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COST OF QUALITY ASSESSMENT AS IT SYSTEM INPUT FOR PRODUCT QUALITY ANALYSIS

RACHUNEK KOSZTÓW JAKOŚCI JAKO ŹRÓDŁO SYSTEMU INFORMATYCZNEGO DO ANALIZ JAKOŚCI WYROBU

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Summary: Changes on the global automotive market have driven automobile manufacturers and their suppliers to search for effective methods and tools to support management processes. Examples include cost-of-quality assessment and managerial accounting. The article outlines the cost components of quality losses based on data from an IT system and the author's prior research into assessments of the cost of quality incurred by an automotive-industry supplier. It provides an assessment of the cost of quality to sales ratio as well as the cost of prevention, control and valuation. Once obtained, the cost of losses is used as a starting point for the identification of the costs of internal and external losses that contribute to total losses. Through research and analysis, the author identifies the underlying causes of the biggest losses in aluminum foundries resulting from product non-conformities and proposes ways to mitigate such losses by improving product quality.

Keywords: cost-of-quality assessment, cost of loss, quality management system.

Streszczenie: Zmienna sytuacja na globalnym rynku motoryzacyjnym skłania producentów samochodów i ich dostawców do poszukiwania efektywnych metod i narzędzi wspierających procesy zarządzania. Jednym z nich jest rachunek kosztów jakości i rachunkowość zarządcza. Artykuł charakteryzuje strukturę kosztów strat jakościowych na podstawie danych z systemu informatycznego oraz danych z wcześniej przeprowadzonych badań autora w zakresie rachunku kosztów jakości w przedsiębiorstwie dostawcy branży motoryzacyjnej. Określono stosunek kosztów jakości do wartości sprzedaży, koszty zapobiegawcze oraz koszty kontroli i ocen. Następnie na podstawie rachunku kosztów strat wyznaczono koszty strat wewnętrznych i zewnętrznych, określając składowe kosztów, które mają wpływ na straty. Dzięki badaniom i analizom określono źródła największych strat w odlewni aluminium z tytułu niezgodnych wyrobów, wskazując na możliwości zmniejszenia strat poprzez doskonalenie jakości wyrobów.

Słowa kluczowe: rachunek kosztów jakości, koszty strat, system zarządzania jakością.

1. Introduction

Today's manufacturers strive for perfection in an increasingly globalized and internationalized world economy by securing new markets, utilizing cheap labour, establishing new sites in less developed countries and adopting proven and tested technologies. A case in point is the automotive industry. Changes in the business environment have forced global automotive companies to adopt new strategies and business models that place more emphasis on emerging markets, new consumer needs, and novel mobility concepts. According to KPMG's Global Automotive Executive Survey [Global Automotive Executive Survey 2018, p. 2], the key drivers of change are globalization, greater production outputs, environmental challenges (the development of electric drives and advances in environmentally-friendly technologies), new consumer behavior patterns that affect cost economy, innovative safety improvements, improved ergonomics, and comfort, as well as urbanization and the emergence of mega cities (in the field of urban auto design).

Approximately 80% of the parts supplied to the automotive industry for new vehicle assembly come from manufacturers that have to deal with changes in the global environment, and are compelled to respond to changing demands from carmakers and their customers, embrace new innovative technologies, adjust to shorter product life cycles, lower production costs and reduce lead times. Such goals can be achieved, in part, by developing information and IT systems that rely on Enterprise Resource Planning (ERP) and provide new insights into the cost of quality and by utilizing information from such systems in their decision-making, often at operational level, as a counter-measure for the short validity cycles of long-term strategies, which quickly become outdated [Lenart 2016, pp. 115-123].

The aim of this article is to conduct qualitative research and analyses of product-related cost-of-loss components using data from IT systems and from previous studies on the cost of quality in a selected automotive industry supplier [Gruszka, Kurzawski 2018, pp. 24-28]. Such cost-of-quality analysis helps identify the component costs of prevention and assessment and the cost of internal and external losses. The causes of the biggest losses were identified indicating opportunities to reduce losses by improving the quality of products that generate the biggest losses.

2. Research and analysis methodology

2.1. Characteristics of the studied company

The research focused on a partially foreign-owned automotive enterprise that comprises aluminum casting and machining units. The company has a quality management system in place designed to ensure conformity with the automotive QM standard IATF 16949:2016. As of the time of the study, the company did not engage in separate cost-of-quality assessments using its IT system that would serve as

a potential direct source of data on individual cost-of-quality items [Gruszka 2018, pp. 24-28]. The company is in the business of manufacturing highly specialized aluminum castings, which it also machine-processes.

2.2. Technological processes

Similarly to machining, casting is conducted on automated lines. In casting, the bodies of items (Figure 1) are gravity cast using reusable molds.

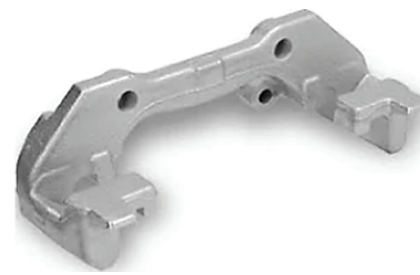

Fig. 1. A TRW brake caliper bracket

Source: own work based on product catalogue of the studied manufacturer.

Once they are cast, products are thermally treated in a process that involves supersaturation and ageing. The parts thus produced are then transferred to machining where they are processed in numerical machining centres and finally washed. The finished goods are shipped to customers, who subsequently fit other elements onto the bodies and ultimately fit finished brake calipers into car braking systems.

2.3. Cost-of-quality research findings

Since the aim of this paper is to examine and qualitatively analyze cost-of-loss components, the author relies on data from prior cost-of-quality assessments [Gruszka, Kurzawski 2018, pp. 24-28] and qualitative data from various levels of product quality management retrieved from the IT system of the enterprise in question. The author employs selected qualitative methods and tools [Raßfeld et al. 2015, pp. 1071-1082; Zymonik 2003, pp. 73-118]. The resulting cost-of-quality components are illustrated in Figure 2. The total cost of quality in the enterprise in question amounts to around 10.7 percent of the market value, which is significantly above Europe's industry average of 4 to 8 percent, leaving the company with ample room for improvement. The predominant cost-of-quality item turns out to be total losses, which amount to 83 percent of the cost of quality, substantially exceeding Europe's industry average of 45 to 55 percent [RWTUV 1993, p. 25].

On the other hand, the cost of external losses remains at the relatively low level of 10 percent. [Malik et al. 2016, pp. 2-20] attribute such cost to stringent shipped product controls. However, the same factors could have driven up the cost of internal losses. To resolve the issue, further research and analyses are conducted into the impacts of

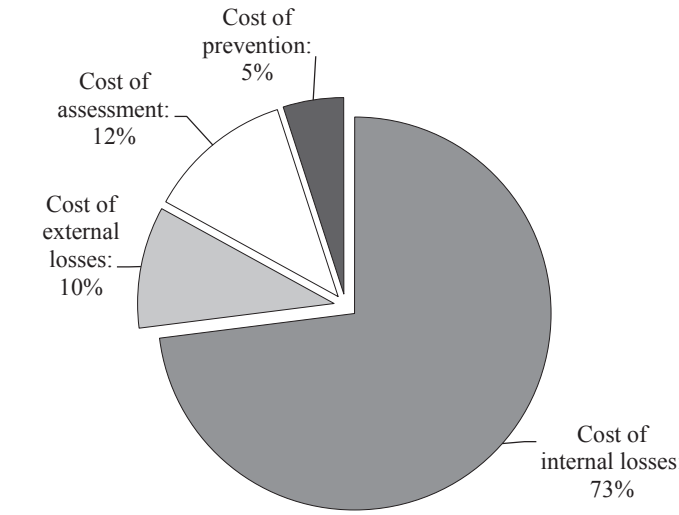

Fig. 2. Breakdown of costs of quality in the company in question

Source: own work.

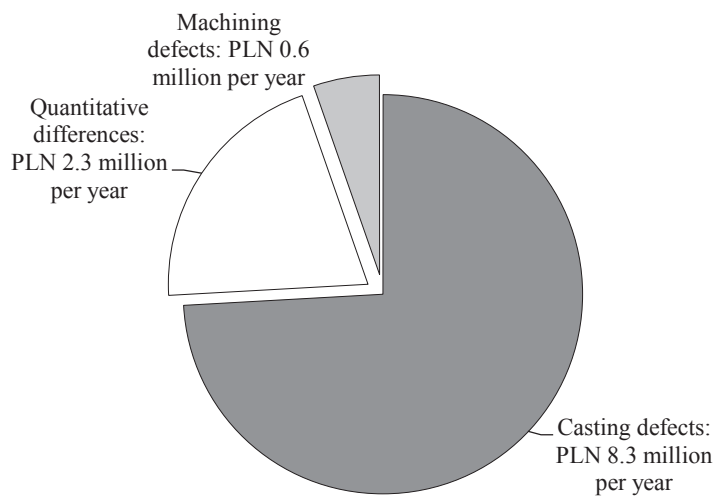

Fig. 3. Breakdown of internal losses in the studied company

Source: own work.

individual cost-of-loss items to both internal and external costs of losses, their findings illustrated in Figures 3 and 4. The main internal cost-of-loss items are costs of losses resulting from defects, which amounts to PLN 8.9 million per year, and quantitative differences, amounting to PLN 2.3 million per year. The main contributor to the cost of losses is casting, which generates losses of PLN 10.6 million per year. The external

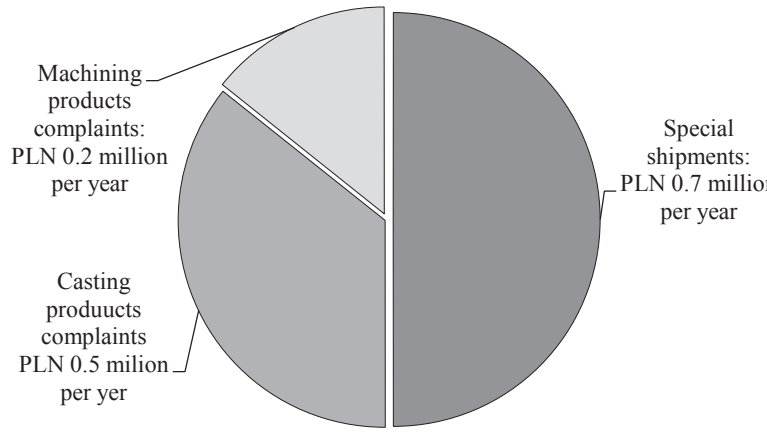

Fig. 4. Breakdown of external losses in the studied company

Source: own work.

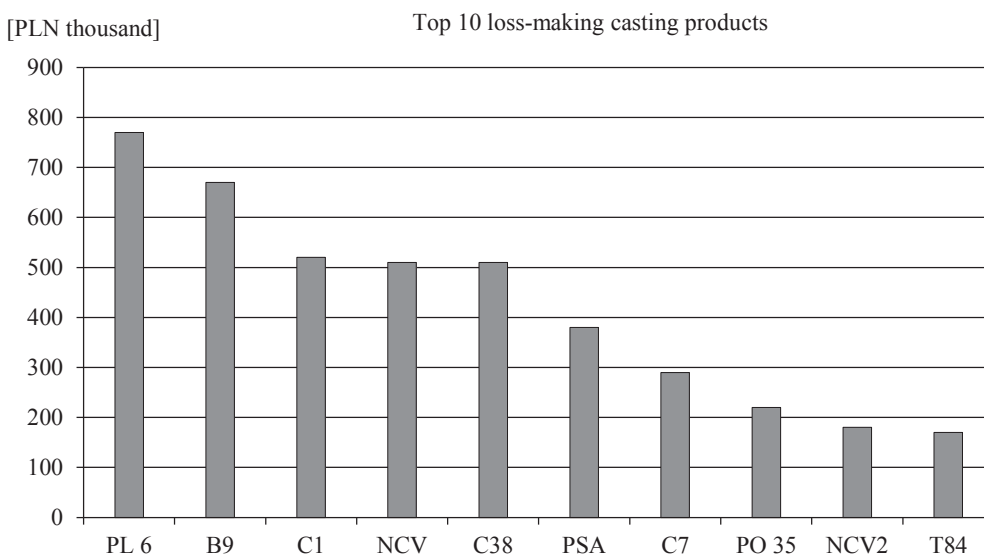

Fig. 5. The top ten products by contribution to casting losses

Source: own work.

cost of losses includes the cost of delays in special shipping in time-sensitive deliveries to the amount of PLN 0.7 million per year and the cost of complaints regarding the delivery of non-conforming products, which amounts to PLN 0.7 million per year. The cost of losses in casting adds up to PLN 0.5 million per year while the cost of losses in machining stands at PLN 0.2 million per year.

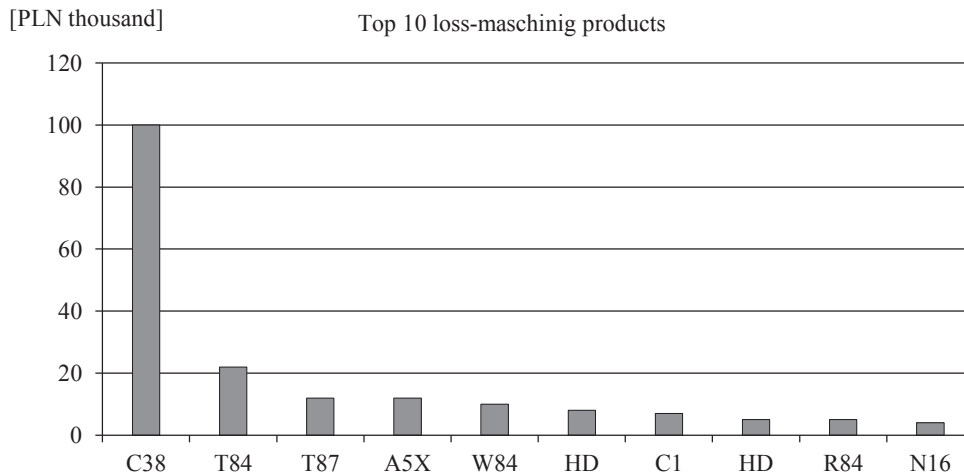

Fig. 6. The top ten products by contribution to machining losses

Source: own work.

Further research findings are obtained by analyzing the cost of losses associated with non-conforming products, which account for the largest share of the cost of losses in casting (Figure 5) and machining (Figure 6). A list of the top ten loss-making products has been compiled with a view to guiding improvement measures aimed at reducing the cost of losses. The improvement program should rely on PFMEA (Process Failure Mode and Effects Analysis), the 5 Whys method for detecting the underlying causes of issues, and lists of errors detected in manufacturing processes and through complaint analysis (the 8 disciplines problem solving method) for individual products.

3. Conclusion

Despite having an IATF-16949-standard-based quality management system in place, the company in question does not identify the full cost of quality in its managerial accounting system. In its IT system, internal cost tracking is limited to casting and machining losses, while its external cost tracking is limited to complaints and special shipments. Cost-of-loss data for individual products need to be additionally assessed outside of that system.

Today the common practice in enterprises is to mitigate the cost of losses by means of quality management. In the enterprise in question it is advisable to begin improvements in the aluminum casting unit.

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