Chapter 1 – Target Value Delivery

by Glenn Ballard

Introduction

Target Value Delivery (TVD) is a process for delivering value to public and private clients/owners, as well as other project stakeholders, within their economic, social and environmental conditions of satisfaction.

TVD was adapted from manufacturing's Lean Product Development. When a manufacturer wants to add a new product to its portfolio, they decide what benefits they expect from the product over its lifetime, then decide what is the most they are willing and able to spend to get those benefits, namely, the allowable cost. This cost/benefit ratio is illustrated in Figure 1.

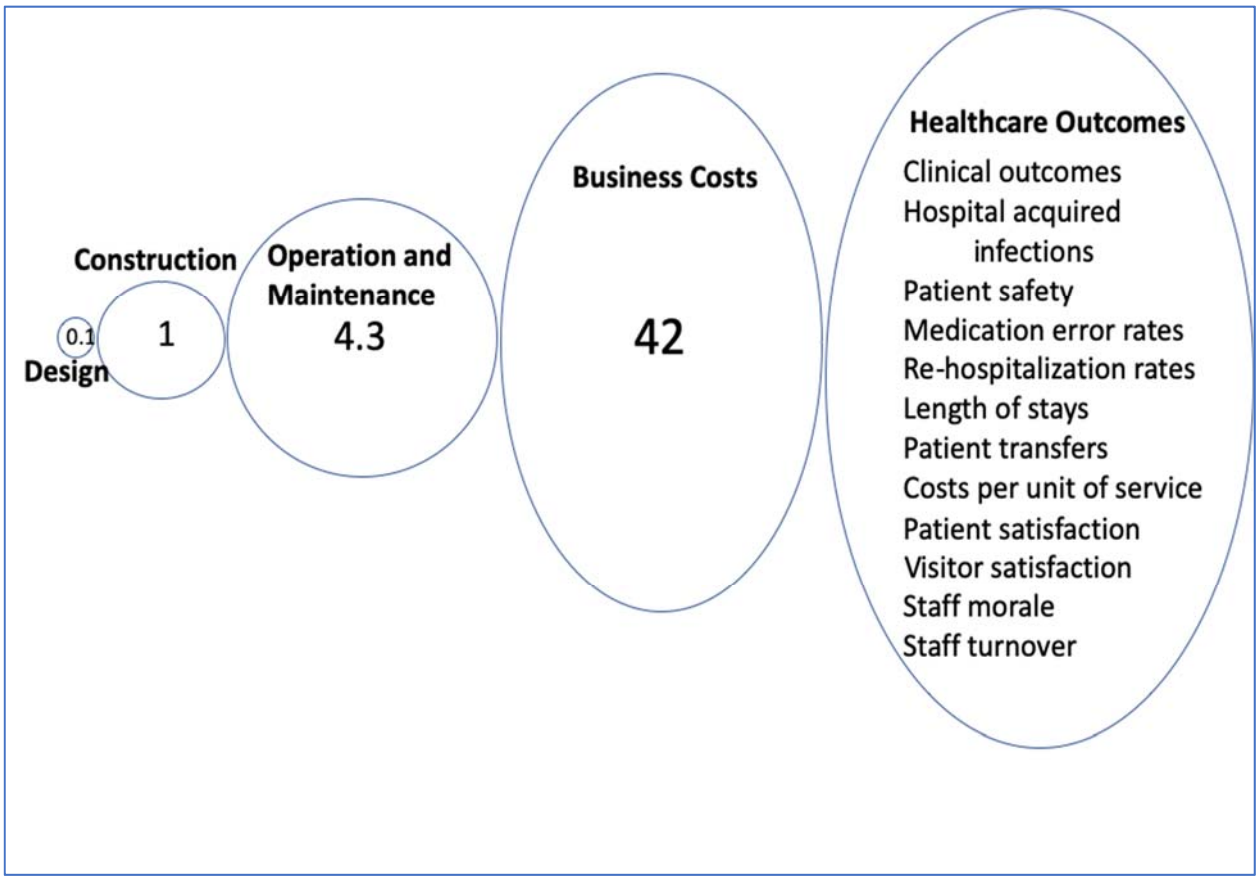
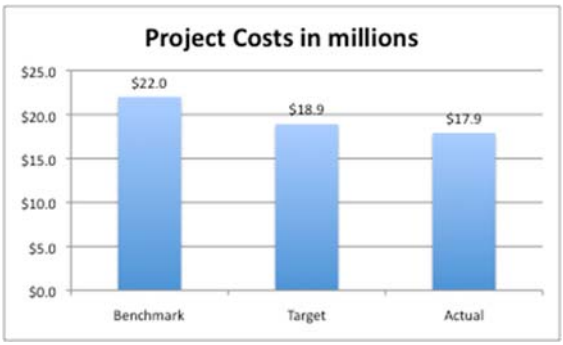


Figure 1. Costs and Benefits

The data for constructing this figure came from a study undertaken for the UK's National Health Service (NHS). "Healthcare outcomes" on the right lists some of the benefits expected from the use of the building to deliver healthcare. Some benefits, such as increased public awareness or projecting a desired image, may not be easily measured in Euros but may nonetheless be valuable to a client/owner. The costs of acquiring those benefits are the sum of capital costs (Design and Construction) and use costs (Operation and Maintenance plus Business) over 20 years. The unit of

cost is *Construction* at 1.0; *Capital* costs are 1.1 units; and *Use* costs are 46.3 units. The value of benefits to the clients/owners must be greater than the sum of whole-life costs in order for the project to proceed. In other words, the area of the big circle on the right must be greater than the sum of the four cost circles.

Cost figures in this diagram are intended to represent the relationship between cost elements. By far the biggest costs are those for business use of the hospital (mainly staffing costs) and for operating and maintaining the physical facility. Engaging these users in designing how healthcare will be delivered in the hospital, and how the hospital will be shaped to facilitate both healthcare delivery and operations and maintenance, is strongly advisable. Otherwise, the risk is great that the cost of using the building for its intended purpose will push lifecycle costs beyond the allowable – or worse yet, the cost is controlled but benefits are not delivered.



Cost at completion was 5.2% below target and 18.6% below market

Figure 2. Early TVD Project Example

This Project – Sutter Health's Fairfield Medical Office Building Project – had an estimated cost of US$22 million based on what Sutter Health and other healthcare companies in California had spent on similar facilities. The target cost for the project was set at US$18.9 million based on a desired return on investment from use of the building through its design life, and the actual cost at completion was US$17.9 million. The cost to design and construct the building was reduced as a result of a combination of factors, chief of which were integrating builders into the design team, providing rapid cost feedback on design alternatives, and shared risk and reward by the key design and construction firms involved in the project. As illustrated in Figure 2, cost at completion was 5.2% below target and 18.6% below market. The success of this early project, completed in 2006, persuaded Sutter Health to use TVD to deliver all of its acute care hospitals.

Key Points

1. Most clients are multi-faceted. They include the business owner, those who use the constructed asset for its intended purpose, and those who maintain and operate the physical facility. These are the primary clients. Additional customers include the neighbors, regulators, lenders and 'patients', the customers of the client. Meeting the different needs of these clients and customers is a challenge every project faces. Even a developer that produces buildings "on spec", meaning that they haven't sold it beforehand, consider *Use* costs because that impacts sales/lease price.
2. Design to targets for net benefits in use – what is wanted and the allowable cost for what is wanted. Don't design and then cost.

How is TVD different?

Many, if not most, construction projects are launched with too little certainty about the challenges they will face and the resources needed to meet those challenges. Unlike TVD projects, it is common for the estimated cost to increase as the design becomes more detailed. Far from establishing a maximum amount that clients/owners might pay, the sum of bids for construction packages is actually the least a client/owner will pay. Better methods for setting and steering to project targets are needed.

Setting Targets and Deciding what Project to Build

The process for setting targets for what is wanted, and for conditions of satisfaction on the delivery of what is wanted, is outlined in Figure 3. Note that allowable cost is what the client/owner is both willing and able to spend to get what they want (benefits in use). Note also that these two (what is wanted and allowable cost) are two sides of one coin. A change in either should always trigger recalculation of the other. If the expected cost of what is wanted cannot be reduced to fit within the allowable cost, what is wanted must be changed. If what is wanted changes, the allowable cost must be recalculated.

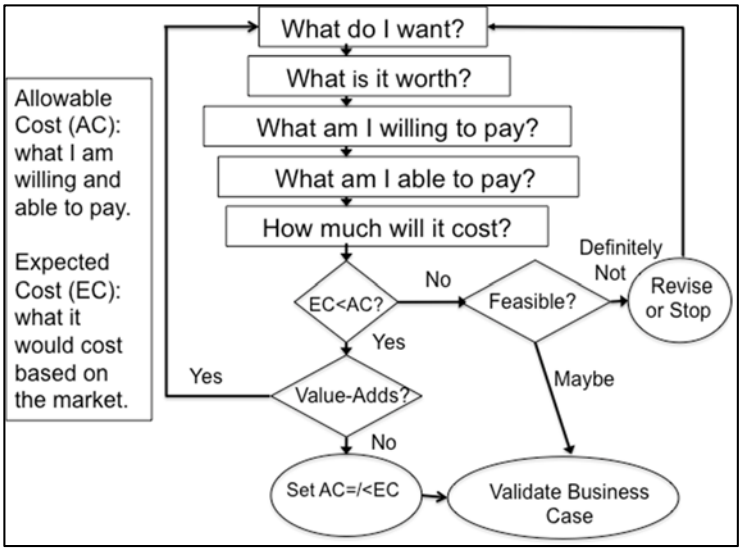


Figure 3. Project Definition Process (adapted from Ballard & Pennanen, 2013)

Both possibilities are illustrated in Figure 3. Once what is wanted and its allowable cost are determined, the next step is to compare allowable cost with expected cost. Common methods for estimating expected cost are unit pricing (cost per square metre, cost per hospital bed) and benchmarking against similar facilities. Unit pricing can be plus or minus 40% from cost at completion. Benchmarking can be closer to cost at completion, but how close depends on both the abilities of the estimator and the quality of data that can be used. A third method for conceptual estimating (estimating cost at completion prior to design, from programmatic data) is to first model the building and then cost it. More common on industrial projects than in building projects, this method, based on engineering logic, is used by Haahtela, a Finnish project and cost management consulting firm based in Helsinki (www.haahtela.fi) in its management of building projects. The

average difference between conceptual estimate and cost at completion for Haahtela's most recent 39 projects is -1.0%, with a standard deviation of 4.9%.

Regardless of the cost estimating method used, decisions about keeping a project moving forward have to be made with limited information and some degree of uncertainty. That is a bit like trying to decide if to *hold 'em or fold 'em* in bidding games. If the difference between allowable and expected cost is so great that it seems unlikely that the gap can be closed, what is wanted must be revised. If there is reason to hope that the gap can be closed, the next step is to fund a feasibility study.

In the private sector, failure to align business requirements and allowable cost can even result in projects being abandoned. That can also happen in the public sector but can be more challenging because projects are initiated to deliver service value to the public as well as wider social and economic benefits – and may do so even when project scope must be sacrificed.

Feasibility studies can be done by client/owner personnel, by appointed external professionals, or by the key players that will deliver the project if funding is secured. The feasibility study consists of producing a plan for project execution, then testing that plan against potential risks and opportunities. What counts as acceptable risk is always the primary client's decision.

Three factors drive the superior performance of TVD projects:

1. The Lean Construction philosophy and methods.
2. Organisational integration – downstream players participate in upstream processes and vice-versa.
3. Shared risk and reward.

They are listed here in order of importance. The philosophy is absolutely necessary. Organisational integration is highly advisable. The 'one team' attitude can be promoted by shared incentives and by reminders that commercial success of each player is dependent on how others perform, not only their own performance. While collaborative contracts such as Project Alliancing and Integrated Project Delivery (IPD) undoubtedly help, other contractual structures, especially those that allow early contractor involvement, can fit with TVD. Such contractual arrangements can also be put in place for public sector contracts too.

The feasibility study may recommend funding or revising the project. If funded, targets will have been set for both what is wanted (functions to be performed, capacities needed for their performance, facility performance specifications) and conditions of satisfaction (cost, time, social impacts, environmental impacts).

In situations of high uncertainty, a client may choose to fund design to the point when it is apparent either that the gap between allowable and expected cost can be closed, or that the gap cannot be closed.

Another key decision to be made by the clients/owners is what instructions to give regarding the design phase. Is the project team to limit their search to designs that: a) deliver targeted net benefits within a fixed cost; or b) increase net benefits even if that increases cost? For this latter alternative, the clients/owners must be able to carry a contingency for funding such opportunities. For

example, injuries to nurses could be reduced by installing patient lifting devices, or revenues from performing particular types of surgery could be increased by enabling such surgeries to be performed in less time, but at an increased cost for support services.

Key Points

How to Enforce Targets

Once targets are set, the next step is to steer each phase of the project toward project targets. Doing that works best when it is in the interest of the design and construction firms to meet targets. That can be done through positive or negative incentives, or some combination of the two.

A client/owner may engage a construction manager or design-build firm to deliver a TVD project where those firms bear the cost risk. However, the greater the uncertainty and complexity of the project, the more premium the client/owner will be charged in order to offset that cost risk. If the cost risk is too great to shift completely, the client/owner will have to take on some or all cost risk. The benefit of doing so is two-fold, avoidance of premiums for taking on risk and the increased control clients/owners have over project delivery.

Capital projects at the University of California San Francisco typically employ rewards to all design and construction firms on each project for hitting specific targets, for example, schedule milestones. Their success inspired the Board of Regents that govern the 10 campus University of California system to demand that all campuses follow San Francisco's example.

When BAA undertook the Terminal 5 Project at Heathrow Airport, the project's expected cost was fully 80% of BAA's net worth, and it was entirely possible that the complexity of the project would result in cost increases that would have pushed BAA into bankruptcy. Faced with this situation, BAA decided to take on all cost risk. By doing so, they could avoid paying the premiums that come with risk shifting, and equally or more important, they were able to deliver the project using Lean management methods, including TVD, to increase the probability of getting what they wanted within an acceptable cost. Framework suppliers (design and construction) had positive incentives through shared cost savings. The project was completed successfully. Given the positive achievements attained with the T5 delivery model, BAA is re-embracing the T5 approach on its new high-risk runway project which will provide greater certainty and control of cost through the adoption of Lean management methods.

Sutter Health's recently completed US$1.5 billion hospital in San Francisco was undertaken using a form of Integrated Project Delivery (IPD) in which a target cost for the project was set. Sutter Health bore the risk of paying costs in excess of that target cost. Some design and construction firms were engaged on fixed price contracts, but key designers and builders were reimbursed for their cost of work and had the risk of receiving reduced or zero profit. If project cost exceeded the target, that excess reduced the profit pool. The project was completed successfully for all parties.

Steering Design to Targets

To decide if to fund a project, the only estimate of cost needed is for the capital cost of the project and for the cost to use the constructed asset over its life. However, design decisions are made system by system and component by component. Hence, in order to steer design to cost targets,

the cost must be broken down into the systems and components of the asset to be designed. Otherwise, there is no way to know what systems and components should cost, and hence no basis for providing feedback to designers. Table 1 shows an example of the level of detail in cost targets used to steer design and construction.

"Steering" design is done through feedback, both prior to and after the production of design alternatives. Designers can see from the cost model what funds are allocated for different parts of the asset to be constructed, and alternatives can be assessed for their conformance to those allocations. Designers are not told how to design, but are rather provided feedback about those designs meeting targets. Generally speaking, if a solution is not found that meets the allocated cost for a specific function or component, the cost overrun must be made up through cost underruns elsewhere.

Table 1: Target costs for a healthcare project (courtesy The Boldt Companies)

Hea BOLDT				**Client**
Facility Replacement - Working Program Project Totals				
Projected Start: 4/1/2019 Completion: 1/16/2022				
			Target Cost	
A		**Substructure**	$	3,172,817
	A10	Foundations	$	3,087,317
	A20	Basement	$	85,500
B		**Shell**	$	16,183,875
	B10	Superstructure	$	8,204,601
	B20	Exterior Enclosure	$	6,029,706
	B30	Roofing	$	1,949,569

C		**Interiors**	$	17,366,284
	C10	Interior Construction	$	11,603,617
	C20	Stairs	$	650,950
	C30	Finishes	$	5,111,716
D		**Services**	$	33,071,923
	D10	Conveying Systems	$	1,316,744
	D20	Plumbing	$	5,425,734
	D30	HVAC	$	13,391,111
	D40	Fire Protection	$	1,079,576
	D50	Electrical	$	11,858,758
E		**Equipment & Furnishings**	$	867,143
	F10	Equipment	$	672,998
	F20	Furnishings	$	194,146

Key Points

- Only the primary client can change targets.
- There are a number of ways to structure commercial terms and to allocate risks and rewards that enable enforcing targets.

Steering Construction to Targets

Design provides the recipe, but construction prepares the meal – steering is still much needed until the constructed asset is delivered to the client/owner. Typically, construction is executed through contracts of one sort or another with firms that are capable of performing each type of work. Using a building as an example, these types of work vary with the construction phases: substructure, superstructure, envelope, interior framing, mechanical, electrical, fire protection, etc. Steering is done by comparing allocated costs to prospective costs for each type of work or work package, and acting to reduce any negative differences. Actions can be taken in awarding contracts, in purchasing materials and equipment, and in installation and testing. When needed, overruns on one work package can be offset by underruns on another – depending, of course, on commercial terms.

Key Tools for TVD

TVD can be understood as a big tool that includes smaller tools for performing specific functions. TVD produces better outcomes using methods such as Set-Based Concurrent Engineering, Choosing by Advantages, A3 reports, and the Last Planner System.

Set-Based Concurrent Engineering (SCBE) originated in Lean Product Development. 'Concurrency' refers to the fact that everyone who touches a product over its life is involved in its design. 'Set Based' involves aligning stakeholder requirements before designing, then generating multiple design alternatives for each system and component of the product (Kennedy et al., 2014).

Choosing by Advantages (CBA) was created by Jim Suhr of the U.S. Forest Service as a method for evaluating and selecting from alternatives against multiple must-have criteria (requirements) and nice-to-have criteria (preferences), and was first applied to the domain of construction projects by John Koga of The Boldt Companies. CBA differs from other such methods by not weighting requirements, by first agreeing on how well each alternative meets requirements, and by deferring consideration of cost until the total importance of advantages of each alternative have been agreed (Suhr, 1999).

A3 reports are used to record proposals and agreements about choosing from alternatives so the knowledge is not lost. 'A3' is the metric size of paper to which the report is limited. The standard structure of these reports facilitates a process of reaching consensus among different stakeholders in the decision or action (Shook, 2008).

Last Planner® System (LPS) is a method for coordinating action; for planning and controlling. Once targets are set, planning how to achieve them is needed, then proactive steering to targets in sometimes stormy seas. LPS provides organisational alignment but also promotes flexibility in project teams to develop new pathways to existing targets or even to new targets. Its principles include:

- Plan in greater detail as the start date for planned tasks approaches.
- Produce plans collaboratively with those who are to do the work being planned.
- Reveal and remove constraints on planned tasks as a team.

- Don't start tasks that you should not or cannot complete. Commit to perform only those tasks that are properly defined, sound, sequenced and properly sized.
- Make and secure reliable promises, and speak up immediately should you lose confidence that you can keep your promises (as opposed to waiting as long as possible and hoping someone else speaks up first).
- Learn from breakdowns (unintended consequences of actions taken).
- Underload resources to increase reliability of work release.

Key Points

- Steering design and construction to targets continues by the project team until turnover, then becomes the responsibility of users throughout the life of the product.
- Steering construction requires cost allocations to serve as provisional cost targets for work packages.

Conclusion

It is hoped that Clients/Owners reading this will see the value that TVD provides and look to adopt TVD on their projects. Here are a few things to keep in mind:

- Be aware that TVD (and Lean generally) is not magic. Even if properly executed, TVD and Lean projects can go wrong for reasons outside the project's control. Improper execution includes failing to follow the recommended process and, even more important, leaders' failure to adopt and live the Lean philosophy.
- Be prepared to play new roles. Clients/Owners will be more directly involved in project execution, and must have the needed competencies and capacity. Builders must learn how to add value in design. Designers must learn how to design for net benefits in use over the life of the constructed asset.
- Don't neglect the importance of selecting the right project team members. Some form of best value selection is needed in order to assure that low price doesn't conceal needed attitudes and willingness to learn.
- There is a lot written on TVD (see recommended readings below), and much that can be learned, but organisations should also learn from those who have implemented TVD and Lean before. Reach out to peers (client-to-client, designer-to-designer, builder-to-builder). They will be glad to share their experiences.

References

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Further Reading

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Bio

Glenn Ballard is a Research Associate at the Project Production Systems Laboratory, University of California Berkeley. Glenn entered the construction industry as a pipefitter's helper, transitioned to construction engineering, and in 1980 was named Manager of Productivity Improvement for a construction division of Brown and Root. He subsequently became an internal management consultant with Bechtel Petroleum, working on all aspects of project delivery, and supporting projects in other Bechtel divisions such as the South Texas Nuclear Plant. He began a management consulting business in 1987. In parallel, he began lecturing on productivity and quality improvement at the University of California Berkeley in 1989, and completed the transition from industry to academia in 2005 when he was named Research Director for the University's *Project Production Systems Laboratory*. He co-founded the *International Group for Lean Construction* (IGLC) in 1993, the *Lean Construction Institute* (LCI) in 1997, the *Project Production Systems Laboratory* in 2005, and *Lean in the Public Sector* (LIPS) in 2007. Glenn retired from his position as Research Director in 2019, but continues in a support role as a Research Associate for the Project Production Systems Laboratory. With lots of help from others, Glenn developed the Last Planner® System (LPS) and Target Value Delivery (TVD) – two key Lean Construction methods, both of which he continues to improve. A new *Current Process Benchmark for the Last Planner System* is due to be published by the end of 2019, and Glenn is now leading research groups to develop better methods for use in Target Value Delivery, namely, conceptual estimating (estimating cost at completion prior to design) and using trade-off curves in aligning potentially conflicting stakeholder requirements. These will be incorporated in a future update of the *Current Process Benchmark for Target Value Delivery*. Glenn has a long list of publications (see Google Scholar), many of which are available at the website of the IGLC (www.iglc.net).