Target Value Delivery in Building Projects

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CHAPTER 1

INTRODUCTION

PETER MORRIS AND GLENN BALLARD

In 2016, the Project Production Systems Laboratory at the University of California Berkeley formed a research group on Target Value Delivery (hereafter referred to as "TVD"). The primary purpose of the research was to inform the building industry about the advantages of TVD and how it is done, focusing on the application of TVD on building projects. This book reports our findings. Members of the TVD Research Group are listed in Appendix A.

Our research included:

- tracing the history of target value delivery concepts and methods;
- identifying methods that deliver building projects much closer to targets than currently assumed possible for targets based on conceptual estimates;
- identifying processes for developing project execution plans and steering to those plans;
- establishing improved cost certainty – fewer and smaller cost overruns;
- documenting improved outcomes for the delivery of value for money – achieving project value requirements at or below the target cost.

Applicability to other types of construction projects is a matter for future research.

What is TVD?

The essential function of TVD is to **set project targets** for value and cost from programmatic data **prior to design**, and then **steer the project** toward those targets.

To do this, TVD has distinct steps within the process. These are:

- first, it must discover if a sufficient population of acceptable buildings exists – at this point it is not setting targets, but establishing confidence that a variety of designs is possible within the owner's allowable cost;
- next, it establishes that targets for value (performance, quality, quantity) and cost are sufficient to allow designers the freedom to design a building that (a) responds to the program, and (b) lives within the allowable cost – and usually, but not always (c), that delivers improved value – more building for lower cost;
- lastly, it must provide a project execution plan (road map) that can (a) guide the designer towards success, and (b) provide the tools for control or steering.

An additional contribution of TVD is Value Management. If you have a plan to deliver, you also have a plan to beat. The Target process allows us the ability to ask questions of the Functional Analysis System Technique (FAST) – HOW can I deliver these functions efficiently, and WHY do I have this design element.

All projects are initiated with some objectives, and all projects set targets for value and cost. Roughly speaking, targets are means for achieving objectives. Suppose someone wants to build a hospital to treat patients with heart disease and cancer. The buildings will need to have spaces capable of supporting the different functions involved in providing treatment, for example registration, examination, and surgery. The spaces will need to provide the environment (lighting, temperature control, air flow) and equipment required for performing their functions. The number of spaces will be determined from the expected numbers of patients and estimated processing rates. Determining the functions to be performed and their frequency of occurrence over time provides targets for hospital design that are means for achieving project objectives.

Target value is stated in a Project Value Statement, which may include not only the functionalities and capacities of the building, but also profitability, energy consumption, carbon release, and so on – whatever is valued by the client. Other project stakeholders (those who deliver the project, financiers, regulatory agencies, neighbors, opponents) may also have expectations for a project. It is usually in the owner's interest to meet those expectations. Clients are likely to value what helps the project succeed, e.g., cooperation among those involved in project delivery.

Ideally, value/cost targets are set for the whole life of the product produced in the project, but in current practice more often only for the project.

The propositions on which TVD is based include:

- Building projects can set *achievable* targets for project value and cost prior to design by understanding client objectives and inferring from ends to means at the level of detail needed for steering, both in design and in construction.
- Steering toward targets is possible, and essential to hit project value and cost targets.
- It is not enough to simply restrict the budget to a maximum. A cost plan must be developed that allocates the project budget to the different elements that are to deliver the desired building functions so feedback can be provided to designers and constructors regarding progress toward both value and cost targets. These allocations are provisional to allow money to move across building systems and the teams responsible for their design in search of designs that better deliver target values within target cost.

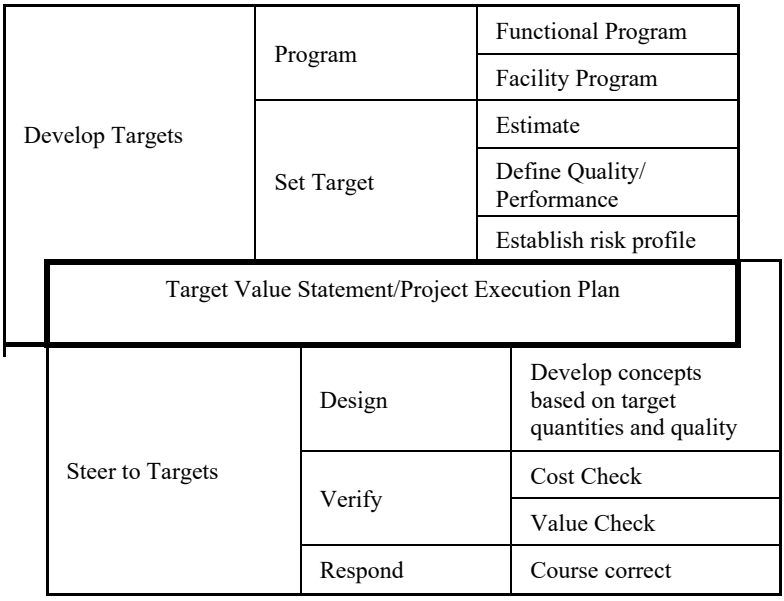

Figure 1-1: Setting and Steering to Targets

- Designers and constructors need to know both what is wanted in terms of functions to be performed in the building and the constraints that must be satisfied in its design and construction (cost, carbon release, traffic load, etc.). Hitting project value/cost targets is necessary in order to achieve project objectives, which can be economic, social or environmental.
- The essential process comprises two phases, namely setting the target and steering to target, with the two steps being anchored by a Target Value Statement and a Project Execution Plan, as shown in figure 1-1. As can be seen, each of the phases has a series of steps, which are discussed further in Chapter 2.

Why TVD?

Target Value Delivery is anchored in the voice of the client. The process starts with the business case and the functional program, and develops specific detailed targets for both cost and value. The targets differ from budgets in that they not only set the cost and quality goals for the project, but also contain sufficient detail to provide direction to the design team – and to provide measurement/validation at the periodic check stages. Because risk is explicitly addressed in TVD, the targets also have smaller, more focused contingencies.

Conventionally, when budgets are set prior to design, they are set with limited information. They may be based on broad based benchmarks or standardized costs, by reference to similar projects, or through a programming analysis with very high-level concept designs. Rarely does the budget setting process delve deeply into the project specifics and seek to tune the budget to the detail of the business case. It is not uncommon for the budget simply to be set based on available funds, with little or no reference to the program. The result is a budget estimate that has a wide spread of possible deviations; ASTM (E833.14R21) notes an expected error band of -25% to +50%.

As the project moves into design, there is nothing in the budget that can inform the design process, so the steering becomes a process of trial and error:

- generate a design,
- undertake a check estimate,
- compare it to the budget,
- modify design, and
- repeat.

In consequence, designing within budget limitations will result in a lot of iterative and wasted work, and often, greater compromise to the project performance, as scope is adjusted in response to the check estimates.

The conventional budgeting approach also tends to result in the application of excessive contingencies. Many agencies require a 30% design contingency at the concept level. Excessive contingencies are wasteful in two ways. In the first place, they lock up available funds, since money that is reserved for one project's contingency cannot be used for another project. Money locked in a contingency represents wasted opportunity, and, at best lost return on investment. Beyond the wasted opportunity cost, they also can lead to wasteful or inefficient use of funds. Rarely do projects return unused contingency; instead, they will often add features to use up any available funds.

Our Findings

Setting Targets

Our research found two primary ways for developing cost estimates of building projects:

- simulation – that is developing estimates based on parametrically modeling quantities from the program, and
- benchmarking – which is developing estimates based on historic costs for buildings or components.

Both simulation and benchmarking can range from the simple and high level to very detailed and sophisticated, particularly with the increased use of advanced computer programs using sophisticated data analysis. Often estimates are set using a combination of both methods, depending on project complexity and novelty.

We found that both simulation and benchmarking can be effective methods for developing estimates of expected cost of the program when used appropriately. Specific approaches may be better suited to specific projects. For example, a novel building type, such as an innovative medical treatment facility, for which no comparative historic data are available needs a different approach from something that is highly repetitive, such as mid-market hotels. The decision will often come down to matching the desired level of effort (and cost) with the desired outcome.

To be effective, both simulation and benchmarking require a thorough understanding of the project objectives (WHY do you need a project?), the functions to be performed in the constructed asset and their capacities (WHAT is needed to enable achieving objectives?), and the cost a client is willing to pay to achieve project objectives (ALLOWABLE cost). It is also important to note that circumstances may change during the course of a project that necessitates changes in objectives and hence potentially corresponding changes in Target Value and the corresponding Target Cost.

An example of a sophisticated simulation is provided by the Haahtela Group (https://www.**haahtela**.fi/en), which consists of a research and development company and a project management company that uses the products of that research under contract with building project clients. The primary tool is a software for creating a model of the building from the voice of the customer (programmatic data). The model is sufficiently detailed to provide steering to designers and builders, is buildable and meets the functions and capacities desired by the buyer. The materials and services in the model are costed to determine the project target cost. If that cost is more than the buyer is willing and able to pay, what's wanted is either reduced or the project is abandoned. If the project moves forward, designers are free to create an entirely different building information model, so long as it delivers desired functionalities and capacities, plus so-called "soft" values such as aesthetics, durability and livability – all within the target cost.

An example of sophisticated benchmarking is function-based BIM as provided by Building Catalyst (https://buildingcatalyst.com). Building Catalyst also creates a software-based building from the voice of the customer (functional data). Function-based BIM applies "big data" analysis from a sampling of real-world completed project information to produce a statistical model – mean, low, and high range prediction of the space program, design massing, schedule, and cost. Chapter 7.4 describes how The Boldt Company applied function-based BIM in the TVD process. Function-based BIM drills down into the departments and the functions within the departments; in other words, the owner or client's business case. By starting with the departments and functions, function-based BIM predicts project outcomes prior to the design and, in doing so, informs the decision-making process.

The result of both simulation and benchmarking or their combination is an estimate of the expected cost to deliver the program. This is an estimate, or opinion of the probable project cost for the delivery of the project, as distinct from the Allowable Cost, which is based on the business case, and represents

the most a buyer is willing and able to pay to get what they want. If these differ and the gap between them is considered too great to be overcome through innovation in product and process design, what's wanted is revised or the project is abandoned.

Steering to Target

We also found that in TVD, project success is measured in terms of hitting both value and cost targets through the careful measurement of progress against plan, thus providing the means for achieving project objectives, e.g., delivering a hospital fit for purpose within the target cost. What's measured is not the accuracy of conceptual estimates, but rather the ability to set achievable value/cost targets and steer the project toward them. Setting achievable targets based only on programmatic data is made possible by advances in conceptual estimating that radically reduce the extent of variation and increase the ability to assess variation risk, e.g., in setting stretch targets.

History of TVD

TVD in its basic form, setting value/cost targets based on programmatic data and steering toward them, has emerged in various places and times, often without awareness of similar practices, as though it was an idea called forth by similar circumstances. Its emergence in the quantity surveyor cost planning tradition is said to have been in response to clients changing from individuals to corporations with greater concern for cost control and the increasing complexity and cost of buildings (Nisbet 1961). Its emergence in Japanese product development after WWII was in response to the scarcity of capital (Womack, et al. 1990). TVD emerged in the 1980s in Finland in response to the need to "rule the costs of governmental building projects and to standardize the governmental subsidies for all kind of building projects like schools, hospitals, churches, offices, hotels, libraries and bathhouses, both new and renovated" (Haahtela 1980). Its emergence in the United States in the 2000s resulted from customer dissatisfaction with industry performance and turning to the Lean tradition for solutions (Egan 1998). To differentiate, we call this "Lean TVD". Client demand for cost accountability, scarce resources and dissatisfaction with industry performance are the fundamental drivers for all forms of TVD. More detail on TVD historical development is provided in Chapter 3.

A note on terminology: We use the term "Target Value Delivery" to signify practices that set project value/cost targets prior to design and then

proactively steer projects toward them. These practices have had different names, e.g., Cost Planning, Target Costing, Target Value Design and Target Value Delivery. Lean TVD first appeared in construction under the name "Target Costing in Construction" (Ballard and Reiser 2004). That was later replaced by "Target Value Design" following Macomber et al. (2007) who suggested that the primary focus was to deliver value within client constraints of time, money and so on. We agree on the priority of value but have adopted the term "Target Value Delivery" because value is not delivered until both design and construction are completed and the building is released to the client to be sold, leased or used as means of production.

Research Questions

The objective of the research reported in this book was to persuade the construction industry to use TVD. That objective is broken down into nine research questions, and chapters are devoted to answering them:

1. What are the essential characteristics of TVD? (Ch 1)
2. What methods are used to set project value/cost targets? (Ch 2)
3. What methods are used to steer projects toward value/cost targets? (Ch 2)
4. What is the history of TVD's development? (Ch 3)
5. Has TVD demonstrated success in setting and steering to value/cost targets? (Ch 3)
6. What estimating methods and tools are used in TVD? (Ch 4 and 5)
7. How is uncertainty managed in TVD? (Ch 6)
8. How is TVD used in practice? (Ch 7)
9. What is the relationship between TVD and Lean? (Ch 3 and 8)

How the book is structured

Ch 1 Introduction

Ch 2 Setting and Steering to Project Targets in TVD

Ch 3 History and Performance of TVD Projects

Ch 4 Principles of Estimating in TVD

Ch 5 Cost Planning in TVD

Ch 6 Managing Uncertainty in Building Projects

Ch 7: How TVD is used in practice
7.1 How a Public Agency does TVD
7.2 How a Design Firm does TVD
7.3 How a General Contractor does TVD
7.4 How another General Contractor does TVD

Ch 8: Discussion and Conclusions

References

Appendices

- Appendix 1: Members of the Cost Modeling in Target Value Delivery Research Group
- Appendix 2: Index of Key Terms.

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CHAPTER 2

SETTING AND STEERING TO PROJECT TARGETS IN TVD

PETER MORRIS AND GLENN BALLARD

What is a Target?

Within TVD a Target is an intended outcome, either for cost or for performance. Typically, when the term Target is used without context, it is meaning Target Cost, but it is important to remember that the ultimate goal is to deliver all the value requirements of a project for the target cost, and that these are all part of the overall target for the project. For this reason, we are using the term "Target Value Statement" to represent the comprehensive project target. It is the documentation of all the targets for the project, including the cost target(s) and the expected value outcomes.

Target Costs

Conventionally, projects have a set cost limitation, usually referred to as a "budget". This is typically a maximum allowable cost, but often the term is not clearly defined, and the term budget is also often used to mean estimate. It is worth noting that ASTM E833.14 (2021) Standard Terminology of Building Economics) does not define the term Budget and uses it interchangeably to mean both funding limitation and estimate. Other terms commonly used are Maximum Allowable Construction Cost (MACC), Funding Limitation, and other more specific terminology.

In TVD, a Target Cost differs from a Budget in several ways:

- it is derived from the "voice of the client;"
- it is focused on specific project requirements and developed using detailed analysis tied to the performance of specific spaces or project elements;

- it includes uncertainty modeling and contains targeted contingencies addressing identified unknown cost components;
- it contains information to guide the design team in designing to deliver what's wanted within budget.

Within TVD, there are three main forms the target can take. These are:

- **Maximum allowable**, or Cap target. The target is set as the funding limit. Costs cannot exceed but can come in lower so long as project objectives are achieved. For this type of target, all deviations must be below the target.
- **Center point target**. In this case, deviation either side of the target, within limits is acceptable.
- **Stretch target**. This type of target is set deliberately low with the expectation that deviations will more commonly be above the target, rarely below, but the goal is to challenge the project team to pursue continuous improvement. Stretch targets may involve some form of incentive or bonus for success, or consequence for failing to meet it.

Stretch targets are routinely used in the TVD adapted from Lean product development, in accordance with the principle to strive for continuous improvement. Incentives to pursue stretch targets are common. When legal, those incentives are provided by using TVD within a Lean Integrated Project Delivery contract in which key members of the project share risk and reward (da CL Alves and Lichtig 2020)[1].

Occasionally there is a fourth kind, more common in alternative project delivery, where the target has an upper and lower bound, quite often with no permissible spread. The intention is to spend all of, but no more than the available funds. This is seen in Stipulated Sum contracts and some Public Private Partnerships.

Many times, projects will have more than one target; for example, a project may have a Cap target that must not be exceeded and a Stretch target to challenge the team to find efficiencies and greater value.

[1] Sharing of risks and rewards is intended to persuade the owners of design and construction companies to give their employees permission to collaborate with others on the project. Achieving collaboration requires creating and maintaining a project culture that provides psychological safety (Matthews and Howell 2005; Howell et al. 2017).

Capital or Life Cycle?

Projects can have many different objectives, use different contracts, have different organizational structures and be managed differently. However, all projects aim to provide desired benefits for their originators within their constraints of cost, time, and – for building projects – often location as well. What counts as a benefit (value) is determined by the client, and may include monetary and non-monetary benefits, but the monetary value of benefits in use must exceed the sum of whole life costs for the project to be economically viable. When a project is producing a product that is part of a portfolio, it may increase the return on investment of the portfolio, but not have a positive return on the investment itself. An example could be preempting a competitor by establishing a service center in an underexploited region. Also, a project that delivers target value but perhaps even a zero or negative return on investment, could be considered successful by a client.

Figure 2-1 is a visual argument for the claim that net benefits in use are the natural target for built environment projects, whether they are constructed for own use or for sale/lease to others. In this hospital example, if the construction cost is set at 1.0, design costs will be around 0.1, costs of operating and maintaining the physical facility over a 20-year period 4.3, and costs of delivering healthcare in the hospital 42, another order of magnitude. The exact numbers will of course vary from building to building, but the order of magnitude of the differences is what's important. This conceptualization fits very well with the lean ideal[2].

In TVD, target benefits in use (value) and the allowable cost[3] for obtaining them are set in the Project Definition phase and are then pursued throughout all project phases. If the product created in the project is for own use, the pursuit of target value and cost continues in the operation, maintenance and use of the constructed asset for its intended purpose.

[2] See https://www.lean.org/WhatsLean/ for this definition: "The ultimate goal is to provide perfect value to the customer through a perfect value creation process that has zero waste." Accessed August 19, 2018.

[3] A project's allowable cost is the most a client is willing and able to pay to get its benefits. In the domain of product development, "allowable cost = target selling price - target profit margin" (Cooper and Slagmulder 1997), but non-monetary benefits can also be considered to be valuable. During project definition, allowable cost and target value (benefits) are both likely to change.

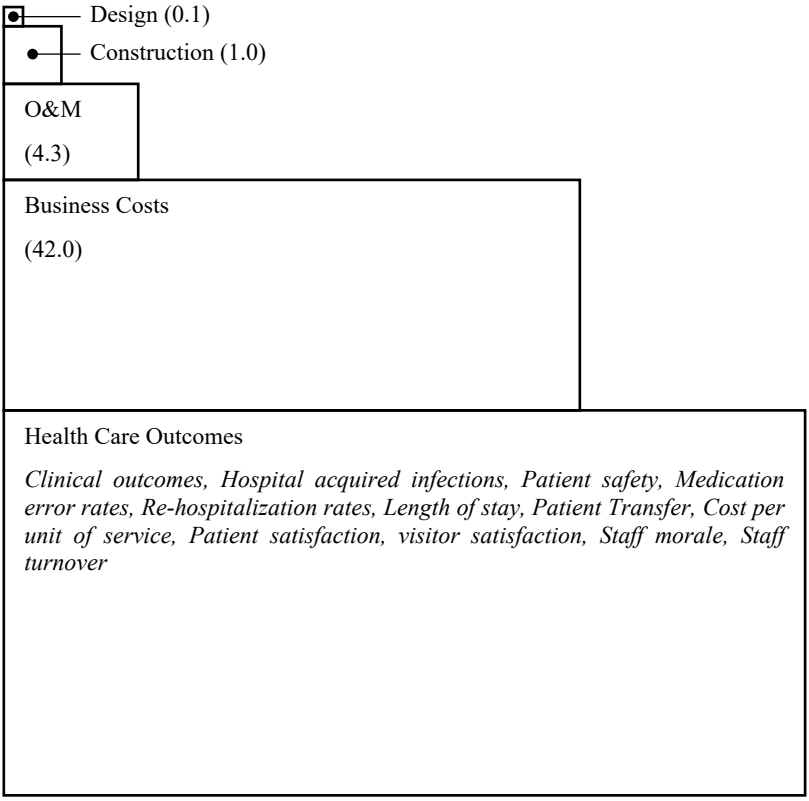

Figure 2-1: Whole Life Costs and Benefits (created from data provided in Evans, et al. 1998)

Setting the Target Value Statement

The process has a series of distinct steps. It is important to note that, while the process shown below is presented as linear, it is essentially dynamic and iterative, with the programs responding to the estimates, ultimately seeking to find a balance between wants and resources, and to establish an achievable outcome that delivers the highest value to the client. Value iteration is discussed further later in this chapter in connection with Target Value Statements.

- Establish the **Functional Program**. This is the statement of requirements for the project: what it must **do**. It is the "voice of the

client". The Functional Program may be as simple as a business case analysis or may be an extensive programming document. Table 2-1 shows the elements of a Functional Program.

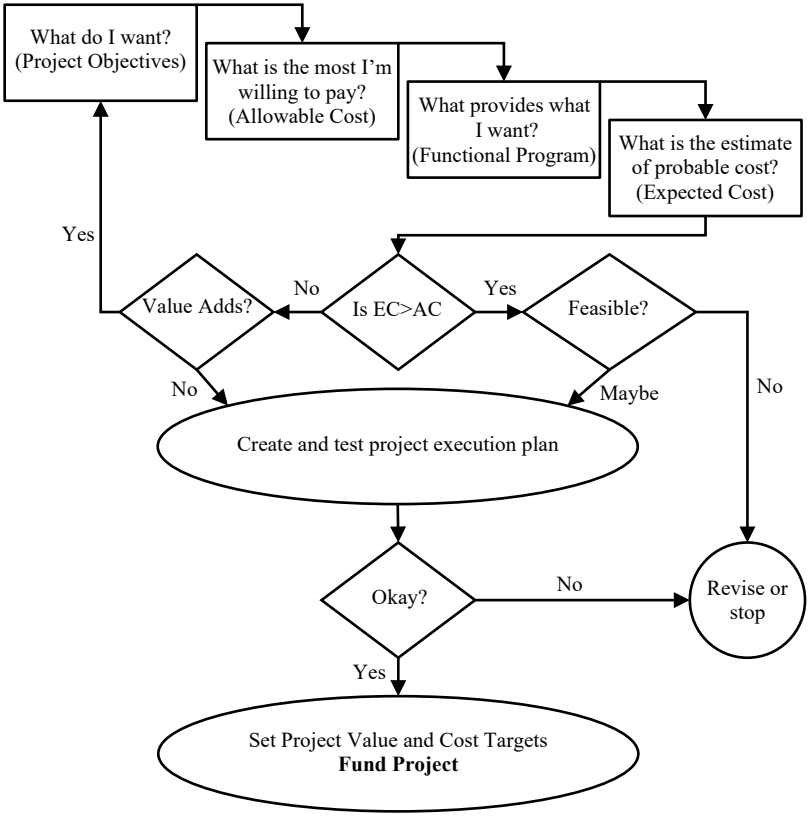

Figure 2-2: Project Definition Process (modified from Ballard and Penannen (2013)

- Establish the **Allowable Cost**. The allowable cost is derived from the client's business case. It represents what the client is willing to pay based on the value of the project to them, and it is independent of the expected cost to construct. The allowable cost could be based on anticipated revenue, or on non-financial metrics – how much a client is willing to pay to gain some non-financial benefit: sustainability, beauty, etc. Often the value is a mixture of financial

benefits, monetized non-financial benefits, and non-financial considerations.

- Translate the **Functional Program** into a **Facility Program**[4]. The Facility Program is the physical representation of the Functional Program. It develops the performance criteria of the Functional Program into quantitative requirements. It is important to note that the Facility Program is still design independent – while there may be sketches or massing diagrams to support the concepts and quantification of the Facility Program, they are not intended to be design solutions.
- Translate the **Facility Program** into an **Estimate** of the probable cost of development of the project. This estimate represents the likely cost of delivering the required function, based on an accepted Level of Confidence.
- If the **Estimate** is equal to or lower than the **Allowable Cost**, then the project can proceed to develop the **Target Value Statement** and the **Project Execution Plan**.

Establish the **Target Cost.** This is informed by the estimate and the two programs, but not dependent on them. Targets may be set at, above, or below the estimate. Within Lean TVD, targets are set with a goal of driving continuous improvement.

Functional Program

The functional program is the expression of the client's wishes for the building, independent of architecture or design, and it is the foundation of the TVD process – it defines the "V" in TVD.

We are choosing to use the term "functional program" to distinguish it from the many other uses of the simple term "program", which, while it is often used to mean functional program, is used to mean the architectural program, which we are calling the "facility program". A term that has grown from the practice of commissioning is Owner's Project Requirements (OPR). It is defined in appendix J of ASHRAE Guideline 0 (ASHRAE 2019), and it contains many of the elements of a comprehensive functional program. Many owners have other names and variations. The US Department of Defense DD1391 document serves a very similar purpose for their projects,

[4] "Translation" in this case is done through regressive reasoning (Koskela and Ballard 2021).

as does the University of California system Program Planning Guide document for theirs.

Regardless of the chosen name, the functional program should include a consideration of each of the four elements shown. The first two are client demands – quantitative and qualitative. The second two are largely external but influenced by client considerations. External conditions are often the result of a client requirement – they may have selected a site – or their program may demand a specific location. Their timing may put them in a specific market. Irreducible uncertainty in this context means the uncertainty in the program that cannot readily be removed or reduced by further study or evaluation.

Functional Program	
Functional Outcomes	Quantitative performance statements: for example, number of procedures to be performed, students to be taught, maximum response time (for building fire stations, for example), gross operating margin
Qualitative Requirements	Adjectival quality statements: for example, grand, economical, top of the line Success measures, 100% up-time, meets needs 80% of the time, achieves LEED gold
External Conditions	Factors external to the program: for example, site conditions, existing building conditions (renovation), overall remoteness, availability of skilled labor
Irreducible Uncertainty	Uncertainty within the program requirements, for example, quantitative uncertainty, long range outcome changes. Also includes unresolved uncertainty

Table 2-1: Functional Program

While most projects will have some functional program developed, it is often limited to the quantitative functional outcomes, possibly supported by some broad qualitative requirements. ASHRAE Guidance 0 notes:

> The OPR is considered the heart and soul of the Cx. When the OPR is not developed, the Owner, designer, contractors, and O&M personnel each interpret the building requirements, including their individual responsibilities, from the standpoint of their own specific needs. This often creates a range of diverse views of the constructed project's needs. Unfortunately, while critical for a successful project, the OPR is rarely developed. Developing an OPR that reflects the actual needs of the Owner, the users or occupants, service and operating units, and sometimes the community is one of the most important aspects for successful implementation of the Cx. (ASHRAE)

Within the TVD process, it is essential to make the values explicit. Where they are not explicit, team members may make assumptions about the project values, or worse still, ignore them. Many of the documents listed above tend, in practice, to be very focused on the quantitative measures (gross area and such like), and, unless carefully and thoroughly completed, are very light on the more subjectively measured qualitative, client vision, outcomes. This is particularly the case if they are being prepared from an engineering perspective.

Allowable Cost

The allowable cost is derived from the functional program and based on what the owner is willing to pay for the functional performance. It has no connection to what the program will cost to build. It is entirely what the program is worth to the owner. In many cases, it will be based on the business pro-forma, and the net contribution to the business revenue, but it may also include non-financial considerations, particularly for non-revenue facilities such as cultural or community facilities (libraries, museums, etc.). Frequently, the allowable cost is heavily influenced by the expected cost of construction, or at least the cost of comparable buildings. For example, a city may be willing to pay a certain amount for a transit hub, simply because that is what transit hubs are expected to cost. Nevertheless, it is important to keep the distinction between the allowable and expected cost.

Facility Program

The facility program is the translation of the client's need for the building into physical characteristics, independent of architecture or design.

As with the functional program, we are choosing to use the term “facility program” to distinguish it from the many other uses of the simple term “program”. The corresponding term that has grown from the commissioning practice is Basis of Design (BOD), although the BOD as defined by ASHRAE is much more limited, typically only documenting the engineering systems. A closer analog may be the Predesign Studies or Detailed Project Programs required for many public sector owners. Regardless of the chosen name, the facility program should also include a consideration of each of the four elements shown. Particularly important are the qualitative requirements. These are often captured in project narratives and area specific requirements, often referred to as Room (or Area) Data Sheets.

Facility Program	
Spatial Program	Quantitative measure of number, type and size of assignable (function) rooms, allowance for non-assignable spaces (corridors, restrooms, elevators, etc.), allowance for structural area
Qualitative Requirements	Space performance narrative, measurable requirements (acoustics, lighting, etc.) and qualitative statements. Often referred to as Room Data Sheets
External Conditions	Impact of external conditions, such as anticipated foundation design, site grading, material selection
Irreducible Uncertainty	Uncertainty within the facility requirements, for example, quantitative uncertainty in un-assignable area, space utilization, extent of daylighting access, floor plate efficiency

Table 2-2: Facility Program

Estimate of probable cost

The estimate of probable cost is the estimator's opinion, based on a judgment of the likely cost of the project. The estimate can be developed by simulation, essentially by developing target quantities and costs from the facility program, or using benchmarks based on similar buildings, spaces or components that match the facility program. Methods of estimating are discussed in detail in Chapter 4.

Probable Cost and Steering Plan	
Cost Estimate Detail	Cost estimate developed in sufficient detail and accuracy to allow for the development of target cost and steering to target
Basis of Estimate	Statement of the underlying premises of the cost estimate, program, procurement conditions, and schedule Expected confidence level of the estimate
External Conditions	Documentation of market conditions
Irreducible Uncertainty	Recognition and management of residual unreduced uncertainty through explicit allowances and contingencies

Table 2-3: Probable Cost and Steering Plan

The estimate of probable cost is not the target, or the budget. It is simply a statement of the likely cost of delivering the functional and facility programs. It is important at this stage that the estimate reflects the uncertainty in the programs to ensure that the risk is explicitly addressed through ranged estimates such that the targets can be set with the appropriate level of confidence. At the least, the estimate should be a three-point estimate (lowest credible, most likely, and highest credible). For more complex projects it may be appropriate to increase to five points: lowest credible, lowest responsible, most likely, highest responsible, and highest credible, or even a probabilistic distribution.

Uncertainty should also be identified, particularly uncertainty related to risks outside the control of the project team. Setting targets that bury irreducible uncertainty means that the achievement of the target moves out of the control of the project team, for example:

	Base Cost	Escalation	Program Contingency	Total
Lowest Credible	$m50	$m5	$m3	$m58
Most Likely	$m60	$m6	$m3	$m69
Highest Credible	$m80	$m8	$m3	$m81

Table 2-4: Making uncertainty visible

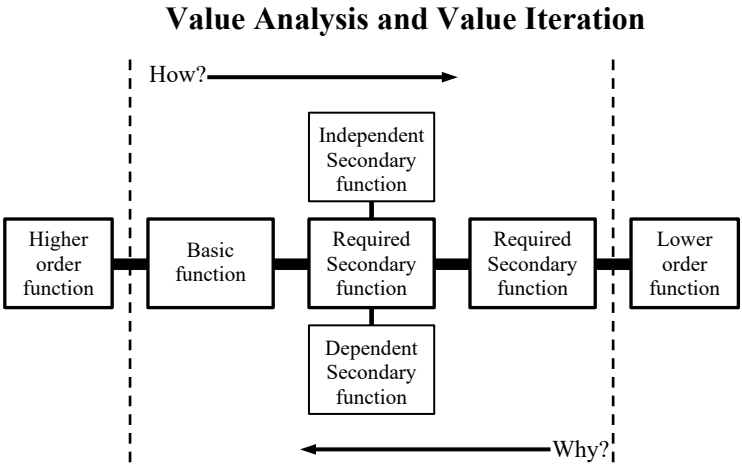

Figure 2-3: FAST Diagram

The process from functional program to estimate is laid out as linear, but in practice, it is typically iterative using a Cost/Benefit process such as Value Analysis or Choosing by Advantages. There is a dynamic interaction between the desired outcome, and the derived cost of delivering that outcome, and part of the target setting process is working with the owner to ensure that the final programs and estimates reflect delivery of the highest value to cost ratio.

It is beyond the scope of this book to delve deeply into the process of Value Analysis. It should be noted, though, that the process of developing the functional and facility programs inherently follows the Functional Analysis System Technique (FAST), with the functional program answering the "why" question, and the facility program answering the "how" question.

In this manner, the TVD process is fundamentally aligned with the practice of Value Management, and both are focused on delivering value to the client.

Setting Target Costs, the Target Value Statement[5], and the Project Execution Plan[6]

Once the functional and facility programs have been reconciled with the estimated cost and provided the estimate of probable cost is no more than the allowable cost, it is possible to move to the final stage of setting targets, namely developing the Target Value Statement and the Project Execution Plan.

The Target Value Statement is the articulation of all the targets for the project, both the target cost and the target outcomes of values or performance. The Project Execution Plan is an articulation of how the project team plans to deliver to target.

As noted at the start of this chapter, there are several types of target cost – and there may be more than one target. The targets should also include an articulation of how success will be rewarded, and how any excess funds will be applied, if the actual cost comes in lower than the target. This is further discussed later in this chapter under steering.

The targets are set with reference to the estimate of probable cost, but do not need to be linked to it. The target may well be set below the estimate in order to drive efficiency and innovation, or it may be set above the estimated cost, if the target needs to be an absolute cap on expenditure. The targets should also be set with a recognition of uncertainty or risk, with any contingencies being made explicit. Once the project level target cost is determined, costs are allocated to different cost items in a Cost Plan.

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[5] See Table 1 (Owner Requirements) in Chapter 7.1 for an example of project value targets.

[6] "Project Validation" is the term used in Lean Integrated Project Delivery. See Grau et al. 2019, 2021.

Another key element of the targets, particularly the value targets, is to set clear measurement or assessment protocols. This means that the targets themselves need to be specific and clearly stated, and that there should be a clear indication of how they will be measured as the project progresses. Even very subjective or long-term targets such as beauty, or community impact can be managed with appropriate evaluation processes. These may include formal approaches, such as an evaluation "committee", or informal over-the-shoulder reviews.

Steering to Targets

What is Steering?

Steering is a process that uses information in the Target Value Statement and Cost Plan to deliver the objectives of the project. It involves designing to the targets, using either target quantities or target elemental costs established in the Target Cost development process, rather than designing first, and then reacting when costs do not match the budget.

Because the steering process is rooted in the project vision and function, it also allows for, and even encourages a process of Value Engineering. The project team should always be focused on the "How". How can we deliver the function at the best possible cost? How can we optimize space performance and utilization? How can we enhance the business case? The design becomes a response to these "How" questions. The targets guide the design, rather than responding to ungrounded design alternatives.

Steering to Targets

The ability to steer projects toward their targets is critical for project success. Steering requires the following attributes:

1. Tracking

Knowing where you are at any point in time relative to the target. Deviation from target must be identified, and representations are needed of where we will arrive if we continue on a current course.

2. Control

An ability to influence the direction. Whenever there is a difference between where you are likely to wind up and your desired destination, adjustment is required to close that gap – we turn the wheel of our car to stay on the road.