Morêda Neto, H., Costa, D., and Thomas, L. (2016). "Target Value Design Approach for Real Estate Development." In: *Proc. 24th Ann. Conf. of the Int'l. Group for Lean Construction*, Boston, MA, USA,sect.3 pp. 63–72. Available at: <www.iglc.net>.

TARGET VALUE DESIGN APPROACH FOR REAL ESTATE DEVELOPMENT

Hugo M. Morêda Neto[1], Dayana B. Costa[2] and Linda Thomas[3]

ABSTRACT

In the delivery of major construction projects, the programming phase is often poorly managed. Additionally, there is often a lack of dialog among the stakeholders during the initial design phase, resulting in projects that are over budget, difficult to construct, and finishing later than desired. Rework, waste, and change orders also often occur.

Target Value Design (TVD) is a management approach that utilizes features of Target Costing and adapts them to the construction industry. TVD's focus is to make the client's value a primary driver of design by improving the project definition during programming thus optimizing the design phase. Despite recent research praising TVD, there still remains a lack of information related to TVD applied to real estate development and construction.

This paper reports on a study aiming to identify weaknesses in processes currently used to define construction projects in light of TVD theory for real estate and construction companies. The authors describe findings from exploratory case studies, various interviews and documents analyzed based on a theoretical framework obtained from a literature review of TVD theory. Consequently, recommendations supporting the application of the fundamental concepts of TVD to real estate projects are presented and discussed, furthering the current debate concerning the adaptation of TVD to the construction industry.

KEYWORDS

Target Value Design, Value, Collaboration, Project Definition, Real Estate Development

INTRODUCTION

Traditionally, managing the cost of a construction project is accomplished in the same manner as managing project duration. Both have been driven by the design of the project and its subsequent implementation, rather than serving as actual criteria for an acceptable design. Cost and time management have attempted to "exert control, after budgets are fixed, by after-the-fact monitoring, detection of negative variances, and taking action to recover to targets" (Ballard, 2006).

1 Civil Engineer, MSc in Construction Management, School of Engineering, Civil, Environmental and Ocean Engineering Department, Stevens Institute of Technology, NJ 07030, USA, hmoredan@stevens.edu

2 Assistant Professor, Engineering School, Department of Structural and Construction Engineering, Master of Civil Engineering, Federal University of Bahia, BA, Brazil, dayanabcosta@ufba.br

3 Professor and Program Director, Construction Management Program, School of Engineering, Civil, Environmental and Ocean Engineering Department, Stevens Institute of Technology NJ 07030, USA, lthomas2@stevens.edu

Furthermore, in the delivery of major construction projects, including mega-projects, the programming phase is often poorly executed consequently increasing the probability of project failure. Additionally, there is often a lack of dialog among the stakeholders during the design phase, and some stakeholder's involvement is often too late to be fully effective. Poor programming, lack of communication and late involvement all tend to result in projects that are over budget, difficult to construct and often delayed. This reality happens to a range of project categories including residential, commercial, infrastructure, and healthcare. Consequently, rework, excessive waste, and frequent change orders abound.

Target Value Design (TVD) is a management strategy that is designed to eliminate waste and deliver value by using a 'design-to-cost' method (Kim and Lee, 2010). TVD turns current design practice "upside-down" (Macomber and Barberio, 2007) and can be used to reduce the typical problems mentioned above.

Findings from a literature review of Target Costing (TC) and TVD reveals a critical gap in knowledge. TVD has mainly been studied in a very narrow and specific context - healthcare projects utilizing integrated project delivery methods. Oliva (2014) presented a study relating TVD for housing products in Brazil proposing an integrated method based on levels of collaboration. Oliva (2014) brought valuable contributions to the field and began the current the discussion around adapting TVD to residential projects, but additional research needs occur to anchor TVD fully in real estate development.

Also, applying target costing and TVD in the construction industry is extremely complex, and there is still no formal consensus on this subject. However, there is still plenty of opportunity to explore such approaches for real estate development, which is the main motivation for this research.

The exploratory case studies conducted and reported in this study aim to identify the weaknesses of the project definition processes and the project phases in light of TVD theory for real estate and construction companies. Finally, recommendations supporting integration of the key concepts of TVD into real estate projects are presented.

BACKGROUND

Target Costing (TC), understood as a cost management tool for reducing the overall cost of a product over its entire life cycle with the help of all departments of a company and the active contribution of the supply chain, is becoming a widespread strategic management tool and aims to enhance cost leadership of leading manufacturers worldwide (Kato, 1993).

Some in the construction industry have tried to adapt and integrate concepts from TC. It is possible to understand these initiatives from two different perspectives:

- There are practices that might be labeled target costing or might have similarities in process or organizational structure, such as contract management, cost planning, design-build-own-transfer and partnering projects, target cost contracts (Zimina et al., 2012), but they are not full adaptations;
- There are applications of the original Target Costing concept in the project-based industry for projects that adapt or translate procedures used in manufacturing:

- "Adapted the TC theory" using Lean Construction elements and different collaborative approaches, "creating" Target Value Design.
- Use the "pure theory" from TC from the manufacturing, translating its elements to construction. Such efforts can be observed in Nicolini et al. (2000), Jacomit et al. (2008), Melo (2015) and others.

The original TC concept has its roots in manufacturing, more specifically applied to the new product development phase. The understanding of TC applied in other fields beyond the construction industry is necessary to proceed. On the other hand, TVD is a TC adaptation using lean elements, and so far its literature is limited to this community.

According to Zimina et al. (2012), the introduction of the Target Value Design technique is another attempt to bring and anchor the target costing practice in the construction industry. The main idea of TVD is to make a client's value (specific design criteria, cost, schedule and constructability) a driver of design, thereby reducing waste and satisfying or even exceeding expectations.

Several definitions have been assigned to TVD as a practice intended to keep design and cost aligned while delivering customer value by matching design-to-cost (Lee et al., 2010). This approach makes the client's constraints inform design for the sake of value delivery (Ballard, 2011), to provide for integrated project delivery through the collaborative efforts of different stakeholders (Jung et al., 2012).

TVD has two key distinctive features: "designing to targets" to increase the predictability of project performance; and the opportunity for a cross-disciplinary "validation study" to increase a shared understanding about the basis of value, design, budget, and risk (Lee et al. 2012).

To do so, TVD concepts powerfully add value to the pre-design/project definition stage with the involvement of the key downstream players. The phase immediately preceding design has been called by a variety of names, including design briefing, programming, front end loading, and project definition. It involvews interaction among stakeholders communicating purpose, design concept and constraints (Ballard, 2006). The now well-publicized MacLeamy Curve demonstrates why the early involvement of stakeholders in the project definition is critical. Design decisions made early in the process have the greatest ability to affect cost and functional capabilities.

It now seems optimal to dedicate significantly greater time and effort to the pre-design, or project definition phase with the key downstream players involved in business planning, either directly, which has occurred occasionally, or through validation of the project business plan and feasibility studies (Zimina et al., 2012).

According to Zimina et al. (2012), the discussion on target costing in the construction research community is limited. Performing additional TVD-focused studies is necessary. Additional research will enable a better understanding of TVD's principles creating broader, more useful information. Denerolle (2013) does describe the "17 principles" presented by Ballard (2011) linking them to key concepts of TVD. Some simplifications were made, and a new column has been added to incorporate Macomber and Barberio's (2007) "nine practices" for promoting the situations to deliver the target-value from the design process. Table 1 depicts these findings.

Table 1: TVD Key Concepts Framework. Adapted from Denerolle (2013) based on Ballard (2011) and Macomber et al. (2007)

•	• Key Concepts		• TVD Benchmark practices	• 9 Practices
Organizing (preparing mechanisms…)	• Commercial terms and interests alignment	· Contractual agreement • · Incentives, accountability	• - Some form of relational contract is used to align the interests of project team members with project objectives.	•
	• Integrated teams and governance	· Timing of the team partners involvement · Owner's participation · Co-location • · Core Group	• - The feasibility study produces a detailed budget and schedule aligned with scope and quality requirements. • - The customer is an active and permanent member of the project delivery team. • - Co-location is strongly advised, at least when teams are newly formed. Co-location need not be permanent; team meetings can be held weekly or more frequently.	- Work in small and diverse groups - Work in a Big Room • - Collaboratively plan and re-plan the project
	• Joint responsibility, transparency	· Team spirit · Trust building • · Open book environment	• - A cardinal rule is agreed upon by project team members – cost and schedule targets cannot be exceeded, and only the customer can change target scope, quality, cost or schedule.	- Work in a Big Room • - Collaboratively plan and re-plan the project
	• Functional interface	· Training, shared understanding • · Work structuring	•	•
Defining (ends & constraints)	• Business case and Target setting	· Access to owner's business case · Whole life cost · How are the targets set? • · Linkage to business case	• - With the help of key service providers, the customer develops and evaluates the project business case and decides whether to fund a feasibility study; in part based on the gap between the projects' allowable and market cost. • - The business case is based on a forecast of facility life-cycle costs and benefits, preferably derived from an operations model; and includes specification of an allowable cost—what the customer is able and willing to pay to get life cycle benefits. Financing constraints are specified in the business case; limitations on the customer's ability to fund the investment required to obtain life cycle benefits. • - All team members understand the business case and stakeholder values. • - Targets are set as stretch goals to spur innovation.	- Work in a Big Room - Collaboratively plan and re-plan the project • - Engage deeply with the client to establish the target-value
	• Stakeholder values	· Definition and measurement of value · Link value directly to design components • · Scope Changes	• - All team members understand the business case and stakeholder values.	- Engage deeply with the client to establish the target-value - Work in a Big Room - Work in small and diverse groups •
•	• Plan Validation	· Validation study process	• - Feasibility is assessed through aligning ends (what's wanted), means (conceptual design), and constraints (cost, time, location, etc.). The project proceeds to	•

		• · Level of details	funding only if alignment is achieved, or is judged achievable during the course of the project.	
Steering (means)	• Cross-functional Teams	· Clusters • · Collaboration	• - Target scope and cost are allocated to cross-functional TVD teams, typically by facility system; e.g., structural, mechanical, electrical, exterior, interiors, etc.	- Lead the design effort for learning and innovation. - Collaboratively plan and re-plan the project - Work in small and diverse groups - Work in a Big Room •
	• Design planning and analysis of alternatives	· Pull scheduling · Last Planner System® · Set-based design · Value engineering · Risk & Opportunity • · A3, selection methodology	- The Last Planner® system is used to coordinate the actions of team members. - The cost, schedule and quality implications of design alternatives are discussed by team members (and external stakeholders when appropriate) prior to major investments of design time. •	- Design to a detailed estimate - Collaboratively plan and re-plan the project - Concurrently design the product and the process in design sets - Work in small and diverse groups - Work in a Big Room - Lead the design effort for learning and innovation. •
	• Cost modeling	· BIM · Cost estimating • · Budget reporting	- The feasibility study produces a detailed budget and schedule aligned with scope and quality requirements. - Cost estimating and budgeting is done continuously through intimate collaboration between members of the project team—'over the shoulder estimating'. - TVD teams update their cost estimates and basis of estimate (scope) frequently. Example from a major hospital project during the period when TVD teams were heavily in design: estimate updates at most every three weeks. • - The project cost estimate is updated frequently to reflect TVD team updates. This could be a plus/minus report with consolidated reports at greater intervals. Often project cost estimates are updated and reviewed in weekly meetings of TVD team coordinators and discipline leads, open to all project team members. •	- Design to a detailed estimate - Collaboratively plan and re-plan the project - Work in small and diverse groups - Work in a Big Room •

Table 2: Case Study

	Company 1	Company 2	Office 1	Office 2
Planning	▪ The author used his network obtained after some years of experience in the industry and contacted the companies and offices. A research summary was provided explaining the objectives and approaches and four companies agreed to participate ▪ A presentation occurred in order to clarify and acquaint the interviewees regarding the topic ▪ Data collection happened in December 2015 for all companies and offices			
Description of the Companies	The real estate development and construction companies are small-medium size from Salvador-Brazil. They are the owner, developer, prime contractor and construction manager, performing all project definition, pre-construction and construction phase, sub-contracting design services. The financing can be through own resources or bank loans. The products are residential units or commercial rooms that are sold or rented		The architectural Offices are medium-large design offices located in Salvador-Brazil. They work in a wide range of areas, such as residential, commercial, hotels, healthcare and special projects. They worked with real estate development frequently, mainly only as designers, working directly with the developers and owners	
Type	Semi-structured interviews		Open interviews	
Interviewees	Technical and developer director	Director	Architect director a Design coordinator	Architect Director
Objectives (Understand how is)	▪ Project definition and feasibility studies are carried out ▪ The target set ▪ Project definition interaction with the budget ▪ Stakeholder involvement		Project phase is carried out ▪ Design process ▪ Interaction with the budget ▪ What are the inputs from other stakeholders	
Interview Parts	▪ New Products/Project, Feasibility Studies, and Market Variables ▪ Target Costing and Budget ▪ Stakeholders (designers, suppliers, sub-contractors, final users)		▪ New Products/Projects, Project Definition, Design Stage ▪ Target Costing and Budget ▪ Stakeholders (other designers, suppliers, subcontractors, final users)	
Documents Collected	Management & quality procedures and guides	Management procedures	Management procedures	
Follow-up	Emails and phones call also were necessary to collect missing or unclear data			

FINDINGS

Based on the interviews and documental analysis, the new project development process and the overall project cycle were examined for Company 1 and 2 focusing on the aspects that are relevant to TVD. Also, the design processes were analysed from the perspective of Offices 1 and 2, highlighting what is important for TVD theory and giving additional knowledge use to examine the companies. The results are presented in Table 3.

Table 3: Companies overall project cycle analysis in light of TVD

Company 1	Company 2

Weaknesses: ▪ Only the architect is involved in the research-sourcing-terrain attainment conversation, and the developer does not have other stakeholders values as input to help him to define the product ▪ The first feasibility study does not involve the other stakeholder in the plan validation ▪ Target cost, budget, and schedule are not shared with the other stakeholders ▪ The pre-construction services are developed with informal or incomplete input from main stakeholders (other designers, suppliers, sub-contractors), without integrated teams and governance ▪ In general, main suppliers only give a generic proposal for their services based on unit quantities. They just think about specific solution to the project when it is in advanced phases ▪ Usually, commercial terms and interests' alignment between the developers and the other stakeholder do not generate collaboration ▪ Joint responsibility, transparency is inappropriate ▪ During the design phase, the process is not collaborative, and cross-functional teams or co-location are not explored ▪ Meetings happen without a pre-established frequency and clash-detection, and compatibility reports are late performed ▪ The final budget is only finished after the conclusion of the executive designs and it can happen during the construction phase ▪ There is no target cost or schedule transmitted to the designers. They only receive scope information ▪ Project constraints are not correctly established ▪ The construction phase is unassociated with the project definition and the product development overlaps with the construction phase. Many solutions, construtability issues and clash are identified only during construction phase ▪ There is no input from the final users	**Strength:** ▪ The division between the development and the construction phases is clear ▪ Important inputs are used in the dynamic feasibility studies from other stakeholders ▪ The project coordination is internally performed within a good timing ▪ Constructibility analysis and solutions are performed before construction, usually during programming ▪ Main suppliers and sub-contractors give more than simple proposals and work with the engineering team to suggest constructability solutions and budget input ▪ The pre-construction services (master planning, budget, etc.) are developed with good input from main stakeholders (other designers, suppliers, sub-contractors) ▪ The final budget is finished before the construction phase **Weaknesses:** ▪ Usually, only the architect is involved in the embryo phase, and the developer does not have other stakeholders formal input. Depending on the complexity of the project, it can change ▪ The first feasibility study does not involve the other stakeholder in the plan validation ▪ Usually, commercial terms and interests' alignment between the developers and the other stakeholder do not generate collaboration ▪ During the design phase, the process is not collaborative, and cross-functional teams or co-location are not explored ▪ There is no input from the final users in their regular real estate projects
	Offices 1 and 2 The overall design process was evaluated for the architectural offices and weakness were identified. It helped to understand and evaluate the project cycle from the real estate and construction

METHODOLOGY

The first phase of this work consisted of an extensive literature review that established the foundation and source of evidence for all other stages. After this, real estate development and construction company and architectural design office exploratory case studies were completed as part of the research strategy. The adoption of the case study strategy in this work is due to the main intention of this research being to investigate contemporary procedures and processes related to the new project development and project definition phase within a real-life context. Due the exploratory nature of this study, no quantitative data were used or analyzed in order to prioritise the different elements/concepts.

Interviews and documental analysis are used as sources of evidence for this work and are analyzed using a theoretical framework based on the literature review (Table 1).

These exploratory case studies are designed to illuminate the development project definition process vis-a-vis TVD theory. The goal is to identify weaknesses as well as useful procedures to be utilized. The exploratory case studies also reveal potential scenarios for adaption of TVD key concepts.Recommendations and comments regarding the adaptation of TVD concepts to real estate are presented ahead based on the exploratory case studies and the literature review.

Commercial terms and alignment of interests: This is a critical barrier to the implementation of TVD. TVD is mostly used in projects with an integrated project delivery method. The traditional commercial terms carried out in most real estate developments do not create an attractive scenario for TVD. However, there are ways to align the interests of the project team members with the project objectives. Using financial incentives, the creation of partnerships and other contract methods can generate results regarding collaboration necessary for the TVD approach and is a solution that can be further explored.

Integrated teams and governance: Team integration currently occurs, but usually with some misalignment. The chief problem is in the timing. The participation occurs at different stages, and it should be realigned to promote involvement earlier in the process. Small and diverse groups working in "big rooms" is necessary.

Joint responsibility and transparency is not encouraged due to the adversarial nature of many contract agreements, because of this, there is often a lack of communication and no sense of joint responsibility among stakeholders. The creation of partnership and use of financial incentives may help to improve this shortfall. Moreover, better team integration with earlier involvement of key stakeholders employing small, diverse teams in a "big room" can potentially improve the overall interaction among stakeholders. The developer should also share project objectives, plans, and targets for increased success.

Functional interface: This is strongly related to other systems, such as Quality Management Systems and other lean practices. An alignment promoting TVD and lean training is necessary. Traditionally stakeholders are not trained in lean concepts and TVD is not a diffused approach. Workshops can be planned before and during construction.

Business case and target costing: This is one of the main challenges for the original use of TVD in the residential market. The business case is extremely important in TVD theory. To improve the business process, the developer must engage the main stakeholders during planning. Identifying the project value for the final user, owner, developer and other stakeholders is necessary and can be accomplished via workshops.

Stakeholder values: Incorporate stakeholder values into the project may not be an easy task. Workshops, big room meetings and co-location of personnel are all tools that can be used to improve the perception of value. The developer should be aligned with the architect to bring the main concept to discussion. It can come from different sources, including the company's profile, market studies, competition, project location and of course the final user's needs. The other stakeholders must also participate, not only in understanding the core goals for the project, but also incorporating their own inputs and helping with value engineering. The teams should also be selected by value criteria.

Cross-functional Teams: The project coordination is essential to TVD making it necessary to implement tools to enable collaboration. The ideal team includes representatives of all stakeholders. The timing is a barrier for this formation, since the

supplies and the constructor start participating more effectively during the construction phase. The developer must ensure that the engineering team (estimation, coordination, planning) has the capacity and knowledge from previous projects to provide important constructability analysis to the design team. The supplier and sub-contactors also need to be more engaged by the designers and estimator in order to bring more comprehensive contributions, not only simple proposals. Small groups and co-location are important.

Design planning and analysis of alternatives: This is more related to the design itself. Several practices from Macomber and Barberio (2007) apply, such as designing to a detailed estimate, collaboratively planning and re-planning the project, concurrently designing the project and the processes in design sets, working in small and diverse groups and working in a "big room". Deadlines and delivery plans must be coordinated. In addition, it is important to highlight other coordination and clash-detections. Alternative solutions to problems are not commonly analyzed collectively at an early stage and frequently, the analysis is performed during the construction phase, which increases the cost of changes and decreases the capacity to use alternative solutions. Performing constructability and alternative analysis with cross-functional teams employing cost modeling is helpful.

Cost modeling: It is currently consistently poorly performed. Building Information Modelling and other advanced tools are not widely used. There is also a lack of interaction among the estimation and design teams. Estimation must be continually performed and updated. Suppliers and sub-contractors play an important role within a project's budget and need to be engaged and participate more deeply in the pricing and solution recommendations. Continuous estimation and budgeting is paramount.

CONCLUSIONS

According to Melo et al. (2014), prior studies have attempted to adapt the manufacturing target costing process to the project-based nature of the construction industry. However, target costing is not a static approach and requires dynamic adaptations. Thus, TC adaptation efforts continue to evolve across different projects, different classes of owners (public and private), and different locations.

TVD is another attempt to adapt TC to the construction industry, however, the applications of this approach have been limited and further studies must be conducted. This paper examines the real estate development sector using TVD theory in order to identify potential uses for TVD and its key concepts. Several recommendations are proposed based on the data determined by analysis of specific companies and a literature review. The authors' intention is to further develop discussions on the TVD topic. Oliva (2014) also brought contributions regarding the TVD for different types of projects, owners, and cultures. Both studies show that the adaption for real estate development and residential construction is possible with some adjustment. Unfortunately, the lack of qualification, understanding and training on lean thinking and Target Costing/TVD topics is a critical barrier to the full use of TVD and its adaption into other areas of construction.

A full research agenda is required to thoughtfully study the key concepts highlighted from Denerolle (2013) and understand how these concepts can be translated to and used in

a new context. Quantification and hierarchy levels can be used in future studies to better prioritise the work needed to be completed and additional concepts to be considered.

ACKNOWLEDGMENTS

This work was made possible by a generous scholarship (first author) supported by CAPES - Brazilian Federal Agency for Support and Evaluation of Graduate Education within the Ministry of Education of Brazil. The authors are greatful for all the support provided.

REFERENCES

Ballard, G. (2006). 'Rethinking Project Definition in Terms of Target Costing' In: 14th Annual Conference of the International Group for Lean Construction. Santiago, Chile, 1-. pp 77-89

Ballard, G. (2011). "Target Value Design: Current Benchmark." Lean Construction Journal, pp 79-84.

Denerolle, S. (2013). Technical Report: The Application of Target Value Design to the Design Phase of 3 Hospital Project. Berkeley: University of California. Available at: [Accessed November 2015].

Jacomit, A.M., Granja, A.D. & Picchi, F.A. (2008). Target Costing Research Analysis: Reflections for Construction Industry Implementation In:, Tzortzopoulos, P. & Kagioglou, M., 16th Annual Conference of the International Group for Lean Construction.Manchester, UK, 16-18 Jul 08. pp 601-12

Jung, W., Ballard, G., Kim Y. and Han, S.H., 2012. Understanding of Target Value Design for Integrated Project Delivery with the Context of Game Theory. In: Proc. Construction Research Congress. West Lafayette, USA, May 21-23.

Kato, Y. (1993). Genka Kikaku: Senryakteki Cost Management (Target Costing: Strategic Cost Management). Tokyo: Nihon Keizai Shinbunsha, pp. 328.

Kim, Y. and Lee, H.W., (2010). Analyzing User Costs In a Hospital: Methodological Implication of Space Syntax to Support Whole-life Target Value Design. Lean Construction Journal, 11, pp.55-63.

Lee, H.W., Tommelein, I.D. and Ballard, G. (2010). Lean Design Management in an Infrastructure Design-Build Project: A Case Study. In: Proc. 18th Ann. Conf. of the Int'l. Group for Lean Construction. Haifa, Israel, Jul 14-16.

Lee, H.W., Ballard, G. and Tommelein, I.D. (2012). Developing a Target Value Design Protocol for Commercial Energy Retrofits – PART 1. In: Proc. Construction Research Congress. West Lafayette, USA, May 21-23.

Nicolini, D., Tomkins, C., Holti, R., Oldman, A. and Smalley, M. (2000). Can target costing and whole life costing be applied in the construction industry? Evidence from two case studies. British Journal of Management, 11(4), 303–24.

Macomber, H. and Barberio, J. (2007). Target Value Design: Nine Foundational Practices for Delivering Surprising Client Value. [White paper].

Melo, R. (2015). Guidelines for target costing introduction in the real estate products development process. PhD Dissertation. The School of Civil Engineering, Architecture and Urban Design - UNICAMP - the State University of Campinas, Brazil.

Oliva, C. (2014). Proposal for Target Value Design integration into Design Process Management in Civil Construction Projects (*translated*). Master's Thesis. The School of Civil Engineering, Architecture and Urban Design – UNICAMP - the State University of Campinas, Brazil.

Zimina, D, Ballard G & Pasquire C (2012). Target value design: using collaboration and a lean approach to reduce construction cost, Construction Management and Economics, 30:5, 383-398, DOI: 10.1080/01446193.2012.676658