Greening Products by Supply Chain Target Costing
The Example of Polyester Linings

Abstract

Green products regularly hold market shares far below 5%. Due to the environmental criteria that have to be met by these green products, they can not be purchased on “normal” markets. In contrast, it is necessary to manage the whole supply chain from raw materials acquisition to customer delivery, which increases their costs.
Hence, transactions costs have to be integrated, yielding a cost management framework on three levels: direct, activity-based and transaction costs, where cost targets have to be met for all three levels.
The framework will be illustrated with an example from the production of polyester linings.

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Introduction

Over the past few years, green products have been introduced into various fields of consumption. While customers would prefer green products, if their prices were equal to those of "normal" ones, they are not willing to pay considerably more for green products. This has led to a situation, where green products have regularly remained within small niches, mostly holding a market share below 5%. The reasons for this are multiple, but two issues are evident: (1) The greening of products drives costs up, as additional requirements have to be met at each stage of the supply chain. (2) No cost management is used in product design and manufacture.

While cost measures are regularly called upon in supply chain management literature, little work has been carried out to date to allow a cost management in supply chains or show, how cost management instruments, such as target costing, can be applied in the supply chain (for exceptions see LaLonde, Pohlen 1996; Cooper, Slagmudler 1999).

The paper presents the approach of supply chain target costing. Starting with some brief notes on the textile chain, the issues of cost management in the supply chain is raised. Therefore, three cost levels, direct costs, activity-based costs and transaction costs are introduced. This concept can be brought into the target costing methodology, emphasising the importance of supplier integration for the achievement of target costs. An example from the fashion industry, the introduction of linings made from environmentally improved polyester allows to give evidence, how the analytical framework offered by the three costs level is applied to reduce cost along the supply chain. These cost reductions allow to use the eco-polyester raw polymers, where some production steps are more costly than for "normal" polyester.

Supply Chain Management and the Textile Chain

These issues address the concepts of supply chain management and cost management. Within increasingly competitive environments, single companies are not able to survive on their own, but only as part of a supply or value chain, a concept that has gained importance since its introduction by Porter (Porter 1998). Together with recent developments in logistics and information technology, it forms the basis for the concept of supply chain management (SCM). "The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through to the end user, as well as the associated information flows. Material and information flow both up and down the supply chain. Supply chain management (SCM) is the integration of these activities through improved supply chain relationships, to achieve a sustainable competitive advantage" (Handfield, Nichols 1999).

The problems raised apply to various products. The focus of this paper will be on the fashion industry. Even though the disposal of used textiles encounters enormous problems, only the supply chain from raw materials production to distribution, as displayed in Figure 1, will be covered subsequently. This allows one to address the design and production of the products.

Brief explanations for the activities carried out at each step of the textile supply chain and the environmental problems associated with them are provided (Schmidt 1999; Myers, Stolton 1999). The focus will be on the production of synthetic fibres, specially polyester, as this provides a basis for the example discussed later on.

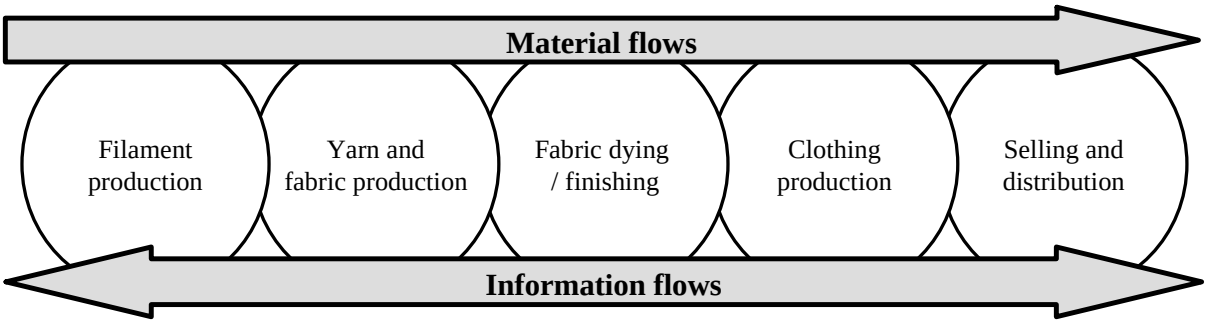

Figure 1: An integrated supply chain in the fashion industry (Seuring 1999)

1. Filament production

Polyester is a man-made fibre, produced from nonrenewable stocks of crude oil. The processing of the crude oil applies to all product groups, so it will not be taken into account further. The raw material, the monomers, is polymerised and cleaned, leading to polyester chips. Improved catalysts yield higher volumes and cause less environmental problems, but are rarely used so far. In batch processing equipment the catalyst can be changed from batch to batch, while additional cleaning is necessary to avoid spill overs. Larger facility operate in continuos processes, so the change of the catalyst would cause a major change of the whole system. Within the next step, filaments (one dimensional) are produced by melting the polyester chips and forcing it through spinneret wholes.

2. Yarn and fabric production

The extruded filaments are collected into thread forms. Next, they are stretched and drawn to yields polyester yarns. Weaving or knitting the yarn (one dimensional) leads to the creation of fabrics (two dimensional). During these manufacturing steps, a number of often environmentally harmful additives is used to allow for an easier production. Furthermore, organic solvents and/or polluted waste water as well as dust and noise are side effects of the yarn and textile production.

3. Fabric dyeing and finishing

Textile finishing includes processes that improve the wearing properties of the fabric or modify its look or feel. The environmental problems of these steps are similar to those in yarn and fabric production. To avoid these problems during production, dyeing and finishing of the yarn and the fabric, more expensive colours and additives are used. Additional storage and handling processes are required to separate the cotton fibres, yarn or fabric from the “normal” material.

4. Clothing production

The next step is the manufacture of the apparel itself. The finished fabrics and linings are combined with other materials, such as zippers or buttons. While this step creates only a limited environmental burden, the work is regularly carried out in second or third-world countries where the workers, mainly women, work under enormous pressure and humiliating labour conditions.

5. Selling and distribution

This step of the supply chain is of great importance as it represents the companies in the chain that decide which fashion is produced in which style and quality. Hence, this step has a major influence on all previous steps since product variety and quality are defined at this level. Apart from transport, only limited environmental problems occur. Selling and distribution can be carried out by a single company or within a tier supplier system of varying depth.

Traditional and integrated co-ordination of the supply chain

In traditional, market co-ordinated chains, the fashion industry usually does not take into account the single production stages. Apparel is bought on spot markets, where suppliers might change from part to part and even more from season to season. Hence, within a time span of six months or less the market is mixed up completely.

Among this set of conditions, it is not possible to buy green products. "Green" fibres, both cotton and polyester is not available on spot markets due to the limited amount available world-wide (e.g. only about 0.05% of all cotton is produced under organic standards; the proportion of environmental friendly polyester is even smaller). Therefore, if a fashion company plans to offer products made of green fibres it has to search for partners along each stage of the supply chain. After finding the partners, the company has to train them to meet the additional requirements. Several apparel companies have set up special programmes to work with their suppliers (see Myers, Stolton, 1999; Hummel, 1997).

These are only a few of the issues that highlight, why green products are often more expensive, but these examples provide sufficient evidence to justify why a smaller amount of output is not the only reason that accounts for the higher prices. To address these multiple reasons, a cost management along the supply chain is needed. Such a concept has to take all costs along the supply chain into account.

Cost Levels in Supply Chain Costing

Traditional cost accounting is not prepared to actively manage costs, which has led to the development of cost management techniques that are used to support specific decisions and the overall management of organisations (Hilton, Maher, Selto, 2000). Still, most cost management techniques look at the internal cost of companies, especially direct and indirect costs. Activity-based costing (Kaplan, Cooper, 1997) provides an alternative approach to the allocation of indirect costs among products. Strategic cost management (Shank, Govindarajan 1993) has emphasised the importance of costs within the value chain, but the discussion of cost drivers stays on a general level. Therefore, instruments are needed to allow for the classification of costs within the supply chain.

Such a supply chain costing has to take into account both, production and transaction costs. This terminology is taken from the concept of transaction costs, that plays an important part within the new institutional economics (Williamson, 1998). Without referring to this concept in detail, the term transaction costs within supply chain costing is applied in a simplistic way, that disregards the variables and explanations given by Williamson's theoretical concept. Building on the traditional separation of direct costs and indirect or activity-based costs, this leads to a differentiation of three cost levels, direct costs, activity-based costs and transaction costs, as Figure 2 shows. The three terms are defined as follows:

1. Direct costs

Direct costs are caused by the production of each single entity of a product and include such costs as materials, labour and machine costs. Mainly, these costs are controlled by prices for material and labour.

2. Activity-based costs

Activity-based costs are caused by activities that cannot be directly related to products, but are caused by administrative activities that have to be performed in order to be able to deliver products to customers. These costs arise from the organisational framework of the company.

3. Transaction costs

Transaction costs encompass all activities dealing with the information of and the communication with suppliers and customers. Therefore, these costs arise from interactions with other companies in the supply chain.

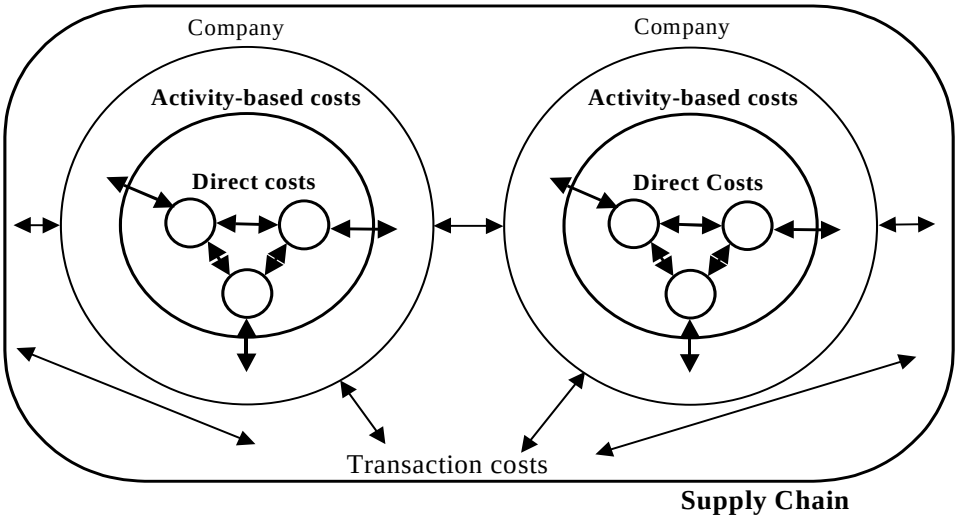

Figure 2: Cost levels in supply chain costing (Seuring 1999)

The three cost levels provide a basis for the analysis and optimisation of costs in the supply chain. For achieving a certain cost level, target costing has been developed. Hence, the three cost levels are introduced to the target costing methodology.

Supply Chain Target Costing

Target Costing has seen a wide range of applications since it first was developed in the Japanese car industry, which can be adopted to be suitable for application within supply chain management. Within supply chain costing, target costing is applied for setting objectives. This has to be accompanied by a process orientated view, such as in activity-based costing (Seuring 2001). The later one is not part of this paper.
The methodology of target costing can be summarized in three steps, as Figure 3 displays.

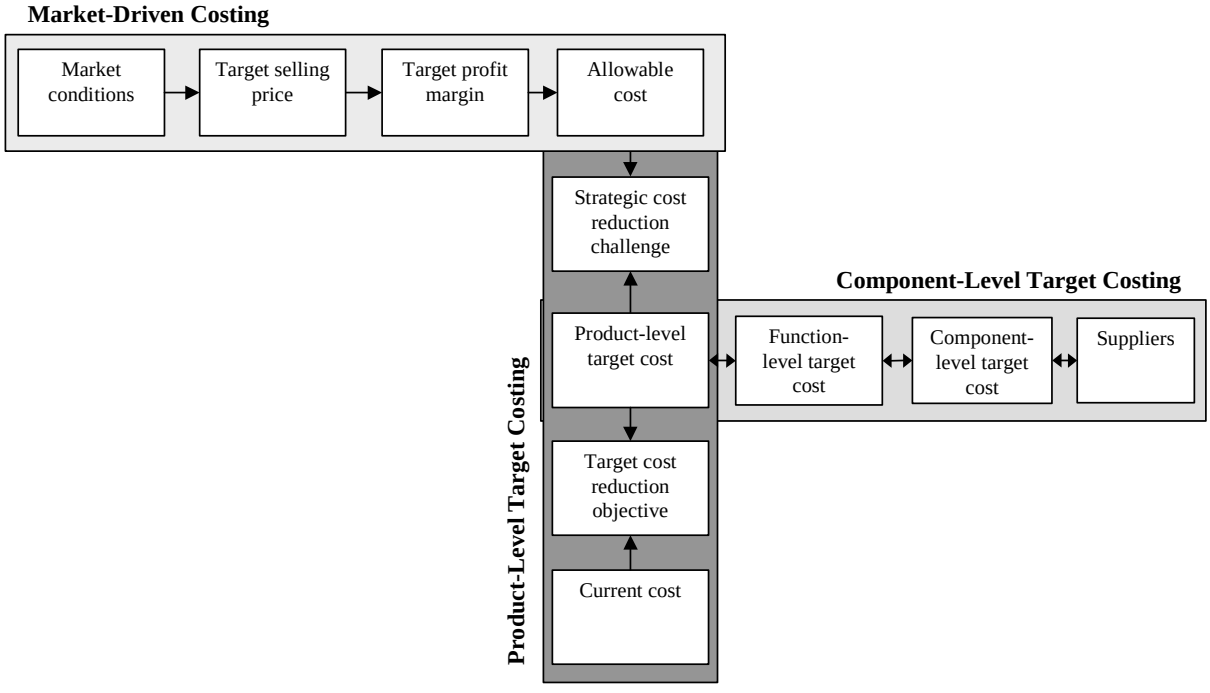

Figure 3: The target costing process (Cooper, Slagmulder 1999)

1. Market-driven costing

All products have to satisfy customer demands, which should drive product development. To avoid products that are to costly compared to the willingness to pay of the customers, cost targets are deducted. This market-driven costing sets the maximum price a product will sell for. By subtracting the target profit margin, the allowable costs are of the product are obtained.

2. Product-level target costing

Within the product-level target costing, the allowable costs are compared to the current cost, which would result form using available design and production technologies. Usually, the current costs will exceed the allowable costs, so cost reductions are necessary.

3. Component-level target costing

For each component of the product, a comparison between its importance to the customer and its costs are made. The component-level target costs can form the basis for contracting with suppliers, hence pushing the cost pressure along the supply chain.

Integrating the Three Cost Level in Target Costing

This leads to a chained target costing on the product or component level, where each supplier has to meet the target costs set by its customer (Cooper, Slagmulder 1999). The methodology of target costing centers on the product level costs. Suppliers are integrated by setting objectives for them, leaving it up to them how they would achieve these targets. Still, the co-operation with suppliers causes activity-based and transaction costs.

The more customized a certain purchased part is, the more specific investments by the supplier might be needed to be able to deliver the component. Looking at eco-fashion products, highly specific developments are necessary at all supplier levels to achieve the environmental standards without compromising on costs. Hence, the attempt to reach the target costs set by market conditions, not only the product level target costs, primarily looking at the direct costs have to be taken into account. The process and the transaction level provide opportunities for cost reductions, too, as Figure 4 addresses.

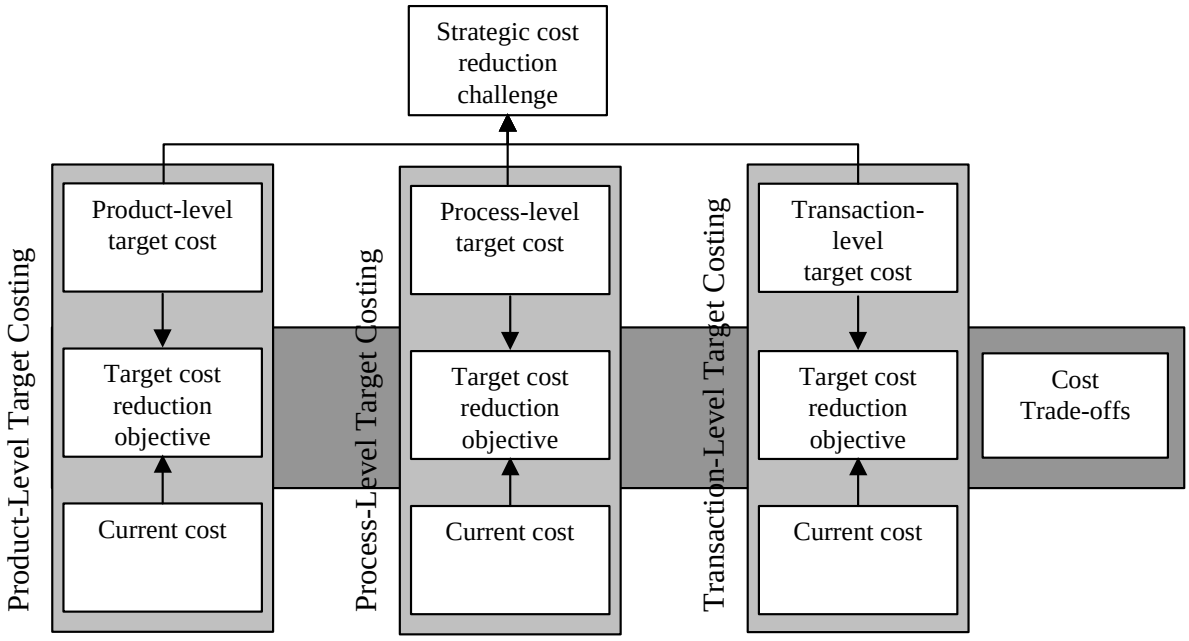

Figure 4: Target costing on the product, process and transaction level (Seuring 2001)

While cost reductions can be achieved on all three levels, cost trade-offs between the three levels offer the chance to search for the most efficient way to reach the target costs set.

The Example of Polyester Linings

For the production of polyester metal catalysts are used, which cause problems in treating reaction residues and waste waters. An improved catalyst is available that contains non-toxic substances and yields a higher output rate. As mentioned before, it is rarely used so far. The smaller production batches and additional cleaning of the production facilities during the polymerization of eco-polyester result in higher prices, which are pushed up the chain. Hence, the current costs exceed the target costs set by "normal" polyester linings, which almost prohibit their further use.

As the direct costs of the eco-polyester production are higher during the polymerization and filament production, measures have to be found to reduce the total costs along the supply chain. This would allow to offer improved products at the same price.

While both fabrics and linings can be made of polyester, the companies in the chain first turned to the linings. Polyester linings are used in a wide range of fashion products and account for about 70% of all linings used for apparel. Therefore, the companies along the chain had to co-operate to be able to bring the environmental friendly polyester to the market. This led to increased transaction costs, but helped to decrease direct and activity-based costs.

Measures and Interactions on the Three Cost Levels

As the catalyst has some influence on the physical properties of the fiber, all subsequent production steps had to be optimized. Therefore, staff from the yarn producer and the weaver and dyer worked together to check each production step. The temperature control of the dying had to be changed to yield high quality dying results. In total, the single steps following the filament production could be adjusted so that they are carried out at the same cost rate.

The activity-based costs are mainly driven by the processes carried out within each company. The lot size has a high influence on these costs, both within the production facility, where it determines the number of set-up processes and administrative processes necessary. By agreeing on lot sizes and production dates, the activity-based costs and the transaction costs were reduced between the filament producer and the weaver and dyer.

Before the search for supply chain improvements started, the seller and distributor of the cloth, who designs the fashion products, used more than 300 different colors for polyester linings. In a project, all design and purchasing staff was brought together to evaluate the colors and qualities of the linings. This led to a reduction of the employed colors to about 30, which are checked and updated every season. The reduced color variety did not lead to any major trade-off in fashion, as this would not be acceptable to the designers.

For this limited number of linings higher amounts are ordered from the suppliers. With the introduction of the eco-polyester one supplier, which covers all steps necessary in weaving, dying and finishing the linings, was selected to deliver all eco-polyester linings ordered. Furthermore, for some standard colors, e.g. black, at the start of every season (about every six month), the volume ordered as well as the approximate total volume of all linings ordered is fixed. Therefore, the supplier guarantees to stock these linings and supply it within two days after an order is placed. These agreements offers the supplier the opportunity to have orders places well in advance, which allow a better use of the production capacities. The reduction in color variety led to higher transaction costs at both companies, but reduced the production costs for the eco-polyester linings significantly.

Taken all measure applied along the linings supply chan together, the target costs of "normal" linings were almost matched. The companies continue to work on the issues and reduce costs furhter.

Conclusion

The measures illustrate, how increased costs on one level, specially the transaction cost level, help to reduce costs on other levels. So far, transaction costs and activity-based costs created at suppliers and customers facilities are often not taken into account, as companies tend to focus on their own production lines. Within the increasingly competitive global environment, partners in the supply chain have to consider the competitiveness of the whole supply chain (Christopher 1998). Cost management will have to form an integrative part of supply chain management on and across all stages of the supply chain. Therefore, the analysis and optimization has to go beyond the statement that costs decrease by applying supply chain management techniques. The example portrayed provides evidence how this might be done, but further work is needed to get the full benefit of supply chain costing. Other cost management instruments, such as activity-based costing and life-cycle costing can be applied to reduce costs in the supply chain (Seuring 2001).

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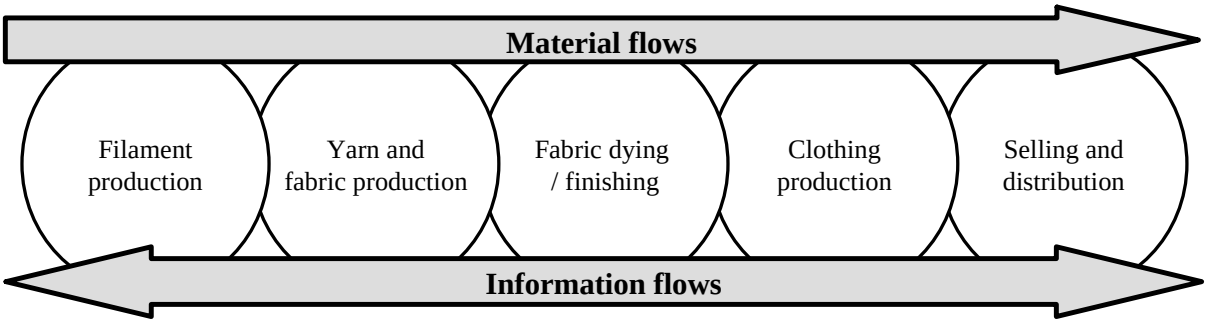

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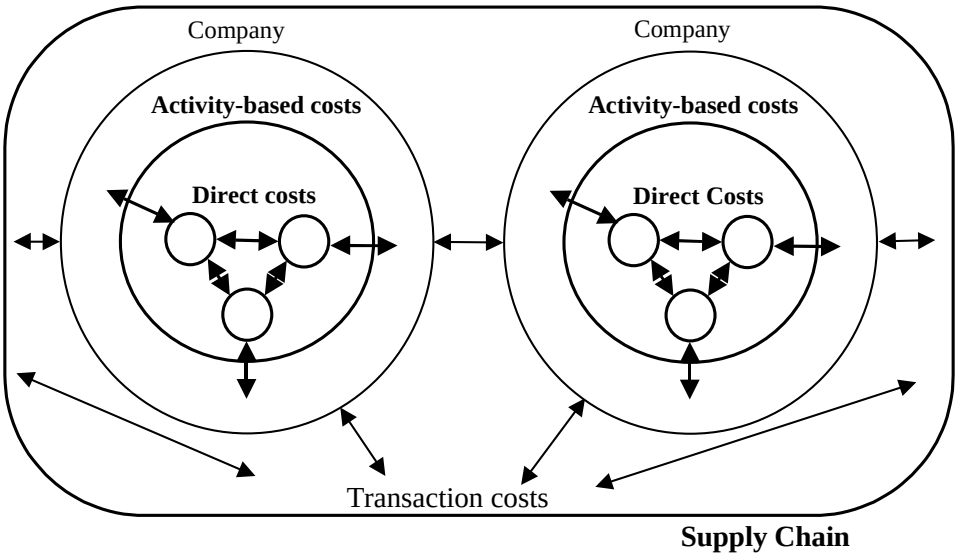

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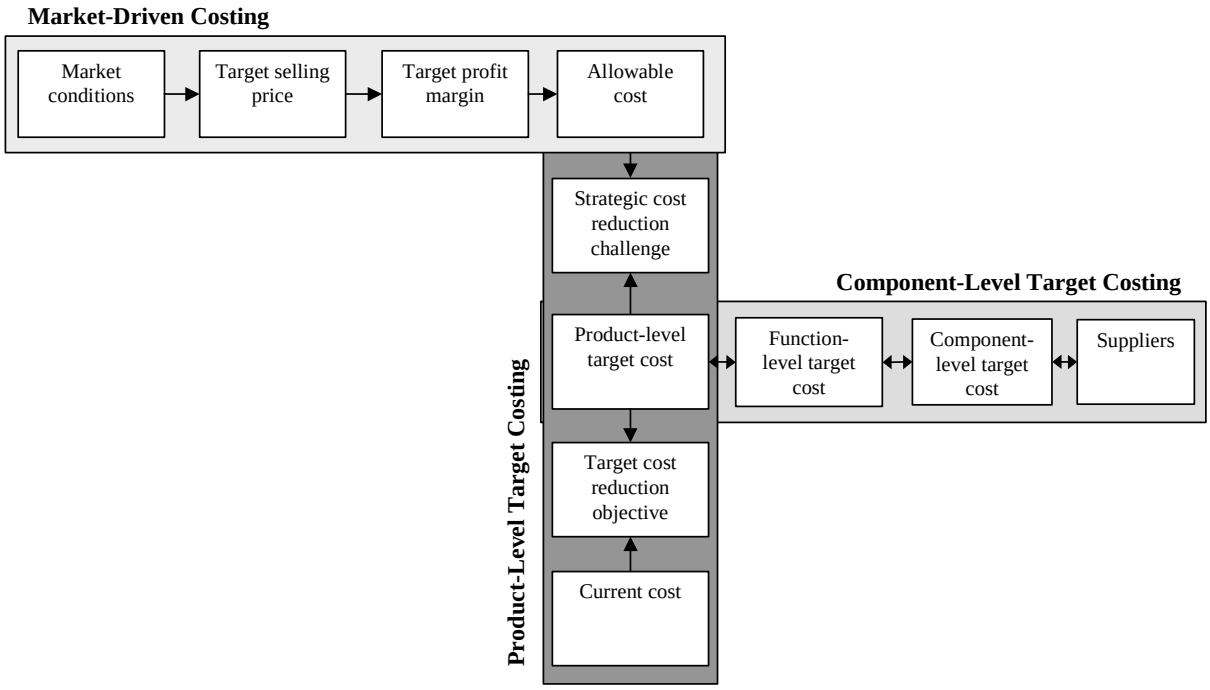

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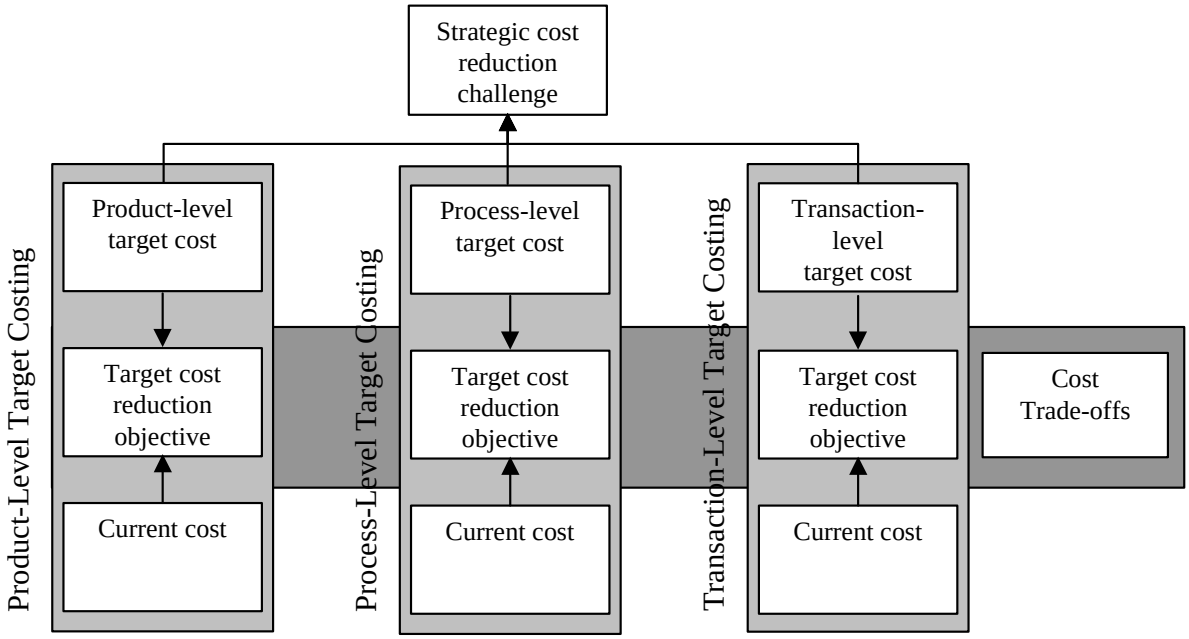

Figure 4: Target costing on the product, process and transaction level (Seuring 2001)