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Use of Target Costing methodology in the construction of wood-aluminium windows — case study

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ABSTRACT

The paper concerns the practical application of Target Costing to a specific product of the woodworking industry with a particular emphasis on customer needs and value analysis principles concerning individual components and functions of the product — a wood-aluminium window Gemini Quadrat FB. Based on principles of value analyses, the study used the functional cost analysis, the quantified target cost index of relevant components and the target cost chart for the allowable cost of components. Two levels of the q parameter — 5 % and 10 % — were used to construct the target cost chart. The target price (EUR 513.19) was assessed. The target production cost was at the level of allowable production costs (EUR 379.31). The results were used to confirm that the ideal value of the target cost index was not achieved for any component, and a higher value of the parameter q can be marked as soft. The paper provides assumptions for the assessment of possible alternatives and potential corrections. The case study presents the description of the Target Costing methodology along with the nuanced characteristics of the approaches used by various authors and the strengths and benefits of using the method.

KEY WORDS

allowable cost, price, profit, Target Costing, target cost index, wood-aluminium window

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Introduction

An effective cost management system is a part of strategic business management. So, it is imperative for the system to show positive results. Solutions must be found to increase the enterprise's competitiveness. The Target Costing (TC) method based on the value analysis seems to be one such possible solution. This method allows applying a cost management system that could meet the requirements of the enterprise and the customers. By applying the

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Target Costing methodology, a particular enterprise could increase its competitiveness by understanding customer preferences. According to Gonçalves et al. (2018), Target Costing is known as a competitive tool of Japanese enterprises. Lang (2005) saw reasons for the application of Target Costing to rapid and dramatic market changes. These are caused by the increasing global liberalisation and strong competitiveness. According to him, traditional calculations have not been effective.

If enterprises want to hold their position and survive in the market, they have to implement other managerial, planning and control tools. This cost management value system brings both positives and negatives. If the information provided by Target Costing is reliable, they can increase the quality and rationalisation of production and the inventory reduction. Target Costing information has to be compatible with the enterprise's opportunities and ideas to meet these goals. Based on the analysis of relevant studies of national and foreign authors, no case was found of applying the Target Costing methodology under the conditions of woodworking enterprises or enterprises producing wood-aluminium and other types of windows, indicating a research gap.

The research object of the applied functional cost analysis was a wood-aluminium window Gemini Quadrat FB. The research aimed at the practical application of Target Costing to a specific product (a wood-aluminium window) under the conditions of the woodworking industry with the particular emphasis on customer needs (market research among customers) and the value analysis related to individual components and functions of the specified product.

This paper contains the following chapters. Literature Review presents and compares viewpoints of many relevant authors on the TC topic and the methodology from the theoretical point of view. The chapter on Research Methods presents and describes the TC methodology application on s particular product — a wood aluminium window.

Results and Discussion deals with the reached results by the calculated/assessed levels of costs, target costs, index of target costs, the "q" parameter and, finally, the target costs chart. The part on Conclusions contains reached results from applying the TC methodology in the process of wood-aluminium windows production, limits of the paper and further research orientation.

1. Literature review

In product design, many activities have to be coordinated to create a product that meets the customer's and manufacturer's needs. The demands and preferences of the customers usually change over time. Therefore, an enterprise has to synchronise a customer demand with its own demand. A product has to be manufactured at the optimum cost and using the most effective operations. At the same time, actual customer demands and requirements must be considered, although customers are not interested in production costs. The customer's principal interest is the target price. The difference between the acceptable target price and the target profit creates the level of allowable cost. According to Kee (2010), Target Costing is the cost management system for designing products with reasonable profitability related to their production. The strategy of Target Costing has come from the standpoint that 80 – 85 % of product lifecycle costs are assessed during the product research and development phase. For this reason, Target Costing focuses on the research and development phase having the greatest potential for cost management.

Vedder (2008) stated that the origin of this calculation technique dated back to the 1970s when the private sector income in Japan rapidly increased and people started to explore a greater diversity of their needs. Many latest research studies have been dealing with Target Costing. Sakurai (1989) defined Target Costing as a cost management tool to reduce the overall product cost over its entire life cycle with the help of production, engineering, R&D, marketing and accounting departments. The Target Costing topic was also studied by Tanaka (1993). Hradecký et al. (2008) stated that the Target Costing methodology was based on customer requirements. The focus on the market and customer has been highlighted by Coenenberg et al. (2016). Based on particular studies, Gonçalves et al. (2018) believed it was very difficult to implement Target Costing outside of Japan. Saatweber (2011) saw the success of the Japanese industry applying Target Costing to a flexible, fast and customer-oriented production system. Comprehensive time and quality management enable high productivity, meeting high-quality standards and flexibly adapting to customer demands and market changes. Target Costing can be described as a valuable approach to the balance between R&D costs and an acceptable market price. All arrangements and methods that will be used can contribute to a transparent cost structure. Kee (2010) referred to Target Costing as a cost management system designed to develop a new product with the level of profitability that considers the production. According to Kato (1993), Target Costing is not only a method of cost reduction but a comprehensive system of strategic profit management. He also noted that Target Costing is an activity focused on reducing life cycle costs for new products together with quality assurance, reliability and other consumer requirements. According to Okano and Suzuki (2006), several leading researchers, such as Kato (1993), Monden and Hamada (1991), Sakurai (1989), Tanaka (1993), and Tani et al. (1994), described Target Costing as neither accounting nor costing. According to them, it enables comprehensive planning and management of profit through frequent and mutual communication and strategy. According to Schlink (2004), Target Costing is an integrated target cost management approach. This system includes a comprehensive package of planning, control and cost assurance tools. Product development and construction comprises specific steps before it is placed on the market. In product planning, research and development, and prototype development, all possible cost-reduction ideas must be explored. According to Saatweber (2011), Target Costing goals dealing with success cover the entire product life cycle. Cost targets are based on the anticipated market requirements when the products enter the market. Balance with the goals is monitored by Target Costing throughout the whole phase of product development.

Based on many international studies, e.g., Novák and Popesko (2014), Potkány and Škultétyová (2019), Dejnega (2010) and Ahn et al. (2018), the Target Costing methodology represents a particular managerial approach aiming to integrate cost management oriented towards the marketplace and customers. These studies also focused on the greater significance of cost management, cost behaviour analyses, and appropriate cost projection to adequate cost systems.

According to Kato (1993), the entire Target Costing methodology is based on a straightforward principle: the target costs represent the difference between the expected market price and the target profit. Based on Kee (2010), Target Costing begins with researching attributes and quality products demanded by customers. At the same time, a price is specified that could be accepted by the customers. Teplická (2011) said that the core idea of Target Costing is market marketing research. The market offers specified product properties and target prices according to customer demands. Kato (1993) considered the target price the starting point for all activities focused on target costs. The sales price determination was influenced by the product concept, consumer expectations, product life cycle, and planned volume of sales, but especially by the competition. Kato (1993) also stated that many Japanese enterprises use the function-based pricing method. This method is based on decomposing the product price into several elements, each reflecting the value that customers want to pay for this element. It is necessary to consider that the products have a function mix, and each can be decomposed into several sub-functions. So, the estimated price is the sum of these values. Based on Ebert (2011), the target price can be determined by market research, and it considers the expected impact of competition. According to Schlink (2004), traditional price calculation approaches are based on the supply market. Ellram (2002) stated that setting the target price begins with understanding the unfulfilled market demands.

Based on Kee (2010) and Kato (1993), the next step in the TC methodology is to determine the allowable costs by the deduction of profitability required by a company from the market price of the product. All of the following activities are focused on achieving allowable costs of the product. The production of a given product has considerable potential if this cost level is ensured. Otherwise, the product is rejected as unrealised from the financial point of view. Ax et al. (2008) said that setting a target profit for a future product is usually based on a long-term profit plan. The target profit can be determined based on both profit levels for similar products and the relative strength of competing offers. Considering the market impact, it is also possible to regard both the actual

$$\text{Target Profit} = \text{Target Price} \times \frac{\text{ROS}}{100} \qquad (1)$$

profit of the previous product and the target profit of the product group. Generally, the target profit is not determined in the absolute level but rather in percentage, usually applying the Return on Sales value (ROS). Tumpach (2008) presented a formula for the target profit calculation (1): According to Šoljaková (2009), the Return on Equity (ROA) could be applied to the calculation of the target profit, and according to Foltínová et al. (2007), it could be applied to the profit margin for the calculation of the target profit. Šagátová (2006) also dealt with possibilities to determine the target profit by calculating the profitability of costs.

Based on Kato (1993), target costs should be set for each product. Therefore, it is necessary to know the expected sales price and the target profit for each product. According to Ebert (2011), target costs must be selected and specified, and their control must be ensured to achieve effective control of target costs. According to Schlink (2004), Target Costing focuses on the demand market. The expected required profit is deducted from the product's real market price, and then target costs are assessed. They should not be exceeded and, therefore, it is necessary to respect the assessed target cost. Schlink (2004) also identified that all enterprise's fields could be considered variables significantly affecting the level of costs already in the development phase. Any market pressure is important to be monitored and integrated into cost management.

The TC methodology also includes the application of value analysis principles, which according to Pollak (2005), systematically and creatively examine all cost items. The goal is to reduce or eliminate costs that do not bring acceptable value from the customer's point of view. At the same time, the required quality and relevant performance must be observed. Based on Kastrup (1999), the value analysis can focus on any function performer. The principal category of value analysis is those functions performed by the components, and they represent a source of benefit to the customer. According to Popesko (2009), target costs are achieved by the value analysis by identifying improvements that could reduce costs but do not limit the product's functional properties. The second option is to eliminate unnecessary functions that can increase costs. According to Coenenberg et al. (2016), the value analysis is not focused only on the cost reduction for individual functions or properties of a product, and it also includes their change to increase the product value.

The TC methodology contains the assessment of the target cost index, and the achieved results can be presented using the target costs chart. According to Saatweber (2011), the target cost index describes the alignment of target costs and the customer's benefit. The proposed solution for managing the differences between a benefit and a function can be too simple, and the relevant function is too complex and complicated. Based on Saatweber (2011), the index is determined by the ratio of market importance to costs. The target cost index allows checking the agreement between the relative importance of the customer and the cost-share of each products component. Jung (2011) considered the target cost index the key indicator comparing the functional weight of individual product functions and their cost-share. If the cost ratio is higher than the relative weight of the function, it reflects the target cost index values. According to Joos-Sachse (2001), this key indicator presents a deviation between the market importance and the causal relationship of costs. Reichmann (1997) also considered the TC index as a control tool of cost adequacy related to the weight of its functions. A result below 1 explains that the cost share is higher than the relative weight of its function. When the result is higher than 1, the product is relatively cost-effective compared to its functional significance. Joos-Sachse (2001) stated that if the index was higher than 1, the component was implemented with insufficient investment money. Vice versa, the index below 1 shows that the component implementation was too expensive, i.e., higher costs were spent. Schneider and Pflaumer (2001) also noted three possible results of the target cost index values: the optimal cost-benefit ratio for the customer, the production being too expensive or too cheap, and the customer emphasis on components rather than costs. The obtained index describes how important are the decision and relevant steps. Horváth (1993) determined the TCI by the weight of the allowable costs from the TC methodology and the weight of the component from a preliminary calculation.

According to Ebert (2011), the importance of each component is calculated from the overall function of the product. First, an index for particular components and then a control chart of target costs should be created. Jung (2011) declared that the results of cost allocation could be visualised in the chart of target cost. The scheme helps to identify those components that need the most corrections. Based on Schneider and Pflaumer (2001), a target cost chart is an important cost-benefit tool for developers and production planners. According to Reichmann (1997), it presents a target cost zone with values below and above the optimal cost level. Ideal values are presented on the line that comes from the beginning. The values on this line represent the balance between the percentages of function weights and the costs. So, there is the ideal value of the target cost index, which equals 1. Based on Schneider and Pflaumer (2001), the key consideration describes the limit of target costs and the also graphical presentation of the target costs level. It is necessary to define the optimal target cost zone because the optimum level with the target cost index equal to 1 is very unusual. Mussnig (2001) stated that the target cost zone is defined by two curves. The upper limit is on the cost zone, and the lower limit is on the benefit zone. According to Schneider and Pflaumer (2001), the target cost zone is defined by two curves. They show that the allowed deviations from the optimum value are higher in the zone of small partial weights than in the zone of high partial weights. The target cost zone represents a space possibly spanning costs of components. For this purpose, the X-axis shows weights of component benefit, and the Y-axis gives real cost shares. These two functions set the target cost zone. According to Saatweber (2011), the target cost chart has a defined target area for each assembly, component or production process as the ratio of the target cost to the benefits. According to Saatweber (2011), the target cost zone in which the components should be located shows deviations. A deviation from the ideal value could be between the upper and lower limit. An enterprise sets its own limit values. According to Joos-Sachse (2001), the parameter q defines the target cost zone. The higher "q" means a more open target cost zone. Accepted limits for deviations are wider. If the costs are too high compared to the benefit, they are above the target cost zone. Then, it is necessary to focus on cost reduction without losing quality. According to Schneider and Pflaumer (2001), "q" indicates the intersection of two functions with the X-axis or the Y-axis. Based on Saatweber (2011), the value of the parameter q at which the zone starts in an axis or in a vector depends on the enterprise. The zone is stricter with the higher target potential of the goal achievement. It also depends on the level of employees' experience. According to Jung (2011), the assessment of the "q" indicator depends on the importance of target costs in the enterprise. It also depends on the importance of production costs and costs of the competition. The assessment of "q" is always strongly influenced by experiences. If the components are outside the target cost zone, action is necessary. According to Schneider and Pflaumer (2001), deviation limits depend on the choice of the „q" indicator. During the determination of the decision-making parameter "q", it is necessary to decide on the basis of the target cost significance, then actual costs, and finally, the costs of competition. The more important the selling prices are (influenced by costs), the smaller "q" should be chosen. The determination of the decision parameter will be influenced by empirical values always.

The study presents the description of the Target Costing methodology together with the characteristics of the nuances in the approaches of various authors and the recognition of strengths and benefits of using the method. Based on the literature review, a research gap was identified, and the following research question (RQ) was formulated.

RQ: Is a comprehensive application of the Target Costing methodology possible in an enterprise manufacturing an innovative product — wood-aluminium window Gemini Quadrat FB?

2. Research methods

The object of our research was an innovative wood-aluminium window Gemini Quadrat FB (Fig. 1). It is a product with excellent resistance properties against weather conditions, and by that, it meets customer demands.

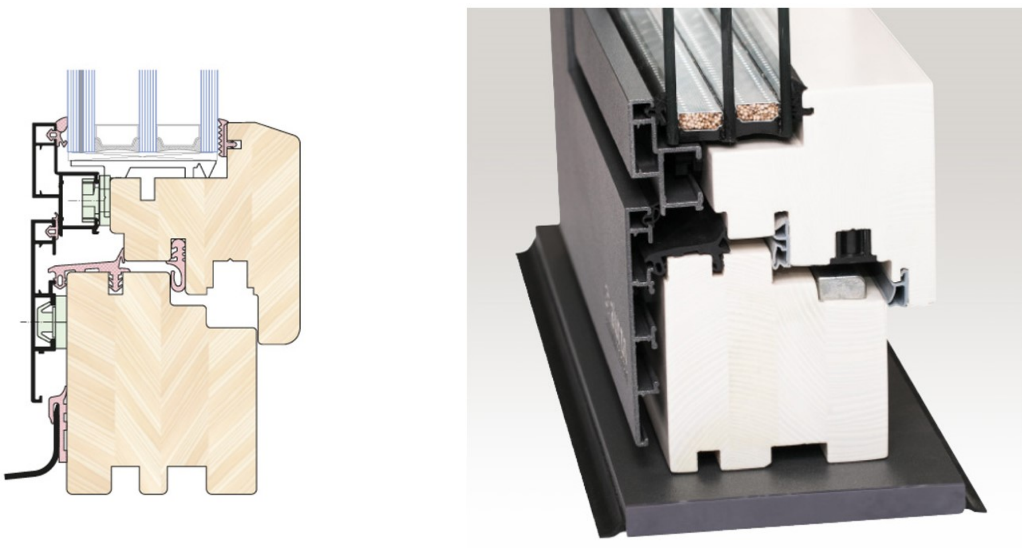

Fig. 1. Wood-aluminium window Gemini Quadrat FB

Source: (http://www.aluron.pl/de/offer/quadrat-fb-2/).

According to Štulrajter (2016), the product consists of the following components:

Frame (K1). The basic construction element is a wooden window block made of spruce, pine and oak. The window profile is covered in the aluminium profile. The window is perfectly protected against the weather long-term, and it also has a longer life.

Fittings (K2). This product contains a system designed for tilt-opened windows. The fitting is hidden in a full-circuit design and complemented by several integrated safety features ensuring a higher safety class.

Insulated glass (K3). The product uses insulated triple glass with excellent thermal insulation properties. A thin layer of noble metal is applied on the inside plate of the glass panel. During winter, it provides excellent insulation properties, and in summer, it protects the interior from excessive overheating. Good-quality glass provides sun protection and is more resistant to accidents; it reduces noise and creates a pleasant interior climate. The heat transfer coefficient is 0.8 W/m2K, the thermal transmission coefficient Ug = 0.7.

Surface finish (K4). The profile is treated by an ecological surface finishing. It provides protection against mould, rot, and water and ensures high vapour permeability and resistance to weather conditions and UV radiation.

Weatherstrips and insulation (K5). A quality system prevents condensation decreasing the chances for mould. At the same time, this will ensure lower heating costs and better insulation. Weatherstrip covers all window sides, the external, internal and central strip between the window frame and the window's wing.

Drip moulding (K6). A rainwater drain is provided to the outer parapet and protects the lower horizontal surfaces of the wooden frame.

The Target Costing methodology was applied to identify weaknesses of the releasing product: wood-aluminium window Gemini Quadrat FB. The frame of this product was made of spruce. Plans exist to extend the product portfolio with pine wood, making the product wood-aluminium window Innovative FB in a higher density and more expressive colour. For insulating glass, the consideration is to use glazing 4-18-4-18-4 instead of 4-12-4-12-4.

The research methodology consists of two phases. The first phase covers the survey, summarising customer preferences and specifications of the research object — the wood-aluminium window. Data collection by the questionnaire was performed from February 2020 to August 2020 using Google Forms. In total, 100 potential customers were interested in buying the research object. The second phase included the application of the TC methodology using the principles of value analysis.

According to Kato (1993), in the initial phase of the TC methodology, the target costs were determined by the formula (2).

The formula (3), according to Šagátová (2006), was used to establish the target profit.

The target price was determined on the basis of a questionnaire survey – step 1. Marketing analysis provided information about customer preferences of the monitored product.

In the second step, the costs of individual components for the Innovative FB product were calculated. They were quantified using the product calculation configured by the departments of construction, research and development. Next, quantitative-functional analysis was used. It identified the relationship among individual functions (customer preferences) and product components. Then, the significance of individual product components was assessed.

The value analysis principles were applied during the implementation of the Target Costing methodology. Analysing customer preferences and using the quantitative-functional analysis, it is possible to determine the percentage of allowable costs of individual components. A complete calculation is based on the multiplication between the significance component and the percentage share of this component on its properties. Consequently, it was possible to determine the target cost index (TCI) for each component using the formula (4) according to Horváth (1993) and then, results were transformed into the target cost diagram.

$$\text{Target Costs} = \text{Expected Sales Price} - \text{Target Profit} \tag{2}$$

$$\text{Target Profit} = \frac{\text{Target Price} \times \text{Cost Profitability Factor}}{1 + \text{Cost Profitability Factor}} \tag{3}$$

$$\text{Target Cost Index} = \frac{\text{Relative Weight Of The Component From Target Costing Methodology}}{\text{Relative Weight Of The Component From Preliminary Calculation}} \tag{4}$$

$$\int_1 = \sqrt{x^2 - q^2} \qquad (5)$$

$$\int_2 = \sqrt{x^2 + q^2} \qquad (6)$$

Formulas (5) and (6) were used for the determination of lower and upper limits of the target cost zone.

The q value represents the tolerance level, in our case it was determined at 5% and 10%.

3. Results and discussion

The results are based on the questionnaire survey evaluation (returned by 100 respondents) on customer preferences for the wood-aluminium window. The most preferred requirements were the thermal and sound insulation properties of the window (P5) and the product life cycle (P9) (Fig. 2). Both properties exceeded the level of 12 %.

Customers also highly preferred product safety (P4). The percentage results of other properties exceeded 10 %; the least preferred property was design (P2) (10.25 %). Thus, customer expectations of particular product properties have about the same importance level. The survey provided an overview of perceived customer preferences for particular product properties. Information is one of the possible sources for further methods applied in this case study.

Formula (2) was applied for the determination of allowable costs. The survey also examined the acceptable product price for customers. The result was a value close to EUR 616, including the value-added tax (VAT). After the deduction of VAT (20 %), the value is close to EUR 513. The profit margin was set at the level of the expected 15 % cost profitability (EUR 66.94), as is presented in formula (3). Using formula (2), the level of allowable costs was set to EUR 446.25. Departments of construction, research and development assessed the conversion calculation respecting allowable costs for the wood-aluminium window Innova-

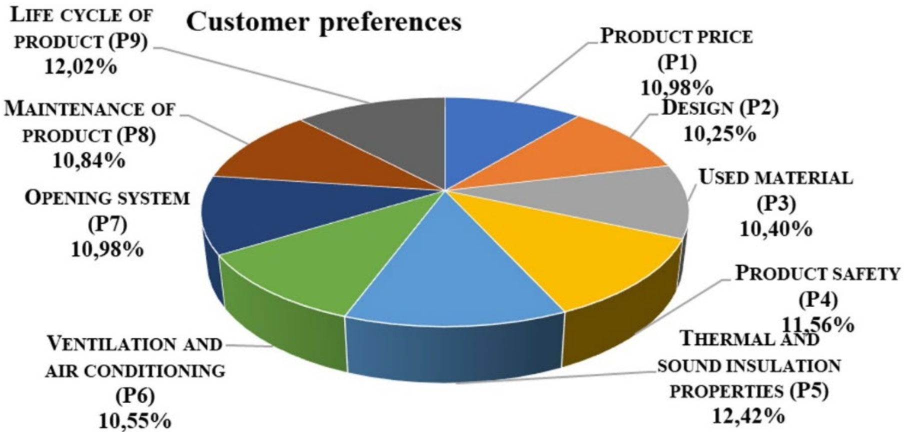

Fig. 2. Customer preferences (P) (%)

Tab. 1. Cost calculation of the Innovative FB in EUR/product

Cost items	Conversion calculation of Innovative FB
Direct material	258.83
Direct wages	80.32
Supply and production overheads	40.16
Production costs	379.31
Sales administration costs and management administration overheads	66.94
∑ Costs	446.25
15 % profit	66.94
Price without VAT	513.19
VAT	102.64
Sales price	615.83

tive FB (Table 1). Particular components should respect the percentage distribution of conversion calculation values for the original window Gemini Quadrat FB. Production costs reached 85 % of the total costs. The level of allowable costs is EUR 379.31.

Quantitative-functional analysis was elaborated by an expert assessment of the construction department. The relationship was identified between customer preferences (9) and particular components (K) (Tab. 2).

We can mention that the component K1 Construction (20.98 %) has the highest importance (Table 2) as a customer preference, the second important component is Fittings K2 (20.46 %). The results of the analysis were used to quantify allowable costs of individual components based on the level of allowable production costs of EUR 379.31 (Table 3).

The comparison of the target costs of individual components with the costs determined by the conversion calculation for the components (Table 3) showed that the company should decrease costs of all components except for the insulating glass K3 and the surface finish K4. These components have higher allowable costs than the costs determined by the preliminary conversion calculation. More detailed analysis and the application of the TC methodology determined the target cost index (formula 4) for each component of the product (Table 4).

Subsequently, a target cost chart (Figs. 3 and 4) was constructed applying formulas (5) and (6).

So, for no component the calculated costs by the enterprise (TCI = 1) did not meet the customer expectations. When a more moderate tolerance limit is assessed by the coefficient q = 10 % (Fig. 3), all analysed components are located in the tolerance zone, because they correspond to the permitted deviation from the target value. The insulation glass K3 and the surface finish K4 can be considered as inexpensive components (their target cost index value is higher than 1). Other components have the target cost index below 1, which means there are considered expensive (cost-intensive), and managers should think about rationalisation steps leading to cost reduction.

Applying a stronger tolerance limit by the coefficient q = 5 % (Fig. 4), the tolerance area is significantly smaller. Only two components are located in the toler-

Tab. 2. Quantitative-functional analysis and the importance assessment of particular components

	K1		K2		K3		K4		K5		K6	
	Share	∑share	Share	∑share	Share	∑share	Share	∑share	Share	∑share	Share	∑share
P1*	30.00%	3.29%	25.00%	2.75%	25.00%	2.75%	10.00%	1.10%	5.00%	0.55%	5.00%	0.55%
P2	30.00%	3.08%	5.00%	0.51%	25.00%	2.56%	30.00%	3.08%	5.00%	0.51%	5.00%	0.51%
P3**	20.00%	2.08%	10.00%	1.04%	10.00%	1.04%	30.00%	3.12%	10.00%	1.04%	20.00%	2.08%
P4	30.00%	3.47%	20.00%	2.31%	20.00%	2.31%	0.00%	0.00%	10.00%	1.16%	20.00%	2.31%
P5	10.00%	1.24%	5.00%	0.62%	25.00%	3.11%	5.00%	0.62%	40.00%	4.97%	15.00%	1.86%
P6	10.00%	1.06%	30.00%	3.17%	0.00%	0.00%	0.00%	0.00%	30.00%	3.17%	30.00%	3.17%
P7	20.00%	2.20%	50.00%	5.49%	0.00%	0.00%	0.00%	0.00%	30.00%	3.29%	0.00%	0.00%
P8	20.00%	2.17%	20.00%	2.17%	20.00%	2.17%	25.00%	2.71%	5.00%	0.54%	10.00%	1.08%
P9	20.00%	2.40%	20.00%	2.40%	15.00%	1.80%	15.00%	1.80%	10.00%	1.20%	20.00%	2.40%
∑	-	20.98%	-	20.46%	-	15.74%	-	12.43%	-	16.43%	-	13.97%

*P1 vs K1 = 10.98% 0.30 ≐ 3.29%; **P3 vs K1 = 10.40% 0.20 ≐ 2.08%

Tab. 3. Preliminary conversion calculation of components for the Innovative FB compared to target component costs

Component	Preliminary cost of Innovative FB product	Allowable cost from Target Costing methodology of Innovative FB product
K1	81.43	79.59*
K2	78.87	77.60
K3	52.90	59.69
K4	43.00	47.14
K5	67.07	62.32
K6	56.04	52.99
∑	379.31	379.31

*K1 = 20.98% from 379.31 € = 79.59 €

Tab. 4. Target cost index for particular components

Component	Target cost index
K1*	0.9773
K2	0.9839
K3	1.1284
K4	1.0962
K5	0.9291
K6	0.9456

*TCI_{K1} = 20.98%/(85.60/398.70) = 0.9773

ance area, i.e., the Frame K1 and the Fitting K2. However, they are considered expensive (cost-intensive) because their TCI is below 1. The difference between allowable costs and the costs determined by the conversion calculation for K1 is at the level of EUR 1.84. K2 is characterised by allowable costs lower than EUR 1.27. Both of these components significantly contribute to meeting the customer preferences (each by more than 20 %). The examination of customer preferences demonstrated that more than 11 % of customers emphasised product safety. Therefore, the search for the best alternative of lower-cost fittings should result in a supplier that could relevantly meet this requirement. Although these two components are located in the tolerance zone, and cost variations are

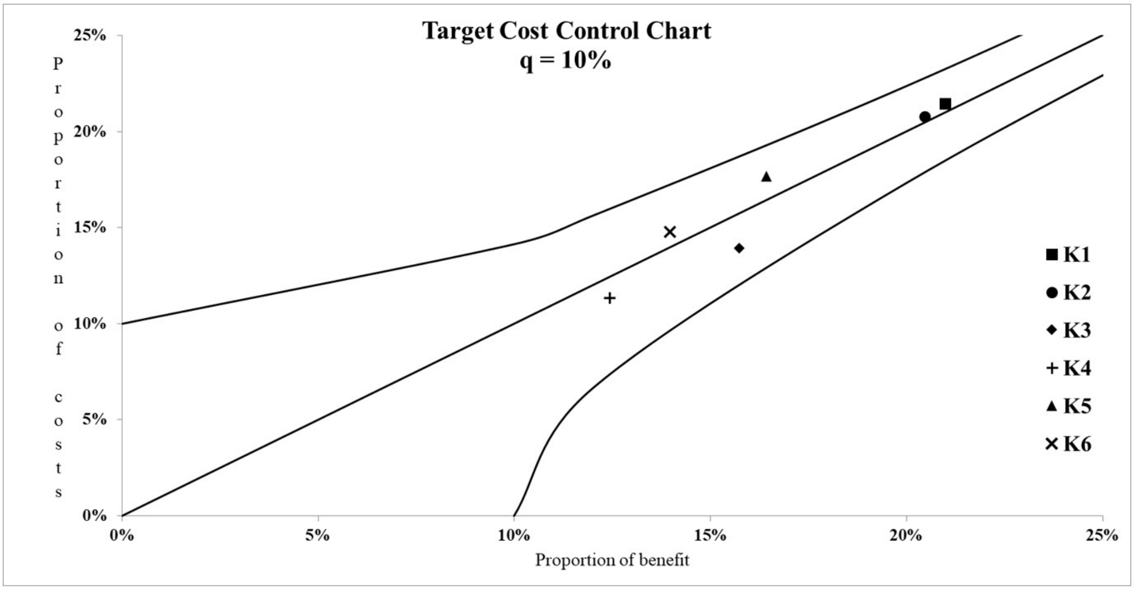

Fig. 3. Target Cost Control Chart comparing different levels of the coefficient q = 10%

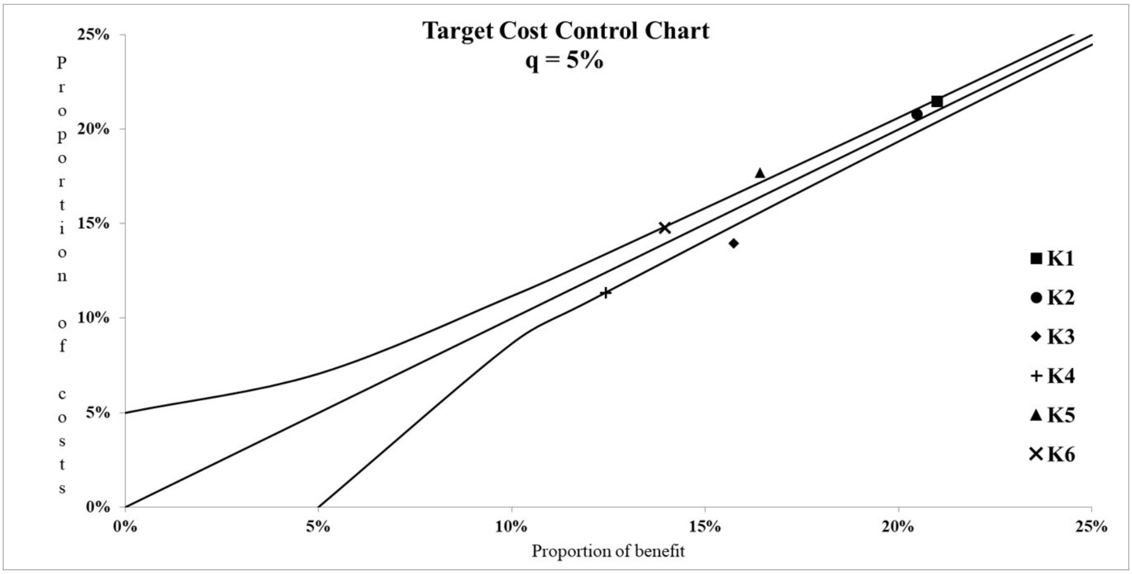

Fig. 4. Target Cost Control Chart comparing different levels of the coefficient q = 5%

still acceptable, the enterprise should deal with them because of their importance for customers. Alternatives for costs reduction should be found while respecting the quality requirements. Allowable costs can be a limit for the purchasing price of these components from an external supplier. In the case of the cost reduction below their allowable limit, the quality of this component should be carefully monitored in the context of meeting customer requirements.

The surface finish K4 and the drip moulding K6 have only limited values. K4 can be considered a cheap component, and K6 can be considered a cost-intensive component. K6 costs are more EUR 3 higher than necessary. On the other hand, a higher focus on quality is required in the case of K4. The allowable costs are about EUR 4.14 higher than the costs assessed by the conversion calculation. Lower costs of a component can result in the value decline of the whole product. The range of colours could be extended, which might increase expenditure and, thus, to be closer to allowable costs.

The insulating glass K3, weatherstrips and the insulation K5 are outside the tolerance zone. If the components are outside the target cost zone, it is necessary to find possible corrective actions. Either the activities will focus on cost reduction or feature improvement. It depends on the position of a particular component in the chart. On the basis of these results, K3 can be considered the cheapest component. Its target costs are about EUR 6.79 higher. These costs cover more than 15 % of functional product properties.

The insulating glass has not yet represented the optimally required benefit for a customer. There is an opportunity to increase its benefit by optimising product functions. In this case, a new type of triple glazing product is launched. So, the enterprise could find a supplier who will declare the higher quality of the particular component at a higher price. Another step could be to use a new type of glass, as stated by Štulrajter (2016), the so-called multifunctional glass. This type of glass covers a wider spectrum of radiation reflection.

The price for this glass is higher than the price for the earlier used triple glazing. It is an advantage for the customer because of significantly lower heat losses resulting in higher heating energy savings. The component weatherstrips and insulation K5 is the most expensive component based on obtained results. This component is very important for thermal insulation functions, and the effort to make savings with this component could lead to its functional damage. A solution could be to re-evaluate the current supplier or agree on a lower purchase price together with agreed long-term supplies or agreed higher purchased volumes of the component.

Conclusions

Target Costing is a cost-effective methodology that can be used by any enterprise, and it can help meet cost management goals. One of its benefits lies in the acceptance of customer preferences and in the market-acceptable level of sales prices. This paper mainly aimed to refer to the practical application of Target Costing to a specific product of the woodworking industry with a particular emphasis on customer needs and value analysis in relation to individual components and functions of the product —the wood-aluminium window Gemini Quadrat FB. The result of the methodology application should be an innovative product — the wood-aluminium window that fully respects customer requirements and satisfies the ideas and demands of the production enterprise. Based on the research results, the Target Costing methodology could be applied to an enterprise producing wood-aluminium windows. The presented case study focused on the application of the Target Costing methodology under specific conditions of wood-aluminium windows production. The established methodology was used to determine the target price (EUR 513.19) and the level of target costs for the product. Production costs were confirmed as the priority and were quantified at the level of allowable production costs (EUR 379.31). Calculating the target cost index for each component and creating the target cost chart while accepting the q parameter at levels of 5 % and 10 %, assumptions were formulated for the assessment of possible alternatives and potential corrections. The results confirmed that with a higher value of the parameter q, the tolerance zone in the diagram enlarges, and the parameter can be marked as soft. The ideal value of the target cost index was not achieved for any component. If an enterprise wants to succeed in the market and compete, it can use the Target Costing methodology as the target costs (set in the initial phases of research and development) are a decisive aspect in the management of all business processes. Ferreira and Machado (2015) stated that Japan and Asia were areas with the highest percentages of Target Costing application, followed by the United States and Europe. Currently, the application of the Target Costing methodology can be seen in various fields. Cunha Callado et al. (2020) and Goncalves et al. (2018) applied this method to information technologies. Alwisy et al. (2020) and Pennanen et al. (2011) dealt with the Target Costing application in the construction industry. The Target Costing Application in the automotive industry is presented by Baharudin and Jusoh (2015) and Ibusuki and Kaminski (2007). Potkány et al. (2012) investigated customer preferences of simple wood-based houses for the purpose of using the target costing. Other examples of the use of the Target Costing methodology can be seen in hotel management (Aladwan et al., 2018), the agriculture sector (Lima et al., 2016), and healthcare facilities (Macuda and Orliński, 2017). Johansen et al. (2021) focused on large and complex infrastructure projects in the context of the Norwegian construction industry.

The practical application of the generally well-known Target Costing methodology under specific industrial conditions is a suggested limitation of the paper. Further research should be focused on furniture-making with a relevant customer preference survey regarding the chosen product.

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Literature

Ahn, H., Clermont, M., & Schwetschke, S. (2018). Research on target costing: past, present and future. *Management Review Quarterly*, *68*(3), 321-354. doi: 10.1007/s11301-018-0141-y

Aladwan M., Alsinglawi O., & Alhawatmeh O. (2018). The applicability of target costing in Jordanian hotels industry. *Academy of Accounting and Financial Studies Journal, 22*(3), 1-13.

Aluron, Aluminium systeme. Retrieved from http://www.aluron.pl/de/offer/quadrat-fb-2/

Alwisy, A., Bouferguene, A., & Al-Hussein, M. (2020). Framework for target cost modelling in construction projects. *International journal of construction management, 20*(2), 89-104. doi: 10.1080/15623599.2018.1462446

Ax, Ch., Greve, J., & Nilsson, U. (2008). The impact of competition and uncertainty on the adoption of target costing. *International Journal of Production Economics, 115*(1), 92-103. doi: 10.1016/j.ijpe.2008.04.010

Baharudin, N., & Jusoh, R. (2015). Target Cost Management (TCM): A Case Study of an Automotive Company. *Procedia – Social and Behavioral Sciences, 172*, 525-532. doi: 10.1016/j.sbspro.2015.01.398

Coenenberg, A. G., Fischer, T. M., & Günther, T. W. (2016). *Kostenrechnung und Kostenanalyse*, Stuttgart: Schäffer-Poeschel Verlag.

Cunha Callado, A. A., Cunha Callado, A. L., & do Bomfim, E. T. (2020). Target costing in micro and small companies from the information technology (IT) sector. *Revista evidenciacao contabil & financas, 8*(3), 125-141. doi: 10.22478/ufpb.2318-1001.2020v8n3.50245

Dejnega, O. (2010). Metody Activity Based Costing a Time-Driven Activity Based Costing a jejich využití v praxi při měření nákladů procesů. *EMI Economics, Management, Innovation, 2*(1),11-19.

Ebert, G. (2011). *Praxis der Unternehmenssteuerung*. München: Oldenbourg Wissenschaftsverlag GmbH.

Ellram, L. M. (2002). Supply management's involvement in the target costing process. *European Journal of Purchasing & Supply Management, 8*(4), 235-244. doi: 10.1016/S0969-7012(02)00019-9

Ferreira, A. de C., & Machado, M. J. C. V. (2015). Target Costing: Review of Bibliography. *Revista gestão & tecnologia - Journal of Management and Technology, 15*(1), 101-126.

Foltínová, A., Dubcová, G., Rajňak, M., Serina, P., Šagátová, S., & Tóth, M. (2007). *Nákladový controlling*. Bratislava: Vydavateľstvo SPRINT – vfra Bratislava.

Gonçalves, T., Gaio, C., & Silva, M. (2018). Target costing and innovation-exploratory configurations: A comparison of fsQCA, multivariate regression, and variable cluster analysis. *Journal of Business Research, 89*, 378-384. doi: 10.1016/j.jbusres.2018.01.054

Horváth, P. (1993). *Target Costing: State-of-the-Art-Report*. Texas: Consortium of Advanced Manufacturing-International.

Hradecký, M., Lanča, J., & Šiška, L. (2008). *Manažerské účetnictví*. Praha: Grada Publishing a. s.

Ibusuki, U., & Kaminski, P. C. (2007). Product development process with focus on value engineering and target-costing: A case study in an automotive company. *International Journal of Production Economics, 105*(2), 459-474. doi:10.1016/j.ijpe.2005.08.009

Johansen, A., Engbo, A., Torp, O., & Kalsaas, B. T. (2021). Development of target cost – By the owner or together with Contractors – Target Value Design. *Procedia Computer Science*, *181*, 1171-1178. doi: 10.1016/j.procs.2021.01.314

Joos-Sachse, T. (2001). *Controlling, Kostenrechnung und Kostenmanagement: Grundlagen - Instrumente - Neue Ansätze.* Wiesbaden: Gabler.

Jung, H. (2011). *Controlling*. München: Oldenbourg Wissenschaftsverlag GmbH.

Kastrup, T. (1999). *Marktorientiertes Zielkostenmanagement für Rundfunkanstalten*. Wiesbaden: Dt. Univ.-Verl.

Kato, Y. (1993). Target costing support systems: Lessons from leading Japanese companies. *Management Accounting Research, 4*(1), 33-47.

Kee, R. (2010). The sufficiency of target costing for evaluating production-related decisions. *International Journal of Production Economics, 126*(2), 204-211. doi: 10.1016/j.ijpe.2010.03.008

Lang, H. (2005). *Manažerské účetnictví – teorie a praxe.* Praha: C. H. Beck.

Lima, A. C., Silveira, J. A. G. da, Silva, S. H. F. da, & Ching, H. Y. (2016). Target costing: exploring the concept and its relation to competitiveness in agribusiness. *Custos e Agronegocio, 12*(3), 11-25.

Macuda, M., & Orliński, R. (2017). Target Costing – a Remedy for Hospitals' Ills?. *Przedsiębiorczość i Zarządzanie*, *18*(1), 113-123.

Monden, Y., & Hamada, K. (1991). Target costing and Kaizen costing in Japanese automobile companies. *Journal of Management Accounting Research*, *3*(fall), 16-34.

Mussnig, W. (2001). *Dynamisches Target Costing: Von der statischen Betrachtung zum strategischen Management der Kosten.* Wiesbaden: Dt. Univ.-Verl. – Wiesbaden: Gabler.

Novák, P., & Popesko, B. (2014). Cost Variability and Cost Behaviour in Manufacturing Enterprises. *Economics & Sociology, 7*(4), 89-103. doi: 10.14254/2071-789X.2014/7-4/6

Okano, H., & Suzuki, T. (2006). A History of Japanese Management Accounting. *Handbook of Management Accounting Research, 2*, 1119-1137. doi: 10.1016/S1751-3243(06)02024-4

Pennanen, A., Ballard, G., & Haahtela, Y. (2011). Target costing and designing to targets in construction. *Journal of Financial Management of Property and Construction, 16*(1), 52-63. doi: 10.1108/13664381111116089

Pollak, H. (2005). *Jak odstraniť neopodstatněné náklady. Hodnotová analýza v praxi*. Praha: Grada Publishing, a. s.

Popesko, B. (2009). *Moderní metody řízení nákladů. Jak dosáhnout efektivního vynakládání nákladů a jejich snížení.* Praha: Grada Publishing, a. s.

Potkány, M., & Škultétyová, M. (2019). Research into customer preferences of potential buyers of simple wood-based houses for the purpose of using the target costing. *Open Engineering, 2019*, 390-396. doi: 10.1515/eng-2019-0048

Potkány, M., Hajduková, A., & Teplická, K. (2012). Target costing calculation in the woodworking industry to support demand at a time of global recession. *Drewno, 187*, 89-104.

Reichmann, T. (1997). *Controlling: Concepts of Management Control, Controllership, and Ratios.* Berlin: Springer-Verlag Berlin Heidelberg.

Saatweber, J. (2011). *Kundenorientierung durch Quality Function Deployment: Produkte und Dienstleistungen mit QFD systematisch entwickeln.* Düsseldorf: Symposion Publishing GmbH.

Šagátová, S. (2006). Kalkulácia cieľových nákladov. *Procesný manažér, 01*, 17-19. Retrieved from http://www.sapria.sk/Pdf/Casopis/Procesny_manazer_1_2006.pdf

Sakurai, M. (1989). Target costing and how to use it. *Journal of Cost Management*, *3*(2), 39-50.

Schlink, H. (2004). *Bestimmung von Funktionskosten: Grundlagen für die kostenorientierte Entwicklung technischer Produkte.* Wiesbaden: Dt. Univ.-Verl.

Schneider, D., & Pflaumer, P. (2001). *Power Tools: Management-, Beratungs- und Controllinginstrumente.* Wiesbaden: Betriebswirtschaftlicher Verlag Gabler.

Šoljaková, L. (2009). *Strategicky zaměřené manažerské* účetnictví. Praha: Management Press.

Štulrajter, M. (2016). *Kalkulácia cieľových nákladov a jej praktické uplatnenie vo vybranom podniku.* Diploma thesis, Zvolen: Technická univerzita vo Zvolene, Drevárska fakulta.

Tanaka, T. (1993). Target costing at Toyota. *Journal of Cost Management*, *7*(1), 4-11.

Tani, T., Okano, H., Shimizu, N., Iwabuchi, Y., Fukuda, J. & Cooray, S. (1994). Target cost management in Japanese companies: current state of the art. *Management Accounting Research*, *5*, 67-81.

Teplická, K. (2011). Nástroje nákladového controllingu a ich uplatnenie v praxi. *Manažment v teórii a praxi, 1*, 4-16, Retrieved from http://casopisy.euke.sk/mtp/clanky/1-2011/mtp1-2011.pdf

Tumpach, M. (2008). *Manažérske* a *nákladové* účtovníctvo. Bratislava: Iura Edition.

Vedder, H. (2008). *The Target Costing Approach*. Berlin: Grin Verlag.