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APPROACH FOR AN INTEGRATED ACHIEVEMENT OF THE COST TARGET

Alexandra Nissl and Udo Lindemann

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Abstract

Target Costing is a multidisciplinary process embracing product development. Various tasks are necessary to design a product that meets the requirements in terms of functionality and product cost. Although a favourable price/performance ratio gains in importance, the employees still have difficulties assessing the effects of their decisions on later product costs. The presented approach provides support for all departments involved in the product development process. Within the enclosing framework, three basic elements are the core of the computer-aided modular system. They include methods and tools for evaluating the costs of components in addition to relevant cost data. Built-in tools help visualise cost progression in the value engineering process. Another goal of the approach is the integration into the value engineering process of all associates influencing the final product costs.

1 Introduction

The product price is a significant factor influencing the buying decision. Therefore, enterprises aspire to offer products with a favourable price/performance ratio. A methodology supporting the development of products with the requested characteristics concerning both functionalities and costs is target costing [1, 2, 11, 12]. At the beginning of the design process, a cost target is defined in relation to the planned product features. For more complex products, the designer needs to split up cost targets for assembly or product functions. The participants of the product development process have to cope with the challenge of developing products that meet the functional requirements and, in particular, the cost targets.

Product development is a multidisciplinary process which involves several departments with different goals. For the creation of products meeting the requirements, all disciplines have to cooperate and to adapt their objectives to a common goal. A basis for cooperation is common access to information about the developed product that also includes information about the final product costs.

The less advanced the design process is, the greater the possibilities are of influencing final product costs (Figure 1). In the early phases of product development, only a few specifications are fixed. Thus, it is hard to predict effects of decisions on the final product costs. Just the choice of the product concept is decisive for the final product costs. As the consequences are diffuse, the concept decision mainly rests on its capacity to realise functional requirements. Since the designers have difficulties assessing the effects of

conceptual decisions on the final product costs, the opportunity for increased efficiency is often missed.

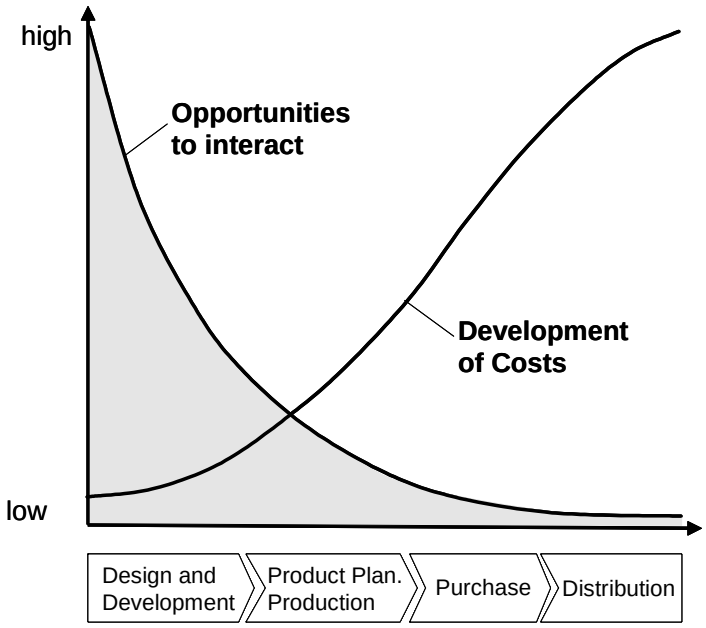

Figure 1. Development of Costs and Opportunities to Interact [4]

There are several methods for cost prognosis during the design process, but usually the designer is not supported in applying them, or the required data is not available. As a result, in early phases there is often either no significant or no cost estimation at all. We ascertained that in many small- and medium-sized enterprises the target costing process is interrupted by the setting of the cost target. It starts again with the precalculation as the first implemented cost prognosis. At that time, the process of detailing is almost completed and the opportunities of influencing the future product costs are only small.

Following the design process, the production planning and purchasing departments have to realise the product in the range of the targeted costs. Generally speaking, these departments do not obtain much information about the hitherto target costing process. More communication and a documentation of the bases for decision-making are necessary.

In this contribution, we present an approach for an integrated achievement of cost targets. The concept provides support for all departments involved in the product development process. This modular system includes methods and tools to evaluate the costs of components and further tools to visualise the progression of the value engineering process. Another goal of the approach is assisting the collaboration between the different departments.

2 Method

Starting with the analysis of the current performance of value engineering processes in SMEs, we defined the requirements for a supporting approach. These requirements formed the basis for the approach for an integrated achievement of the cost target.

2.1 Value Engineering Process

With the implementation of the methodology target costing, the mechanism of cost control in design changed. Shorter cycles of testing the effects of decisions replaced the extensive cycle of cost orientation (Figure 2). After every design step, an examination of the probability of achieving the cost target with the current development status takes place. Thus, excessive costs are revealed early and adequate measures to reduce the later product cost can be taken.

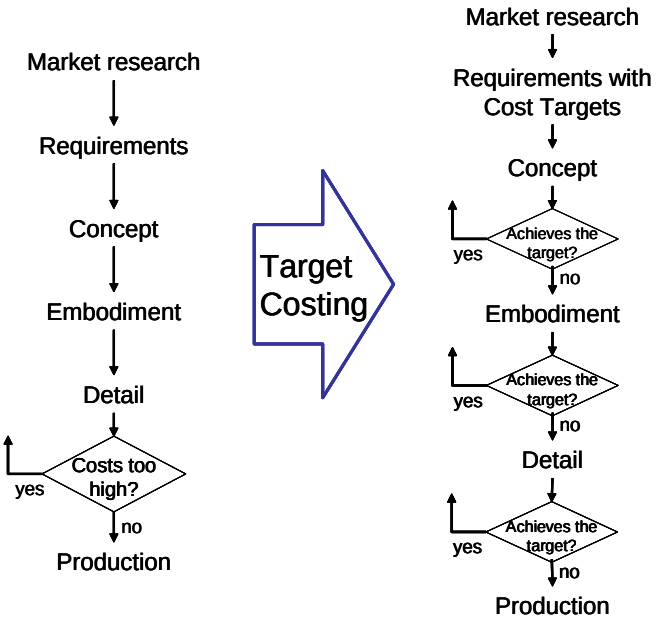

Figure 2. Control Cycle of Cost Orientation in Design [4]

The control cycle of cost orientation in design forms the basis for the proposed procedure in the value engineering process.

2.2 Requirements for the Approach

In the first step, we extracted requirements from an analysis of the current situation. The investigation was based on the findings of a detailed literature research and the experience of industrial cooperation. Value engineering extends beyond the design process. Various departments have to work together in its course to facilitate successful results. An approach supporting this important period of target costing should integrate all disciplines over all phases, from market research up to the distribution of a product. As the participants have different tasks with developing a product, they have different demands for the format of the cost information and the support with cost prognosis. Furthermore, to make the collaboration between the departments worthwhile, the current cost information as well as the present status of the target cost achievement has to be provided in a transparent way. Thus, the employees are able to observe the whole value engineering process. The experience gained from watching the further progression fosters continuous learning during the product development process.

The initial analysis of the current situation showed that a key for the achievement of the cost target is an early identification of excessive costs to ensure measures are taken as soon as possible. For the monitoring of the progression of the costs, a constant calculation structure

supports the comparability of the cost information. The use of actual costs of similar products ensures reliable cost data even in early phases of the design process; a fundamental part of a working value engineering process. For the preparation of cost prognosis, a supporting system also has to integrate knowledge besides cost data, to facilitate an early cost influence. For an optimal working environment, a minimization of data redundancies and care expenditure is essential.

An additional analysis of the current situation was conducted by means of a survey [8]. The difficulties engineers deal with in decision situations was the first question posed. The second request referred to the circumstances of cost identification and the third aimed at the support the participants of the product development process would like to have according to their position. The questions were phrased very openly, so that the respondents were not restricted in their answer. The findings of the survey are based on the responses of 24 employees in 21 companies.

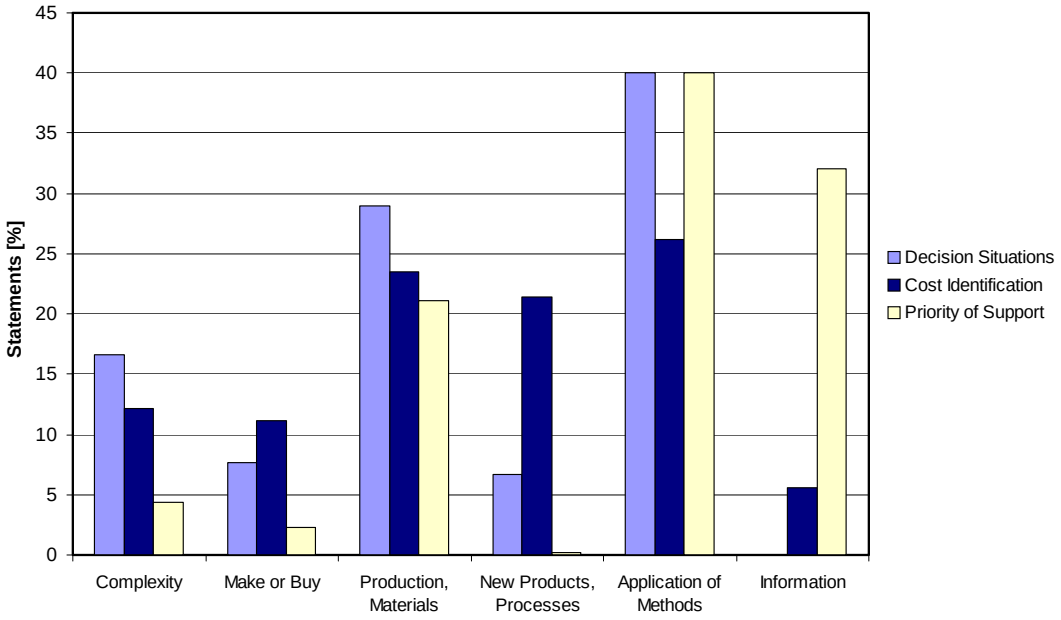

Figure 3. Findings of the survey [8]

The evaluation of the survey shows the demand for support of the target costing process in SMEs (Figure 3). The responses from employees of diverse companies indicate that in similar departments of different enterprises, engineers struggle with comparable problems. This is independent from the company size or the type of design carried out.

The answers were classified into six categories: complexity of the product or its manufacturing processes, the question of make or buy, difficulties with the choice of production processes or materials because of a lack of knowledge of involved costs, problems with cost estimations for new products or processes, inadequate methods for cost prognosis, and unavailable or deficient cost data.

It was found that in decision situations, 40 per cent of the respondents suffer from a lack of adequate methods, or have difficulties applying the existing methods. Twenty-nine per cent struggle with the choice of manufacturing processes or the material because of missing cost data. With the identification of product or process costs, the employees have three main

difficulties: the application of methods (26 per cent), the choice of manufacturing processes or materials (24 per cent), and the identification of costs for new products or processes (22 per cent). The respondents prioritise support with adequate methods to generate cost data (40 per cent), information about the cost influencing factors (32 per cent) and cost data and knowledge about new production processes and materials (21 per cent).

The questionnaire ascertained that the participants require assistance with methods and approaches to forecast the costs of products and manufacturing processes. In order to carry out cost estimations they also need to be supplied with adequate cost information. A collaborative focus on the cost target will enable a more efficient target costing process.

2.3 Concept

As the most important requirements for the approach, we elaborated on the continuity of the value engineering process for achieving the comparability of cost data and the support of a fast, sufficiently exact prognosis of the final product costs. The results found that such an approach must above all comprise adequate methods and tools for cost prognoses. For this purpose, the necessary data has to be provided. The underlying database has to be organised with a favourable effort-value ratio.

A further important requirement of an approach for an integrated achievement of the cost target is the recording and documentation of the generated cost prognoses with the underlying parameters. This information helps to reconstruct decisions later in the course of product development. In order to ensure continuity and transparency of the system, the visualisation of prognosis results during the course of the product development is necessary. The data form the basis for an intensified cooperation during the value engineering process in the enterprise. In connection with the documented prognoses, cost-effective definitions can also be identified at a later date. This allows taking specific measures for cost reduction. The generated documents also foster an intensified interdisciplinary cooperation during the value engineering process. Later on, the documented prognoses help to identify cost-effective decisions. In this way, the employees gain experience, which benefits future development processes.

An approach for an integrated achievement of the cost target, used during the course of product development, has to support departments with different objectives. A uniform system can not satisfactorily accomplish this task. Moreover, it has to offer suitable assistance in every decision situation that needs information about the effects on the future product costs. Hence, the structure resulted in modular system architecture, providing the necessary data and tools for every associate in the respective situation.

3 Results

The result of our research into an approach for an integrated achievement of the cost target is a modular programme system. Within the enclosing framework, its core consists of three basic elements for cost prognosis accompanying the product development process.

3.1 Approach

On the basis of the developed requirements, we derived a computer-aided approach. Its mode of operation with its elements and their necessary characteristics and functions are described in more detail in the following section.

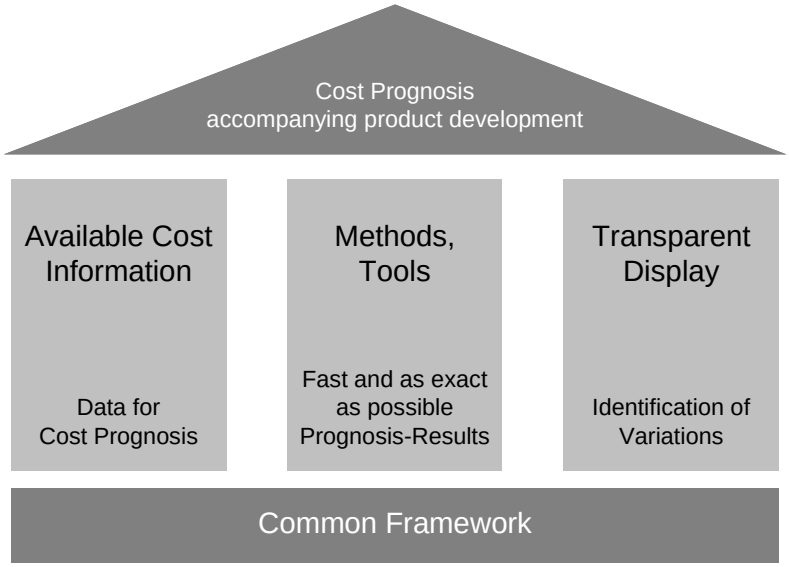

Figure 4. Approach for an integrated achievement of the cost target

Available cost data forms the basis for the prognosis of final product costs. The module "Available Cost Information" comprises the cost data of the enterprise. The supply of substantial cost data is the premise for a successful value engineering process. The quality of the provided data is an important criterion for the definition of the data administration, because a cost prognosis is always less precise than the underlying data. In the survey, many participants criticized insufficient access to cost information, and demanded an improved supply of data relevant for their tasks. Therefore, the module supports the structuring, conditioning and care of the data in a simplified way. In addition to the data necessary for cost prognosis, the module "Available Cost Information" comprises norms relevant for the users' activity and internal guidelines. Here, the user can also find links to internal systems, which are also used during the value engineering process.

For the prognosis of final product costs, and thus of effects of single definitions during the product development process, the user needs different tools, depending upon existing input. The module "Methods, Tools" provides them. An important characteristic of the comprised tools is the quick generation of sufficiently exact cost prognoses. Different tools have to be at the users' disposal depending on the phase of product development. Since each tool provides results with different precision, due to the input data, the documentation of the results with the past and future parameters is an important attribute of the system. This documentation also takes place in the module "Available Cost Information". All generated cost prognoses are stored there with supplemental documents. Thus, the system user has access to all cost prognoses of the current value engineering process. By means of the stored information, it is possible to reconstruct earlier decisions and, if necessary, to introduce measures to ensure the achievement of the cost target. The documents archived in this module also serve as the basis for cooperation between the associates of different departments of the enterprise.

The module "Transparent Display" ensures the continuity of the value engineering process. The comprehensive control of the achievement of the target costs takes place here. The forecasted costs of all processes contributing to the total cost target are listed in a special bill of materials. By displaying the actual cost forecasts of the product components, an early identification of probable cost exceeding is possible. Accompanying the product development process, the results of accomplished cost prognoses are listed in the “Transparent Display”. At the same time, the user records the generation of the cost prognosis. Even later in the development process, by means of the visualisation of the progress of the product costs, it is possible to identify the decisions, which have lead to a deviation of the costs.

The elements of the approach are integrated into a common framework (Figure 4). It offers all functionalities necessary for a modular system structure and a structured presentation of information. The user has direct access to contained data and can easily integrate further contents into the system.

3.2 Proposed Procedure with the Approach

The approach represents a central support in the target costing process independent from original, adaptive, or variant design. Value engineering represents a multidisciplinary process. Only a close cooperation between associates of the product development process facilitates the achievement of competitive cost targets. For this reason, all employees whose decisions affect the final product costs should apply the approach.

Product Planning. The product development process starts with an existing product idea or a customer enquiry that is usually based on requirements and first concepts. This forms the basis for the definition of the later product price, from which the target costs of the product are derived. If the determination of the later product price is made entirely or partly out of the enterprise, then it is usually carried out on the basis of experience and procedures which can only partly be reconstructed in the later value engineering process. Existing tools are easy to integrate due to modular system architecture. Later on, the conditions of the determination of the target costs can be reconstructed on the basis of the stored documentation. Applying this approach, tools for fast prognosis of the final product costs already assist employees in this early phase. The user obtains fast access to the cost history of completed developments. This supports the reflow of experiences from similar, finished projects into the sales price calculation of developed products. The extended opportunities the use of prognosis tools offer improve the results in defining the profit margin. This allows a more competitive market price.

The next step in the value engineering process is the splitting of the total cost target into partial cost targets for components, assemblies or even product functions. The defined values are recorded in the started cost control file in the module “Transparent Display”. The file stores the target costs and the actual cost prognosis of all components or special cost factors in a special bill of materials. The visualisation of the successive enlisted data supports associates in controlling the achievement of the cost targets during the value engineering process.

Design and Development. The first cost prognosis of the future product, accomplished in the planning phase, already suggests certain building and/or operational principles which could lead to optimal product costs. Applying the proposed approach, the employees document these results in the system. Thus, design and development departments can integrate the considerations into the solution search. The search for the most favourable operational principle is supported by archived cost evaluations of known concepts. With the help of the documentation of earlier prognoses, the designer can also directly contact the editor of the documents for further information. The common access to the data provides the basis for an intensive cooperation. In the course of detailing, further tools of the module “Methods, Tools” support the cost evaluation in decision situations. Thus, the employee is able to analyse the effects of decisions such as the choice of material or the manufacturing. After relevant design steps, the results of cost prognoses are recorded in the cost control file in the module “Transparent Display”. In the case of presumed increased product costs, this facility serves to identify the development step that led to the deviation. Suitable measures can be introduced dependent on the reasons for the initial decision. If this is not possible, an adaptation of the subdivision of the cost targets may be reasonable. The cost control file offers helpful support for the observation of the value engineering process for the whole product.

Purchase. After design completion, an evaluation of the most favourable sourcing option is accomplished, depending on whether in-house or external production is used. Ideally, the product component would have been detailed in arrangement with manufacturing experts. The associate of the purchasing department extracts information about the earlier considered manufacture of the components from the stored documents of cost prognoses. In more simple cases, appropriate references in the module "Available Cost Information" show the designer which in-house or external manufacturing options are suitable. For constructions that are more complex, an arrangement between designer and representatives of purchasing and production planning is necessary. The designers’ recorded cost prognoses provide reference values for production costs. These values may also be important for the evaluation of supplier offers where the plausibility of numerical values is significant. The result of the cost prognosis may assist in negotiations. If an offer differs with previous internal prognoses, then the offering enterprise should be able to justify the differences. The gained experiences flow back into the system, for example in the form of advice or adapted data that serves as the basis for future developments. As soon as the offer price is fixed, the future costs are recorded in the control file.

Production Planning. For a first prognosis of manufacturing costs it is helpful for the employees of the product planning department to access the recorded cost prognoses of the other departments involved in product development. The production planner will update the available calculation due to the then specified manufacturing steps, and record the presumed product costs into the control file. As a result, a need for information from other departments of the value engineering process may be noticed. The missing information, such as manufacturing innovations, can be given directly to the respective colleague, and by means of advice in the module "Available Cost Information" to all associates of the value engineering process.

After a successful value engineering process, all members of the product development process should consider the archived prognosis documents. The extracted conclusions help them improve future prognoses.

4 Discussion

Starting from the developed requirements of a support of the value engineering process as part of the target costing, we developed a computer-aided approach. All employees whose decisions influence the final product costs will be involved through the common use of the system. Thus, the achievement of the cost target represents a common goal of all.

Target Costing represents a multidisciplinary methodology, which requires the common effort of all members of the product development process towards competitive products. The more associates applying the proposed procedure, the more potential may be tapped from the presented approach.

The approach for an integrated achievement of the cost target supports associates in the value engineering process. Forecasts of the final product costs form a foundation for the decision between different design alternatives. Therefore, supporting the preparation of cost prognoses during the entire product development process is an important aspect of the approach. In the module "Methods, Tools", different implements are available for cost prognoses for specific applications depending on the known product features.

According to the proposed procedure, the associates apply the approach during the entire product development process. The files of generated cost prognoses together with the underlying boundary conditions are archived in the module “Available Cost Information” of the system. In this element, the user finds all relevant cost data of the enterprise for the development of cost-efficient products. The results of the prognoses are recorded in the control file in the module "Transparent Display". This element also comprises the visualisation of the current status of the achievement of the cost target. Thus, the employees are able to integrate the collected information in later development processes.

5 Conclusion

The presented approach for an integrated achievement of the cost target provides the potential to realize the requirements.

- Support of a continuous, integrated value engineering process in terms of target costing: all associates of the product development process have shared access to the computer-aided approach throughout value engineering.
- Support with forecasts of the final product costs: the system provides methods and tools for cost prognosis of different applications.
- Transparency of the present status of the target cost achievement: associates have permanent access to a visualization of the current situation.
- Support of multidisciplinary cooperation: associates have collective access to all information and documents stored in the system. This forms a basis for communication and the achievement of a common purpose, the cost target.
- Quick and easy-to-use: the modular system structure facilitates an easy adaptation to specific requirements. It focuses on the main objectives of the value engineering process.

The premise for the achievement of the cost target is the access and utilization of the system functions. Thus, all associates influencing the final product costs have to be integrated into

the value engineering process. Adapting the approach is an important contribution for the maintenance and improvement of the competitiveness of the enterprise.

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For more information contact:

Alexandra Nissl
Department for Product Development,
Technische Universitaet Muenchen,
Boltzmannstr. 15
D-85748 Garching,
Germany,
Tel: +49 (0)89 289 15152
E-mail: nissl@pe.mw.tum.de
URL: www.pe.mw.tum.de