



An introduction to Cost Engineering

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No one who has responsibility for managing major, complex, high-tech programmes with a high development content will dispute the importance of the cost and financial aspects involved in the projects, or the particular difficulty of assessing and controlling costs. Cost will be a constant source of concern, particularly so when considering different technical options, in conducting cost/technical trade-offs, in establishing budgets, in the submission and evaluation of price proposals, in preparing for contract negotiations, and in assessing the cost impact of introducing changes to existing designs. The question is how to tackle these aspects to be best able to predict or assess cost, how to minimise the risk and impact of overspends against budgets, and how to ensure that there is an appropriate balance between technical aspects and the related costs.

Cost engineering essentially attempts to capture practical experience in a systematic way, to analyse that experience in order to develop tools and models which, together with expert judgement, can be applied under different circumstances to make predictions of likely cost or assessments of whether a proposed cost is reasonable. An assessment of the likely cost and risk is made taking account of past experience with similar activities and the assessment of associated trends, and of any changes in working practices and productivity gains. But cost engineering extends beyond the estimation and assessment of cost, because these capabilities can also be applied to support the aim of achieving more cost-effective results.

What is Cost Engineering and Why is it important ?

Cost is the value of an activity or asset. Generally, this value is determined by the cost of the resources that are expended to complete the activity or produce the asset. Cost is one of the three fundamental attributes associated with performing an activity or the acquisition of an asset. These are (1) price (cost), (2) features (performance), and (3) availability (schedule). The need to understand and quantify the attribute of cost spawned the engineering discipline of cost engineering. Cost engineering is the application of scientific principles and techniques to problems of estimation, cost control, business planning and management science, profitability analysis, project management, and planning and scheduling. While this definition seemingly addresses non-cost areas, it lists key engineering activities that either generate cost when they are performed or define plans and processes that cause (or influence) cost to be generated in other activities and/or assets.

Cost Engineering is the practice of applying formal processes, procedures and techniques, systematically throughout each phase of the project, in the areas of business analysis, planning and scheduling, estimating and cost control to enable the project team to forecast, and communicate, realistic end-of-job costs and completion dates continuously during the project.

The discipline of 'cost engineering' can be considered to encompass a wide range of cost related aspects of engineering

and programme management, but in particular cost estimating, cost analysis/cost assessment, design-to-cost, schedule analysis/planning and risk assessment. These are fundamental tasks which may be undertaken by different groups in different organizations, but the term cost engineering implies that they are undertaken throughout the project life-cycle by trained professionals utilising appropriate techniques, cost models, tools and databases in a rigorous way, and applying expert judgement with due regard to the specific circumstances of the activity and the information available. In most instances, the output of a cost engineering exercise is not an end in itself but rather an input to a decision making process

Cost Engineering may be defined as "A cost-focused methodology that supports the design and implementation of specifications at the lowest total cost of ownership, across the end-to-end lifecycle." This definition encompasses several elements which are critical to our view of the scope and reach of cost engineering across the business:

- **"Cost-focused."** Cost-engineering activities are focused on bottom-line impact. If they succeed, the business will save money.
- **"Supports."** While bottom-line impact is the ultimate outcome, cost engineering must also serve as an enabler within the organization. It brings stakeholders from multiple functions together to work collaboratively on the design and implementation of specifications.
- **"Lowest total cost of ownership."** Cost engineering is holistic in scope, considering all types of cost (e.g., capex and opex, together with recurring and non-recurring costs) across the entire value chain.
- **"End-to-end lifecycle."** Cost engineering is not a standalone activity; it must be an integral part of the full produce lifecycle, from initial ideation to ultimate disposal or recycling.

Dimensions of Cost Engineering

Cost engineering is an area of engineering practice concerned with the "application of scientific principles and techniques to problems of cost estimating, cost control, business planning and management science, profitability analysis, project management, and planning and scheduling. Before a company can decide whether or not a project is right for them, they need to carry out the process of cost engineering in order to be aware of any basic and possible costs they may run into during the assignment

Key objectives of cost engineering are to arrive at accurate cost estimates and to avoid cost overruns. The broad array of cost engineering topics represent the intersection of the fields of project management, business management, and engineering. Most people have a limited view of what engineering encompasses. The most obvious perception is that engineering addresses technical issues such as the physical design of a

structure or system. However, beyond the physical manifestation of a design of a structure or system (for example, a building), there are other dimensions to consider such as the money, time, and other resources that were invested in the creation of the building. Cost engineers refer to these investments collectively as "costs". Cost engineering can be considered an adjunct of traditional engineering. It recognizes and focuses on the relationships between the physical and cost dimensions of whatever is being "engineered".

Cost engineering therefore embraces many facets of project management and engineering. Cost engineering is the engineering practice devoted to the management of project cost, involving such activities as estimating, cost control, cost forecasting, investment appraisal and risk analysis. Cost Engineers budget, plan and monitor investment projects. They seek the optimum balance between cost, quality and time requirements.

Where does the Cost Engineer fit in?

Engineering Design impacts whole-life cost of products produced. Understanding true cost of a product and the cost drivers during the design stage could guide the design process to obtain more competitive solutions. Cost engineering is concerned with cost estimation, cost control, business planning and management, profitability analysis, cost risk analysis and project management, planning, and scheduling.

A successful cost engineering department is built on three pillars: people; infrastructure, tools and data; and integration into operations. Sound cost engineering thinking, planning, design, estimating, scheduling, cost plan, control, negotiation, project management, administration and execution are the bases for the realization of good engineering projects and services, which are the cutting edge of twenty first (21st) century technology.

The Cost Engineer plays a key integration role on projects. The Cost Engineer must liaise and co-ordinate primarily with the Business Manager, the Project Manager and the Engineering Manager to make sure all parties are aligned at all times regarding cost, schedule and scope. The Cost Engineer is the eyes and ears of the project and must stay alert for any critical bits of information which could potentially affect the project.

The Key functions of Cost Engineering (CE) as defined by the International Cost Engineering Council (ICEC) are as shown thus:

- To provide independent, objective, accurate and reliable capital and operating cost assessments usable for investment funding and project control; and
- To analyze investment and development for the guidance of owners, financiers and contractors.
- Estimates of capital or asset costs including development costs
- Estimates of operating and manufacturing costs through an asset's life cycle
- Risk assessment and analysis
- Trending of scope and cost changes
- Decision analysis and Financial analysis
- Project cost Control including Planning and Scheduling
- Facility management needs assessment
- Project feasibility and budget assessment

- Cost management, management, Contract administration
- Whole-life appraisals;

The Discipline of Cost Engineering

Cost engineering essentially attempts to capture practical experience in a systematic way, to analyse that experience in order to develop tools and models which, together with expert judgement, can be applied under different circumstances to make predictions of likely cost or assessments of whether a proposed cost is reasonable. An assessment of the likely cost and risk is made taking account of past experience with similar activities and the assessment of associated trends, and of any changes in working practices and productivity gains.

Cost engineering therefore embraces many facets of project management and engineering. Cost engineering is "the engineering practice devoted to the management of project cost, involving such activities as estimating, cost control, cost forecasting, investment appraisal and risk analysis." [1] "Cost Engineers budget, plan and monitor investment projects. They seek the optimum balance between cost, quality and time requirements.

Skills and knowledge of cost engineers are similar to those of quantity surveyors. In many industries, cost engineering is synonymous with project controls. A cost engineer is "an engineer whose judgment and experience are utilized in the application of scientific principles and techniques to problems of estimation; cost control; business planning and management science; profitability analysis; project management; and planning and scheduling

One key objective of cost engineering is to arrive at accurate cost estimates and schedules and to avoid cost overruns and schedule slips. Cost engineering goes beyond preparing cost estimates and schedules by helping manage resources and supporting assessment and decision making. The discipline of 'cost engineering' can be considered to encompass a wide range of cost-related aspects of engineering and programme management, but in particular cost estimating, cost analysis/cost assessment, design-to-cost, schedule analysis/planning and risk assessment. The broad array of cost engineering topics represent the intersection of the fields of project management, business management, and engineering. Most people have a limited view of what engineering encompasses. The most obvious perception is that engineering addresses technical issues such as the physical design of a structure or system. However, beyond the physical manifestation of a design of a structure or system (for example, a building), there are other dimensions to consider such as the money, time, and other resources that were invested in the creation of the building. Cost engineers refer to these investments collectively as "costs".

Conclusion

Cost has become a major business driver in many industries. It is observed that there is a lack of understanding about the process to estimate, manage and control costs across the lifecycle of a product. Sound cost engineering thinking, planning, design, estimating, scheduling, cost plan, control, negotiation, project management, administration and execution are the bases for the realization of good engineering projects. The discipline of 'cost engineering' can be considered to encompass a wide range of cost related aspects of engineering and programme management, but in particular cost estimating, cost analysis/cost assessment, design-to-cost, schedule analysis/planning and risk assessment. ■