Large Capex Projects: Solving the ROI Dilemma

Striking the right balance between capital expenditures and financing options is key to maximizing return on investment in large capex projects.
A new steel mill, an offshore wind park, a mammoth aircraft carrier, a floating oil platform, a state-of-the-art manufacturing facility—these examples of large-scale capital expenditures (capex) are vastly different in nature but all face a crucial challenge: finding the right trade-off between capex cost and financing options to optimize return on investment (ROI).

Every industry has large capex projects, and besides the ROI challenge, they share many of the same characteristics:

**Complexity.** Not surprisingly, large capex projects demand a multitude of results—decisions made, technical problems solved, financing requirements assessed, supplier capacities evaluated, legal issues addressed. The list goes on and on, and not even the smallest detail can be overlooked.

**Multiple stakeholders.** Aligning the many functional stakeholders typically involved in large capex projects is a major task. While finance wants to ensure export credit agency (ECA) coverage, for example, procurement is looking for the best costs and supply security, and engineering is lobbying for the finest technical solutions. The burden increases when projects are led by international consortia.

**Interfaces.** The combination of functional and international stakeholders and different segments and procurement packages requires well-managed interfaces. Good communication is essential.

While finance wants to ensure export credit agency (ECA) coverage, for example, **procurement is looking for the best costs and supply security.**

**Negative supply-market shifts.** Large projects can create market demands that may be detrimental. For example, the steel requirements can cause prices to rise and negatively affect the project’s budget.

**Bankruptcy risks.** Negative market shifts, budget overruns, and delays can lead to significant problems—including bankruptcy. Since procurement comprises the lion’s share of costs, a well-planned procurement strategy is crucial to a project’s success.

**Complexity of Expectations**

Generating the best possible returns on investment is arguably the main objective of a large capex project. One of the toughest challenges in reaching that objective is meeting the expectations of stakeholders who have their own concerns and expertise, such as the following:

- **Financial.** Financial stakeholders want to ensure that funding meets an acceptable debt-to-equity ratio at the lowest possible costs as affected by interest rate and borrowing period.
- **Procurement.** Procurement experts are looking to do business with the most cost-competitive suppliers and contractors while ensuring that all standards are met—in price stability, supply security, and quality.
• **Technical and engineering.** Engineers seek to ensure system integrity, meet required quality standards, and manage multiple interfaces.

• **Project management.** Project managers focus on getting the project built, installed, and fully operational within the defined time frame.

• **Commercial.** Commercial stakeholders push to reach profitability in the shortest possible time. This is often achieved by minimizing capital and operating expenditures, allowing the company to price competitively and maximize revenues.

• **Legal.** Lawyers aim to achieve the least possible contractual risk. Having many different contractors—or, at the other extreme, one very large contractor—heightens the risk of potential disputes over liability claims.

Some of these expectations are in direct conflict with others. For example, easy access to capital could incur many procurement restrictions, which might well have mixed effects on the commercial side. On one hand, procurement restrictions could have a positive impact on financing costs, while on the other they could have a negative impact on overall costs if ECA requirements necessitate higher-priced suppliers. Every expectation has the potential for similar conflicts and contradictions.

The bottom line is this: Managing total capex is the key to carrying out a successful project. After all, the most important criterion for potential owners to evaluate a project is its ROI, and a good ROI depends on the project’s commercial attractiveness, which depends on financing costs, which influence capital structure and capex, which must meet all stakeholders’ quality and time requirements (see figure 1).

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**Figure 1**

**The dilemma of large capex projects**

![Diagram showing the relationship between ROI (commercial), capex (procurement), and financing cost (finance)](source: A.T. Kearney analysis)

And, if this is not complex enough, consider that different financing options assert different influences on large capex projects, primarily because large projects require multisource funding. These options include:

**Stakeholder equity.** Equity from owners is always part of the financing package, if only to meet minimum requirements. Depending on each owner’s financial stability and the complexity of the ownership structure, the project will have different equity shares, each based on the amount
the owner is willing to invest. Equity funding is generally more expensive due to owners’ dividend expectations, and, depending on their long-term views, may be relatively short-lived.

**ECA-guaranteed debt.** ECA loans are granted by commercial banks and backed by state export credit agencies, such as Euler Hermes in Germany, Coface in France, or Export-Import Bank of the United States (see figure 2). These loans can have much longer tenures compared with non-guaranteed commercial debt, but they require more approval time and are more expensive. Moreover, ECA loans carry strict requirements related to the share of goods supplied by companies from the ECA country and the extent to which local entities are granted equity shares.

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**Figure 2**

**Examples of large capex projects financed by multiple export credit agencies (ECAs)**

<table>
<thead>
<tr>
<th>BTC</th>
<th>Three Gorges</th>
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<tbody>
<tr>
<td><strong>30% equity</strong></td>
<td><strong>Hydroelectric dam in China’s Hubei province</strong></td>
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<tr>
<td>Equity</td>
<td>Additional power tax across China</td>
</tr>
<tr>
<td>International Financial Corporation (IFC)</td>
<td>Government bonds</td>
</tr>
<tr>
<td>European Bank of Reconstruction and Development</td>
<td>Development bank of China</td>
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<tr>
<td>Commercial bank loans</td>
<td>Foreign investors</td>
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<td>Coface (France)</td>
<td>EDC (Canada)</td>
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<td>ECGD (UK)</td>
<td>Euler Hermes (Germany)</td>
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<td>Euler Hermes (Germany)</td>
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<td>EXIM (U.S.)</td>
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<td>JBIC (Japan)</td>
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<td>OPIC (U.S.)</td>
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<td>SACE (Italy)</td>
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**ECAs**

Note: BTC is Baku–Tbilisi–Ceyhan.
Source: A.T. Kearney analysis

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**International Financial Institutions (IFI) guaranteed debt.** IFI money is similar to ECA loans, the difference being that requirements apply not to the countries supplying material and equipment but to the country where the project is located. An example of an IFI is the European Bank for Reconstruction and Development (EBRD), which invested in a total of 380 projects in 2011. One of the largest financial investors in its region—which stretches from central Europe and the western Balkans to central Asia—EBRD helps countries become open-market economies. It is owned by 63 countries, the European Union, and the European Investment Bank.

**Commercial debt.** Financed by commercial banks, this debt is as close as you can get to market debt, and thus is greatly affected by general market conditions. During the 2009 credit squeeze, for example, few of these funds were available and interest rates were higher.

The larger the project, the likelier it is to depend on ECA and IFI financing, especially if the project lacks a major shareholder that could take on a large share of the financing.
These divergent stakeholder expectations challenge owners of large capex projects to find the right trade-offs—especially capex and financing costs—to maximize ROI while simultaneously satisfying the stakeholders.

Finding the Solution

Given the complex mix of investment and expectations, it is appropriate to define large capex projects as non-linear, multidimensional optimization problems that have more than their share of conflicting objectives. In short, these projects are large, expensive dilemmas that put asset-intensive companies in the difficult position of finding an optimal solution.

Following is our four-phase approach to successfully managing large capex projects (see figure 3):

Figure 3
The four-phase approach to managing big capex projects

<table>
<thead>
<tr>
<th>Phase 1: Define data and constraints</th>
<th>Phase 2: Develop different scenarios</th>
<th>Phase 3: Discuss output and adapt scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Multidimensional optimization</td>
<td>Number of suppliers and contractors</td>
</tr>
<tr>
<td>Engineering and construction</td>
<td>Several conflicting objectives</td>
<td>Total capex costs, including material,...</td>
</tr>
<tr>
<td>Supplier and contractor</td>
<td></td>
<td>Local content</td>
</tr>
<tr>
<td>Logistics</td>
<td></td>
<td>ECA eligible costs</td>
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<tr>
<td>Financing (including ECA)</td>
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<td>Untied costs</td>
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**4. Evaluate and select final procurement scenarios**

Note: ECA is export credit agency.
Source: A.T. Kearney analysis

**Phase 1: Define data and constraints.** As a starting point, we define and specify data-input categories that include material, engineering and construction, logistics (including quotes from suppliers), supplier and contractor information, and financing (including ECA data). If data is unavailable from the project-owner side, the gaps are filled from expert interviews, estimates, or the A.T. Kearney database.

Determining the most granular level of input data needed is key to obtaining high-quality output data upon which to base the best procurement strategy in Phase 4.
In addition to input data, it is important to determine the constraints that lead to added complexity. We find the following constraints to be the most common in large capex projects:

- In ECA financing (which usually imposes several constraints), contract share and local content from the ECA country
- Technology restrictions on material quality or types used
- National content requirements, such as percent of raw material purchased in a certain country
- Interface risks—the higher the number of suppliers, the higher the risk

These constraints serve as the basis for defining appropriate procurement scenarios for the optimization phase. In general, scenarios should cover a wide range of realistic solutions to guarantee effective decision making (see case study: Structuring the Best Procurement Strategy).

To simulate different scenarios, input data and constraints are translated into model language, and various scenarios are developed in the model.

Phase 2: Develop different scenarios. To simulate different scenarios, input data and constraints are translated into model language, and various scenarios are developed in the model, starting with an unconstrained scenario and gradually adding constraints to evaluate possible solutions.

Phase 3: Discuss output and adapt scenarios accordingly. The model provides the optimal supplier mix that meets all constraints and minimizes capex for each procurement scenario. Output can be analyzed at the most basic data level specified in Phase 1, such as costs per machine, cost per country, and capex category.

Structuring the Best Procurement Strategy

A major steel producer planned to invest in a new, fully integrated steel mill in Eastern Europe. We analyzed the supply market and found that just three suppliers met the requirements for engineering, procurement, and construction (EPC) companies delivering a fully integrated mill and these suppliers had limited capacity for proposing, planning, and executing projects. Because the steel market was at an all-time high, most steel producers were expanding capacity and thus forcing steel prices up.

To avoid an oligopoly, we reassessed supply factors in an “unwrapped” scenario, breaking down the proposed steel mill into sub-plant (for pig-iron production), process plant (blast furnace), components, and assembly and construction work. After testing several technological options and analyzing their price impact, the supply market opened up, especially for components. On the other hand, the breakdown increased project complexity and the risk of overruns.

We helped the company take two important steps to define its procurement strategy: (1) evaluate all aspects to assess vulnerabilities—interface complexity, integrated components, sub- and process plants, supply-market assessment, and cost impact; and (2) define purchasing and procurement packages for the steel mill, hot- and cold-roll mills, pig-iron production, and all infrastructure. Capital expenditures were optimized for 75 packages with manageable risk.
Discussing results and business impact often leads to further areas of optimization. This usually involves changes in input data and adding more constraints—and, therefore, more scenarios—and may lead to a rerun of the model. We have found that up to as many as 100 scenarios need to be analyzed to cover the range of realistic options.

**Phase 4: Evaluate and select final procurement scenarios.** In the final phase, a filter system is used to select procurement scenarios that best fit all requirements. These filters include the supply-market situation, financing impact, and risk assessment.

**Navigating the Optimization Process**

Collaborative optimization is an excellent tool for navigating the process of finding the best procurement strategy. It is an innovative sourcing technique that creates value through bidding and business-award optimization, and helps identify the best combination of lots and suppliers to meet buyer requirements and supplier strengths.

Collaborative optimization allocates bidders according to the constraints detailed in Phase 2 (see figure 4). For each scenario the goal is to minimize the following:

- Adjusted payment to bidders, including optional discounts and penalties
- Penalties for violating rules related to constraints
- Prices of lots that don’t get allocated

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**Figure 4**

*The collaborative optimization model*

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Note: ECA is export credit agency.

Source: A.T. Kearney analysis
Collaborative optimization is an excellent tool for navigating the process of **finding the best procurement strategy**.

If the solution cannot be implemented, we add constraints such as minimum contract value and national content requirements to create further scenarios to help find a solution.

**The "Three-Filter" Approach to Assessing Scenarios**

In most cases there are many possible procurement scenarios to analyze. We’ve developed a three-pronged “filter” approach to paring down the number of scenarios until the best one is left standing (see figure 5).

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**Figure 5**

**Filtering down to the best procurement strategy**

1. **Supply situation and available market capacity along key value-chain steps**
   - Is the supply situation the same for all technical options?
   - Are standard materials used?
   - …

2. **Financing and capex impact on ROI**
   - Select scenarios with the best impact on ROI
   - Filter scenarios to achieve minimum ECA coverage
   - …

3. **Risk**
   - Operational risk
   - Contracting risk
   - Risk of competition limits during tendering

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Notes: ROI is return on investment, ECA is export credit agency.
Source: A.T. Kearney analysis

The first filter aims to eliminate scenarios that offer a poor supply-market situation. Favored scenarios are those in which material types are applied across industries, products do not involve non-standard production steps, and products have adequate production capacity in the market. The availability of construction companies that can deal with special materials or components can be another factor. The goal here is to identify scenarios that don’t involve materials, products, or components that might become bottlenecks in times of high demand.
Filter two is crucial, since it focuses on ROI. Here scenarios are filtered according to the impact of their financing costs and capex on the project’s ROI. We filter scenarios by calculating an isoquant curve, which are graphs showing several possible combinations of inputs that result in a given output level. Scenarios that appear along the same isoquant curve show the same impact on tariffs or fees, even though they have different capex and financing costs (see figure 6).

**Figure 6**

*Isoquant curves help determine impact of capex and financing costs*

Source: A.T. Kearney analysis

Filter three is a basic risk assessment to determine the following:

- Operational risks resulting from complexities such as large numbers of suppliers or different types of interfaces
- Contracting risks, such as money expected to be available to a company in the event of seeking recourse, and the ease of recovery
- Risk of limited level of competition among potential bidders during the tendering process

Our three-filter approach usually results in a selection of two to five final procurement scenarios ranked according to the filtering criteria. Once the final selection is made, the second choice should be reserved as a back-up option in case it is needed during the tendering process (see case study: Applying the Three-Filter Approach on page 10).

**Maximizing ROI**

In closing, it is important to note there is no one-size-fits-all solution to the dilemma of striking the right balance between financing options and ROI for a large capex project, but our four-step approach comes close. It tackles stakeholders’ often-contradictory objectives, identifies and analyzes different requirements of all the stakeholders, and generates a transparent, comprehensive understanding of all the factors involved in this optimization challenge. The bottom line is that this analysis helps companies that want to minimize the costs and maximize the ROI in a large capex project.
A.T. Kearney was retained to help a company develop a procurement strategy for a large-scale energy infrastructure project. Our first step was to determine the obligations and constraints of the company’s procurement strategy, a process that included interviews with procurement, technical, finance, legal, commercial, and risk-management personnel and with shareholders to determine their constraints. The figure shows some of the potentially conflicting elements.

From our analysis, we developed multiple scenarios—more than 100—to cover the entire range of possible options. The scenarios varied from one in which the company performed all procurement to one in which procurement was outsourced to EPC companies that were also responsible for engineering, construction, and long-lead purchases.

Finally, the team pared down the scenarios using the three-filter approach, determining in filter stage two the impact of capex and financing costs on tariffs and fees. In a process of elimination, the choices were narrowed to three and then one—a final scenario that eventually produced 15 percent more in capex savings compared to the company’s initial capex plan.

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A.T. Kearney is a global team of forward-thinking, collaborative partners that delivers immediate, meaningful results and long-term transformative advantage to clients. Since 1926, we have been trusted advisors on CEO-agenda issues to the world’s leading organizations across all major industries and sectors. A.T. Kearney’s offices are located in major business centers in 39 countries.

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