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Research Article

Unlocking the Green Treasure Trove: Improving Resource Efficiency through Circular Economy Cost Management

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Abstract

The aim of the article is to show the usefulness of modern cost management tools in improving the efficiency of the use of company resources. Particular attention was paid to activity-based costing (ABC), including its latest concept of time-driven activity-based costing (TD ABC), target costing and kaizen costing. An important advantage of these tools is the continuous improvement of production processes and product quality, informing about activities leading to an increase in the efficiency of the company's operations in the future, about the size of resources unused in the company and related costs, as well as about possible current surpluses and shortages of operational capacity. The implementation of these tools enables more efficient use of resources and their allocation between cells. Thus, these tools support the systematic transition to a circular economy.

In order to achieve this goal, the literature on the subject was reviewed and research was carried out among enterprises from the SME sector in the context of their knowledge of the assumptions of the circular economy concept and the tools used for management (including cost management).

Keywords: activity-based costing, time-driven activity-based costing, target costing, continuous improvement costing, effective resource management

Introduction

The circular economy is a concept aimed at the rational use of resources and reducing the negative environmental impact of manufactured products. It is a response to the problems resulting from the decreasing availability of natural resources. Implementing this concept allows for sustainable development, reducing environmental pollution, business development, and increasing social well-being.

The circular economy aims to minimize the consumption of raw materials and reduce emissions and the level of energy use by creating a closed cycle of processes in which waste is used as raw materials in subsequent production

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stages. According to this concept, raw materials, materials, and products should remain in the economy as long as possible. Circular economy principles should be applied at every stage of a product's life, from design to the point where it ultimately becomes waste. The introduction of the circular economy allows ensuring greater stability of raw material prices and security of supplies, reduces the demand for new raw materials, reduces the generation of waste, and optimizes the consumption of resources used for the business, including raw materials, water and energy, and employees' time, which generates savings for the company.

The implementation of such solutions can also ensure better, more lasting relationships with customers, and be a way to stand out in the market, increase competitiveness and draw attention to increasingly aware and demanding consumers.

The introduction of the circular economy allows the company to reduce production costs and increase revenues from new areas of activity, which in turn leads to further economic development and measurable economic benefits.

Most managers are aware that they are at the initial stage of implementing this idea, and the implementation of this concept will require new activities, actions, a new vision.

The aim of the article is to show the usefulness of modern cost management tools in improving the efficiency of the use of company resources in accordance with the concept of the circular economy. Particular attention was paid to activity-based costing (ABC), including its latest concept of time-driven activity-based costing (TD ABC), target costing, and kaizen costing. An important advantage of these tools is the continuous improvement of production processes and product quality, informing about activities leading to an increase in the efficiency of the company's operations in the future, about the size of resources unused in the company and related costs, as well as about possible current surpluses and shortages of operational capacity. The implementation of these tools enables more efficient use of resources and their allocation between cells. Thus, these tools support the systematic transition to a circular economy.

To achieve this goal, a review of the literature on the subject was made.

The tools presented in the article were not created with the circular economy in mind, but according to the author, implementing them is the first step to effective resource management, eliminating waste, organizing the company's impact on the environment, and, in the longer term, transforming it towards a circular economy.

Assumptions of the circular economy

The reason for the growing interest in the term "circular economy" is not only the fulfillment of the legal requirements proposed on December 2, 2015, by the European Commission (EC) as part of the communication entitled "Closing the loop - EU action plan for the circular economy", but rather a conscious understanding of the very idea of the circular economy in the surrounding reality of rising raw material prices, deterioration of the environment or planned failure rate of products and a large amount of packaging and waste (Bachorz, 2017).

In the world literature and publications of many international organizations, the term circular economy describes, in simple terms, a model of production and consumption that consists in sharing, borrowing, reusing, repairing, renewing, and recycling existing materials and products for as long as possible. This extends the product life cycle. The European Commission has a similar view, which defines the circular economy as the value of products, materials, and resources in the economy maintained for as long as possible, and the generation of waste is limited to a minimum (Communication ... 2015).

According to the Innovative Economy Institute, the circular economy is a modern concept of creating value through the rational use of resources. It allows for minimizing the negative impact of manufactured products on the environment thanks to such changes at all stages of the product life cycle that enable the reuse of the materials used.

In the Road-map of transformation towards a circular economy, the circular economy was defined as a concept in which the value of products, materials, and raw materials should remain in circulation as long as possible, and the generation of waste should be minimized as much as possible (Roadmap.., 2019).

According to the Ellen MacArthur Foundation, circular economy means incorporating the possibility of repair and regeneration into the product design and maintaining the highest utility and value of products, components, and materials at all times, distinguishing between technical cycles (concerning non-renewable raw materials) and biological cycles (renewable raw

materials) (Ellen MacArthur Foundation, 2012). Similarly, the World Business Council for Sustainable Development (WBCSD) defines circular economy, which emphasizes that the goal of circular economy is to preserve the greatest possible value of resources, products, components, and materials and to create a system that ensures long life, optimal reuse, maintenance, regeneration, and recycling, extends the principles of circular economy, indicating: durability, renewability, reuse, repair, replacement, modernization, renovation, and reduced consumption of raw materials (WBCSD, 2017).

The presented circular economy approach contrasts with the traditional, linear economic model, which is based on the scheme produce - use – dispose of. Although, as can be seen from the quoted definitions, this new model of development is associated with already functioning approaches such as: reusing, repairing, refurbishing, and recycling products in accordance with the well-known 3Rs principle (reduce, reuse, recycle), extended to 4Rs (reuse, repair, renew, recycle) (Szyja, 2016), or sustainable supply chain management, i.e. managing the economic, social and environmental impact of the supply chain throughout the product life cycle in order to create value for all stakeholders involved in this process. However, GOZ goes further. It includes action not only on the production side but also on the consumption side. It is a systemic approach that fits into the new sharing economy, which is an element of the new, intensively developing phenomenon of the collaborative economy. Its essence is distributed networks of interrelated individuals and communities, cooperation stimulated and supported by the Internet, mobile devices, social media, and big data. Thanks to the collaborative economy, it has become possible to innovatively and effectively use the hidden wealth of resources that have not (fully) been used so far (e.g., circulation of products through sharing or lending) (Botsman, 2013).

The Circular Economy concept eliminates both the concept of the end of product life and the category of waste that gains value by becoming a resource again. The resource efficiency of the circular economy results not only from the departure from wasting resources thrown away as waste but also from their more effective use (also in connection with extending the life of products and their cycles), switching to renewable resources, and conscious consumption. All activities preceding the generation of waste at earlier stages of a product or service's life are to ensure that waste becomes secondary raw materials (if it must be generated). The essence of the circular economy is a new way of looking at the relationships between markets, customers, and resources (Jastrzębska, 2017). These goals can be achieved gradually by implementing cost management tools in the first place.

Assumptions of Cost Management

There are many definitions of cost management in the management accounting literature. However, there are no unambiguous views as to the essence and goals of this management concept. Different authors emphasize different elements in their definitions. An overview of these definitions was presented by e.g., Nowak and Wierzbiński (2010).

In Nowak's opinion (2011), the primary goal of cost management is to improve the efficiency of the use of company resources, which enables the achievement of another goal in the form of customer satisfaction. The most important way to achieve this goal is to increase the rationality of incurring costs through various actions taken to reduce them. This is related to the continuous improvement of processes and the introduction of improvements that make them more effective.

The lexicon of management reduces the concept of cost management to activities related to the effective use of resources (material, financial, information, and human) possessed by the organization to achieve the assumed goals (Romanowska & Adamska, 2004). The key role of management in controlling the use of company resources is emphasized by the International Federation of Accountants, IFAC. The International Good Practice Guidelines developed by IFAC define governance as a set of responsibilities and practices applied by the board of directors and senior management, e.g., in order to control whether the organization's resources are used in a rational way (Nowak, 2011)

According to the author, the concept of cost management should be understood as purposeful actions of managers aimed at the continuous analysis of the level and structure of costs in all areas of the company's activity, aimed at improving the efficiency of the use of its human, material, financial and information resources. Importantly, the effectiveness of these activities requires managers to obtain reliable,

useful information with specific qualitative characteristics.

The effect of applying modern methods and concepts of cost management is the rationalization of costs through the elimination of activities that do not bring value, the improvement of ineffective activities, the selection of materials appropriate in terms of quality and price already at the product design stage, modification of the organization and production methods, increasing the quality and usability of products, meeting the needs of customers in as much as possible (Wikarczyk & Szczerbak 2022).

Advantages of Modern Cost Management Tools

Activity-based costing (ABC) is a response to the need for more accurate information on the costs incurred (for the purposes of process management). Activity-based costing is one of the most important elements for effective business management. It allows for a detailed measurement of the costs of an economic entity in various areas of activity, which contributes to proper control enabling their minimization, ensures a precise determination of the actual technical cost of production, valuation of labor product inventories, and thus precise determination of the cost of sales and the financial result.

The ABC Product Cost Report lists material requirements and activities for specific products. The activity requirement list is the source of information about the activities needed to produce each product or order. It contains descriptions for individual products: orders for the sequence of actions taken to produce the finished product, quantitatively described the consumption of individual activities, costs of activities necessary to produce products and costs of individual activities per product unit (Mokrzycka, 2018). The analysis of the existing interdependencies of activities and processes, necessary to create the ABC model, is also a source of information about the involvement of resources used in individual phases of the product development processes in the company. Constructing a model provides the management with a lot of information in order to avoid redundant activities, and redundant resources, and reorganize and simplify the processes functioning in the company (Śliwiński, 2008).

Management of activities can contribute to reducing the costs of operations, including those related to waste (proposal: locating waste management as an auxiliary process to the production process, when the carrier would be e.g., the landfill area, the amount of waste imported per day/week). The management staff may carry out corrective actions, including, among others: the elimination of unprofitable products or products generating excessive waste, replacing them with substitutes, and improvement of the production process (the action may be product quality control, and the carrier may be the number of inspections carried out (Kister, 2021), investing in modern technologies, changing the policy and strategy (Kaplan & Cooper 2000).

A new variant of activity-based costing is the concept of time-driven activity-based costing (TDABC). This model simplifies the costing process. It uses one type of resource carrier - duration carriers. After determining the time necessary to complete a specific activity product and multiplying it with the calculated cost per unit of time, the cost of the activity product is calculated.

In this version of activity-based costing, resource costs are allocated directly to cost objects based on two sets of estimates:

a) the first involves determining the unit cost of production capacity by dividing the sum of the costs of ensuring the production capacity of resources (premises, equipment, technology, personnel, supervision) provided for a specific process by the total production capacity of a given economic unit;

b) the second allows determining the estimated time needed to perform a specific process related to the involvement of specific resources (production capacity), and at the same time reveal unused production capacity and costs of unused resources. Multiplying the unit cost of production capacity by the estimated commitment of production capacity to the implementation of individual processes (transactions) expressed in time informs about their costs. Compared to the traditional variant, time-driven activity-based costing makes it possible to determine the time and cost of performing individual activities focused on a specific cost object. Thanks to such a procedure, time-consuming RKD is reduced due to a simplified calculation, with a direct allocation of costs, to specific cost objects. The model is also useful for forecasting future capacity (resources)

and costs based on the expected number of activities resulting from customer orders. Accordingly, the entity may increase its resources or limit them, as well as conduct negotiations with customers, taking into account future costs and financial results.

The advantage of time-controlled RKD - in addition to the simplifications introduced - is the reduction of the behavioral burden, because fewer people decide on the results through the use of estimates, which can be helped by the ERP (Enterprise Resource Planning) system, whose software is tailored to the specific characteristics of the business entities and their size (Jaworska & Kiziukiewicz, 2018).

The key assumptions of time-controlled costing perfectly fit into the assumptions of the circular economy concept, which strives not only to process raw materials into products with higher added value but also strives to minimize the negative impact on the environment by reducing materials, energy, and resource consumption and prevents the generation of waste (OCDE 2009). In this context, target costing may also work. It is a system that leads to the determination of the assumed (target) cost of the product at the pre-production stage in order to reduce all cost components of a given product throughout its life cycle, taking into account data on costs from the research and development department, through the design, production, and marketing departments until the product is withdrawn from the market. Basically, the desired (target) selling price for a particular product is identified in the design phase and the target profit margin is subtracted to determine the target cost of manufacturing the product. In doing so, the specific quality and functionality of the product are taken into account, and the exact specification of the product and its better design and construction are prepared. In addition, various departments and areas of the company are integrated - as a result of the operation of interdisciplinary teams - during the project implementation. Aspects of research, development, design of products and technological processes, production phases, marketing, distribution, and customer service are systematically assessed (this is the so-called value analysis). The result may be, for example, streamlining production, changing the used materials to cheaper or reusable ones (Jaruga et al. 2014).

The concept of target costing, is currently considered a strategic tool for lean management accounting or strategic cost management, which is a response to the growing competition on a global scale and to the extremely dynamic development of information technology in recent years and communication. The concept was first used in Japan at Toyota Motor Corporation in the 1960s. At the end of the 1980s, other countries such as the USA, Germany, and France became interested in it. The authors of this philosophy are the Japanese scientists M. Sakurai and T. Tanaka. The target costing concept is based on a strategy that emphasizes the use of multidisciplinary financial and non-financial performance indicators. It is characterized by a market and a strategic approach to the calculation of product costs. Its purpose is to reduce product costs throughout the product life cycle, while maintaining a certain level of functionality and quality (Szychta, 2008). When analyzing the presented goals and definitions of target costing, it can be noticed that different authors perceive the goals of target costing differently. For some authors, target costing is a tool, technique, method, system, concept, or philosophy of strategic resource management that will contribute to cost reduction, for others it is a technique, system, or profit management strategy. The presented definitions also allow us to indicate the perception of target costing in two dimensions: narrow and broad. In the narrow sense, target costing is understood as a tool or technique for calculating product costs, taking into account its specific quality, functionality, and price. In a broad sense, it is perceived as a method, a system, and a philosophy of strategic management of company costs. What all definitions have in common is the fact that target costing is aimed at determining product costs in such a way that the basis for determining the acceptable cost of the product is customer expectations regarding its price, function, and quality. This approach results in extending the life of the product, which is part of the activities aimed at a circular economy.

As a result of linking or time-controlled target costing or target costing, a new cost management tool is created to support decision-making both in the long-term perspective and in relation to the short-term operation of enterprises. In addition, by using the kaizen concept, which assumes the need for permanent improvement of the organization in order to increase its quality, the unit eliminates all threats of waste of resources, time, and waste. This is due to the fact that the kaizen strategy means continuous improvement and improvement at every level of management, creating a new way of thinking and managing process-oriented. Management based

on the kaizen strategy focuses attention on the involvement of the entire team to formulate conclusions that improve processes and activities in a given unit. The technique of continuous improvement through kaizen assumes defining and recognizing the problem and introducing changes that ensure favourable conditions for achieving the goal. Kaizen is also a process of continuous quality improvement in all areas of the company (Kowalczyk, 2013).

Important issues are the activity and awareness of employees in thinking and striving for improvements and searching for better solutions. In the area of cost management, this concept is expressed by kaizen costing, i.e., cost reduction, also known as continuous improvement costing. Management in accordance with this concept enables the optimization of resource consumption by identifying places of savings (Zyznarska-Dworczak, 2012). The main task of this concept is the continuous measurement of costs and the introduction of improvements that will help eliminate the gap between the value of the planned profit and the expected profit possible to be achieved in future conditions (Papaj, 2016). A characteristic feature of kaizen costing is that each employee should look for solutions that will improve the processes for which he is responsible. Therefore, it is a continuous and uninterrupted process, carried out in small steps, of a long-term nature (Franke, 2016). The essence of kaizen costing can be considered (Niedziółka & Piasek, 2009): a strong focus on cost reduction, striving to achieve a set level of costs, continuous improvement of the production process, increasing operational efficiency, defining reduction targets on a monthly basis and comparing and analysing the resulting deviations from the cost reduction targets, agreeing with manufacturing employees on the level of cost reduction.

In Poland, there is an increasing number of organizations that have introduced or are planning to introduce cost accounting for management purposes, such as target costing, activity-based costing, time-controlled costing, or continuous improvement costing. The main reason is the benefits that can be gained by using these methods (Romaniuk, 2018). Reduction of waste, cost reduction, rationality and efficiency of the resources used, higher quality of products, and better contact with employees are just a few of the advantages of these concepts (Podobiński, 2015).

Conclusion

Cost accounting and cost management are undoubtedly the most important areas of modern management accounting. Their role and importance in managing economic units cannot be overestimated. Enterprises operating in the conditions of global competition must take into account the costs that are the effects of the actions taken. Therefore, costs should be recognized not only retrospectively but also prospectively. They should be subject to systematic measurement, which is dealt with in cost accounting. The level of costs must also be influenced, which is an important task of cost management.

Cost control should always be one of the priorities of management and managers in economic units (Doyle, 2006). Rational management of resources (because they generate costs), reducing waste, and providing maximum value to customers while minimizing costs are the key directions that modern managers should follow. These assumptions are the basis of the circular economy concept. They can be implemented e.g., by: promoting technological progress; use of information and communication technologies; organizational and social changes; increasing professional mobility; increased investment in research and development; implementation of modern cost management tools (activity-based costing, time-driven activity-based costing, target costing, continuous improvement); product market reforms - increasing durability, improving quality, cascading use of products, eco-efficiency of processes; promoting cooperation in the value chain, sharing, widespread use of renewable materials; minimizing waste by reusing, recycling, and implementing full recovery; treatment of waste - if it is generated as a potential source of secondary raw materials, e.g. for the use of waste heat or multiple water management; introducing a financial policy supporting the development of new technologies, processes, and services as well as investments and organizational solutions implementing measures towards a circular economy; education in the area of sustainable consumption.

Such activities are usually convergent with an increase in productivity and efficiency - they translate into new jobs, services, and industries, enabling a higher standard of living (Kozioł, 2004).

Poland, like many countries in the world, considers the circular economy as a way to achieve emission targets, improve living

conditions and increase the competitiveness of the economy. This model of management is also a response to difficult geopolitical times, as business innovations and the reuse of materials, raw materials, and waste make supply lines and value chains more resilient and flexible.

In order to determine future development opportunities for each economy, including Poland, it is important to understand how a given economy is today involved in the assumptions of the circular economy model. Therefore, it is important to continue research among economic entities on the level of awareness of the circular economy, and the tools used, including cost management tools, such as activity-based costing, target costing, or continuous improvement costing. These tools not only support cost management but also streamline all processes and activities in the organization. They significantly increase and strengthen the competitiveness of enterprises by improving resource management, eliminating unnecessary waste, and limiting the harmful impact of economic activity on the environment.

The educational market faces an important task - providing information to the managers of enterprises, especially from the SME sector, about the possibilities offered by modern cost management tools. Emphasizing that these tools not only play a role in better cost control, but above all they are used to effectively use resources. Such arguments and examples may encourage managers aware of the requirements of the modern environment to implement them.

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