NAC Executive Insights

Procurement Management in Large Complex Programs

Key Points

- Opportunity exists to improve overall program capital efficiency.
- Programmatic approach facilitates the development of supplier relationship agreements.
- Programs must be global in scope.
- Use of Client Furnished Materials (CFM) provides the program with increased opportunities to manage the challenges of scale and complexity while capturing some of the opportunities of leverage.
- Standardization of major equipment provides benefits for ultimate operations, allowing training early in the program.
- Use of prefabricated or preassembled materials is characteristic of large programs.
- Purchasing consolidated bulk materials leverages spend across projects and provides efficient management of surplus materials.
- Material management encompasses activities required to receive, accept, store, maintain, control, disburse, track, and document CFM provided to project contractors.
- Programs may employ more than one procurement strategy at a time.
- There is a need to consider logistical issues associated with major supplier locations, shipping, and other transportation links, as well as any intermediate work locations.
- Supply chains are transitioning to "thinking" supply chains enabled with Big Analytics.

Introduction

Procurement in a program management organization represents a focused effort to improve overall program capital efficiency by seeking to capture the opportunities of leverage embedded in the program scale, simplify market complexities and risks by increasing their visibility, and enhancing management of programmatic supply risks by creating opportunities to utilize risk mitigation strategies typically not available at the project level.

Risks facing large engineering and construction programs include:

- New global sources of supply

- Increased use of module fabrication facilities
- Growing multi-country risk
- Increased competition for essential construction materials
- Constrained shop capacity for select equipment
- Broadened set of financial risks
- Common cost drivers across multiple categories of supply
- Increased importance of current supplier risk performance assessment
- Export compliance risks
- Corruption risks
- Increasing complexity of products and services
- Increased financial volatility
- Increasingly global labor markets
- Volatile energy prices
- Shifting industry structures
- Exposure to a growing number of regulatory environments

To address these challenges, procurement in program management organizations has available a wide range of strategies which, while applicable in large project settings, provide added benefits in large programs. These strategies include:

- Supplier relationship agreements
- Global sourcing
- Client Furnished Material (CFM)
- Bulk material CFM
- Material management
- Alternative contracting strategies
- Logistics management
- Emergent artificial intelligence (AI)-enabled supply chain

Supplier Relationship Agreements

A programmatic approach facilitates the development of supplier relationship agreements with quality suppliers that have the capacity to competitively meet the program's needs. The formulation of these supplier agreements allows the program to build a partnership arrangement that brings the procurement activity and critical vendor input forward in the overall program cycle.

Value-adding inputs from these strategic suppliers can influence design decisions with an eye towards reducing overall costs and schedules. Procurement cycles are reduced or eliminated for releases after the initial agreement is put in place and quality inspection activities can be more targeted for better results.

Supplier relationship agreements:

- Are pre-priced and pre-negotiated agreements with key suppliers.

- Provide volume-leveraged pricing from suppliers who maintain high quality and performance.
- Reduce risk profiles through improved supplier performance and cost certainty with positive impacts on contingency, warranty, schedule float, and product quality.

Global Sourcing

Procurement activities in these programs must be global in scope while recognizing market limitations; differential market pricing opportunities; differential financing and financial risks, including foreign exchange and sovereign risks; alternative delivery opportunities created by the use of client furnished materials (discussed below); and potential counter-trade requirements.

Global sourcing requires the program manager to have an understanding of the unique requirements and risks associated with each supply jurisdiction. It would not be uncommon for a large program to have primary or secondary sourcing from 50 to 100 countries.

Global sourcing requires a clear understanding of logistics involved; trade and other customs regulations; visa limitations affecting inspection activities; export control regulations; embargo considerations; clearing and quarantine times; required documentation; and fees.

Particular attention must be paid to any increased susceptibility to corruption as a result of this sourcing approach. Processes must be in place to insulate the program.

Client Furnished Material (CFM)

Client furnished materials in large engineering programs may include:

- Engineered materials, such as major and minor equipment
- Prefabricated or preassembled materials
- Bulk materials

In general, the use of CFM provides the program with increased opportunities to manage the challenges of scale and complexity while capturing some of the opportunities of leverage inherent in large engineering and construction programs utilizing a program management approach.

Engineered Materials

Engineered materials have been traditionally considered as an area for use of CFM, especially as it relates to major equipment, particularly specialized, process-oriented equipment with long lead times that are central to overall program performance. Major equipment on large programs may involve purchases of multiple such units and as such may lend itself to the use of Supplier Relationship Agreements as previously discussed.

Standardization of major equipment provides benefits for ultimate operations as operators may be trained on units completed in early phases of the program. Similarly, construction erection

methodologies may build upon prior learning experiences to drive towards a best practice as the program is built out.

Newer in its application is the use of CFM for major portions of minor equipment comprising the program. Minor equipment may include pumps, valves and controllers, motors, switchgear, and other program components that are uniquely tagged but not necessarily long lead in nature. The principle drivers for the use of CFM for minor equipment include:

- Standardization of components for operations and maintenance
- Reduced program-level spare requirements
- Increased inter-changeability of components
- Consistency of quality acceptance criteria
- Improved installation guidelines and protocols
- Reduced contractor risk and contingency
- Leverage from consolidated procurement

Prefabricated or Preassembled Materials

The increased use of prefabricated or preassembled materials is characteristic of many large programs where either absolute labor constraints exist or site logistics otherwise constrains the ability to undertake all construction and fabrication activities at the site. Benefits include:

- Reduction in program duration
- Improved productivity through transition from a stick-built to a manufacturing approach
- Reduced field labor and associated general conditions costs (camps, ancillary facilities, other labor premiums)
- Reduced risk through better defined and controlled work processes
- Improved safety by reduced work at heights

This prefabrication activity may cover all major disciplines and trades and include:

- Concrete decks and wall sections
- Steel plate structures
- Rebar cages
- Steel struts or other structural steel members
- Mechanical equipment units such as pumps, compressors, and heat exchangers
- Pipe racks
- Control rooms
- Switchgear, distribution rooms, and other electrical subassemblies
- Sampling stations
- Minor buildings
- Major buildings or portions thereof
- Complete process units

Full scale modularization is not discussed in this Executive Insight.

Bulk Materials

An alternative approach is for the program manager to manage the majority of the bulk material requirements for the program including:

- Identification
- Bid
- Purchase
- Expedite
- Inspect
- Transport
- Receive
- Warehouse
- Issue to construction

This approach:

- Leverages spend across projects
- Provides efficient management of surplus materials
- Reduces waste streams on a program-wide basis
- Prioritizes allocation of scarce materials for program advantage
- Improves material quality control
- Identifies material quantities from engineering at an earlier stage
    - Not required to be allocated to projects or contract packages
- Reduces program-wide inventories and storage requirements
- Improves site logistics
- Facilitates a structured approach to material substitution

Material Management

Material management activities at the site include all those activities required to receive, accept, store, maintain, control, disburse, track, and document client furnished materials to be provided to project contractors. These activities include:

- Complete warehousing activities, inclusive of material receiving and distribution
- Inspection during receiving
- Preparation of overage, shortage, or damage reports
- Inventory management and control
- In-storage preventive maintenance
    - Specific requirements for preservation and maintenance of client furnished equipment and materials will be identified in conjunction with suppliers during the initial engineering phase of the program.

    - Construction equipment provided as CFM will be maintained in accordance with manufacturers' recommendations.
- Storage based on classification:
    - Outdoor storage permitted
    - Indoor storage only
    - Protected outdoor storage
- Material control planning
- Back charges to suppliers
- Site procurement of miscellaneous materials
- Security

Utilization of robust material tracking techniques such as RFID tags and bar codes would be expected and well-developed material management processes and tools are essential. The success of programmatic procurement strategies will very much rest on the ability to meet commitments to project contractors.

Alternative Contracting Strategies

Large scale programs open up new opportunities to improve program capital efficiency as well as shorten overall program schedules. Achieving these benefits may result in alternative contracting strategies being deployed that can span a wide range. Programs may employ more than one procurement strategy at a time and the mix of strategies may vary over the lifetime of the program.

Examples of some alternative contracting strategies can include:

- Supplier relationship agreements for major equipment to be installed by others
- Supplier relationship agreements for minor equipment to be treated as free issue material (client furnished material or CFM) to project contractors
- Supplier relationship agreements for bulk materials to be treated as CFM
- Supplier relationship agreements for select program services, such as heavy marine transport; customs clearance; and site-wide medical services
- Engineer, Procure, Construction Manage (EPCM) contracts with or without incentives
- Engineer, Procure, Construct (EPC) contracts with or without incentives
- Engineer, Procure (EP) contracts
- Engineering only contracts
- "Horizontal" or program-wide construction contracts such as:
    - Site grading
    - Off-sites and utilities
    - Master electrical contractor
    - Master automation and controls contractor
- Equipment leasing and maintenance contracts
- Concrete batch plant

- Non-process infrastructure and other enabling works contracts:
    - Man-camps
    - Commissary
    - Fueling services
- Public Private Partnership or other life-cycle contracts that provide a delivered service versus just an asset. These contracts may extend into the program's operations and maintenance phase.
- Capacity building contracts to meet local sustainability objectives
- Independent inspection and monitoring contracts

Logistics Management

Logistics management begins by developing a plan that addresses specific program conditions and needs. These needs may differ for the various project sites that comprise the program, and the logistics management plan also will need to consider logistical issues associated with major supplier locations, shipping and other transportation links, as well as any intermediate work locations such as those associated with prefabrication, preassembly, or full modularization.

Elements of the program that represent logistical complexity or risk must be identified at the earliest stage. Logistical constraints must be clearly identified at each shipping and receiving location and can include:

- Maritime
    - Maximum draft
    - Handling capacity limitation
    - Available transport capacity
    - Demurrage costs
    - Operating rules
    - Cargo limitations
    - Seasonal or heavy weather limitations
    - Flagging
    - Customs or quarantine-related issues
- Railroad
    - Route limitations
    - Dimensional limitations
    - Hours of operation
    - Work rules
- Road
    - Transit hours
    - Dimensional limits – height; width; length
    - Restricted cargo
    - Maximum axle loadings
    - Maximum bridge loadings
    - Turnout frequency and availability

    - Police escort
- Marshalling, customs or quarantine storage, and warehousing facilities

Logistical contractors for transportation of abnormal loads can be booked up to a year in advance. Proper planning is required to avoid schedule impact.

The program manager must also pay particular attention to the cumulative challenges and opportunities associated with program logistics by evaluating such items as:

- Consolidated multi-project shipping and transport
- Programmatic contracting of heavy marine vessels; railroad locomotives and cars; trucking; and specialized transport vehicles (such as the SPMTs required by large modules) and cranes.
- Conflicting and peak logistics requirements

Materials sourced offshore require special attention for customs, license, and freight forwarding services. Examples include:

- Duty exemption lists
- Freight forwarding
- National flag carriers
- Customs clearance
- Anti-boycott Laws
- Export compliance

Emergent AI (Artificial Intelligence)-Enabled Supply Chain

Across many industries, digital transformation is changing the supply chain more than any other functional area. It is driving efficiency and resiliency to disruption. The supply chain is transitioning to a "thinking" supply chain, one that is broadly and tightly connected to all data sources. In industry after industry, the supply chain is enabled with Big Analytics, is collaborative through cloud-based networks, and is focused on cyber threats. This transformation, however, has yet to be realized in the engineering and construction industry.

Supply chains face two major gaps. The first is an analytics gap where even AI capabilities are not keeping up with the growth and diversification of data sources. Available data must be fully leveraged — structured, unstructured, and dark data, which is defined as data not yet visible to the organization.

Organizations have a great deal of data buried in contracts and transactional systems and externally, among regulators, that can be applied for intensified procurement insights. Using cognitive computing capabilities to parse through unstructured data, such as news feeds and social networks, can augment learning for supply risk scoring and supplier performance.

The AI-enabled supply chain must have access to the data and be able to analyze it for value in real time. This data include:

- Customer communications

- Transportation modes, routes, and rates
- Competitive pricing and news
- Weather/storm disaster data
- Geopolitical data
- Global inventory
- Procurement process
- Spend analysis
- Supplier evaluations
- Contracts

The second gap is one of attention and knowledge. Supply chain organizations have pursued cost reduction and lean practices. While this may be productive in the short term, as data analytics capabilities grow, there likely won't be enough "eyeballs" to act upon the resulting insights. The role of AI and machine learning is critical.

The AI platform is the modern supply chain's control tower: collating, coordinating, and conducting decisions and next best actions across the chain in an automated and timely fashion. It can prioritize attention based on potential impact. It aids in risk management, spend analysis, logistics, and distribution.

Machine learning applies algorithms to Big Data to discover insights to track and predict supply chain disruptions, thus providing new levels of visibility. It can recommend alternative actions for unplanned events and transportation disruptions. Weather data integrated with operational data can predict potential problems and alert transportation and logistics service personnel with recommended actions.

It pulls together diverse unstructured data from within and outside the company and visualizes it in a way that helps specialists make quick and accurate decisions.

About the Author

Bob Prieto was elected to the National Academy of Construction in 2011. He is a senior executive who is effective in shaping and executing business strategy and a recognized leader within the infrastructure, engineering, and construction industries.