

Project Cost Management

PMG 213

Lecture 8

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Value Management & Time and Cost
Change Management



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First: Value Management will be covered through the following ideas:

1. Value engineering
 - 1.1 What is value?
 - 1.2 Unnecessary cost
2. Target value design
3. Value engineering in construction

Second: Time and Cost Change Management will be covered through the following ideas:

2. Change Order
 - 2.1 Change order sources
 - 2.2 Change order proposal process
 - 2.3 Change order proposal pricing
 - 2.4 Negotiations and approvals
 - 2.5 Incorporation into cost control and accounting control systems
 - 2.6 Unresolved change orders
 - 2.7 Summary

1. Value engineering :

Value and cost do not necessarily mean the same thing.

Value is total return on the dollar, not just income, but also service ability, life, efficiency—
any consideration that has cost or operational considerations.

1.1 WHAT IS VALUE?

The concept of value is something which we all apply in our everyday lives when we part with money to acquire an item of furniture or a washing machine or the weekly supply of groceries. Value is not necessarily represented by the lowest-priced product in its class but rather by the one which, for the purposes for which we want it, gives a better combination of ideas, functions, reliability, etc., for its price than the competition.

Example 1: Concept of Value

When buying a hydraulic press for a factory, there is a Chinese machine priced at \$5,000 and a German one at \$8,000. The lower price belongs to the Chinese machine. However, the German machine lasts twice as long, consumes less power, and requires rare maintenance. Here, the German machine represents higher value, even though its initial cost is higher.

Value is not an inherent property of a product.

It can only be assessed by comparison with other similar products on offer at the same time and under the same conditions. **It can be considered in four types:**

1. **Exchange value:** that which enables an article to be offered in exchange for money or for another article.
2. **Cost value:** the sum of the materials, labor and other costs required to produce an article or to perform a service.

3. Use value: the sum of the properties and qualities possessed by an article which perform a use or provide a service.

4. Esteem value: the sum of the features of the article which, beyond its actual use, prompt the decision to buy.

In industry the principal concern must be with use value, the highest value being obtained where the cost is lowest within the limitation that the product must give a satisfactory performance. However, the VA (value analysis) exercise which tries to ignore esteem value or to eliminate it is very often riding for a fall since it will, more than likely, recommend a product which, although near perfection in respect of its performance, is just not saleable—it has lost those features that attract the buyer

In certain products it is vital to consider the provision of esteem features as one of the essential functions. A water tank hidden in the roof space of a house needs no features other than those concerned with its use but a cooker installed in the kitchen needs many features that have nothing to do with its use or the ladies will never accept it! In summary, good value is the lowest cost reliably to accomplish the essential functions.

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Example 2: Use Value vs. Esteem Value

A company needs to buy 100 chairs for its new headquarters.

Option A (Ergonomic Standard Chair): Cost = \$100/chair. It provides perfect support for an 8-hour workday (Use Value = \$100).

Option B (Luxury Leather Executive Chair): Cost = \$350/chair. It performs the exact same physical support function but adds corporate prestige (Esteem Value = \$250, which is the difference between \$350 and \$100).

The Math: If the company buys Option B for all 100 back-office employees who never meet clients, they spend an unnecessary cost of \$25,000 (\$250 premium $\times$ 100 chairs) with zero added use value to employee productivity.

1.2 UNNECESSARY COST

Value analysis is an unrelenting search for waste, or, put in other words, it is an organized campaign for the elimination of unnecessary cost. Unnecessary cost is defined as any expenditure that can be removed without impairing the quality, reliability, sale ability or (if applicable) the maintainability of the subject.

But what allows unnecessary cost to appear? The reasons fall into six main headings that must not be thought to be critical of the design function alone, but are often just as applicable to buying, production, planning and, indeed, to management. They are:

1. **Lack of information:** Is everybody up-to-date in respect to materials, methods, techniques, etc? And, of prime importance, is accurate, detailed and understandable cost information available outside the enclave of accountancy?

2. **Lack of original ideas:** What are people doing with their brains? Using them creatively to find and develop new ideas or reducing them to mere memory banks capable only of responding to the dictates of tradition?
3. **Honest wrong beliefs:** Long-established and honestly-held beliefs can be wrong, even on technical matters, and can lead to unnecessary costs.
4. **Temporary or changed circumstances and time pressures:** A temporary expedient is introduced “to-get-it-into-production.” “It’s costly but don’t worry, old man, it will be put right tomorrow”— and that tomorrow never comes! Or “We shall have to do it this way because of the particular conditions of this order—it will be put right later”—or will it?

5. **Habits and attitudes:** Human beings are creatures of habit and adopt attitudes. The older we get the stronger the habits become and, by consequence, the stronger the built-in resistance-to change. To what extent are personal attitudes towards materials, methods, money and, perhaps, of the greatest importance, men, allowed to influence decisions?

6. **Overdesigning:** This should be considered in its broadest sense and not confined to the designer. Does the specification give the customer exactly what he wants? He may want something much simpler. If so, he is getting poor value.

Example 3: Unnecessary Cost Due to Changing Circumstances

During a residential building project, the main site crane suddenly broke down. To avoid delays, the contractor rented a smaller, more expensive backup crane as a temporary expedient for one week "until the original crane is fixed." Due to neglect and schedule pressure, the costly rented crane remained in use for 6 months instead of one week. This represents an unnecessary cost caused by a temporary fix becoming permanent

Example 4: Types of Value & Unnecessary Cost

In kitchen design, a water tank hidden in the roof space only needs "use value" (being durable and leak-proof) without needing aesthetics. In contrast, a cooker installed in the kitchen needs "esteem value" (modern design and colors) for the buyer to accept it. Painting the hidden water tank with luxurious colors is considered an unnecessary cost caused by overdesigning.

Value engineering is a rational or scientific approach to maximizing value.

A value engineer tries to “get the biggest bang for the buck.” That is, the value engineer attempts to minimize direct costs and eliminate overdesigning while providing serviceability, safety, and favorable returns. It is one area where cost engineering and design work are securely fused into one operation. Because of the complex nature of most projects, it is also a task that requires a team effort, utilizing professionals with many skills and operating at its best with a committee type structure rather than operating under the control of a strong leader. As projects continue to grow in size and complexity, there will continue to be an ever-increasing emphasis on value engineering.

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2. Target value design:

Target value design (TVD) is a subset of lean construction. TVD has also been referred to as target value costing and originated in manufacturing industries – again, from the automobile industry. Similar to lean, TVD works well with negotiated and design-build projects. The project owner sets the budget and the design team is tasked to design to that budget. The budget is divided up amongst the different design disciplines like pieces of a pie. Each design package must financially fit within their piece of the pie, so the entire project meets the owner's budget; they design to the target cost. This process either assumes the designers have estimating capabilities in-house or an outside estimating consultant is engaged, or a construction manager is contracted early.

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Some critical subcontractors may need to be brought on to the team early during design development such as mechanical, electrical, and plumbing (MEP), curtain wall, landscape, elevator, and others. This process then makes it difficult to obtain competitive bid pricing which therefore makes TVD sometimes unfeasible especially on public works bid projects.

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The owner's satisfaction is the number one priority for the design and construction team, especially if the owner's focus is on cost. The design team must anticipate cost when making design decisions rather than wait until bids are received. If the budget is exceeded the project must be redesigned, often with input from value engineering. The design must be targeted to 'final' cost as a design parameter, which is often different than bid or contracted cost. The target value design process includes active management of owner contingency logs and value-added logs, which are similar to a subcontract buyout log or VE log.

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A target value design project often starts with a workshop where all of the team members buy into the concept.

A considerable amount of collaboration is needed between all of the parties, not only the project owner, architect, and general contractor, but also the design engineers and major subcontractors. The estimate is established from the top down, which in construction is the opposite way most estimators work, generally beginning with a more detailed focus, such as quantity take-offs and pricing recaps, and summarizing as they work towards the final price.

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In this regard, TVD is similar to pull planning which will be discussed later where the end is determined and the plan is developed in reverse. If one element of the project is over budget, such as structural steel, money must be moved from another system to compensate, such as electrical. Like many lean concepts, TVD connects well with building information modeling. Fourth and fifth dimension modeling can help with early contractor-generated estimates.

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Target value design has some pitfalls though. Each of the budget pieces of the pie might initially fit together, but when contractor bids are solicited there is no guarantee that prices will correspond. Project owners often request detailed schedules of values from contractors with their bids and proposals. But contractors have been known to weigh one portion of the estimate heavier than another due to potential change order opportunities or front-loading strategies of early pay request line items.

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TVD also does not consider changes of economy, such as the price of copper pipe and wire escalation, or supplier and contractor backlog changes which can impact pricing. Change orders also occur on most construction projects and the owner's budget needs to anticipate these. Design-build and CM/GC project deliveries are both understood to have fewer change orders than traditional lump sum bid projects and therefore fit the TVD model better.

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A satisfied owner is looking for the design to match final cost, not just budget or even bid cost. If the project utilizes a cost-plus pricing method with no guarantee of total price, this places the owner at risk. Although the initial project budget and bid might have fit the target, the final price might not.

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Example 5: Target Value Design - TVD

An investor has a budget of \$1 million to build a commercial complex . In traditional projects, the engineer designs first, and then the owner is surprised that construction costs \$1.5 million, forcing a redesign . In the TVD approach, the architect, electrical engineer, and plumber set a specific financial ceiling for each discipline from day one and never exceed it during design (designing to the budget).

Example 6: The Risk of Bid Prices in Target Value Design

In a hospital project using TVD, the design team successfully split the budget and allocated \$200,000 for HVAC design. However, when subcontractor bids were requested, the lowest market price received was \$260,000 due to a sudden shortage of specialized labor in the market. This illustrates a pitfall of TVD, where matching initial pie pieces does not guarantee the actual contractor bid prices will correspond.

3. Value engineering in construction:

Value engineering to some members of the built environment, especially some designers, implies cheapening of the project's design, but that is not true VE. VE includes analyzing selected building components to seek creative ways of performing the same function as the original components at a lower life-cycle cost without sacrificing reliability, performance, or maintainability. VE studies may be performed by consultants during design development, as a contractor-performed preconstruction service, or by the contractor during construction.

The most effective time to conduct such studies is during design development.

Target value design, as just discussed, needs to happen before design to be efficient; VE is the opposite and often happens either during the design process or after design.

Value engineering studies are typically performed during the preconstruction planning phase. The intent of the process is to select the highest value design components or systems. The essential functions of each component or system are studied to estimate the potential for value improvement.

The VE study team needs to understand the rationale used by the designer in developing the design and the assumptions made in establishing design criteria and selecting materials and equipment.

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The intent of VE is to develop a list of alternative materials or components that might be used. Preliminary cost data is generated, and functional comparisons are made between the alternatives and the design components being studied. The intent is to determine which alternatives will meet the owner's requirements and provide additional value to the completed project. Often life-cycle cost data is analyzed for each VE alternative before presentation to the project owner. Preparation of value engineering proposals includes analysis of advantages and disadvantages of each alternative and the ones representing the best value are then selected for presentation to the designer and the owner.

The VE proposal looks very similar to a post-contract change order proposal, including all detailed costs and markups and substantiation.

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All cost data prepared by the VE team should be included with the proposal, similar to a change order proposal.

Each VE proposal is tracked in a log, similar to other cost control or equipment tracking logs managed by the construction team. The proposals are submitted to the designer and the owner for approval. If approved, VE proposals should be incorporated into the contract documents.

VE proposals approved after the construction contract is awarded must be incorporated into the contract by change order. A sample VE log from the Olympic Hotel and Resort case study project is included here as Table 11.1.

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Table 11.1 Value engineering log

Evergreen Construction Company Olympic Hotel and Resort Updated: 2/20/2020							
<i>Item</i>	<i>Description</i>	<i>Date Proposed</i>	<i>Value Proposed</i>	<i>Value Accepted</i>	<i>Value Rejected</i>	<i>Date Resolved</i>	<i>Comments</i>
14	Replace janitor's closet VCT with sheet vinyl	1/15/2020	\$3,500	\$3,500		1/16/2020	Better maintenance
15	Move window blinds into owner's scope	1/22/2020	-\$15,550				Still open, tax considerations
16	Add one more year to landscape warranty	1/22/2020	\$5,750		\$5,750	1/31/2020	Owner will contract separately
17	Open paint spec to three suppliers continued...	1/31/2020		-\$12,322		2/10/2020	

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Example 7: Value Engineering in Construction

Replace the janitor's closet VCT (Vinyl Composition Tile) with sheet vinyl .Cause and Effect:

For a minor additional cost of \$3,500, we get better water resistance and easier

maintenance. This saves thousands of dollars in future maintenance (life-cycle cost)

2. Change Order:

may be additive, if they add scope of work, or deductive, if they delete work items. Since they occur on most construction contracts, managing change orders is an important project management and cost engineering function.

2.1 Change order sources:

Change orders arise from a variety of sources or causes. Four of the most common are elaborated on in this section. Most change orders originate due to *design errors*. These can arise for a variety of reasons, including:

- 1- Architects and engineers may not have sufficient funds, resources, or time to do a complete design;
- 2- Clients may contract with the engineers (such as mechanical or electrical engineers) directly and not through the architect. This may result in multi-discipline documents that are not fully coordinated;
- 3- A complex project such as a hospital; and/or
- 4- People make mistakes, including architects, engineers, and project owners.

Client-requested *scope* or *programming changes* are among the most expensive change orders but are relatively easy to process and gain approval for as this is something the project owner wants to add or change. Additional scope changes are usually accompanied with an architect generated construction change authorization or construction change directive (CCA or CCD) with new or revised drawings and specifications. Change orders which occur due to *uncovering unknown site conditions* can be among the most difficult type of change order for a client to accept as they were unforeseen or unanticipated. These generally, result from inadequate site exploration prior to starting design.

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Hidden or latent conflicts or conditions are common in site work (for example, wet or contaminated soil) or remodeling (for example, mold or insect infestation) and may use up the client's contingency funds early in the project. When the contractor encounters hidden site conditions that adversely impact construction, the general contractor's (GC's) jobsite project team must 'promptly' notify the architect and client and provide the designer an opportunity to make an inspection; this is often through the use of a request for information (RFI).

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Materials and equipment supplied by the project owner for installation by the contractor, or *not-in-contract (NIC) equipment*, result in a fourth category of change order if the products are not fully coordinated. Some construction consumers believe that by contracting directly with subcontractors and suppliers they save the general contractor's fee. This is common with items such as kitchen equipment, swimming pool subcontractors, exercise equipment, furnishings, custom casework, and landscaping on commercial projects. Problems may surface and the project can be disrupted due to the lack of coordination of client-furnished materials.

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These conflicts are unfortunately, often not discovered until the materials first arrive on site. Conflicts may have been mitigated if the construction team had reviewed the client's purchase orders and vendor submittals and identified potential issues through the use of requests for information. Project owners may pay much more to resolve conflicts associated with NIC materials than they would have originally paid the general contractor to manage the work.

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There are several other ways change orders may occur such as weather, changes initiated by the City when issuing the building permit, contractor and supplier requested material changes, and others. Most of the processes to develop and account and manage change orders will follow the same path as discussed. The change order process begins with preparation and pricing of change order proposals (COPs). After the proposals have been approved, they are incorporated into the contract through formal change orders.

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Cost accounting and cost control systems must be continually modified to reflect approved change orders. If the contractor and the project owner cannot agree on change order pricing and time impacts, then the general contractor and its subcontractors may process claims which require a formal dispute resolution process to resolve.

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Example 8: Change Orders & Markups:

During foundation excavation, the contractor surprisingly encounters high groundwater that did not appear in the initial soil report (unknown site conditions) . The contractor sends a Request for Information (RFI) to the architect , then submits a Change Order Proposal (COP) that includes the extra excavation costs plus a 7% markup for overhead and profit as agreed in the contract .

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Example 9: Multi-Discipline Design Coordination Errors :

A project owner contracted directly with a mechanical engineer for the fire sprinkler design and separately with a structural engineer for the concrete frame. During site installation, it was discovered that large fire pipes run directly through main concrete beams. This multi-discipline coordination error forced a costly change order to reroute the piping, resulting from clients contracting engineers directly instead of through the architect .

Example 10: Owner-Furnished Equipment (NIC) Conflicts

To save money, a hotel owner decided to buy the commercial kitchen equipment (NIC) directly from a supplier, rather than through the general contractor. When the heavy equipment arrived on site, it was larger than the kitchen door openings, and the electrical lines did not match the voltage. The owner paid a huge change order to the GC to widen doors and modify electrical panels, costing much more than the fee they tried to save .



Thank You