# A STRATEGIC APPROACH FOR OPTIMIZING MATERIALS AND SERVICES IN OIL AND GAS PRODUCTION OPERATIONS

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## *1. Introduction*

Oil and gas blocks are typically awarded through competitive auctions involving both private and national oil companies (L.N. Murthy, 2018a). Once awarded, the operating company must invest substantial capital—often subject to host government approval under production-sharing contracts—to explore the field for commercially viable reserves (L.N. Murthy, 2017b). Exploration proceeds through sequential stages, including exploration drilling, appraisal drilling, and development drilling. Progression from one stage to the next depends on the economic and technical feasibility of earlier results. In many cases, significant

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expenditures are required before a successful production well is established (L.N. Murthy, 2018a). Importantly, only the production phase of an oil and gas field generates revenue; all preceding stages represent cost outlays. The overall success of operations therefore depends heavily on the operator's technical expertise and industry experience (L.N. Murthy, 2018b).

Production operations demand the procurement and deployment of highly specialized materials and services sourced from global markets (L.N. Murthy, 2017a). These inputs span multiple categories—such as stores, spares, chemicals, and consumables—as well as services including Original Equipment Manufacturer (OEM) support, manpower, and specialized technical services. Because of their high cost and criticality, efficient utilization and optimization are essential. Effective material requirements planning, guided by experienced operations and maintenance teams, ensures both cost control and the timely availability of required inputs.

The procurement process itself is multi-stage and time-sensitive, requiring careful planning to maintain uninterrupted production (L.N. Murthy, 2017a). It begins with an indent raised by the user department, subject to approval by the competent authority and materials planner. The indenting department must conduct a thorough assessment, detailing requirements such as quantities, bidder eligibility and evaluation criteria, delivery schedules, specifications, inspection procedures, approved vendor lists, and pricing formats. These steps safeguard the quality and suitability of procured goods and services. Moreover, compliance with extensive legal and statutory obligations is mandatory throughout production operations (L.N. Murthy, 2018c). Finally, companies must implement robust measures to protect procured materials from theft or damage, as these risks can undermine operational efficiency (L.N. Murthy, 2018d).

## *2. Categorization and Classification*

Effective supply chain management in the oil and gas industry requires systematic categorization of materials. Categorization groups materials according to shared technical characteristics and sourcing markets, thereby facilitating the development of appropriate procurement strategies (IMM Manual, 2019). When multiple departments generate similar requirements, these are consolidated into a single indent to streamline procurement and enhance efficiency (IMM Manual, 2019).

Materials are commonly divided into several categories. Consumables, chemicals, and commodities are items typically used up within a year. Spares refer to equipment or machine components that lack independent functionality and must be installed within a larger system to operate (IMM Manual, 2019). Capital items include durable assets such as equipment and machinery that are not consumed during routine operations. In addition, proprietary materials constitute a distinct category, produced and marketed exclusively by entities holding legal rights to their manufacture and sale (IMM Manual, 2019).

**2.1. Chemicals:** Oil and gas production relies on a wide range of chemicals for process operations, flow assurance, corrosion control, and utility functions (L.N. Murthy, 2017a). Most chemicals have a limited shelf life, after which their performance diminishes, making timely usage essential. Once expired, chemicals incur a double cost: the value of the unused chemical itself and the fees paid to authorized waste-disposal agencies for safe handling in compliance with statutory guidelines (L.N. Murthy, 2017a).

**2.2. Spares:** Exploration and production operations depend on extensive, interconnected equipment, much of which requires spares to remain functional (L.N. Murthy, 2017a). Maintaining a minimum stock of essential spares is critical; the failure of a single component can interrupt multiple operations. Procurement decisions should draw on the maintenance team's expertise, experience, case studies, and consultations with Original Equipment Manufacturers (OEMs) to ensure timely availability of necessary spares (L.N. Murthy, 2016). A lack of spares reduces equipment availability, while overstocking leads to excessive inventory costs, sunk costs, and wasted capital (L.N. Murthy, 2017a).

**2.3. Outsourced Services:** Certain services in oil and gas operations must be outsourced, including drilling, well services, well logging, seismic surveys, and various industrial services such as calibration, third-party testing, audits, and statutory compliance (L.N. Murthy, 2017a). Because in-house personnel cannot perform all functions, many critical operations rely on external manpower. These workers, though employed by third-party service providers, are integrated into the operator's team and play essential roles in sustaining production (L.N. Murthy, 2018e).

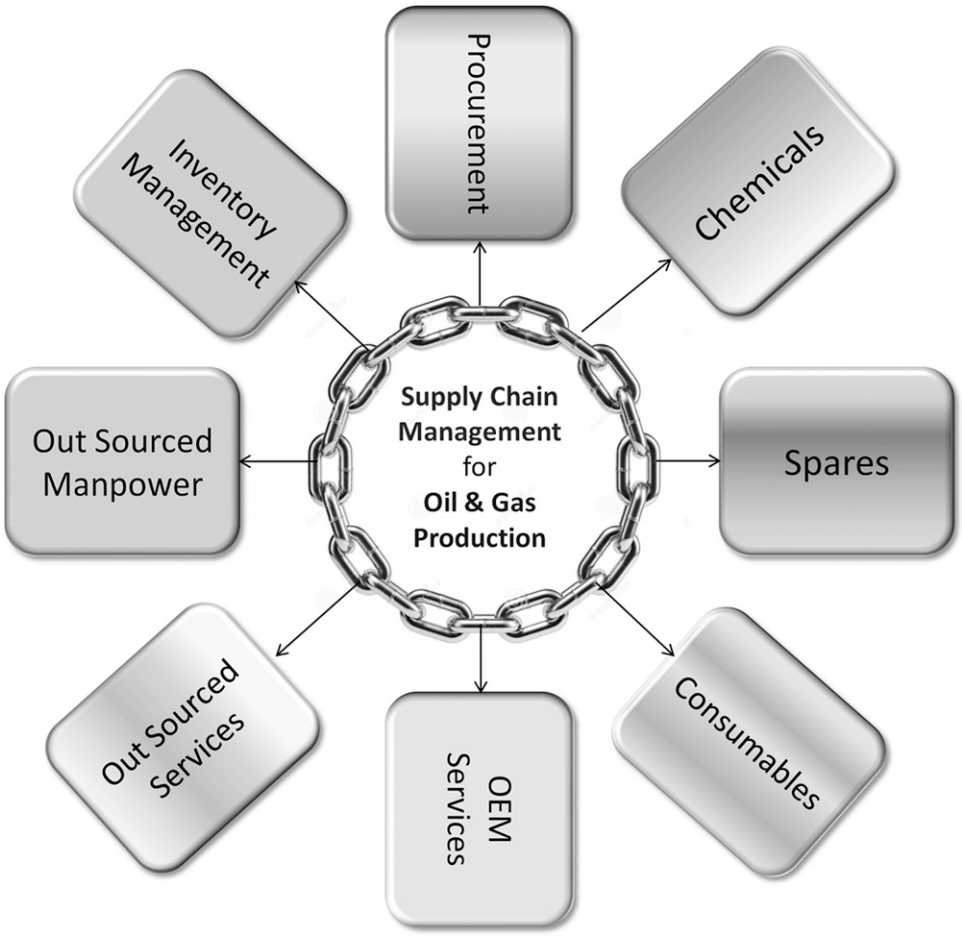
Figure 1 illustrates the components of supply chain management in oil and gas production.

## *3. Material Requirement Planning*

Material Requirement Planning (MRP) is a cornerstone of supply chain management in oil and gas operations (IMM Manual, 2019). The primary objective is to avoid excess inventory while ensuring timely procurement of essential items. MRP also enables the redistribution of inventory across sites, enhancing utilization without incurring additional purchasing costs (IMM Manual, 2019). Ineffective MRP, particularly in the absence of skilled controllers, can result in the accumulation of non-moving items, raising both purchase and maintenance costs.

Accurate material forecasting is essential for uninterrupted plant operations, as procurement budgets must be allocated in advance (L.N. Murthy, 2017b). Forecasts provide the basis for budgetary allocation and must be approved by the MRP function (IMM Manual, 2019). Many firms rely on Work Breakdown Structure (WBS) elements, cost centers, or fund centers—whether in SAP or similar systems—to distribute budgets across functions. Indenters must reference the appropriate WBS or cost codes to ensure proper financial control and allocation.

Figure 1
ILLUSTRATION OF ESSENTIAL FUNCTIONS OF SUPPLY CHAIN MANAGEMENT OF OIL AND GAS PRODUCTION




Source: Author's compilation.

### *4. Cost Estimation*

Cost estimation underpins procurement decisions and typically follows four approaches: (1) should costing, (2) work breakdown costing, (3) budgetary quotations, and (4) last purchase rate (LPR) analysis (IMM Manual, 2019).

- *Should costing* calculates projected costs by summing labor, material, tooling, consumables, device, setup, maintenance, and profit margin elements.
- *Work breakdown costing* divides the scope into smaller units, estimates each individually, and aggregates to obtain the total cost.

- *Budgetary quotations* are obtained by circulating the scope of work to multiple bidders without obligation. The lowest technically qualified quote is typically adopted; at least three quotes are generally required. Quotes may be hardcopy or electronic and must be valid for a defined period.
- *LPR-based estimation* uses historical prices for similar materials or services procured within the past two years, with adjustments for inflation, fiscal indices, or exchange rate variations. If no recent LPR exists, data up to five years old may be considered. This method, however, applies only when prior procurement records exist.

### *5. Contracts and Contracting Options*

Contracts for oil and gas procurement are awarded through open tenders, limited tenders, or nomination-based awards (IMM Manual, 2019). Open tenders are accessible to all bidders, with requests for quotation (RFQs) published online or in newspapers. Limited tenders restrict participation to selected vendors. Nomination-based awards are direct allocations, often applied to spares, annual maintenance, or proprietary OEM services.

Contracting options include cost-plus, fixed-plus, and fixed-price agreements (IMM Manual, 2019). Cost-plus contracts apply where service costs are uncertain. Fixed-plus contracts, with escalation or fall clauses, are used when reliable indices exist. Fixed-price contracts are adopted when underlying costs are stable. For OEM-supplied spares and services, nomination is often unavoidable; however, firms typically negotiate equal pricing with other customers and request reductions when OEMs lower prices elsewhere.

### *6. Tendering and Scope of Work*

Procurement begins with a purchase requisition (PR) in SAP, accompanied by an RFQ and approval note (IMM Manual, 2019). Firms may adopt single-bid systems, where technical and price bids are submitted together, or double-bid systems, where they are submitted separately. In the latter, price bids are opened only after technical evaluation.

RFQs must clearly specify scope and requirements, including material or service specifications, eligibility criteria, inspection procedures, delivery terms, statutory obligations, performance guarantees, payment terms, and conditions of contract. Incomplete specifications must be developed and approved before tendering. To ensure fairness, technical eligibility criteria—such as prior experience—must be explicitly stated (IMM, Manual 2019).

Following evaluation, a purchase order (PO) is issued in SAP, while a Letter/Notification of Award (LOA/NOA) is issued separately. Before final

confirmation, firms may require a security deposit or bank guarantee from the winning bidder. Service contracts are formalized through signed agreements.

Inspection and acceptance are conducted by designated authorities. Non-compliant materials may be rejected, or liquidated damages imposed. Accepted goods are recorded in the warehouse as a Goods Receipt Note (GRN), while accepted services are documented as a Service Entry Sheet (SES) (IMM Manual, 2019). When specifications are unclear, firms may issue an Expression of Interest (EOI) to gather market information on scope, specifications, and potential suppliers.

### *7. Bid Protest*

Procurement decisions can generate disputes, particularly regarding technical or commercial evaluations. Bid protests, if mishandled, may result in legal challenges (Ties van der Horst, 2013). To mitigate risks, tender documents must clearly outline evaluation criteria, rejection grounds, and prequalification requirements (Manual for Procurement of Works, 2022). Without such clarity, rejections may be legally contested.

### *8. Legality of Contracts*

Contracts represent legally enforceable agreements that create rights and obligations between parties (Contracts Law, 2019). They must be entered into voluntarily, with free consent, lawful consideration, and legitimate objectives. Contracts that violate public policy, morality, or statutory law are void. Parties must be treated equally under the law, and any clause disproportionately favoring one party may render the contract void.

Contracts may also become void due to changed circumstances ("void at execution") or may be voidable at the option of one party. The principle of privity of contract ensures that only contracting parties have enforceable rights or obligations (Contracts Law, 2019).

Long-term supply and service contracts—for example, supply of 100 MT of HCl over three years or manpower contracts of similar duration—require firms to honor their commitments. Failure to order agreed quantities may expose firms to legal action. Likewise, unilateral cancellation clauses may be deemed unenforceable (Contracts Law, 2019).

### *9. Discussion and Conclusion*

Supplier relationships are critical, given the broad and complex networks involved in oil and gas operations (Monnac, 2015). These relationships span from small enterprises to large multinational firms. While managing multiple suppliers increases complexity, it enhances resilience and provides a competitive advantage.

Long-term contracts foster trust, reduce uncertainty, and stabilize supply chains (Monnac, 2015).

In procurement, approaches such as cost-plus and turnkey contracts reflect the industry's need to manage risk and uncertainty (Mohammad and Price, 2003). Strategic, innovative contracting is essential in a high-risk environment.

Equally important is optimizing inventory: procuring unnecessary items raises costs, while failing to secure essential materials risks production interruptions (L.N. Murthy, 2017a). Materials must be stored according to manufacturer recommendations to preserve quality, and all procurement and contractual records should be maintained in computerized systems with reliable backups (L.N. Murthy, 2022).

Ultimately, oil and gas production requires a strategic approach to the procurement of materials, spares, chemicals, and services. Effective planning, transparent contracting, and resilient supplier relationships are indispensable for ensuring uninterrupted operations and sustaining long-term production efficiency.

The optimization of materials and services in oil and gas production is not simply a matter of cost control; it is central to the reliability, safety, and sustainability of operations. Inefficiencies in procurement, inventory management, or contracting can create significant financial burdens, disrupt production, and expose firms to operational and legal risks. Conversely, a strategic approach—grounded in effective material requirement planning, transparent contracting, and resilient supplier relations—ensures that resources are available when needed, expenditures are rationalized, and production remains uninterrupted. In an industry defined by high capital intensity, global supply chains, and market volatility, strengthening supply chain management is not optional but essential for long-term competitiveness and sustainable energy development.

**Policy Implications:** Governments and regulatory bodies can play a critical role in strengthening the oil and gas supply chain by mandating transparent procurement practices, enforcing compliance with statutory guidelines, and incentivizing the adoption of efficient contracting models. Such measures not only reduce systemic inefficiencies but also help ensure energy security and sustainable resource management.

**Practice Implications:** For industry practitioners, adopting robust material requirement planning, cost estimation methodologies, and supplier relationship strategies can significantly reduce operational risks. Building long-term partnerships with suppliers, investing in digitalized procurement systems, and aligning contracts with market realities will enhance operational resilience, lower costs, and support uninterrupted production in a highly competitive sector. Ultimately, the strategic optimization of materials and services is not only a driver of efficiency in oil and gas operations but also a cornerstone of long-term competitiveness and sustainable energy development.

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