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INTEGRATED COST ACCOUNTING FOR QUALITY AND ENVIRONMENTAL PROTECTION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

Abstract

Objective: Presentation of a modern approach to managing quality costs and environmental protection costs in the context of sustainable development requirements and actions taken in this area in the Polish economy.

Research methodology: The method of critical analysis of scientific literature in the field of quality cost management, environmental protection costs, and accounting was used. Induction and deduction methods were used. In the empirical part, research was conducted – interviews on the comprehensibility and usefulness of the integrated cost accounting for quality and environmental protection.

Findings/Outcomes: The article indicates that because traditional cost measurement accounts are characterized by low accuracy and low cost of measuring quality costs and environmental costs, it is reasonable to implement and use an integrated quality and environmental protection account, especially in the era of sustainable development requirements.

Originality/value: The added value of the article is an example of an integrated model of quality costing and environmental protection costs developed by the authors to be used in enterprises and the resulting conclusions from the conducted research, which can be a recommendation for practice.

Keywords: *quality costs, environmental protection costs, sustainable development, integrated quality and environmental protection cost accounting, cost management*

Introduction

In the current reality, the survival and development of each enterprise are determined by the knowledge and understanding of the environment in which the entity operates.

Practice shows that the role of environmental protection and the costs incurred in this area is increasing, as well as the role of quality, which occupies an increasingly significant place in the activities of enterprises. Issues related to the broadly understood quality of the product and the activities of the company are an important factor in the management process (Ekins, Zenghelis, 2021, pp.949-950).

The most important source of information on the company's operating costs is undoubtedly the cost account, which is an element of the management

information system in general, and cost management in particular. Properly conducted cost accounting is used to determine the effects and enables control over economy and is the basis for making the right economic decisions (Chenhall, 2003, pp. 127-168).

Karmańska 2023, Sadowski, Kołodziejczyk 2017, Sadkowski 2020, Szadziewska, Majchrzak Remlein, Szychta 2021 emphasize that the more detailed the cost classification, the greater the possibilities of minimizing waste, optimizing resource management and achieving better financial results.

Cost management is a concept that encompasses activities aimed at improving the efficiency of resource use. The costs incurred by the company reflect the quality of work in various areas of its operations. In order to take actions to rationalize costs, organizations must have the information necessary to achieve this goal (Bragg, 2018). The most important source of information regarding the costs of an enterprise's operations is undoubtedly cost accounting, which is an important element of the management information system in general and cost management in particular (Drury, 2019).

Meanwhile, the literature search indicates that both the costs of quality and the costs of environmental protection have not been precisely defined, and so far there has not been developed and adopted tool providing managers with integrated information on the costs of quality and environmental protection incurred (Haddab, Daim, Muhsin, 2020 pp. 174-175). In the context of the above, an attempt was made to develop an integrated account of quality costs and environmental protection costs.

The main purpose of the study is to present an integrated account of quality costs and environmental protection costs in the context of the requirements of the concept of sustainable development and the benefits that enterprises may have from the information contained therein. In order to achieve this goal, the essence and importance of the concept of sustainable development were discussed, including activities for sustainable development in the Polish economy. A query of the literature on the subject was made in terms of the systematics of quality costs and environmental protection costs. In the current reality, the survival and development of each enterprise are determined by the knowledge and understanding of the environment in which the entity operates.

The empirical part of the study presents an integrated model of accounting for quality costs and environmental protection costs, which, according to the authors, should be used in every enterprise. An interview was conducted with the management staff of 62 entities in order to assess the comprehensibility and usefulness of the proposed integrated cost accounting for quality and environmental protection.

In conclusion, outcomes and recommendations for practice were formulated.

The essence and importance of sustainable development

Sustainable Development is a term that is still gaining in popularity. It is defined and interpreted in many different ways. The concept of sustainable development, which closely links ecological, economic and social issues, was defined in the Brundtland Commission Report (1987) prepared for the UN. This report and the statements it contained directly became the basis for the ground breaking UN conference *Environment and Development* in Rio de Janeiro in 1992. Since then, as a result of the conventions adopted in Rio, indications for the implementation of the principles of sustainable development (SD) have been systematically included in the guidelines of both – strategic international policies and national documents as well as those formulated at the local level. Poland fully implemented them into its legislation and was even a pioneer in the implementation (Ciechanowicz-Mclean, 2015, p. 62). In September 2015, at the United Nations General Assembly, countries from around the world signed the 2030 Agenda for Sustainable Development and committed to implementing its 17 Sustainable Development Goals. Representatives from countries around the world pledged to eradicate poverty, protect the planet and ensure peace and prosperity for all people (https://sdgs.un.org/2030agenda).

The goals contained in the Agenda can be divided into 5 areas: people, planet, prosperity, peace and partnership. The 2030 Agenda, together with the Paris Climate Agreement, sets out an action plan for building a better world and a global framework for international cooperation in the field of sustainable

development and its economic, social, environmental and administrative dimensions. According to Bojar-Fijałkowski, full identification of the subjective human right to an environment of appropriate quality, development carried out in accordance with the assumptions of economic environmental law, can create an opportunity for a more complete implementation of the idea of ecological justice, both in the intra – and intergenerational dimension (Bojar-Fijałkowski 2018, p. 30). The contemporary modernization effort should focus on eliminating poverty in all its manifestations, while simultaneously achieving a number of economic, social and environmental goals, constituting a continuation of global efforts to improve the quality of life of all people in the world. The agenda, in addition to such priorities as health, education, nutrition and food security, indicates a number of economic, social and environmental goals, striving to transform economies in such a way as to create the basis for long-term, sustainable growth, leading to the creation of new jobs. The complexity and interpenetration of the SDGs require broad commitment and responsible cooperation, which is why it is important to translate the global goals into national, regional and local contexts and to raise awareness of their importance for everyone. Article 21 of the Agenda recognizes the responsibility of each State for its implementation at national, regional and global levels, taking into account realities, opportunities and levels of development, based on respect for national development policies and priorities.

The basic goal of implementing the concept of sustainable development is to reduce the imbalance between economic growth, social development and the natural environment (Poskrobko, 2009, pp. 25–29).

Trojanowski points out that sustainable development of enterprises is taking actions aimed at achieving their basic economic goal and supplementing it with issues related to taking care of the social and environmental aspects of its operation (in accordance with accepted ecological standards). The implementation of *the company's financial goals must take into account social and ecological aspects as the main areas of sustainable development* (Trojanowski, 2015, p. 240). Gryga writes that the basis for building a sustainable and sustainable company is sustainable production and consumption. It draws attention to the modernization of production, leading to optimization of processes, reduction of energy and materials, as well as effective dialogue between entrepreneurs

and state authorities" (Gryga, 2016, p. 23). Mazur-Wierzbicka expresses sustainable development through three areas: ecological, economic and social (Mazur-Wierzbicka, 2005, pp. 33–37). It is also necessary to introduce an organizational management system that allows for monitoring and adjusting to external conditions (Lorek, 2015, pp. 17–20).

In Poland, the issue of sustainable development gained constitutional and statutory importance in the 1990s (Boltromiuk 2003, pp. 44–49). The sustainable development paradigm was enshrined for the first time in the Polish Constitution of 1997 and thus became of fundamental importance.

Another legal act in force in Poland regulating the discussed issues is the Environmental Protection Law of 2001, where sustainable development is understood as: socio-economic development, in which the process of integrating political, economic and social activities takes place, while maintaining the natural balance and the durability of basic natural processes (Environmental Protection Law 2001, Article 3, point 50). Jezowski considers the presented definition to be the most complete, because it is based not only on the principle of integrating the natural, economic, social and political spheres, but also on the principle of equal opportunities for access to resources and intergenerational justice (Jezowski 2002, p. 47). In turn, Gorka and others emphasize that the essence of the concept of sustainable development is such a way of doing business, using the potential of the environment and organizing society, which ensures the dynamic development of production processes, sustainable use of natural resources and achieving a high quality of life (Gorka, Poskrobko and Radecki 2001).

Economic sustainability requires increasing the company's profitability through efficient use of resources. Ecological sustainability requires preventing harmful and irreversible consequences for the environment through the efficient use of natural resources, by promoting renewable resources, protecting soil, water, and skillful waste management (Szczerbak 2022, pp. 29-30). Social sustainability requires responding to the needs of society, including all other stakeholders (Abidin, Pasquire, 2007, p. 277).

The concept of sustainable development also guarantees to conduct an ethical, ecological and economic business, based on common values shared by stakeholder groups grouped around the company (Arnold, 2010, p. 20).

Business entities that take action to reduce pollutant emissions and the amount of waste contribute to maintaining the continuity of processes related to the protection of natural resources and the sustainability of economic processes (Hilson, Murcka 2000, pp. 228-229). Sustainable development in enterprises is also related to the need to adapt to changing environmental conditions, continuous learning and reorientation of the company's goals toward increasing value for contractors (Grudzewski et al. 2010, p. 27). However, this entails the need to meet many demands, such as determining the company's impact on its environment, or building an image based on a positive impact on the environment and society. (Burchell 2008, pp. 111-118).

The implementation of the principles of sustainable development in practical terms manifested itself in the development of the EN – ISO 14001 Environmental Management Systems – Requirements standard, which became a guide for enterprises in the implementation of pro-ecological behavior. Adamczyk lists – in line with the sustainable development strategy – specific, unique and ecological instruments of competition that can be used by enterprises (Adamczyk, 2001, p. 122):

Integrated account of quality costs and environmental protection costs

The search for ways to optimize costs is a strategic factor when implementing the principles of comprehensive quality management in the company. It should be emphasized that the size and structure of costs should be helpful to the company's management in the selection and implementation of long-term plans. At the same time, it is necessary to know the number of costs and the basic relations between them. Therefore, cost information must be available, understandable, comprehensively analysed and used in decision making.

The economic calculation of enterprises usually reflects only those costs of using resources and natural environment values that are related to achieving their financial results, but environmental costs arising from non-equivalent destruction and use of elements of the natural environment are not. Their use is to lead to reducing the nuisance of the activities carried out in enterprises,

and thus to maintaining the assumed level of quality of the natural environment. According to Dobrzanski (2010, pp. 314–323), these tools are in the nature of control norms, defining tasks, directions and methods of action in the field of environmental protection.

Both the increase in the importance of environmental protection in the activities of enterprises and the expected increase in the quality of manufactured products or services render it necessary to obtain information on the impact of the company's operations on the natural environment, including environmental costs and knowledge of the costs of maintaining quality. A special role in providing this type of data is played by the cost accounting maintained by the economic entity, which is part of its accounting system (Famielec, Stępien, 2005; Karmanska 2007, Szadziewska 2010).

On the basis of the cost classification presented in the literature and author's observations, an attempt was made to create an integrated account of quality costs and environmental protection costs. A prerequisite for determining the above-mentioned costs is to determine the impact of the business entity's activity on the natural environment and the needs related to the implementation of the environmental and quality objectives set in it, and to identify the activities and processes in which these costs occur. Processes and activities will generate quality costs or environmental protection costs to varying degrees. Are Some more noticeable, others more difficult to identify. In each enterprise, the strength of this relationship will be different due to the type of activity, its scope and activities performed in the organization.

The classifications of quality costs and environmental protection costs presented in the literature confirm the diversity of authors' approaches to the issues related to this issue (Hansen et al. 2007, Karmanska 2007, p. 326-328, 362-363, Szczypa 2011, p. 495-496, Sadkowski 2020, p.115).

Along with the development of interest in quality and environmental protection, various categorizations of costs were created, the types of which interpenetrate in the structure, and new elements used for division appear, such as the costs of lost profits (the so-called hidden estimated costs). The most important criterion for the division of costs related to quality or environmental protection is their availability. Most, however, are hidden costs, and those visible and easily are relatively few (this applies in particular to quality

costs). From the point of view of the company, which strives to increase the effectiveness of management systems, improve quality and optimize the costs associated with it, it is crucial and causing the most problems – to identify their places of origin, so that they are recorded according to actual places of origin, not places of disclosure (Sadowski, Kolodziejczyk 2017, p. 374).

The authors, attempting to create an integrated account of quality costs and environmental protection costs (Table 1), took into account such cost items that will not be difficult to identify and, most importantly, to estimate in enterprises. The key seems to be the category that refers to hidden estimated costs and includes many cost items that are not easy to analyse and estimate at first glance. For example, these are lost sales revenue as a result of poor quality in the past. A way of calculating these costs may be to estimate them on the basis of information on lost orders or lost market shares. If companies want to calculate such costs, they must manage the risk of such losses and make a detailed analysis of important losses resulting from critical errors. Then entities can estimate these costs based on the loss analyses that have been recorded and the information. Therefore, they can be referred to as hidden estimated costs (Yang 2008, pp. 179-180).

The indicator of the share of quality and environmental protection costs in total costs allows customers to assess how important it is for the company to take care of quality and environmental protection in total costs. Such information may contribute to building a positive image of the company, which in turn may translate into greater customer interest and positive relations with other stakeholders, such as employees, suppliers or investors. In addition, customers increasingly demand that companies manufacture their products and provide services in accordance with quality and ecological standards. In practice, it is assumed that the share of quality and environmental protection costs in total costs may have a significant impact on the company's financial results (Żukowska et al., 2016, p. 13).

In the period January – March 2023, 62 interviews were conducted with representatives of companies (service, production and construction) in the Mazowieckie Voivodship on the comprehensibility, usefulness and usefulness of the developed integrated cost accounting for quality and environmental protection. The interview was conducted by employees of one of the accounting

and tax offices serving some companies. The managers of the surveyed enterprises were asked five questions in the order indicated in Table 2 in a way that did not suggest answers. Based on the recorded answers, the authors analysed the results.

Most of the respondents are familiar with the concept of sustainable development. Most often perceived as the impact of the company's activities on the environment. For 44 companies that had implemented the ISO 9001 and/or ISO 14001 systems, the report was understandable, legible and useful. Opportunity costs were of great interest among this group of managers. On the one hand, it raised doubts as to their estimation, on the other hand, its amount and impact on the costs incurred. The remaining 16 enterprises considered such a bill as useless. The arguments were mainly:

1. excessive detail of integrated cost accounting items,
2. type of activity conducted by the surveyed enterprises,
3. the costs of its preparation.

In addition, in these organizations, the vast majority (about 80%) of cost items related to quality was not identifiable due to the lack of an implemented quality management system. It is worth emphasizing at this point that the type of business activity should not be the reason for not taking the initiative in the management of quality costs and environmental protection costs. The integrated cost accounting presented by the authors can be used by enterprises regardless of the type of business activity. The purpose of its presentation is primarily to provide information on the development of quality costs and environmental protection costs in various sections, as well as the impact of these costs on the company's financial results.

Conclusion

The business priorities for the managerial staff of Polish and global companies is to change the management of operational activities in order to improve cost efficiency. For a long time, companies have achieved a competitive advantage, e.g. due to lower operating costs or improved quality. However, today's

economic realities pose further challenges to them. We need to *enter* the next level of economic development. The introduction of new solutions – regarding cost accounting, such as quality cost accounting and environmental protection cost accounting – by enterprises (especially from the SME sector) will be a phenomenon that proves the increasing market maturity of this type of entity.

Based on the query of the literature on the subject and the analysis of the conducted research, the authors formulated the following conclusions, which may constitute recommendations for practice:

1. The concept of sustainable development is one of the newest strategies of economic development, as it is the only one in contemporary economic theory that comprehensively addresses the problem of the long-term ability of the economy and society to develop, taking into account the aspects of environmental protection.
2. Enterprises have difficulties with measuring, recording and settling quality costs and environmental costs, which is related to the lack of uniform solutions in this field. This results in low usefulness in effective cost management.
3. Recording, analysis and use of the quality cost and environmental protection cost account is enabled by a well-designed, implemented and constantly improved quality management system. Enterprises that have implemented such a system are able to estimate and identify the costs of its operation faster and more accurately.
4. Traditional cost measurement accounts are characterized by low accuracy and low cost of measuring quality costs and environmental costs.
5. The need to obtain relevant and reliable information on environmental costs (necessary for reporting and decision-making purposes) requires companies to introduce appropriate solutions to their cost accounting systems.
6. New cost measurement systems should eliminate the shortcomings of the existing systems. Although they may initially turn out to be cost-intensive, the advantage of benefits over costs in the long term (learning path) should eliminate this shortcoming.

7. The integrated cost accounting proposed by the authors (including the costs of environmental protection and quality costs) may be a solution for many enterprises, regardless of their size and industry.

In the light of the formulated conclusions, the authors postulate the continuation of research in the field of identifying quality costs (especially hidden costs) and environmental protection costs, their impact on the company's results and assessing the usefulness of the proposed integrated quality and environmental protection cost accounting, taking into account the division into industries and sectors in which enterprises operate.

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Table 1. *Integrated account of quality costs and environmental protection costs.*

COST ITEMS		CURRENT PERIOD	PAST PERIOD
QUALITY COSTS		2022	2021
A. Costs of prevention/preventive activities:			
1.	A. Development of quality programs – external consulting cost, services invoice Internal (settlement number of man-hours)		
1.	B. Development of quality programs – internal costs (hourly rate[1] x number of hours)		
2.	Implementation of the ISO 9001-2015 quality management system (development of full documentation, including the organizational context of the entity, Implementation of the ISO system (date, year) Operating income in the year of ISO implementation		
3.	Remuneration of the quality management representative		
4.	Suppliers evaluation		
5.	Process quality control		
6.	Maintaining and developing the quality management system		
7.	A. Training and development of employee awareness - external trainings		

[1] Average hourly rate in 2022 = Total Employment Cost / Number of Employees/ 168 hours

7.	B. Training and development of employee awareness - internal trainings (hourly rate of the manager conducting training[2] x number of hours)		
8.	Other costs		
B. Quality Assessment Costs:			
1.	Testing and inspection of input materials		
2.	Trial and inspection of own products/services		
3.	Maintenance and calibration of test and inspection instruments		
4.	Measuring equipment and testing equipment		
5.	Document reviews/man hours (internal auditor)		
6.	Internal audits - (Valuation using used man-hours)		
7.	External Audit - Invoice		
8.	Other Costs		
C. Costs of internal non-compliance:			
1.	Fixing defects (Quoting using man-hours used)		
2.	Unplanned breaks		
3.	Repeated service/processing		
4.	Implementation of preventive actions, valuation using man-hours used		
5.	Other costs		
D. Costs of external non-compliance:			
1.	Creation of a complaints department		
2.	Replacement of damaged products/part		
3.	Repetition of the service (Price based on used man-hours)		
4.	Correcting the defect		
5.	Discounts, rebates -ADJUSTING INVOICE-		
6.	Reimbursement - INVOICE		
7.	Costs of specialists' opinions - EXTERNAL SERVICES		
8.	Implementation of preventive actions - valuation of employee training		
9.	Other Costs		
E. Opportunity costs			
1.	Loss of revenue due to the departure of existing customers		
2.	Loss of potential customers (Number of meetings with potential customers, valuation of potential contracts)		

[2] Average hourly rate in 2022 = Total Cost of Management / Number of Managers/ 168 hours

3.	Loss of potential sales growth resulting from providing customers with non-compliant products		
4.	Loss of customer loyalty[3] (Total revenue in year n / Number of customers in year n)		
5.	Costs of rebuilding customer loyalty		
6.	Conflicts, disputes between departments (WORKING HOURS)		
7.	Other Costs		
ENVIRONMENTAL PROTECTION COSTS			
A. Costs of using the environment			
1.	Fees for using the environment.		
2.	Eco taxes		
3.	Charges for waste storage		
4.	Water consumption charges		
5.	Charges for electricity consumption		
6.	Charges for the emission of gases and dust into the air		
7.	Fee for sewage disposal		
8.	Fees for mining activities		
9.	Charges for substances that deplete the ozone layer		
10.	Operating and license fees		
11.	Other fees for using the environment (gas)		
12.	Fees for pollution removal		
13.	Wastewater treatment costs		
14.	Consumption of environmental resources: coal, biomass, etc.		
15.	Consumption of office supplies		
16.	Consumption of household materials		
17.	Operating and license fees,		
18.	Transportation of fuels and environmental raw materials		
19.	Depreciation of fixed assets involved in environmental protection (protective devices, filters, screens, sewage treatment plant, etc.),		
20.	Costs of devices for monitoring and measuring the company's environmental impact		
21.	Inspections of protective devices		
22.	Fees for removing trees and bushes		
23.	Remuneration of employees of environmental protection services		

[3] Total revenue/ Number of customers

24. Social insurance and other ZUS contributions for service employees		
25. Business trips of employees of environmental protection services		
26. Other Costs		
B. Costs of prevention for environmental protection:		
1. Employee training in the field of environmental protection,		
2. Ecological risk insurance costs,		
3. Amortization of intangible assets involved in preventing environmental non-compliance (licences, patents)		
4. Costs of advertising organic products (expenditure related to commercial information, participation in fairs, advertising products),		
5. External Environmental Management Services		
6. Designing processes and products (implementation of cleaner production projects) - research and development of the environment		
7. Control of environmental hazards		
8. Development of environmental management systems		
9. Product recycling		
10. Reducing emissions by switching fuel		
11. Obtaining the ISO 14001 certificate		
12. Investments in cleaner technologies		
13. Expenditures on integrated investments		
14. Installation of electrostatic precipitators		
15. Other investments reducing emissions		
16. Employee training in the field of environmental protection,		
17. Other Costs		
C. Environmental Protection Assessment Costs:		
1. Audit of environmental activities		
2. Product and process control		
3. Noise measurement in facilities		
4. Pollution level measurement		
5. Water quality measurement		
6. Measurement of pollution and noise concentrations		
7. Analysis of electromagnetic fields		

8.	Water quality tests, expertise in the field of pro-ecological innovations		
9.	Other Costs		
D. Costs of non-compliance with environmental protection requirements:			
1.	Treatment and disposal of toxic waste		
2.	Medical care due to air pollution		
3.	Removal of the effects of ecological failures (in and outside the company, pollution of the lake, water, soil, air)		
4.	Remuneration of employees of environmental protection services for work in connection with the elimination of emerging threats		
5.	Social insurance, protective and working clothes, preventive and regenerative meals and other benefits for employees of environmental protection services,		
6.	Services of liquidation of the effects of ecological failures		
7.	Other costs		
E. Restitution costs:			
1.	Costs incurred to replace used (destroyed) environmental resources		
2.	Costs of liquidation of the effects of the conducted production activity		
3.	Other Costs		
I.	**TOTAL OPERATING COSTS**		
II.	**TOTAL REVENUE OF THE COMPANY INCLUDING REVENUE FROM ENVIRONMENTAL PROTECTION: SUBSIDIES, AWARDS, REVENUE FROM WASTE RECYCLING**		
III.	**PERCENTAGE SHARE OF QUALITY AND ENVIRONMENTAL PROTECTION COSTS IN TOTAL COSTS**		
IV.	**PERCENTAGE SHARE OF QUALITY AND ENVIRONMENTAL PROTECTION COSTS IN TOTAL REVENUE**		
V.	**ANNUAL OPERATING REVENUES IN THE PERIOD OF ISO IMPLEMENTATION**		

Source: Own elaboration based on the systematics of costs presented in: Hansen D.R, Mowen M.M., Guang L. (2007).

Table 2. *Interview Questionnaire.*

1.	Is the company familiar with the principles of the concept of sustainable development?
2.	Is there a quality management system in place?
3.	Does the company pay attention to quality costs?
4.	Is an environmental cost report prepared?
5.	Is the integrated cost accounting of quality and environmental protection understandable and useful for management purposes?

Source: Self-Elaboration.