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TARGET VALUE DESIGN: THE CHALLENGE OF VALUE GENERATION

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ABSTRACT

Target Value Design (TVD) is a management approach that aims to maximize value in the framework of a pre-established cost target. TVD views AEC (Architecture, Engineering and Construction) as a complex system and transforms the current design practice upside down. In spite of the existing studies, applying TVD in the context of AEC still represents a major challenge. Creating a structure that enables and measures value generation to the client is part of this challenge.

However, despite the contributions already made by TVD, the results and implications related to value generation remain poorly documented. To throw light on value generation in the TVD context, it is useful to understand how the TVD and lean construction literature considers the concept of value. Thus, this study uses a literature review to understand the TVD background, as well as the main contributions made by studies carried out using this approach. The TFV (Transformation, Flow, Value) theory is considered as a baseline to understand the value generation. This paper reports a study that seeks to contribute to the challenge of adjusting the method of TVD to make value generation more explicit.

KEYWORDS

Target Value Design, target-cost, value, TFV theory, principles of value generation.

INTRODUCTION

The term Target Value Design (TVD) first appeared in a paper by Macomber, Howell and Barberio (2012) and is seen as an adaptation of Target Costing for construction industry peculiarities (Morton and Ballard, 2009; Jung, et al., 2012; Zimina, Ballard and Pasquire, 2012; Do, et al., 2014a). Target costing or 'Genka Kikaku', as originally named in Japan, is not only a tool for managing costs, but a strategic approach for the development of new products, that aims to reduce costs, ensuring quality, reliability and other attributes that will add value to the customers (Nicolini, et al., 2000; Jacomit, Granja and Picchi, 2008). In fact, Feil, Yook and Kim (2004) explain that Genka Kikaku started in Japan in the 1960s as an application of value engineering and that later this concept was translated into 'target costing'.

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In the construction context, some researchers (Denerolle, 2013; Do, et al., 2014b) emphasize that TVD started in the first successful implementation of a “designing to target cost” technique carried out by Ballard and Reiser (2004). Since then several definitions have been assigned to TVD as a management practice, method, approach or strategy: to eliminate waste and deliver value by using a ‘design-to-cost’ method (Kim and Lee, 2010); to keep design and cost aligned while delivering customer value by doing design-to-cost (Lee, Tommelein and Ballard, 2010); to make customer constraints drivers of design for the sake of value delivery (Ballard, 2011); to provide for integrated project delivery (IPD) through the collaborative efforts among different stakeholders (Jung, et al., 2012).

From this set of definitions, it is possible to highlight that TVD applies methods for the design to be developed in accordance with the constraints, especially cost (e.g. ‘design-to-cost’ or ‘design-to-targets’). TVD considers the customers’/clients’ and stakeholders’ vision to define such restrictions and deliver the required target values. Moreover, the TVD effort to keep design and costs aligned requires collaborative approaches among different stakeholders. All these efforts indicate a potential for generating value beyond cost reduction.

However, despite the contributions already made by TVD, the results and contributions related to value generation remain poorly documented. The TVD projects are mainly documented in the US and highlight the achieved cost savings but limited definition and measurement of value in the TVD projects.

To throw light on the value generation in the TVD context, it is useful to understand how the lean construction literature considers the concept of value. Thus, this study uses a literature review to understand how the studies report the contributions to value generation made by studies carried out in TVD. The usage trends of the concept of value for the lean community are considered as a baseline reference. Moreover, this study uses the five principles of the value generation cycle proposed by Koskela (2000) within the scope of TFV (Transformation, Flow, Value) as a baseline to understand value generation.

RESEARCH METHODOLOGY

The TVD papers were initially identified from IGLC conferences, the Lean Construction Journal and from websites such as Project Production Systems Laboratory P2SL Berkeley. From these papers, other conference papers, journal papers, reports and white papers were identified. The search for the papers tried to cover all papers with studies or applications on TVD, as well as papers on Target Costing as they were considered as TVD precursors or closely related to TVD.

From a sample of 30 papers identified as related to TVD, the following were documented: objectives, target value design (or target costing) definition, value concept, value expressions (value for money, customer/client values, project values, stakeholders values) and related approaches (e.g. value management, value engineering, customer requirements), client and suppliers of empirical studies, contributions, and indications for future studies.

LITERATURE REVIEW

THE VALUE CONCEPT IN THE LEAN CONSTRUCTION COMMUNITY

According to Bertelsen (2004), the work within Lean Construction has its weakest point in understanding, dealing with and managing value, which is a topic of growing importance as projects become more complex, dynamic and fast. In this sense, TFV Theory proposed by Koskela (2000) identifies three interdependent angles to production: transformation (achieved by resources workers, machines, etc.) oriented (T), materials flow oriented (F) and customer oriented (V) (Koskela, et al., 2007).

In this theory, the concept of value is approached in two different views: the value added by the transformation (inputs into outputs/products) and the value generated by the interaction between the customer/client and supplier. In both views (of value) there is the difficulty in defining and measuring value. Part of the problem is related to the complexity of the construction projects that are delivered to clients, a combination of buildings/built environments (physical attributes) and services (functionality, social context). Although this combination is usually linked to a physical product, its character is essentially intangible (Lovelock and Wright, 2002).

Considering the complex nature of the concept of value, some researchers have been faced with the need to consider the subjectivity of perception of value. Some research has sought to exploit the intangible results of the project, especially in relation to the focus on value generation and benefits. Salvatierra-Garrido, Pasquire and Miron (2012), when carrying out a literature review focusing on the use of the value concept through nineteen years of experience of the International Group for Lean Construction (conferences from 1993 to 2011), identify the following trends:

- several efforts have mainly endeavoured to examine and understand particular customer's requirements with regard to value delivery,
- some research has explored newer and broader approaches, such as benefits realisation, to understand the value generation in new projects,
- some research uses the theoretical framework from marketing.

Regarding customer requirements, some researchers advocate close involvement of the customer in the briefing, design process and project definition (Leinonen and Huovila, 2000; Emmitt, Sander and Christoffersen, 2004). The subjectivity of the perception of the value is recognized (Emmitt, Sander and Christoffersen, 2005) and the importance of the design to value generation is emphasized (Leinonen and Huovila, 2000).

Sapountzis, et al. (2010) propose the BeReal model as an approach specifically developed for the construction industry, based on the Benefits Realisation Approach from the Information Systems and Technology (IS/IT) sector. By exploring the intangible results of the project, the BeReal model moves the focus to the generation of value and benefits to different stakeholder groups involved (Tillmann, Tzortzopoulos and Formoso, 2010). According to Rooke, et al. (2010), the benefits realisation management process considers value as an issue of lean knowledge management, value being best understood as an 'intersubjective' phenomenon. In this conception, 'objective' and 'subjective', rather than being mutually exclusive categories, are more like points on a continuum in which objectivity is socially established from the stream of our perceptions (Rooke, et al., 2010).

The marketing area provides a considerable amount of research on the value concept. For instance, Hierarchical Value Maps (HVM) (Gengler, Klenosky and Mulvey, 1995) are a common output of a Means-End Chain (MEC) model, which connects the concrete attributes of a product/project (tangible attributes) with the emotional and personal values (abstract and intangible objectives) (Gutman, 1982). Considering a marketing background, Bonatto, Miron and Formoso (2011) demonstrate that a visual device, such as an HVM, can help decision makers involved in housing projects to understand the perceived value by the users. In the same way, Hentschke, et al. (2014) propose a method for defining value adding attributes in customized housing projects, which can support decision-making in project development (through the application of MEC and HVM).

THE PRINCIPLES OF VALUE GENERATION

The TFV theory (Koskela, 2000) has influenced the conceptualisation of value from current researchers and practitioners of the IGLC community (Salvatierra-Garrido, Pasquire and Miron, 2012). In this theory the cycle of value generation between the customer (client) and supplier is also related to the five principles structured by Koskela (2000).

Rooke, et al. (2010) argue that value should be treated as a problem for lean knowledge management and that all five principles require adequate management processes, as presented in Table 1. The information flows (getting information to the right people at the right time) can be traced throughout all five processes (Rooke, et al., 2010). Particularly, process 2 requirements are of flow-down (Koskela, 2000). It is argued that processes 1, 3 and 5 (requirements capture, design and evaluation) are concerned with the definition of economic value (exchange value or utility value) and that these are best seen as a continuous learning and improvement cycle (Rooke, et al., 2010). The evaluation seems to be the least explored process for which further research is recommended (Rooke, et al., 2010): long term outcomes and immediate outputs of the project, qualitative reporting and explicit methods for turning evaluation into improvement.

Table 1: The Principles of Value Generation (Koskela, 2000) and the associated Knowledge Management Process (Rooke, et al., 2010)

Principles of Value Generation	Knowledge Management Processes
1. ensuring that all customer requirements, both explicit and latent, have been captured;	1. to adequately discover and define customer requirements;
2. ensuring that relevant customer requirements are available in all phases of production, and that they are not lost when progressively transformed into design solutions, production plans and products;	2. to deliver knowledge of customer requirements to relevant parties throughout the production process;
3. ensuring that customer requirements have a bearing on all deliverables for all roles of the customer;	3. to transform these into an optimum design;
4. ensuring the capability of the production system to produce products as required;	4. to identify the required inputs for production;
5. ensuring by measurement that value is generated for the customer.	5. to facilitate customer evaluation and production process learning cycles.

CONSIDERATIONS ABOUT VALUE GENERATION

From the literature, some essential elements can be highlighted to be considered for value generation: the context of each project, the clear identification of the client/customer and their involvement in the project, the information (requirements) flow-down management in the design phase, the customer-supplier relationship, the evaluation cycles and knowledge management.

Notwithstanding its subjective nature, value can sometimes be subject to objective measurement, though this measurement often depends on context (Thyssen, et al., 2010). Moreover, value could be best understood as an intersubjective phenomenon (Rooke, et al., 2010), which possibly could be mapped by tools such as Hierarchical Value Maps (Gengler, Klenosky and Mulvey, 1995). In this sense, the purpose of projects is to generate economic value, but the specification, production and delivery of value are governed by sociological values (principles, guidelines for living) (Rooke, et al., 2010).

TARGET VALUE DESIGN

TVD views AEC (Architecture, Engineering and Construction) as a complex system, which includes the project definition, design and construction stages (Zimina, Ballard and Pasquire, 2012). TVD transforms the current design practices upside down because the costs determine the design instead of the design determining the costs (Macomber, Howell and Barberio, 2012). According to Lee, Ballard and Tommelein (2012a), TVD has two key features, distinctive from more conventional practices in design development: the former is 'Designing to targets' in order to increase the predictability of project performance; the latter is related to a cross-disciplinary 'validation study' (enhanced feasibility test) in order to increase shared understanding about the basis of value/design/budget/risk.

Ballard (2011) argues that TVD is both a method that assures customers get what they need (delivers value) and also a method for continuous improvement and waste reduction. Following this idea many papers emphasize the need to develop a relationship with the client, as well as the necessity to define the client values, stakeholders values and values of the team (Ballard and Reiser, 2004; Pennanen and Ballard, 2008; Lee, Tommelein and Ballard, 2010) to deliver these so-called value(s) as result of the project. In the meantime, some definitions of value are described in TVD papers: value is an assessment made relative to a set of concerns that someone wants addressed (Macomber, Howell and Barberio, 2012), value is what customers need to accomplish their purposes (Rybkowski, Shepley and Ballard, 2012). Explicit values are defined, such as an adaptable yet durable design layout and materials (Novak, 2012).

The paper by Novak (2012) is possibly the one that best documents the practices that help create and align value with project goals in a TVD context. However, in the same paper, interviews with the project participants revealed that the design thinking and explicit project value definition had not been developed as fully as the others (target-costs). Besides, the lack of a unified vision of values, especially sustainability values, created gaps in the value creation dialogue (Novak, 2012).

Thereby, in the TVD context, the definition of what is 'value' is still unclear. The 'values' appear to be being used as a plural of value (what customers need) and not in the sense of sociological values (principles, guidelines for living). The distinction

between value and values definitions have implications for lean theory and could help in practical problems for knowledge management in the built environment. In the practical implementations of benefits realisation, both values and value are negotiated between project participants/stakeholders and these processes (conversations) are implied in the basic formulation of the V theory (Rooke, et al., 2010). Additionally, the hierarchical perspective detailed through marketing techniques helps to improve the understanding of perceived value and provides useful information that can also support strategic decision-making by clients and project stakeholders (Bonatto, Miron and Formoso, 2011; Brito and Formoso, 2014; Hentschke, et al., 2014).

TVD CONTRIBUTIONS AND THE PRINCIPLES OF VALUE GENERATION

From a sample of 30 papers, 16 are identified as theoretical studies (including simulations and analysis of previous studies). The main contributions so far appear to be related to:

- adapting target costing to construction context (Jacomit, Granja and Picchi, 2008);
- outlining foundational and advanced practices to implement TVD (Macomber, Howell and Barberio, 2012) and update the benchmark in TVD (Ballard, 2005; 2011);
- improving the accuracy and feasibility in estimating and modelling costs and risks (Pennanen and Ballard, 2008; Morton and Ballard, 2009; Ballard, 2012; Lee, Ballard and Tommelein, 2012b; Ballard and Pennanen, 2013);
- improving the design process to achieve target cost (Kim and Lee, 2010; Rybkowski, et al., 2011; Kim and Lee, 2014);
- analysing and improve collaborative approaches, including integrated project delivery - IPD (Jung, et al., 2012; Pishdad-Bozorgi, Moghaddam and Karasulu, 2013; Melo, Granja and Ballard, 2013; Do, et al., 2014b).

Among these contributions, the foundational and advanced practices to implement TVD (Macomber, Howell and Barberio, 2012), when compared with the five principles of the value generation cycle (Koskela, 2000), seem to be more related to principles 2 and 3, which seek to ensure the flow-down requirements and their availability in design and production phases. Principle 1 (requirements capture) is pursued through customer/client engagement. Principle 5 (evaluation) seems to be regarded as process learning cycles. Similarly, the practices introduced by TVD Benchmarks (Ballard, 2011); also present consolidation between principles 2 and 3, although principle 1 is more present. Moreover, principle 5 appears to be considered, although exclusively related to the target cost.

Considering the contributions of 14 empirical studies (including statistical analyses) related to TVD, it is possible to highlight:

- adaptations of target costing/TVD to construction and to other countries such as the United Kingdom and Brazil (Nicolini, et al., 2000; Oliva and Granja, 2013; Melo, et al., 2014);
- demonstration of positive results of TVD implementation, specially to the projects costs (Ballard and Reiser, 2004; Zimina, Ballard and Pasquire, 2012; Denerolle, 2013; Do, et al., 2014a; Do, 2014);

- improvement of project definition and design approaches for achieve target cost (Ballard, 2006; Lee, Tommelein and Ballard, 2010; Pennanen, Ballard and Haahtela, 2010; Novak, 2012);
- improvement of management strategies and contractual approaches to apply TVD (Lee, Ballard and Tommelein 2012a; Rybkowski, Shepley and Ballard, 2012).

The studies demonstrated that most TVD projects involved private clients. In this sense, Melo, Granja and Ballard (2013) identified that the public sector owners may be limited in their ability to achieve a complete TVD application due to federal or local laws that prevent early collaboration among key project stakeholders.

Furthermore, we noticed that most TVD papers in our sample indicate some level of relationship between the practices proposed and applied with the principles of value generation. However, the focus of value generation appears to be closely linked to target-cost and all necessary environment (contracts, design and collaborative approaches) to manage costs. The other requirements, benefits and objectives of the projects are not clearly documented, described or measured in the studies.

CONCLUDING COMMENTS

The TVD approach enables a project environment with favourable characteristics to generate value, comprising: emphasis on the design activities, making the client an important participant of the process, and enhancing the client-supplier relationship, requiring collaborative approaches. However, the major focus of TVD is the target-cost, which should contribute to client value, but still the point of focus is target-cost.

From these findings, some suggestions for future studies related to value generation can be drawn to the lean construction community: (a) seek a consensus on the use of the concept of value and values, (b) apply the principles of the cycle of value generation (Koskela, 2000) in research, (c) aim to better document the capture, processing and traceability of requirements throughout the project, (d) measure the value delivered for the project clients, not only in relation to costs or objective measurements, (e) evaluate the post-occupancy phase and whole life cycle of the built facility to measure the fulfilment of requirements and the evolution of perceived value to users and customers over time.

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