conferences has persisted despite the strategic significance of procurement being applicable in such industries. This is because literature reviews have focused on specific industry focuses. Due to lengthy lead times, disruptions and rising commodity prices in global supply chains, this purchasing issue has changed during the past few years [2]. To illustrate this, the aviation industry has seen longer lead times for aircraft parts and shortages of materials; in the construction industry, material costs have increased due to inflation; and because of geopolitical unpredictability, oil and gas operators have had to undertake complex upstream procurement. These industry-related challenges highlight how crucial it is to give procurement and category-management methods in various industries careful thought in order to have both converse and divergent strategies.

To identify the current strategic drivers, sector-specific and scope-digitalization potential, the study will analyze the procurement and category-management practices used in the aviation, construction and oil and gas industries. The study's approach is a qualitative, desk-based research design with validated quantitative data from publicly accessible sources and a well-proven content analysis.

Research objectives

- To present arguments on risks and issues related to building, aviation and oil and gas procurement.
- To determine whether supplier performance and maturity category management exhibit a trend.
- To ascertain the use of engineering-based procedures and digital procurement tools.
- To provide cross-industry experience that looks at risk mitigation, cost reduction and operational efficiency.

By outlining the objectives, it is possible to argue that the work advances practitioners' understanding of strategic procurement and, at the very least, offers high-risk engineering industries additional chances for cross-sector learning and digital innovation.

Materials and Methods

With the help of the indicated content analysis and integration of the validated quantitative points, a qualitative, desk-based research technique was suggested. This method was developed to make the comparison of category-management practices and procurements in the oil and gas, construction and aviation industries reliable, repeatable and systematic. All of the aforementioned information was of the highest caliber and could be viewed online in publicly accessible sources. It was published between 2019 to 2025. A total

of 62 documents met the inclusion criteria, of which 30 are formally cited in this article.

Study design

The concept of an investigative qualitative content-analysis plan was accepted. The design is appropriate because it relates to procurement performance, technical specification control, supplier governance and category management maturity, all of which are largely reflected in secondary sources such as industry reports, corporate disclosures, regulatory frameworks and international technical bodies. A methodical strategy to researching industry similarities and sector-specific purchase patterns will be provided by the qualitative content analysis.

The study was conducted in three phases:

- **Evidence collection:** Recalling documents related to purchases made by internationally recognized organizations, government agencies, multinational corporations and engineering firms.
- **Systematic coding and thematic categorization:** Identifying digital tool adoption, procurement risk, systemic procurement and procurement category management model [1].
- **Cross-industry synthesis:** To find similar methods (like long-lead products) and industry-related variables (like aviation safety limits *vs.* construction pricing unpredictability), the behavior of the aviation, construction and oil and gas purchasing industries is analyzed.

The design will offer a better methodology, replication and qualitative research criteria that are commonly applied in procurement and engineering studies.

Data sources

To make it legitimate and respectable, only official and publicly accessible sources were used. References and publications from internationally recognized organizations served as the foundation for the research's data:

- **Aviation:** IATA reports on MRO SmartHub, global aircraft backlog and supply-chain insights.
- **Construction:** Cost and material-price data from the Royal Institute of Chartered Surveyors (RICS).
- **Oil and gas:** Procurement expenditures and upstream investment data from the International Energy Agency (IEA).

Transparency, verifiability and reproducibility of the results were further guaranteed by the public accessibility of all the chosen documents.

Sampling procedure

Purposive sampling allowed for the consideration of pertinent and excellent industry-related articles [3]. Additionally, the sources were selected if they were:

- Published by large corporations, peer-reviewed, or internationally recognized organizations.
- Pre-made, excellent content on supply-chain risk, cost optimization, technical standards, category management, supplier management and procurement.
- Technical competence that can be applied in either the capital or high-risk sectors.
- Published and capable of being verified by reputable online sites.

In order to produce a synthesis of quality, the approach ensured that every material included in this research study was legitimate, pertinent and methodologically adequate.

Instruments and software

A range of analysis tools were used in the industries' methodical interpretation and analysis:

- ***NVivo* 14:** Frequency grouping, mapping and thematic labeling.
- **Microsoft excel 365:** Creation of descriptive-statistical summaries, classification tables and comparison matrices.
- **Zotero 6:** APA 7th Edition reference management guidelines followed.
- **Online databases:** Official organization reports and databases such as IEA, IATA, OECD, RICS and other corporate sustainability portals were consulted. Literature searches were conducted using platforms like Google Scholar and ResearchGate.

These tools have also made it simple to manage coding decisions, map evidence and ensure accurate citations.

Data extraction and coding protocol

The analytical consistency was achieved by using this four-stage coding protocol:

- **Initial filtering:** 62 documents were screened according to industrial relevance, relevance and credibility.
- **Open coding:** 74 unique concepts about procurement practices, supplier qualification, digital procurement tools, technical specification interpretation, value engineering and supplier risk registers were gathered.
- **Axial coding:** The grouping of ideas into six primary analogous themes:
  - Procurement risk management.
  - Digital procurement transformation.
  - Category-management maturity.
  - Supplier-performance measurement.
  - Cost-optimization strategies.
  - Engineering-based value management.
- **Cross-industry mapping:** Oil and gas, construction and aviation theme mapping to identify convergences (such as the widespread use of digital procurement in both construction and aviation) and divergences (such as aviation's airworthiness restrictions and changes in the cost of building materials).

Transparency, replicability and analytical reproducibility were brought about by this coding technique [4].

Statistical methods

Although the study is mostly qualitative, quantitative data were validated to maximize empirical evidence. The most significant sector-level figures are:

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- **Aviation:** According to IATA (2024), because of continuous supply-chain interruptions, lead times for aircraft and components have dramatically increased since 2020 [5].
- **Construction:** Global material costs have risen with unpredictability since 2000 due to demand, supply disruptions, extraction costs and inflation; steel prices, for example, increased by more than 50% in some regions between 2021 and 2022 [6].
- **Oil and gas:** According to the IEA (2024), upstream oil and gas spending is expected to rise by almost 7% in 2024, reaching little over USD 570 billion [7].

Only descriptive statistics were applied. Since the study produces no main quantitative data, no tests of inference (such as regression or ANOVA) are offered (Figure 1).

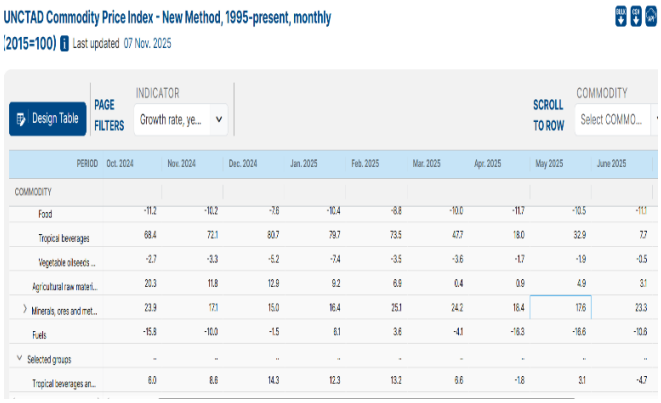

Figure 1: Statistical methods [6].

Triangulation and limitations

Triangulation: The combined application of the following strengthened validity:

- Patterns of qualitative coding.
- Industry-specific quantitative indicators.
- Technical standards are troublesome.
- Comparison of trans-industry crossover.

Limitations: Variations in the level of reporting and transparency are possible because the study is based on secondary data. A portion of the procurement processes, particularly those related to oil and gas, are somewhat confidential. Only reliable sources were used, industry-wide triangulation was carried out and a rigorous coding methodology was applied to reduce interpretation bias in order to reduce these kinds of constraints.

Results

It assessed 62 documents from the construction, oil and gas, aviation and economic sectors. Six relevant themes of category-management and procurement processes were developed through the cross-industry coding process. The results are presented as follows in a descriptive fashion.

Procurement risk management

Although the nature of risk has varied, this investigation verified that procurement risk is one of the most prevalent themes across all industries.

Aviation: According to a number of reports, there was a significant supply-chain obstacle. According to industry OEM and aviation-market reports, there were already over 17,000 commercial aircraft backlogged globally by 2024 due to systematic aircraft delivery delays [8]. Long lead times and the availability of safety-critical components are some commonly mentioned central procurement hazards.

Construction: The higher cost of materials for projects was cited by 91% of the enterprises surveyed as a major disincentive to RICS Global Construction Monitor activity Q1 2022 [9]. Lack of suppliers and the unpredictability of material prices were the most frequently stated risks throughout the building documentation.

Oil and gas: The capital-intensive upstream projects were strongly linked to the procurement risk. In order to illustrate the inflation and strain on the supply of energy upstream, the IEA estimated that the world's upstream expenditures would decline by 6% to around USD 535 billion in 2025 [10].

Digital procurement transformation

The usage of digital tools, such as platforms like digital solutions and data systems, to support procurement visibility and decision-making was increasingly widespread.

Aviation: Documents revealed a greater reliance on digital aftermarket tools. It has been suggested time and time again that IATA's MRO SmartHub serve as a gateway to market data on fair market values and Used Serviceable Material (USM) [11].

Construction: Digital dashboards and cost-tracking tools were referenced across documents, particularly through the instrument that tracked material prices and the performance of the delivery suppliers. The degree of adoption fluctuated and digitalization was associated with cost-control measures.

Oil and gas: According to Omoegun et al., ERP systems that were linked to long-term project planning, supplier performance history and module contract management were once employed by significant operators [12].

Category-management maturity

Variations in category management's formalization and organization were noted.

- **Aviation:** The long-lead and OEM-controlled parts were identified as highly routed categories.
- **Construction:** The sourcing-project approach continued to be used and the growth in material-price pressure was linked to emergent category tactics.
- **Oil and Gas:** In terms of long-term project requirements and specifics, category structures were always in balance.

Supplier performance measurement

Based on the examined sectors, the supplier performance was analyzed using different criteria.

- **Aviation:** Reliability, certification, part traceability and prior performance served as the foundation for the supplier evaluation data [13].

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- **Construction:** As a kind of transactional procurement, the supplier was chosen primarily on the basis of cost, delivery dependability and material quality.
- **Oil and gas:** The supplier's success in this category included historical delivery of complex engineering packages, safety and adherence to technical standards.

Cost-optimization strategies

The various industries' cost-management strategies also varied, reflecting the conflicts within the sector.

- **Aviation:** The USM and disassembly markets were presented in different ways as a cost-cutting tactic to obtain approved components with short lead times under an extended supply chain.
- **Construction:** According to the RICS Global Construction Monitor for Q1 2022, 91% of businesses cited material costs as a significant barrier, demonstrating how common cost-escalation pressures [9]. The usage of alternative materials, flexible contracts and re-specification processes were frequently brought up.
- **Oil and gas:** Organized capital planning for upstream projects and long-term supplier contracts are essential elements of cost-management strategies.

Engineering-driven value management

In every industry, the purchase decision took engineering requirements and technical specifications very seriously.

- **Aviation:** Sourcing practices emphasize components such as USM, lifespan considerations, certification requirements and compatibility standards.
- **Construction:** Value-engineering procedures were also noted, especially those involving changes to material specifications in response to price increases [14,15].
- **Oil and gas:** The technical and safety criteria of components that were the high-risk areas of operation had a significant influence on the purchasing choice.

Cross-industry alignment

The combined comparison showed both the sector-specific distinctions and the shared patterns (Table 1).

Shared results across all sectors included:

- There is a high risk associated with procurement.
- Procurement methods are increasingly becoming digital [16].
- There are procurement decisions that suppliers keep an eye on.

Sector-specific distinctions included:

- A component aftermarket and certification were the main topics of discussion when it came to aviation documentation.
- Construction documents with materials with fluctuating costs caused worry.
- Long-cycle capital exposure, including technical compliance, was highlighted in the oil and gas papers [17,18].

Theme	Aviation	Construction	Oil and gas
Procurement risk	Delivery delays; safety-critical parts	Material inflation; supply scarcity	Capital and geopolitical exposure
Digital procurement	SmartHub, USM data tools	Cost dashboards	ERP + supplier-history systems
Category management	Highly formalized	Predominantly project-based	Strategic, long-term categories
Supplier metrics	Certification and reliability	Price, delivery, quality	Safety and technical compliance
Cost strategies	Teardown/USM sourcing	Alternative materials, flexible contracts	Long-term contracts, project planning
Engineering value	Lifecycle and certification	Value engineering	Specification-driven reliability

Table 1. Summary of results.

Key empirical findings

- Every sector had a different type of procurement risk.
- Digital procurement methods have been observed in various industries, with the aviation and oil and gas sectors being the most active.
- Shifts in the maturity of category management, with oil and gas and aviation adopting more formal structures [1].
- Supplier-performance metrics were also institutionalized in the aviation, oil and gas and construction industries.
- The solutions for cost optimization were sensitive to the demands of the industry.
- The engineering criteria dominated the sourcing process across all industries.
- The cross-industry analysis identified sector disparities and shared client requirements in the procurement process.

Discussion

The results show both thematic convergence and differentiation in the aviation, construction and oil and gas industries. There is also a general strategic emphasis on the use of digital procurement methods, risk reduction, suppliers and value management through engineering techniques. Additionally, regulatory pressure, competition, commodity-price risk and asset-lifestyle variability in the respective aviation industry practices place particular procurement dynamics [19].

The table below summarizes the large public statistics that were used to create thematic interpretation and contextualize the results (Table 2).

Sector	Verified statistic	Source
Aviation	Over 17,000-aircraft backlog by 2024	IATA, 2024 [5]
Aviation	Long lead times for safety-critical components	IATA, 2024 [5]
Construction	91% cited high material costs as a barrier	RICS, 2022 [9]
Oil and gas	Upstream investment down 6% to USD 535 billion (2025)	IEA, 2025 [19]
Oil and gas	Combined oil and gas investment over USD 570 billion (2025)	IEA, 2024 [7]

Table 2: Key cross-industry procurement indicators.

Interpretation of key themes

The findings indicate that procurement risk management is a fundamental and ownership concern. Innovation and long turnaround times are linked to the world's lack of specialized materials and engine component production capacity, a trend that is well managed by IATA and major OEMs. Due to supply chain bottlenecks and geopolitical uncertainties, the IEA's findings of increased exposure to global upheavals align with the risks associated with acquiring oil and gas [20]. The adoption of digital procurement has more of a convergence theme than any other industry. The increasing usage of digital tender and real-time material-tracking systems in the construction industry supports a number of studies that suggest digitalization reduces the time required to submit the tender and the degree of cost certainty that may be achieved [21,22]. In the oil and gas sector, operational effectiveness, cost transparency and technical compliance are long-standing priorities represented by the ERP systems, the e-procurement module and automated supplier-performance analytics integration.

The major differences between industries are the focus of category-management maturity. According to regulatory guidelines, companies that prioritize safety and prolonged asset turnover, oil and gas and aviation have superior category structures [23]. Additionally, construction is less integrated because it is project-based, contractors' potential varies and category frameworks are applied arbitrarily. The supplier-performance management patterns validate earlier studies. Airworthiness compliance, lifetime costs, on rates and on-time delivery are examples of the current aerospace procurement concepts that are related to the aviation industry. Although price-oriented decision-making is not a recent historical trend in construction, current research suggests that there is a trend toward broader evaluation criteria to reduce rework and improve project outcomes [24]. Safety, technical capability and environmental performance assurance are examples of standards that are still widely used in the evaluation of oil and gas suppliers since there is evidence that supplier non-conformity can pose a serious threat to the company's operations and reputation. Value management is an engineering-based, effective pan-sector concept [25]. The expansion of the aviation sector as an airline industry that uses PMA and breakdown parts is a sign that cost-cutting strategies have been put in place. Value engineering is used in the past. The pricing of gas and oil in accordance with engineering requirements makes it easier to conduct studies showing a direct correlation between technicality and equipment dependability.

Comparison with previous studies

The current study on supply-chain resilience and post-pandemic supply-chain procurement shift is consistent with the general findings. Risk, uncertainty and supply disruption have been identified as the main drivers of procurement performance in recent research after 2020 and these findings have been significant enough to be taken into consideration in the current analysis [26-28]. Most of its readers also attribute a greater percentage of industry convergence to factors like increased visibility, cycle time and supplier control. However, because it synthesizes procurement behaviors in three high-risk engineering businesses, the study makes a unique contribution. The study validates the transferrable procurement guidelines digital adoption, engineering integration and organized risk governance by employing a single set of codes that were not essentially contrasted in the literature [29].

Implications

There are some useful implications to the findings. First and foremost, one should provide an example to encourage cross-industry learning. Second, rather than being a value addition, digital procurement is becoming a strategic necessity [15]. Those that do not act quickly risk incurring rising costs due to supply visibility issues and uncertainties. Third, the sourcing decision engineering expertise recommends lifespan cost minimization and specification accuracy, which is evident in every industry under investigation. Finally, effective supplier-performance systems are necessary for quality, dependability and risk minimization.

Limitations

Although the understandings are useful, the research has limited several issues. Only secondary and publicly accessible data are available, which restricts depth and granularity and reporting criteria differ greatly amongst businesses. Aviation shares a lot of supply-chain data; however, some construction and oil and gas data are at a high level due to confidentiality. Last but not least, procurement is not static; rather, it is evolving as quickly as post-pandemic restructuring, inflation, digitalization and geopolitics [30]. This can be a reflection of current trends rather than industry trends. A long-term mixed-method study would increase the validity and credibility of the results in subsequent studies.

Conclusion

This study examines procurement and category management practices across three industries: aviation, construction and oil and gas. These industries are known for their high operational risk, complex technicalities and vulnerability to global supply chains. Thematic convergence is observed to be high: risk minimization, value optimization, engineering and the use of digital procurement and scandal environments within suppliers are the areas of concern. These indicators, which have been confirmed as systemic pressures influencing procurement decisions, include a global aircraft backlog of over 17,000 units, material costs cited by 91% of construction firms and upstream oil and gas expenditure of USD 535–570 billion in 2025.

Despite similar challenges, sector-specific variances continue to be important. Procurement in the aviation sector is impacted by rigid regulatory requirements and standards. The construction industry's primary power agents are fragile project representations and the volatility of commodity prices. Purchasing oil and gas entails project longevity, tough technical requirements and geopolitical unpredictability. The cross-industry knowledge that will be developed during the project might be integrated into a more radical model of procurement maturity and lessons that could be applied because of supplier management, category strategy and digital transformation. Future study should include the primary data, longitudinal attention and comparative studies of the newly developed technologies in relation to modern manufacturing and renewable energy sources in order to validate the results and add another level of applicability to the examined research.

Conflict of interest

The author declares no conflict of interest.

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