

# **Schedule Improvement Through Innovative Procurement Strategies**

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### **Abstract**

Saudi Aramco's quest for improving the Program Schedule has been very intensive, continuous and a direct result of Company's desire to bring its production facilities on line in a shortest time frame, to stay competitive and to command leadership.

Over the years, Saudi Aramco has developed and implemented several initiatives to reach or exceed parity with industry benchmark for cost and schedule. These initiatives include development and use of best practices data bank, application of Construction Industry Institute (CII) concepts, and Innovative execution strategies. The Company has since identified hundreds of millions of dollars in project cost savings and substantial improvement in schedule.

Of these initiatives, few have been more important or more productive as Company's efforts to develop sound and innovative procurement strategies. The application of innovative procurement strategies is one of the key contributing factors which reduced typical Program Schedules anywhere from 4-5 months, beginning with the development of the Shaybah Producing Facility in the remote empty quarter of Saudi Arabia, followed by grass roots Hawiyah and Haradh gas processing complexes, and Qatif Producing facilities...all world class mega-projects...in sheer magnitude, complexity and logistics. Saudi Aramco through implementation of several innovative procurement strategies shortened the overall Program Schedule. The innovative procurement strategies include – “equipment novation”, “partial funding” “use of integrated team”, “use of restricted/regulated vendor list”, “focused expediting effort”, and utilizing alternate “mode of shipment”.

The paper will highlight the application of major procurement strategies which optimized procurement cycle and resulted in substantial improvement in program schedule.

The presentation will be augmented by participation of two (2) EPC Contractors, one from Europe and one from Asia. Their participation will be in the form of panel discussion after the presentation.

### **Background**

Saudi Aramco's quest for improving the program schedule has been very intensive, continuous and a direct result of our desire to bring our production facilities on line in a shortest time frame, to stay competitive and to command leadership.

Benchmark studies had indicated that we in Project Management were spending more and taking more time to complete the projects than our competitors and the rest of the industry.

With this background, Saudi Aramco Project Management developed and implemented several initiatives to reach or exceed parity with industry benchmarks for cost and schedule. These initiatives included:

- Organization realignment reflecting use of integrated team
- Application of Saudi Aramco Best Practices, and CII Best Practices
- Selection of appropriate contracting strategy
- Partnering with contractors and proponents during project execution; and,
- Long term supply agreements with pipe vendors.

Of these initiatives, few have been more important or more productive as Company's efforts to develop sound and innovative procurement strategies. The application of innovative procurement strategies is one of the key contributing factors which reduced typical Program Schedules anywhere from 4-5 months, beginning with the development of the Shaybah Producing Facility in the remote empty quarter of Saudi Arabia, followed by grass roots Hawiyah and Haradh gas processing complexes, and Qatif Producing facilities...all world class mega-projects...in sheer magnitude, complexity and logistics. This paper focuses on the application of procurement strategies within Saudi Aramco and how these major program achieved schedules comparable or better than industry benchmark.

In summary, the paper will:

- Review the impact of procurement on project schedule
- Review a typical procurement cycle for long lead engineered equipment.
- Highlight improvements to procurement cycle which resulted in improved Program schedules, and;
- Summarize results achieved by implementing these improvements on mega projects that were recently executed by Saudi Aramco.

### Impact of Procurement on Project Schedule

Several studies have highlighted that material delays have substantial impact on Project Schedule and labor productivity. Construction Industry Institute (CII) studies indicate that material procurement is a major target area where substantial improvements in the design and construction process can be achieved. These studies estimate 10-12 % in construction labor costs could be saved if materials and equipment had been available at work when needed. The result are even more staggering for projects executed in Middle East, most of which are procurement driven and gets even more dramatic when we factor in the recent security concerns, high risks, and competition for work elsewhere. Success depends on early or on-time delivery of materials and equipment.

### Typical Procurement Cycle

A typical procurement cycle and the activities therein is provided (Exhibit 1) below:

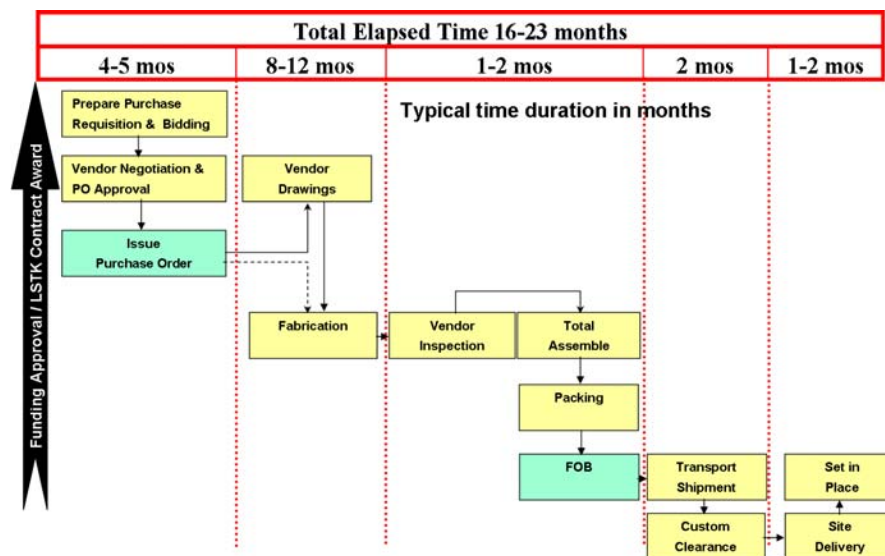


Exhibit 1 – Typical Procurement Cycle

The process begins with the preparation of a purchase requisition followed by bidding cycle, issuance of PO's, approval of vendor drawings, equipment fabrication, inspection, assembly, packing, transport, custom clearance, delivery, and installation at the site.

For a typical long lead engineered equipment, the overall cycle time could be anywhere for 16-23 months depending upon the type and the complexity of the equipment.

The process is relatively long. It is essential to shorten the duration for the individual activities or look for alternatives which could expedite the bidding cycle by possibly placing the PO's for the critical long lead equipment prior to funding and/or LSTK contract award to optimize the overall schedule. Identification of the critical long lead equipment is an integral part of the front-end planning. Early in the preliminary engineering phase of the project, an aggressive master schedule is developed from which key long lead material and equipment are identified. Initially, this is the basis for decisions on pre-purchasing of long lead equipment prior to funding approval and or LSTK contract award.

### Improvements to Procurement Cycle

#### Novation

The Procurement Strategy reflecting placement of Purchase Orders for long lead equipment, prior to funding approval and before the LSTK Contractor is on board will provide immediate payoff in terms of reduced procurement cycle time and improved program schedule. In Saudi Aramco, we refer this process as Equipment "Novation". The novation concept was adopted by Saudi Aramco in January 1996 for Shaybah Oil Field Development Program. Novation allows the placing of critical orders with a vendor including the right to transfer (Novation) to an LSTK contractor, who then becomes the owner of the Purchase Order. To date over \$1 Billion of equipment has been authorized to be Novated by Saudi Aramco.

Equipment selected for "Novation" is determined by schedule consideration for long lead time equipment, or immediate need for detailed vendor information, or constructability requirements in access restricted plots. The Purchase Order is placed prior to funding authorizing the vendor to start engineering and shop drawings with an option for the equipment. The Purchase Order responsibility is then transferred to the successful LSTK Contractor(s), concurrent with the execution of the LSTK Contract(s).

The novation process reduces the project schedule by removing those items from the project's critical path.

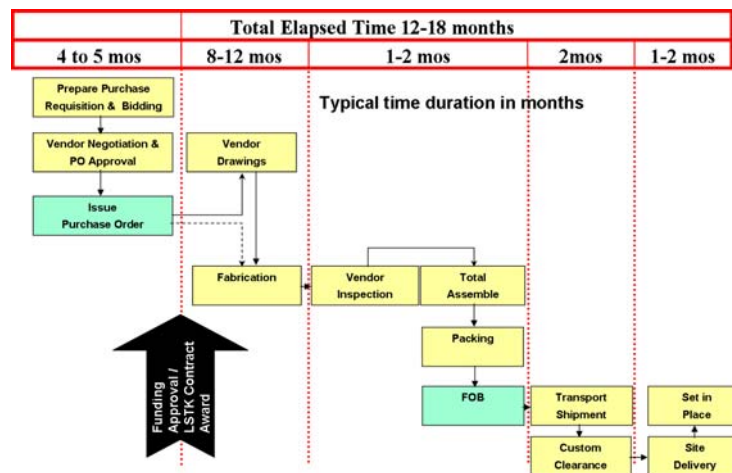


Exhibit 2 – Procurement Cycle after “Novation”

As can be seen in Exhibit 2, the “Novation” process reduces the overall cycle time and the overall Program Schedule anywhere from 4-5 months or more.

Typical equipment considered for novation are Engineered Equipment such as Gas Compressors, Heat Exchangers, Combustion Gas Turbine Generators, High Voltage Electrical Equipment, and Process Control Systems.

The primary considerations for novation is the required on site date and the need date for vendor data, but constructability is also considered. Even though there may be some float in the equipment delivery dates, “novation” maybe required to meet engineering’s need for vendor information, for example, foundation drawings and utility requirements. The late receipt of vendor information will impact the engineering progress with respect to issuance of IFC drawings.

Another reason for novation could be constructability, where space limitation and sequence of erection could be a factor. For example, adding additional module to existing facilities.

Material novation is not risk free. The immediate risk is the cost of abandoned engineering in case the project is deferred or cancelled. The cost of committed engineering ranges from 3% to 5% of the novation orders values. There is also the chance of scope gap between supply chain entities, additional costs of transferring the risk to contractors, problems with warranty issues, and lack of full cooperation from vendors. However, drawing from experience with material novation, a sound strategy could be developed for managing the novated material which encompasses all of the lessons learned in purchasing, installing, and testing equipment.

### **Partial Funding**

Another strategy is to secure partial funding for material cost only in case the complete project funding approval date is a long way ahead.

This approach is typical with non engineered equipment where a complete purchase order can be placed in a short time (2-3 months). A major example is the line pipe. Current workload and vendor capacities have created an unprecedented market conditions. The normal lead time for the pipe delivery was 6-8 months. Now it is 12-16 months. To overcome this delay, Saudi Aramco started obtaining partial funding and procuring piping material prior to project funding.

Risks associated with this approach are similar to one previously highlighted for equipment Novation.

### **Integrated Team**

Typically, support services such as contracting, finance and procurement are provided through matrix organizational arrangement reflecting the absence of dedicated personnel assignment. The absence of dedicated personnel and, in turn the lack of an integrated team has negative schedule impact. Recognizing the value of the integrated team, project teams for Saudi Aramco mega projects are organized by placing highly experienced personnel from operations, support organizations, and project management in key positions.

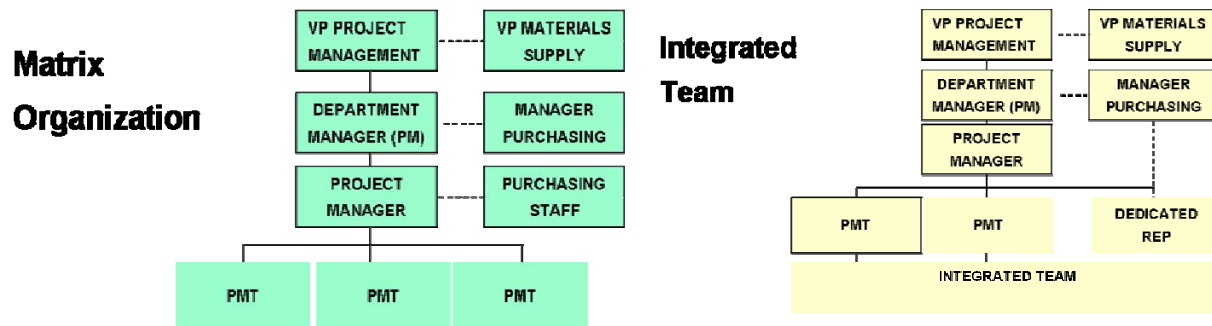


Exhibit 3 – Integrated Team

With the assignment of a dedicated purchasing representative, we are able to resolve issues faster and take decisions at the project level without referring them to the parent organization. The dedicated assignment has resulted in team building through which we are able to take full control of quality and schedule. Our experience has indicated that the procurement strategy reflecting the dedicated assignment of the purchasing representative has shortened the overall program schedule by a minimum of one month.

### Regulated Vendor List

Exhibit 4 shows the number of vendors by major equipment that Saudi Aramco had throughout our facilities in the late 1990's. It was recognized that the supplier list was long and could become more complex as new vendors came to the market. It was recognized that the “long list” was adding more time to our Procurement Schedule.

Equipment	Number of Manufacturers
Compressors	62
Valves	396
Electrical Meters	154
Electrical Equipment	246
Pumps	670

Exhibit 4 – Typical Vendor List

The benefits of regulating the number of vendors from whom we purchase major equipment was recognized by Saudi Aramco during the front-end planning for mega-projects and was implemented initially for equipment selected for “novation” and procurement of “Process Control System” The lists identify vendors that are recognized in the industry as producing quality products at competitive prices. The use of regulated vendor list:

- Allows standardization of selected equipment across multiple contracts after competitive bidding.
- Enhances quality and reduces risks as only approved and inspected suppliers are used.
- Improves schedule as suppliers are familiar with inspection and testing requirements for Saudi Aramco.

The risk with Restricted Vendor List, as we have seen in the last two years is limiting your options in an already tight market conditions. Flexibility and ability to respond is critical in this case.

## **Focused Expediting Efforts**

Focused expediting efforts are essential to ensure the critical equipment is delivered at the job site on or before the need date. These efforts could include:

- Management involvement including visitation to manufacturing facility – frequent visit at a predetermined interval by Company Management would instill a sense of partnership with the vendor and will assist in expediting the shipment of the critical equipment. It could also lead to potential alliance agreements with major vendors.
- Full time assignment of in-plant expeditors/inspectors – this would ensure strict compliance with QA/QC program and also resolve technical issues faster and results in expedited fabrication and shipment of critical equipment. The benefits of assigning dedicated resident engineer / inspector at the vendor fabrication facilities is apparent during the resolution of QA/ QC issues especially for novated equipment. The dedicated engineer is responsible for all activities in the fabrication shop beginning with the review of the vendor fabrication schedule through the release of accepted materials. In the absence of full time assignment, the QA/ QC function is generally contracted in limited to “witness of critical test”.
- Joint responsibility – the collective efforts and joint responsibility for shipping critical equipment shared by the owner and the contractor, has been proven to be productive since both the owner and the contractor focus on the same mission and are sharing limited resources.

The delivery of some of the critical novated equipment could be improved anywhere from 1 -2 months through focused expediting efforts.

## **Mode of Shipment/ Custom Clearance**

To ensure that the materials are delivered on time, Saudi Aramco Project Management Team visited all the major suppliers to emphasize the team work.

The evaluation and the development of an effective transportation strategy (Air Vs Boat shipment) is a must for timely delivery of materials. For example, the delivery of some critical equipment from Italy to be shipped by boat required a total of 40 days of delivery time. This was not acceptable. Through studies and discussions, Saudi Aramco and the vendor jointly agreed to change the mode of shipment from boat to surface ..... that is to ship the equipment from Italy through Greece, Turkey, Syria, Jordan and to Saudi Arabia by surface. This revised transportation mode took only 14 days by truck and was instrumental in maintaining the program schedule.

Likewise, Saudi Aramco took a different approach for customs clearance. Saudi Aramco physically stationed project materials personnel at the customs office(s) at the seaport, airport, and at the border posts. Through bonding and teamwork between the Saudi Aramco and the customs personnel, custom clearance was improved from 3-4 days to one day, again improving the overall program schedule.

## **Modularization**

Although not utilized extensively within Saudi Aramco, modularization as an mythology is frequently used in the industry especially to improve the construction schedule where the circumstances support it. Modularization is defined as a process wherein the individual components of major sections of a plant are assembled away from the field. Over the years it has been clearly demonstrated worldwide that modularization of process plants can produce significant cost savings. A study was commissioned by Saudi Aramco to investigate the applicability of these savings to the Saudi Arabian environment. The study confirmed:

- cost savings of about 20%
- project schedule could be improved significantly; and,
- reduces safety risks

The basis for cost savings are:

- Modularization requires less materials – the concept is to install more than one processing unit on a single steel frame. This reduces the clearance between the units hence, the quantity of bulk materials required.
- Site labor costs are higher – a cost premium is normally required for a worker to relocate to a remote site location.
- Workshop productivity is higher – this is due to the better workshop equipment and controls which will result in lower percentage of rejected work.
- Shop fabrication is more precise – modular design involves all items to be defined in 3D CAD, this means ability to fabricate to tie geometrical tolerances.

Overall cost savings are estimated in the order of 9% as shown in Exhibit 5.

Project Phase	Conventional	Modular	Difference
Engineering	\$70	\$ 77	10%
Procurement	\$ 20	\$ 24	2 %
Fabrication	\$ 500	\$ 585	34%
Transportation	\$ 30	\$ 34	13 %
Construction & Startup	\$ 380	\$ 195	(50)%
Total	\$ 1,000	\$ 915	(9) %

Exhibit 5 – Modularization – Cost Difference

Exhibit 5 shows results of representative costs normalized to \$1 Billion conventional process plant. The net savings of approx. 9% for the modular approach is made up of a number of differences in the impact of modularization. The biggest phase, construction& start-up, offers savings in excess of 50% reduction primarily from a decrease of field man-hours. Balanced against the savings are extra costs for:

- Engineering: design of structural frame of the module which must withstand forces during transportation.
- Procurement: additional cost of evaluating and selection of module fabricators.
- Fabrication: as more work is performed in the shop and
- Transportation: due to use of specialized carrier, and higher insurance cost.

The elapsed time from the start of engineering to plant start-up can be reduced by six (6) months through modularizations. The schedule reduction is possible as modularization strategy incorporates better QA/QC, multiple parallel operation, better materials control and, increased shop testing

## Summary

In summary, the procurement cycle improvements can be achieved through:

- Material Novation
- Partial Funding Strategy
- Use of Integrated Teams
- Regulated Vendor Lists
- Focused of expediting efforts
- Review of alternate mode of shipment
- Stationing of Saudi Aramco personnel at the sea, air and border posts for custom clearance; and,
- Modularization

The application of these strategies has resulted in an overall schedule improvement anywhere from 4 to 5 months on Saudi Aramco mega-projects. These strategies provide a few examples of what we all can do by thinking “out of the box” to optimize the procurement cycle time and save millions of dollars.