TARGET COSTING RESEARCH ANALYSIS: REFLECTIONS FOR CONSTRUCTION INDUSTRY IMPLEMENTATION

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ABSTRACT

Target costing or Genka Kikaku, as originally named in Japan, is not only a tool for managing costs, but a strategic approach for development of new products, that aims to reduce costs, ensuring quality, reliability and other attributes that will add value to the customers. This paper presents a framework that summarizes a product development process with the literal application of target costing, and seeks to compare this framework to three implementations of it in the construction industry. It started with elaboration of a flowchart that allowed the definition of the parameters to be used in the analysis. Results show that none of the cases studied covers a completed target costing implementation as envisioned in manufacture. Finally, this work points out some issues that need further development such as studies about alternative ways of obtaining the target cost – based on the current market price instead of historical data.

KEY WORDS

target costing, target cost, cost management, value engineering

INTRODUCTION

Target costing was developed over the last 30 years by Japanese car manufacture companies, in particular by Toyota and Nissan, from the principles of the American value engineering (Monden 1995, Nicolini et al. 2000). Together with value engineering, it was considered cornerstones of Japanese cost management programs, but had not received as much attention in the West until recently (Cooper, 1997). Nowadays, it is applied worldwide in different industries (Monden 1995, Nicolini et al. 2000). It is a different way of developing products, which aims to reduce their costs – life-cycle costs or whole life costs – at the same time to ensure their quality, reliability

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and other attributes that will add value to the customers by examining all possible ideas for cost reduction and involving the whole company and the supply chain (Nicolini et al. 2000).

It is applied to all product development phases, starting at the project definition phase[1], until the beginning of the production phase[2]. In this phase, the ongoing processes of minimizing costs and maximizing value applying several tools is then called kaizen costing, which is not object of this study.

In a conventional cost management system, like cost-plus approach or cost-based method, a product price is determined based on its production cost, as follow: price = production cost + profits (Monden 1995, Nicolini *et al*. 2000). In a target costing context, the market analysis is the first step (Nicolini *et al*. 2000). According to Monden (1995), target costing aims to ensure that the resultant cost from a composition of required characteristics of a product does not go beyond a certain target cost or allowable cost[3] determined from the maximum sale price that the market is willing to pay for the product, ensuring the company's profits. Hence, the concept of product's allowable cost assumes the following request: target cost = market price – profit (Monden, 1995).

This paper presents a framework that summarizes a product development process applying the target costing approach and compares this framework to three implementations of this approach in the construction industry described in literature. In the next section, a product development process applying target costing will be presented. Following, the paper discusses the employees' role in the target costing practice and the methodology applied in the comparative analysis that will be showed next. The paper concludes with a review of the three chosen target costing implementations, the discussion of their similarities and differences, and suggestions for future research.

TARGET COSTING IN PRODUCT DEVELOPMENT

A framework that summarizes a product development process applying the target costing approach is presented in Figure 1. It is based on Nicolini et al. (2000), Monden (1995) following the six target costing principles developed by the International Consortium for Advanced Management (CAM-I) – price-led costing, focus on costumers, focus on design, cross-functional teams, value-chain involvement, life cycle costing reduction – (Ansari et al. 2006, Lin et al. 2005). In Figure 1 the main steps of the target costing approach are explicit. Having in mind the product's functional attributes, it is possible to perform the first estimative of the production cost (PC) through conventional budgeting methods (Figure 1, part 8). Normally the first

[1] Project definition phase is the phase that precedes the design phase, following Ballard (2006) terminology.

[2] In the "IGLC-12 White Paper: Project Financial Management" it is made clear that target costing should be applied throughout the product life and it does not mention "*kaizen* costing". Though, Monden (1995) suggests that during the production phase the ongoing processes of minimizing costs and maximizing value focused on the production processes themselves should be called "*kaizen* costing".

[3] In this paper, target cost and allowable cost are considered as synonymous.

estimative of the production cost is above the target cost (PC > TC). Then, "target costing firms teams" go through a process of reassessing the model until they could be able to produce the product with attributes required by the market at a price the market will pay (Nicolini et al. 2000) or until they could obtain PC ≤ TC (Figure 1, part 9). In order to reach this goal, it is necessary to apply value engineering and inter-organizational cost-management systems.

Value Engineering (VE) is the core of target costing, providing the means for production cost determination and its adjustment to target cost (Monden, 1995). The concept of value is the relationship between function and cost (value = function/cost), where the function is associated to the specific need of the user for the product or service in question (Cooper, 1997). Value engineering is a tool that allows designers to cut costs while maintaining the product's required performance characteristics (Ansari *et al*. 2006). Generally, the it is applied during the project definition phase, where just 20% of the costs have been incurred, and 80% thereof have already been determined (Cooper and Slagmulder 1999).

Inter-organizational cost-management systems are described by Nicolini *et al*. (2000) as systems capable of identifying component level target cost. Therefore, cost pressures are distributed across the supply chain. As such systems are not available for most firms and surely demand a long time, great efforts and investments to be developed, alternative ways to analyze and optimize the process need to be implemented. Ballard and Reiser (2004) carried out a two days target costing workshop involving designers, engineers, client and supply chain representatives among other people involved in the project. Ideally, the target cost adopted for this case study should be broken into parts and those parts that represented a process capable of being optimized were then divided into systems, subsystems and components. These workshops aimed to reduce costs, to improve collaboration across teams and the quality of the facility produced, as well as to guarantee that the client's needs and expectations are being attended during the whole process.

Ideally, the inter-organizational cost-management systems break the target cost (TC) and the production cost (PC) into component level (Figure 1, part 10). Therefore, it is possible to determine the cost gap (cost gap = TC – PC) at component level or the gap between target cost and the production cost (Nicolini *et al*. 2000) (Figure 1, part 11). As a result, the components with highest cost and mainly those with highest cost gap are identified and thus the key process and key suppliers (service providers and product suppliers) are pointed out and should be brought into the target costing process (Figure 1, part 12). Each of these contractors needs to improve their production process and reduce his cost, seeking to reach the target cost envisioned by them. Innovation in the supply of materials and provision of services is often as important in achieving the cost-reduction goal as the redesign of final product structure or assembly processes (Nicolini *et al*. 2000). A collaborative approach to innovation is usually facilitated by an open book policy (Figure 1, part 13). Adopting this policy, each of the assemblers has access to the costs and functional data and starts to reassess his own product development system or, ideally, to apply the target costing approach. Then, a continual value engineering process is initiated and runs until the assembler gets the product with the right attributes at the cost he thinks the costumer will pay for (Nicolini *et al*. 2000). Closing the gap between the target cost and the production cost requires solving trade-offs between the product's features and functions (Ansari *et al*. 2006). In other words, the process will be limited to the steps

9 to 14 (Figure 1) until the target cost is reached (PC ≤ TC), then the product can be produced (Figure 1, part 15) and the *kaizen* costing process starts.

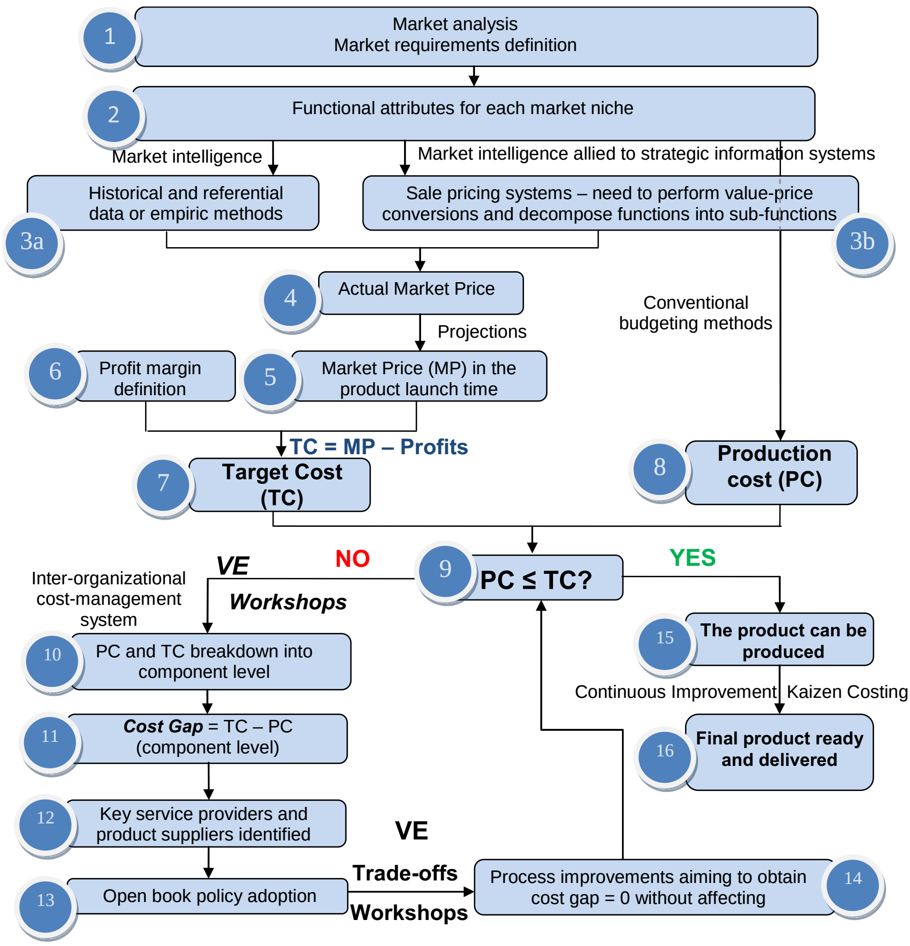

Figure 1: Flowchart showing a product development process applying target costing. Based on Nicolini et al. (2000) and Monden (1995)

TARGET COSTING IMPLEMENTATIONS IN THE CONSTRUCTION INDUSTRY

Flowchart presented in Figure 1 allowed the definition of the parameters to be used in the comparative analysis of the three chosen target costing implementations in the construction industry. These three implementations are pioneers outside Japan in applying target costing in the construction industry and were chosen according to the papers availability. The comparison is showed in Table 1. The comparative analysis will be presented along this section.

TARGET COSTING IN THE JAPANESE CONSTRUCTION INDUSTRY

A recent survey carried out by the SJVE[1] showed that, in the Japanese construction industry, 15 percent of the companies are using target costing or some concepts of target costing and that 36 percent desire to use it in the future. This implies that almost half of the construction companies have no plan to introduce target costing in the near future. This is surprising because target costing has been used in Japan for approximately 30 years and has provided Japanese companies with a competitive advantage over Western companies in the competitive global market. Also, target costing helped many Japanese companies overcome the collapse of the economy bubble in the early 90s and the 50 percent increase of Japanese currency in the mid 90s (Yook *et al*. 2005).

Aiming to evaluate this numbers for big construction companies, Yook *et al*. (2005) carried out a survey with 40 companies listed in the Tokyo Stock Exchange. They aimed to investigate the extent of target costing adoption in the construction industry, examining performance results of target costing, and discussing critical success factors and provide suggestions for improvement. In terms of target costing implementation, the survey results show that the average time of target costing adoption in the construction is only 7 years, while the average implementation period for Japanese companies in general is 17 years, according to the authors. Sixty-five percent of the companies were using target costing company-wide, however less than half of the sample companies manage cost explicitly all the way from design to construction. Most of the companies have a separate department to support target costing. Value engineering was considered by the interviewers as the most important tool in the process of reaching the target cost.

TARGET COSTING IMPLEMENTATIONS IN THE WESTERN CONSTRUCTION INDUSTRY

Outside Japan there are some reports of target costing implementation in the construction industry, nevertheless it appears that statistics reflecting the extension of the target costing implementation in this industry does not exist. Research initiatives in target costing have been carried out by the University of California, Berkeley's Project Production Systems Laboratory, where two complete case studies reporting target costing implementation in the construction

[1] Society of Japanese Value Engineering, 2000, *supra* note 1.

industry were developed and other two are being conducted (Ballard 2006).

In this paper, three of these implementations were analyzed – Nicolini et al. (2000), Ballard and Reiser (2004), and Robert and Granja (2006) (Table 1). Nicolini et al. (2000) investigate the possibility of applying target costing in the British construction industry. The target costing approach was introduced in the project to experiment with a new way of procuring work in construction. An activity control process based on the target costing approach was elaborate and the work team was separated in clusters2 involving the suppliers. These clusters worked to determine life-cycle cost or whole life cost at component level. Finally, the authors conclude that a fully-fledged target costing implementation was not possible, mainly because the combination of existing commercial practices and industry weakness (particularly related to costing systems).

Ballard and Reiser (2004) and Robert and Granja (2006) carried out successful cases of target costing in the construction industry. Ballard and Reiser (2004) described the construction of a field house for a college in Minnesota between 2001 and 2002. Target costing was implanted after the completion of schematic design and was introduced in the project through a two-day target costing workshop in which took part representatives of the main contractor (Boldt) and most of the teams involved. None of the subcontracts that participated was bid and then, could be brought to the process after the final design was complete. There were formed specialized trade teams: site, enclosure, interior, mechanical and electrical, each of them consisting of 3-6 people. Each team was challenged to complete the design with savings beyond their target cost. By the end, the Boldt's team managed to achieve the target. The field house that applied target costing was compared to a similar field house constructed at the same town a year before: the last one took ten months longer to complete and cost 54% more (in $/ft2) than the Boldt's one.

Target costing implementations in Brazil

Based on a literature survey, there are some reported target costing implementation cases in the construction industry in Brazil. Formiga (2005) carried out two case studies, evaluating the target costing implementation in a company budgeting process. Kern *et al.* (2006) undertook a descriptive case study reporting successful cost reduction and value enhancements applying the target costing approach. Robert and Granja (2006) applied target costing and *kaizen* costing (continuous improvement) along the design and construction phases of brand retail units (BRU) – whose projects were being carried by one of the authors. Target costing was applied to the design stage of all the four BRU and *kaizen* costing was applied to the construction stage of two of them. Two target costs were set – one for the 45 days BRU and other for the 60 days BRU – both based on the BRU historical cost data. In this implementation results of the target and *kaizen* costing effort were directed

[2] A cluster is "a "design and construct" mini-project that takes place within the larger framework of the project" – extract from Nicolini *et al*. (2000).

towards the BRU direction, so the authors needed to determine the issues that did not represent value for the customers and employees, so then they could operate cost trade-offs related to these issues. An open book policy was adopted involving the BRU and two service providers – the architectural firm and the construction company. The results showed that, applying only target costing, the total cost resulted 9% under the target cost (BRU historical cost data). Basically, it was achieved through cost trade-offs and redesign. With the combined application of target and *kaizen* costing, the reduction costs beat 13%. Improvements in constructive process proposed by the construction company workers (kept the same) were the responsible for the cost reduction applying *kaizen* costing.

COMPARATIVE ANALYSIS OF THE TARGET COSTING IMPLEMENTATIONS

The three implementations seem to confirm the difficulty pointed out by Yook et al. (2005) of managing cost explicitly all the way from design to construction. Ballard and Reiser (2004) and Robert and Granja (2006) had a schematic design ready before applying target costing. Nicolini et al. (2000) tried to design focusing at functionality and cost at the same time, but ended getting the design first and looking at the cost implications later. Ballard and Reiser (2004) and Robert and Granja (2006) also seem to confirm the most representative performance results of target costing implementation pointed out by Yook et al. (2005), such as active participation in cost reduction and decrease in construction costs.

Table 1: Characteristics of the target costing implementations analyzed

Authors	Country	Building characteristics	Market price determination	Target Cost	Target cost breakdown	Work teams formation	Supply chain involvement	Design to Target Cost
Nicolini *et al.* (2000)	UK	Construction of two training and recreational facilities for the MoD	NO	Historical data	YES	YES - work team separated in clusters	YES - Service providers	NO. Initially, they tried to design focusing at functionality and cost at the same time, but ended getting the design first and looking at the cost implications later.
Ballard and Reiser (2004)	USA	Construction of a field house for a college	NO	Amount donated for an alumni family	YES	YES. During the target costing workshop.	YES - Service providers	YES. After the completion of schematic design.
Robert and Granja (2006)	BR	Construction of four BRU (Brand Retail Units)	NO	BRU historical cost data	YES	NO. Few people involved.	YES - Service providers	NO. They did not use the established target cost to design. The cost trade-offs were based in the results of the value perception analysis carried out along with the customers and employees.

Authors	CAD nD	Complementary methods to cost determination	*Kaizen* costing (KC) implementation	Target cost goal	Construction industry implementation	Target Costing (TC) Workshops	Target Cost Contracts	Cost reduction based on
Nicolini *et al.* (2000)	NO	Tried to apply whole life costing, using NPV to compare options. But, they were confronted with the lack of reliable data on durability and maintenance. The use of NPV was contested, and a "through-life cost strategy" was introduced.	YES	NO	NO	No, only separated clusters meetings	Not specified.	Negotiation with suppliers after the design is relatively frozen, rather than detailed value engineering and functional analysis at the design stage.
Ballard and Reiser (2004)	YES	They propose the application of life cycle costing selective and limited to the items with highest maintaining costs or that need replacement.	NO	YES	YES	YES	Not specified.	Value engineering and functional analysis after the completion of schematic design. Some work teams achieved cost reduction bellow target and other above.
Robert and Granja (2006)	NO	-	YES	YES – cost reduction of 9% applying TC and of 13% applying TC+KC	YES	No, only separated meetings.	YES. With 50-50 share profile.	Improvements in constructive process and cost trade-offs.

Kaizen costing was applied for Nicolini *et al*. (2000) and Robert and Granja (2006). Ballard and Reiser (2004) did not mention *kaizen* costing and seem to apply target costing even in the construction phase. The divergent nomenclature becomes difficult to compare the methods, then, it is necessary a standardization of the process of target and *kaizen* costing, especially in the construction industry. In this paper, k*aizen* costing was addressed as a continuous improvement process of maximizing value and minimizing cost during the production phase. *Kaizen* costing is a valuable complement of the target costing process, because it represents the lowest impact of value management chain on costs (Nicolini *et al*. 2000). Then, cost-reduction activities are not finished when the design is complete – they move to a new phase (Williamson 1997).

A fundamental principle of target costing is life cycle costing reduction (Ansari *et al*. 2006, Lin *et al*. 2005). It is important because, according to Nicolini *et al.* (2000), “a contractor might well be able to meet a cost reduction in capital construction at the expense of increased maintenance cost for the client at a later time”. But, the adoption of life cycle costing (or whole life costing) strategy seems to be a barrier for applying target costing in the construction industry, as related by Nicolini *et al*. (2000), mainly because the lack of reliable data on durability and maintenance necessary for modeling whole-life costs. Ballard and Reiser (2004) proposed the application of life cycle costing selective and limited to the items with highest maintaining costs or that need replacement.

A valuable tool to quickly reveal the cost implications of potential design actions, pointed out by Ballard and Reiser (2004), is an integrated design/cost model. Designing in nD models (like CAD 5D = CAD 3D + schedule + budget) becomes instantly visible any changes in the design model, making easier to avoid producing design outputs that do not meet target cost.

Robert and Granja (2006) set the target cost based on historical reference data from the BRU construction. The target costing approach could be more precisely applied if the company applying the target costing approach was the subcontractor construction company. This way, the BRU construction reference data = market price, and the target cost would be determined based on the company’s profit policy. Nicolini *et al*. (2000) adopt historical reference data for similar buildings to set the target cost. Although the calculation was led by costing experts, it was “highly controversial from the beginning” and the criticism was high. Contractors objected that the data were derived from buildings of poor quality and low functionality; were possibly bidding data instead of outturn ones; and were based on recession times. In the Ballard and Reiser (2004) study case, the target cost was set based in the amount available for the construction and after the completion of the schematic design. It may be one way of avoiding the problems presented by Nicolini *et al*. (2000), considering that the subcontractors had an idea of what they were dealing with. Though, these subcontractors could only be brought to the target costing process because they were not bid. Every subcontractor that joined the main contractor in the three implementations appeared to be service providers. The participation of subcontractors is firmly linked with the bid situation – if the subcontracts are bid, the subcontractors cannot took part at the early stages in the target costing process (Ballard Reiser 2004).

In an open book policy, the contractor and the subcontractors work together for process improvement aiming to reduce costs. But, generally in construction, the subcontractors struggle to sell its products for the maximum price acceptable to the main contractor (Nicolini *el al.* 2000). To balance this opposed purposes, Robert and Granja (2006) adopt a 50-50 target cost contract (Figure 2A), or, in other words, the fraction of the cost that was reduced applying target costing was shared equally between the main contractor (BRU direction) and the subcontractor (construction company). Though, the 50-50 target cost contract is not the most customary used in practice, according to Broome and Perry (2002) (Figure 2). Figure 2A shows how target cost contracts with 50-50 share profile work, with any cost under or over run against the target cost split in 50-50 portions (employer and contractor share = 50%). Broome and Perry (2002). The share fractions should be defined taking account of the constraints and risks that act on the project and strengths and weaknesses of the parties to it (Broome and Perry 2002). Figure 2B represents one relatively large employer with repeat order business for the same sort of work with the introduction of a progressive cap, whereby the contractor progressively takes a great share of any overrun until, at above +30% of the target, when he takes 100% of any further cost overrun. The contractor, in this case, executes a simple, not complex work with low level of risk.

None of the three implementations analyzed seems to have developed or used any system similar to the described in Figure 1 as "Strategic information systems". As any of them had to determine a product market price, it would not be necessary. Though, it appears that even an "inter-organizational cost-management system" (systems capable of identifying component level target cost) was not implemented. Although, Ballard and Reiser (2004) carried out a two-day target costing workshop where issues as target cost breakdown were addressed, it is not clear if any system capable of identifying target cost component level was introduced.

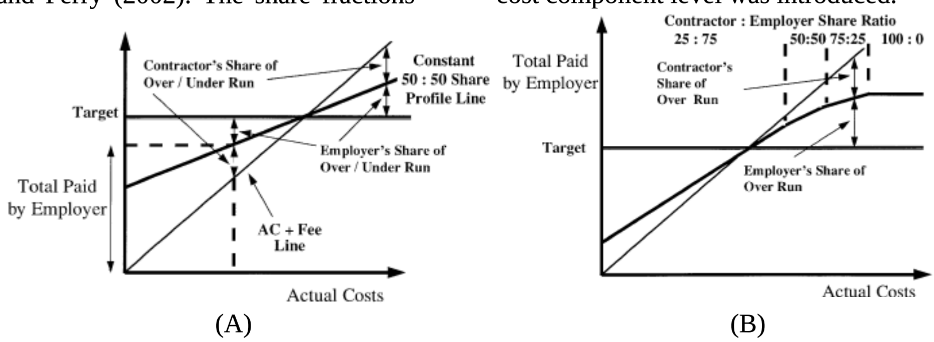

Figure 2: How practitioners set share fractions in target cost contracts (Figures 2 and 5, respectively, in Broome and Perry 2002)

CONCLUSION

This paper presented a framework that summarizes a product development process with the literal application of the target costing approach as it is envisioned in manufacture, and sought to comparatively analyze three implementations of this approach in the construction industry described in literature, but it has no intention of exhausting the topic of differences between target costing implementations in its original context and in the construction industry.

None of the three target costing implementations analyzed corresponded to a literal implementation of the approach (Figure 1), as it was previously discussed in the chapter before. Finally, it was identified some issues that need further development in the construction industry context: (i) Market price determination or "strategic information systems", (ii) Target and production cost breakdown or "inter-organizational cost-management system, (iii) Life-cycle costing strategy in the target costing context, (iv) Supply-chain integration considering (or not) bid situation, (v) Target cost contracts, and (vi) Combined application of target and *kaizen* costing.

In the three implementations analyzed, the target cost was not set based on the market price. In an ideal application of target costing in its original context, the determination of the target cost based on the market price is unavoidable because adopting historical data instead of current market price when setting the target cost do not ensure the main contractor that the project will be profitable. Although there are some cases in which it is still true for the construction industry context – e.g. when the client is unknown, as in the case of apartment buildings –, in the three cases analyzed in this paper the market price determination would be completely unnecessary, because the client was only one. The definition of what should be priced by the market (e.g. product to be constructed, services to be provided, etc.) depends on who are applying target costing in the first place.

Target and production cost breakdown need major attention, mainly through the development of specific inter-organizational cost-management system. Also, a life-cycle costing strategy that supports the target costing implementation in the construction industry could be developed. Alternative ways of integrating the supply-chain into the target costing process are essential as well. And, finally, if the target and *kaizen* costing implementation are integrated, it would add a cost reduction function to the cost management system, allowing companies to make profits even in rather competitive markets.

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