CHARACTERISTICS OF SUCCESSFUL MEGAPROJECTS


PURPOSE

The National Research Council’s Committee to Assess the Policies and Practices of the Department of Energy to Design, Manage, and Procure Environmental Restoration, Waste Management, and Other Construction Projects was established to develop recommendations to improve the Department of Energy’s (DOE’s) oversight and management of large scientific projects.

BACKGROUND

and for Other Purposes.\textsuperscript{1} directed the DOE to conduct a study to review the policies, procedures, and practices for identifying, planning, designing, and managing its portfolio of projects. To do this review, the DOE established the Committee to Assess the Policies and Practices of the Department of Energy to Design, Manage, and Procure Environmental Restoration, Waste Management, and Other Construction Projects (also known as the Reinschmidt Committee, after committee chairman Kenneth F. Reinschmidt of Stone and Webster, Inc. [retired]).

During the committee’s deliberations, it identified many factors that were common to large construction projects, or “megaprojects,” that were delivered successfully from the standpoint of cost, schedule, and scope. These characteristics were described in an appendix to the committee’s final report entitled Characteristics of Successful Megaprojects and are summarized here.

Thirteen experts with backgrounds in project management, contracting, budgeting, and cost estimation; environmental remediation and waste management; civil, environmental, and nuclear engineering; government management and administration; and systems and performance analysis served on the committee.\textsuperscript{2} Committee members also had extensive experience with DOE policies, procedures, and practices for identifying project requirements, developing the scope of work, executing and managing design work, preparing cost estimates and schedules, selecting contract types, and executing and managing environmental restoration, waste management, and construction projects.

\textsuperscript{1}See U.S. Congress, Making Appropriations for Energy and Water Development for the Fiscal Year Ending September 30, 1998, and for Other Purposes, HR 105-271, pp. 96, for the appropriations bill language that relates to this report.

\textsuperscript{2}For a complete list of committee members and members of the Board on Infrastructure and Constructed Environment, see Committee to Assess the Policies and Practices of the Department of Energy to Design, Manage, and Procure Environmental Restoration, Waste Management, and Other Construction Projects (2000), pp. iv–v.
METHODS/APPROACH

Experience has shown that a greater amount of planning and greater skill are necessary to develop, sustain, and successfully deliver a “megaproject” than to do the same with a conventional construction project. The many characteristics of successful megaprojects are complex but are not well documented. Information on megaprojects is usually assembled solely to document what went wrong with a project rather than to document the circumstances surrounding success with a project.

The information presented by the Committee to Assess the Policies and Practices of the Department of Energy can be used as a benchmark against which characteristics of megaprojects can be measured. These characteristics do not describe a process, but rather serve as checklists for comparing a specific project with other projects that have proven to be successful. These benchmarks are based on the collective experience and best practices of more than a dozen highly knowledgeable professionals with experience in large-scale projects.

The following checklists can be used for assessing large projects at various stages—e.g., during the development of baseline parameters, during a postmortem for identifying lessons to be shared with other project managers, or at any time during a project to identify likely sources of problems.

FINDINGS AND RECOMMENDATIONS

The findings of the Committee to Assess the Policies and Practices of the Department of Energy study were presented in the form of categorized checklists. The items in the checklists are divided into five groups of "conditions" (i.e., characteristics): general conditions, special conditions, and three types of technical conditions—scope, costs, and schedule. Each of the five groups is further divided into three categories: conditions that are essential to success, conditions that are important to success, and conditions that are beneficial to success. These checklist items can apply to the settings, surroundings, and/or sponsors of megaprojects.
Not every listed characteristic must be present for a project to succeed. However, a good correlation with a successful project, particularly if the characteristics listed as “essential to success” are met, indicates a higher likelihood of project success.3

General Conditions

Conditions Essential to Success

- The project has a purpose, and the benefits are clearly defined and understood by all participants.
- The sponsor/owner/user is clearly focused on the successful completion of the project throughout the life of the project.
- All stakeholders attend regularly scheduled management review meetings with prepublished agendas.
- The responsibilities of owners and contractors are clearly understood by all parties.
- Incentives, as applicable, may be provided so that each contracting party shares in the benefits of improvements in project performance.
- Risks are borne by the parties most able to manage, control, or reduce those risks.
- Responsibility and accountability for project success or failure should be clearly assigned to key individuals.
- There is no change in the political will during the execution of the project.4

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3For a complete list of items in the report’s checklist, see Committee to Assess the Policies and Practices of the Department of Energy to Design, Manage, and Procure Environmental Restoration, Waste Management, and Other Construction Projects (2000).

4It should be noted that some large projects have been canceled for good political reasons (e.g., the end of the Cold War and a lessening of the need for nuclear weapons facilities) that specifically addressed changing national needs. These project cancellations should be viewed as national successes, not project failures.
Conditions Important to Success

- Contracts are awarded on the basis of value, not just cost.
- The roles and responsibilities for each key person are published, and the chain of command is clearly defined.
- The depth, stability, and time commitments by key personnel are appropriate for the project to ensure low turnover in management and key technical positions.
- The public and stakeholders understand and accept the purpose of the project, the types of technologies to be employed, the processes used to award contracts, and the past relationships of the contractors with the local labor force, suppliers, and vendors.
- All stakeholders have a voice in decisionmaking.
- Agreed-upon project protocols have been published and are observed by all.

Conditions Beneficial to Success

- The project is relatively immune to external factors that could affect its scope, mission, quality, cost, or duration.
- Project leaders are open to outside information, advice, improvements, technology, and independent assessments.

Special Conditions

Conditions Essential to Success

- Scope, cost, schedule, and quality are closely interrelated.
- The benefit-to-cost ratio for the project is high enough that increases in costs within preset limits will not threaten the viability of the project.
- Budgets include allowances for explicit contingencies.
- Actual cost and schedule performance are periodically compared with planned performance.
• All proposed scope or design changes are justified with regard to configuration and project objectives and are priced out and documented to include their nonlinear effects.

• Milestones that are significant to each interested party have been identified and explained.

• Contractors are brought into the project early in the process so that they can participate in the project design.

Conditions Important to Success

• Wherever possible, budgets are multiyear, updated, and extended annually.

• The uncertainties in costs and schedules are estimated and include a range of impacts from public or political opposition to the project.

• Systems are in place to track and report progress against the cost and schedule baselines at regular, planned intervals.

Conditions Beneficial to Success

• Actual and budgeted costs of performed work are tracked in the field.

• Suppliers and vendors are involved during the planning and design stages to ensure that supplies of required materials and the latest technology are available.

• An active quality-improvement program addresses every level of staff and all processes, as well as work products.

Technical Conditions: Scope

Conditions Essential to Success

• The scope of work is clearly defined in terms that are relevant to the project team.

• The quality-assurance/quality-control program is tailored to meet project-specific requirements, and the scope of the project
reflects both project requirements and expectations as set forth in the contract.

- Site conditions are well known and have been thoroughly investigated.

**Conditions Important to Success**

- A project’s published quality-control plan establishes quality requirements for all staff and parties at all levels.

- When an environmental impact statement (EIS) and record of decision precede project initiation, every environmental action noted in the EIS is translated into specific mitigation plans that are attached to each work package to ensure compliance with the EIS and applicable law.

**Condition Beneficial to Success**

- The project does not take so long to execute that the science or technology upon which it is based becomes obsolete before the project is completed.

**Technical Conditions: Costs**

**Condition Essential to Success**

- Cost estimates, at all stages, reflect the level of detail and explicit contingencies required at each stage of design development, so as to limit the likelihood of significant cost increases during design development, following project authorization.

**Conditions Important to Success**

- Biases in the cost estimates are addressed through independent reviews.

- Cost estimates objectively account for all risks, changes, and hazards.
Conditions Beneficial to Success

• A cost estimate should be stochastically stated to reflect the risks inherent in the project.
• Confidence factors, or the likelihood that a given cost will not be exceeded, are associated with cost estimates at all stages to give project sponsors a clear idea of the risk of cost variances and overruns.

Technical Conditions: Schedule

Conditions Essential to Success

• Schedules and cost estimates are prepared simultaneously and are based on key factors.
• To minimize exposure to internal and external changes, the schedule is aggressive and is pursued vigorously.

Condition Important to Success

• Risk analysis and probability techniques are applied to the duration of tasks.

Condition Beneficial to Success

• Critical equipment and materials are available to support the schedule.