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IDENTIFICATION, MEASUREMENT AND RECORDING OF ENVIRONMENTAL COSTS: THE CASE OF COMPANIES IN SERBIA

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Starting from the importance of proper identification, allocation, and management of costs, as well as the fact that, in addition to the economic dimension, the ecological aspect is also crucial for company operations – and considering the low level of the integration of environmental aspects into accounting practices – this paper aims to examine the extent to which companies are familiar with environmental cost-accounting methods and whether practices differ depending on the implementation of the ISO 14001 standard. The research was conducted on a sample of companies obliged to report data to the National Register of Pollution Sources. The data analysis was carried out using quantitative statistical methods, primarily descriptive statistics and non-parametric tests. The results indicate that companies pursue a reactive environmental policy, recognizing costs only after they occur, while preventive measures are neglected. Environmental costs are often hidden within general costs due to reliance on traditional accounting methods. It is concluded that the main issues are an inadequate regulatory framework and a lack of motivation. The research highlights the need for systemic changes, greater company motivation, and the improvement of the regulatory framework.

Keywords: environmental costs, environmental accounting, cost-accounting methodologies, ISO 14001

JEL Classification: M41, M49, Q59

INTRODUCTION

Throughout history, companies were not required to worry about pollution and were relatively indifferent to whether their air emissions reduced air quality, whether they discharged untreated wastewater into rivers, or whether they endangered plant and animal life or not. This indifference stemmed from a deeply rooted perception that there was an abundance of resources that organizations and individuals could use without affecting the environment. However, environmental issues are now an integral part of modern business strategies. A. Susanto and

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M. Meiryani (2019) suggest that a company's response to environmental challenges is crucial not only for the environment itself but also for the development of its corporate image, sustainable practices, and environmental certification. These aspects enhance a company's reputation and improve managers' understanding of environmental issues and their responsibilities toward society as a whole.

Companies are facing increasing pressure to demonstrate the value and performance of their Environmental Management Systems (EMS). Managers are also becoming more aware of the benefits of properly identifying, measuring, allocating, and recording environmental costs (Stanescu, Cucui, Ionescu, Paschia, Coman, Nicolau, Uzlau & Lixandru, 2021; Broccardo, Giordino, Yaqub & Alshibani, 2024). Experience shows that managers have very limited access to current cost-accounting documentation and are generally aware of only a small portion of total environmental protection costs. On the other hand, financial controllers hold most of the relevant information but are unable to isolate environmental costs without further guidance from cost accounting. Therefore, companies should rely on cost accounting to correctly identify and measure environmental costs before allocating them to the appropriate production activity and before implementing control measures (UNDSD, 2001; IFAC, 2005). In doing so, the company will not only reduce costs but also its negative environmental impact, operating in line with the Sustainable Development Goals (European Commission, 2023), thereby improving the overall quality of society (Wedasuari, Yintayani & Sudana, 2022). For these reasons, government institutions should exert institutional pressure by creating environmental protection laws and encouraging companies and media to report on environmental issues (Deb, Rahman & Rahman, 2023; Wiredu, Osei Agyemang & Agbadzidah, 2023).

Environmental accounting can significantly influence the measurement, identification, and disclosure of valuable information on the environmental impact of a company's activities (Üçoğlu, 2022; Ratmono, Mail, Cahyonowati & Janie, 2024). It also helps organizations identify resource usage and the environmental costs arising from their operations (Schaltegger, Christ, Wenzig & Burritt, 2022). The calculation of environmental costs contributes to corporate sustainability by identifying environmental protection costs, which are often "overlooked" in conventional cost accounting. The efficient calculation of environmental costs is essential for identifying and quantifying environmental protection costs, which are often hidden among general overheads (UNDSD, 2001; IFAC, 2005). As a result, production management is neither motivated to reduce them nor aware of their magnitude and impact, which is particularly important given that environmental costs can account for more than 20% of total operating costs (Ditz, Ranganathan & Banks, 1995; Expósito, 2018).

The calculation of environmental costs is still in its early stages in developing countries (Nyide & Lekhanya, 2016), as priority is given to issues such as unemployment, reducing inflation rates, infrastructure development, and the like. Consequently, there is limited empirical evidence on companies' attitudes toward the identification, measurement, allocation, and recording of environmental costs, as well as their reporting. Therefore, the subject of this research is the identification, measurement, and recording of environmental costs in companies operating in Serbia. The paper aims to examine the extent to which companies are familiar with the methods of environmental cost accounting and whether practices differ depending on the implementation of the ISO 14001 standard.

The study was conducted on a sample of the companies that are required to submit data on environmental pollution sources to the National Register of Pollution Sources (NRPS) in compliance with the provisions of the Protocol on Pollutant Release and Transfer Registers (PRTR) (https://sepa.gov.rs/prtr-registar/). The data had been collected through interviews and a questionnaire distributed to the management of each company in the sample. The data analysis was conducted using descriptive statistics and non-parametric tests.

The study contributes to the literature in three ways. Firstly, environmental accounting is increasingly gaining attention in both the academic literature and practice, as environmental costs can be significant

for certain industrial sectors. This is supported by studies conducted more than thirty years ago, such as the study by D. Ditz *et al* (1995), which showed that environmental costs in the Yorktown refinery accounted for at least 22% of operating costs, as well as more recent studies, such as A. Expósito (2018), which found that environmental costs represented 20% of the total costs of the water supply service in the agricultural sector in the river basin areas of the Spanish Mediterranean. Therefore, the first contribution of this study relates to the literature on the share of environmental costs in total costs, as well as the approaches to identifying and assessing environmental costs. The study provides the evidence of a relatively low share of environmental costs in the total costs of Serbian companies and the excessive reliance of Serbian companies on traditional cost-accounting methods.

Secondly, environmental regulations have become significantly stricter in many countries (e.g. Germany, Sweden, the Netherlands, France, Japan, and Canada), and they are expected to become even more stringent in the future. Non-compliance with the law often results in substantial fines and penalties, creating strong incentives for adherence. However, even if a company complies with the law, this does not mean that it will avoid high environmental costs. Therefore, it becomes an important business objective to choose the most cost-effective way to comply with regulations and minimize the company's environmental impact. To achieve this goal, companies must measure and manage environmental costs. The second contribution of this study thus relates to the literature on the relative importance of environmental regulation in influencing companies to keep records of the environmental impact of their business activities. The study provides the evidence that the companies included in the sample almost exclusively keep records of internal failure costs and only consider those environmental costs they are legally required to account for.

Thirdly, the growing environmental awareness among consumers and the pressure from environmentally responsible competitors are becoming a significant competitive challenge for companies. To respond to these pressures, companies must pay attention to their environmental impact, as well as the management of environmental costs. Therefore, the third contribution of this study relates to the literature on the relationship between specific efforts made by companies to improve their competitive position and the records they keep of their environmental impact. The study provides the evidence that the implementation of the ISO 14001 standards and the decision to include environmental costs in the cost calculation of finished products (CCFP) significantly influence certain records, particularly those of potential environmental liabilities, environmental obligations, and costs.

The paper is structured into five sections. After the introduction, it provides the theoretical framework of the study and a review of previous research. The third section explains the research methodology. The results of the empirical study are presented in the fourth section. Finally, the fifth section offers conclusions and points out the limitations and possible directions for future research.

THEORETICAL FRAMEWORK, REVIEW OF PREVIOUS RESEARCH, AND DEVELOPMENT OF RESEARCH QUESTIONS

The interest in identifying, measuring, allocating, and recording environmental costs is relatively recent. Namely, as long as the public was insufficiently concerned about the damage companies caused to the environment, the legal system allowed polluters to shift the costs of cleanup onto society. However, social expectations have changed, and society has begun to demand that companies reduce their negative environmental impacts. Additionally, changes in legislation and consumer pressures are the factors that have created the need to account for environmental costs using various methodological approaches. Developed accounting procedures regarding environmental costs contribute to improving environmental protection activities, the sustainable development of companies, and the enhancement of community relations (Figure 1).

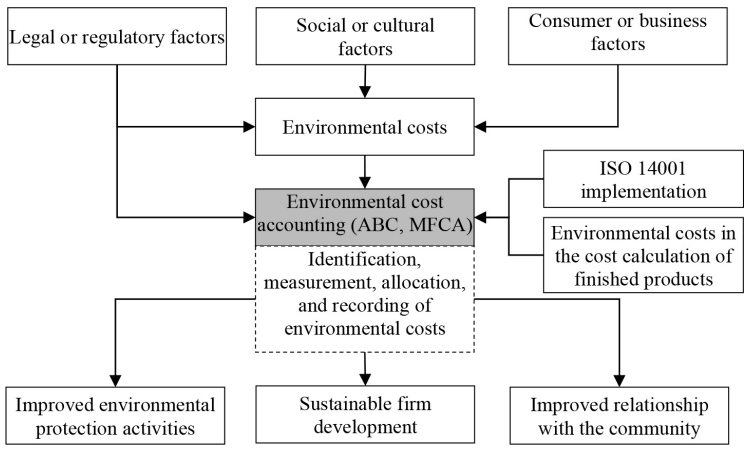

Figure 1 The summary of a theoretical framework and previous research

Source: Authors

The theoretical framework and the results of the previous studies presented below, and summarized in Figure 1, are the starting point for formulating the research questions.

Environmental costs

Environmental costs are often hidden, related to the occurrence of a certain event, and intangible, whereas some arise before the start of certain activities, and some arise potentially in the future. The key challenge for the accounting profession regarding environmental costs is their precise and complete identification. Like other costs, environmental costs can be defined and classified in different ways (UNDSD, 2001; Wang, Wang, Zhu & Li, 2018; Gonzalez & Peña-Vinces, 2022).

The United States Environmental Protection Agency (EPA, 1995) defines environmental costs as the costs with a direct financial impact on a company (private costs), individuals, society, and the environment (societal costs), but points out that a firm's definition of environmental costs depends on how it intends to use the information on them. In some countries, it is legally determined for tax and/or statistical purposes that environmental costs include the costs of labor and equipment generally used to improve the environmental impact of the firm. For some companies, however, this definition does not include the essential element – the total cost of waste.

As waste indicates production inefficiency, the costs of waste materials, capital and labor, as well as the costs and taxes linked to creating landfills, should also be considered. A review of several projects conducted by companies mainly in Austria and Germany carried out by the Berlin Institute for Ecological Economy Research, Augsburg Institute for Management and Environment, and the Technical University of Graz, showed that the costs of waste disposal typically accounted for 1-10% of total environmental costs, whereas the costs of acquiring wasted materials represented 40-90% of environmental costs, depending on the business sector (UNDSD, 2001).

Given that there are different definitions of environmental costs, R. L. Burritt (2004) points out that five classifications deserve to be paid special attention to when defining and determining the importance of environmental costs in business operations. These five classifications are based on:

- conventional cost accounting – the job and the process; direct and indirect; historical and standard; fixed and variable; ordinary and extraordinary;
- measurability – conventional; indirect hidden; less tangible; contingent; societal;

- quality – prevention; assessment (appraisal); internal and external failures;
- the life cycle and activities – the life cycle; research and development; design; production etc.; activity-based; unit; batch; product sustaining; facility-level; and
- the target audience – internal (managers, employees) and external (shareholders, tax and environmental agencies, suppliers, creditors, the public, local communities, etc.).

In addition to this classification, C. C. Gonzalez and J. Peña-Vinces (2022) point out that environmental costs can be classified as the costs of a) prevention, b) detection, c) internal failures, and d) external failures.

Both theory and practice suggest that there is no universally accepted classification of environmental costs, as it is influenced by numerous factors. Considering the subject and the aim of this research, the study will adopt the classification of environmental costs proposed by C. C. Gonzalez and J. Peña-Vinces (2022), which aligns with the classification of quality costs.

The determinants of environmental costs

Companies usually incur environmental costs for three reasons: 1) legal or regulatory, 2) social or cultural, and 3) consumer or business. The knowledge of environmental costs and their causes can lead to the process redesign that results in less material use and fewer pollutant emissions into the environment (the interaction between innovation and cost reduction incentives). By reducing costs in the present and the future, the company is expected to become more competitive.

The above indicates that information on environmental costs is important for a company for several reasons. It improves the decision-making process (Doorasamy, 2015; Rounaghi, 2019), serves as support for financial disclosure (Hubbard, 2006; Okafor, 2018), improves the efficiency of waste management (Yousefloo & Babazadeh, 2020), and boosts a company's performance, especially through ecological innovations (Gerged, Zahoor & Cowton, 2024). Additionally, under the polluter pays principle, environmental costs are included in the price of the product, which leads to an increase in sales prices (Herrera Diaz, Scouse & Kelley, 2022). Environmental costs are determined by the nature of the activity itself, the approach to creating the product assortment, the choice of technological processes, and the use of equipment to achieve the goals of sustainable development.

There is evidence that environmental costs can be reduced by investing more in prevention and detection activities. An example often cited in the literature is the Ford Motor Company, which was committed to improving its environmental performance. As part of this comprehensive commitment, Ford obtained the ISO 14001 certification at all of its facilities worldwide, which saved hundreds of thousands of dollars in environmental costs. General Motors reduced its waste disposal costs by $12 million by establishing a reusable container program with its suppliers, Commonwealth Edison realized $25 million in financial benefits through a more effective use of resources, and Public Service Electric and Gas Company saved more than $2 million in 1997 by modernizing its inventory management process (EPA, 2000). In addition, Baxter International Inc., a manufacturer of medical products, reduced toxic waste emissions into the air, the water and the land from 1992 to 1999 by increasing recycling, thus achieving environmental savings of $98 million. Similarly, Interface Inc. saved $50 million over four years through lower material costs, energy cost savings, and waste reduction (Hansen & Mowen, 2003).

S. T. Mukah (2021) found that the calculation of environmental costs contributes to pollution prevention, global environmental preservation, and resource recycling, and consequently to the productivity of companies in the timber industry of Cameroon. E. G. Mieseigha and C. J. Ihenien (2014) found that waste management, employee health, financial, and other environmental costs are relevant in making strategic business decisions. They suggested that companies should make information on environmental costs available so that the true costs of the company could be properly determined and allocated.

The aforementioned statements unequivocally indicate that it is crucial for a company to have a well-developed and efficient environmental cost accounting system.

Environmental cost accounting

The importance of environmental accounting stems from the understanding that the calculation of environmental costs aims to achieve sustainable development and a positive relationship with the community and ensure effectiveness and efficiency in environmental protection activities. M. Porter and C. van der Linde (1995) find that companies do not usually track environmental spending carefully and that they could benefit from the implementation of more modern accounting systems in order to measure underutilized resources. R. L. Burritt, C. Herzig, S. Schaltegger and T. Viere (2019) reveal the importance of fostering cleaner production practices through a number of management accounting tools, arguing that companies should not rely on only one management accounting method, like material flow cost accounting, if they are to improve their environmental performance and stakeholder relations.

P. de Beer and F. Friend (2006) point out that environmental cost accounting contributes to environmental cost and liabilities reductions. They indicate the importance of the EEGECOST (Environmental Engineering Group Environmental Costing) model, developed to promote environmental accounting in South Africa. They used the EEGECOST model in a case study on the life cycle assessment of a functional unit of one million cigarettes at the Heidelberg factory of British American Tobacco (BAT). The case study indicated the importance of accounting for environmental costs, both internal and external, and their allocation to cost types and cost drivers in a structured environmental accounting model. They also found that impact costs (fines, penalties, provisions, etc.), internal intangible costs, and external costs were usually not considered in traditional accounting systems, although they accounted for 16% of the total production costs of cigarette production. The results indicated that the model could assist the South African industry in identifying, recording, and allocating environmental costs within environmental media groups, using cost types and cost drivers, to improve their corporate decision-making processes.

Regulation is often identified as the key determinant of environmental costs and accounting practices. S. Joshi, R. Krishnan and L. Lave (2001) find that an increase in regulatory stringency significantly increases the visible and hidden costs of complying with environmental regulation, where the hidden costs are eight to ten times the visible costs at the margin. They further reveal that managers are aware of these hidden costs but find it difficult to isolate and measure them through traditional cost-accounting systems. Similarly, J. Senn and S. Giordano-Spring (2020) find that French companies indicate the difficulty of splitting between environmental and non-environmental costs because of the lack of a measurement method, express the need for more environmental accounting regulation, and tend to limit environmental accounting information disclosure to the existing regulation.

M. M. Hossain (2019) found that the critical challenges for the implementation of environmental accounting in Bangladesh were environmental cost involvement, a lack of skilled workforce, a lack of the set rules on environmental accounting, inadequate environmental accounting standards, the low adoption of environmental accounting, no specific principles of environmental accounting, and so on. T. K. T. Nguyen (2020) conducted a study on the application of environmental accounting in the mining industry of Vietnam and found that various factors influenced the adoption of environmental accounting, including the coercive pressure from government agencies, the environmental awareness of senior executives, business characteristics, and accountants' qualifications in environmental accounting. N. H. Tran, T. T. H. Nguyen and T. P. Nguyen (2021) investigated the factors influencing the implementation of environmental management accounting in Vietnam's automotive industry and found that the coercive, normative, and mimetic pressure, business environmental uncertainty, the environmental strategy, the benefits of applying

environmental management accounting, and task complexity were especially important.

The implementation of the ISO 14001 is also often considered an important factor in the implementation of environmental accounting and its effectiveness. M. S. Ismail, A. Ramli and F. Darus (2014) find that the ISO 14001 certified Malesyan companies (mostly manufacturing ones) have implemented environmental management accounting practices in their efforts to account for hidden environmental costs and fulfil their role as socially responsible companies. D. Jovanović and V. Janjić (2018) find that the benefits of the ISO 14001 implementation are reflected in the improvement of a firm's environmental performance, efficiency, and profitability. They also find that Serbian companies only partly recognize the role of accounting in the ISO 14001 implementation.

Based on the theoretical framework and previous research studies, this paper addresses the following research questions:

- Do companies in Serbia record environmental costs as a separate category of costs?
- What types of environmental costs do companies in Serbia most commonly identify, and do they recognize and record preventive environmental costs?
- Are environmental costs included in the cost calculation of finished products, and what is their share in the total costs?
- Which cost calculation methods do companies in Serbia most frequently use, and are they familiar with the methods such as Activity-Based Costing (ABC) and Material Flow Cost Accounting (MFCA)?
- Is there a statistically significant difference between the companies that apply the ISO 14001 standard and those that do not in terms of recording activities with an environmental impact?
- Is there a statistically significant difference in the way environmental activities are recorded between the companies that include environmental costs in the cost calculation of finished products and those that do not?

METHODOLOGICAL APPROACH

The main steps and activities of the research methodology used in this study are summarized in Figure 2.

The data were collected through a questionnaire survey and interviews with the management of the companies included in the sample. The questionnaire

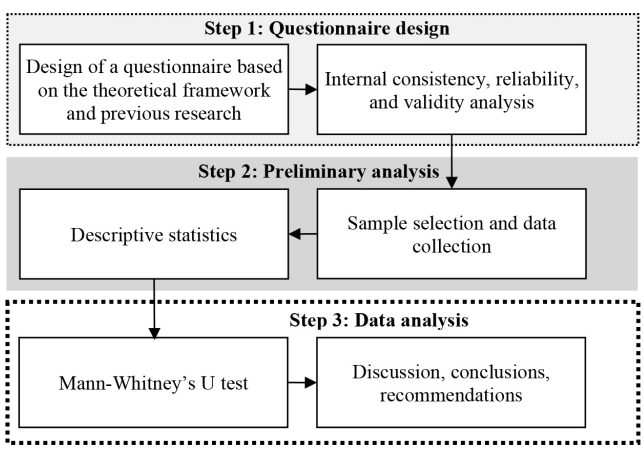

Figure 2 The research methodology

Source: Authors

was designed following the assumptions, concepts, and results identified in the studies presented in the theoretical background and the literature review. The questionnaire consists of 18 questions, and this study includes the questions related to the environmental costs and environmental business activities records kept by the companies included in the sample. Most questions in the questionnaire are close-ended, based on the five-point Likert scale. The managers were offered the answers, ranging from 1 – strongly disagree to 5 – strongly agree.

Lengthy statements, ambiguous pronoun references, and negatively worded and connotatively inconsistent statements were avoided, and the readability of each statement was considered (DeVellis, 2016). The questionnaire was tested in a pilot study so as to ensure a proper interpretation and reduce ambiguity in statements. Afterwards, minor changes were made in the wording of the questions. The value of Cronbach's Alpha is 0.834 and is greater than 0.7, which indicates that the final version of the questionnaire has good internal consistency (Hair, Risher, Sarstedt & Ringle, 2019).

The study was conducted on a sample of companies obligated to submit the data on the sources of environmental pollution to the NRPS, under the provisions of the PRTR protocol (Official Gazette of the Republic of Serbia, 2011). According to the Serbian Environmental Protection Agency (SEPA, 2022), 179 companies (250 plants) were obligated to submit the data to the NRPS. The questionnaire was sent to all 179 companies, out of which 59 completed the questionnaire. This gives a response rate of 32.96%, which is similar to some previous studies (Darnall, Henriques & Sadorsky, 2008; Henri, Boiral & Roy, 2016; Mativenga, Agwa-Ejon, Mbohwa, Sultan & Shuaib, 2017; Astuti & Datrini, 2021). All the companies included in the sample had been phoned before sending the questionnaire in order to obtain proper mailing addresses of the firm's management and more detailed information about the firm's attitude towards environmental management through interviews.

As is shown in Table 1, the majority of the companies were limited liability (55.9%) and joint-stock companies (32.2%), while public companies (11.9%) were the least represented. The majority were large companies (42.4 %), while small companies (22.0%) were the least represented. As many as 55.9% of companies implemented ISO 14001. The majority of the respondents were women (61.0%) and persons aged 36 to 45 (39.0%). The respondents were mostly CEOs (15.2%), CFOs (32.2%), and CTOs (8.5%). As many as 44.1% of the questionnaires were filled out by the Chief Commercial Officers (CCO), the heads of accounting, the QMS and EMS directors, and the others. The sample predominantly included the respondents with a university degree (97.0%), where 57.6% graduated in economics. Finally, the questionnaire was predominantly composed of

Table 1 The characteristics of the sample

	Frequency	%
The legal form of the firm:		
public company	7	11.9
joint-stock company	19	32.2
limited liability company	33	55.9
The company size:		
small	13	22.0
medium	21	35.6
large	25	42.4
The ISO 14001 standard implemented		
Yes	33	55.9
No	26	44.1
The gender:		
male	23	39.0
female	36	61.0
The position in the company		
Chief Executive Officer (CEO)	9	15.2
Chief Financial Officer (CFO)	19	32.2
Chief Technical Officer (CTO)	5	8.5
Other	26	44.1
Years of experience:		
3 - 5	4	6.8
6 - 10	7	11.9
11 - 15	11	18.6
16 - 25	19	32.2
>25	18	30.5
Total	59	100.0

Source: Authors

the people with more than 10 years of experience (81.3%). Given the characteristics of the sample and the structure of the respondents – namely that the questionnaire was completed by the university-educated individuals in the managerial positions employed in the companies listed in the NRPS – and based on similar studies conducted worldwide, it can be concluded that the sample is relevant.

The data obtained from the questionnaire were analyzed in the Statistical Package for Social Sciences (SPSS), Version 20.0. Descriptive statistics were used to measure the central tendency (mean, median, and mode) and variability (standard deviation) of the variables. The non-parametric Mann-Whitney U test was used to identify significant differences in the respondents' answers.

RESEARCH RESULTS AND DISCUSSION

Before examining the aspects specifically focused on the calculation of environmental costs, Table 2 presents the results of the analysis of the responses related to the record-keeping of the activities that impact the environment. The respondents were asked to use the Likert scale to indicate whether they maintained records of the activities that affected the environment. Based on the analysis of their responses, it can be concluded that the companies do keep such records, considering that the average value is above 4, while both the mode and the median are equal to 5 – i.e. the most frequent response was 5. The highest mean values were recorded for waste management (4.83), energy consumption (4.73), and environmental liabilities (4.53), which is expected given that companies are legally required to keep records in these areas.

The analysis of respondents' answers regarding the cost calculation methods applied in the companies included in the sample is presented in Table 3, which shows the respondents' answers concerning the cost-accounting methods applied in the companies included in the sample. The results indicate that 69.5% of the companies include environmental costs in the CCFP, 49.2% of respondents are familiar with activity-based costing (ABC), and 44.1% of the respondents are familiar with material flow cost accounting (MFCA). It should be noted that one question in the questionnaire was open-ended, and the respondents were supposed to answer which cost-accounting system they used in cost accounting. The results obtained by analyzing the answers to this question and by interviewing the respondents as well indicate that Serbian companies still do not recognize the true importance of cost accounting. The companies included in the sample that apply cost accounting and answered this question apply actual costing or a combination of actual and standard costing, while only one company applies ABC (it is a large company

Table 2 The analysis of the records of the activities that have an impact on the environment

	N	Min	Max	AS	SD	Med.	Mod.
Waste	59	2	5	4.83	0.53	5	5
Energy use	59	1	5	4.73	0.78	5	5
Environmental obligations	59	1	5	4.53	0.86	5	5
Costs related to environmental protection	59	1	5	4.51	0.99	5	5
Product and packaging recycling	59	1	5	4.27	1.05	5	5
Potential environmental obligations	59	1	5	4.25	1.01	5	5
Returnable packaging	59	1	5	4.25	1.20	5	5

Notes: N – the number of the respondents, Min – minimum, Max – maximum, SD – standard deviation, Med. - Median, Mod. - Modus

Source: Authors

Table 3 The cost-accounting methods applied in the companies included in the sample

	Are environmental costs included in CCFP?		Are you familiar with ABC?		Are you familiar with MFCA?	
	N	%	N	%	N	%
Yes	41	69.5	29	49.2	26	44.1
No	18	30.5	30	50.8	33	55.9
Total	59	100.0	59	100.0	59	100.0

Note: N – the number of the respondents

Source: Authors

with foreign capital). The results are in accordance with earlier empirical research, which also showed that companies in Serbia relied on traditional cost-accounting methods and rarely applied modern cost-accounting methods (Jovanović, Janjić & Janković, 2014).

Table 4 shows the structure of the sample based on the share of the environmental costs in the total costs. The share of the environmental costs is lower than 3% in the majority of the companies included in the sample, whereas only six (10.2%) respondents stated that the share was greater than 10%. The respondents could also specify the types of the environmental costs recorded in their firm. Following the classification of environmental costs presented in C. C. Gonzalez and J. Peña-Vinces (2022), it was found that the sample companies most often recorded the costs of internal defects (the costs of the measurement, testing, removal, and treatment of hazardous and non-hazardous waste and wastewater; the costs of monitoring water, air, and soil; the costs of packaging and waste disposal; the costs of operating and maintaining the equipment used for reducing or eliminating pollution; environmental taxes), and rarely recorded the costs of external defects (the costs of the restoration and arrangement of green areas; the costs of the inefficient use of materials, energy, and land; the costs of cleaning contaminated land and water), and prevention costs (the costs of studies on the assessment of an environmental impact; the costs of the project and technical documentation for the elimination of pollution; the costs of conducting contamination tests; the costs of the salaries of the employees in the environmental protection sector).

Types of environmental costs recorded in companies included in the sample imply that they generally implement a defensive environmental policy. By including a proactive environmental strategy in the company's business strategy and through the effective management of environmental protection, companies can achieve numerous benefits related to reduced waste and costs, increased customer satisfaction, greater employee commitment, better quality products, and improved public relations (Gadenne, Kennedy & McKeiver, 2009). The companies included in the sample, however, almost exclusively keep a record of the costs of defects and consider the environmental costs they are legally obligated to when cost accounting is concerned. The preventive activities in most companies are reduced to a minimum.

A total of 23 companies (8 large, 9 medium-sized and 6 small) answered the question on the amount of environmental costs. Environmental costs range from 2,500 euros (mostly in the small companies) to

Table 4 The share of the environmental costs in the total costs of the firm

	Frequency	%	Cumulative %
less than 3%	32	54.2	54.2
from 3% to 5%	14	23.7	78.0
from 5% to 10%	7	11.9	89.8
from 10% to 15%	3	5.1	94.9
more than 15%	3	5.1	100.0
Total	59	100.0	

Source: Authors

500,000 euros (mostly in the medium-sized and large companies). The exception is one company with the environmental costs of 23 million euros – it is a public company that had large environmental investments recorded as environmental costs. The stated amounts should, however, be taken with a grain of salt given that the cost accounting applied by the companies included in the sample is underdeveloped and relies on the traditional cost-accounting methods that do not recognize environmental costs as a separate category of costs, implying that most environmental costs are hidden within general costs. More specifically, it can be assumed that the amount of the environmental costs is probably higher for all the companies included in the sample taking into account that they are considered major polluters and are legally obligated to submit data on pollution to the NRPS.

Attempts were made in previous studies to determine whether the ISO 14001 implementation and the decision to include environmental costs in CCFP affect the approach companies use to keep records of activities with an environmental impact. The motivation for these studies lies in the potential benefits that companies may have from the implementation of the ISO 14001 and the correlation between the calculation of environmental costs and the ISO 14001 when the identification, reduction, and inclusion of environmental costs in CCFP are concerned. These studies usually find that the ISO 14001 implementation leads to environmental costs and waste reduction and a more efficient use of resources (Gavronski, Ferrer & Paiva, 2008; Jovanović & Janjić, 2018; Zimon, Madzík, Dellana, Sroufe, Ikram & Lysenko-Ryba, 2022). To further investigate these issues, the Mann-Whitney U test was used in this study, and statistically significant results are accounted for in Tables 5 and 6.

Based on the results of the Mann-Whitney U test in Table 5, it can be concluded that there is a statistically significant difference between the companies that have and those that have not implemented the ISO 14001 when keeping a record of environmental costs, potential environmental obligations, and product and packaging recycling are concerned. This impact is small when speaking about the environmental costs and the medium for the other two types of records. The identified differences suggest that the implementation of an internationally recognized environmental management system encourages organizations to adopt a more formal and systematic approach to monitoring the environmental aspects of their operations, which is consistent with the findings of I. Gavronski *et al* (2008) and M. S. Ismail *et al* (2014), who indicate that the ISO 14001 serves as an important incentive for the development of the internal accounting practices that incorporate the environmental aspects of business operations. However, the effects are not uniform across all the categories of records, and the research results indicate that no statistically significant differences

Table 5 The impact of the ISO 14001 on the approach the companies use to keep records of activities with an environmental impact

	ISO 14001 was implemented		ISO 14001 was not implemented		U	Z	r
	Obs.	Med.	Obs.	Med.			
Records of waste	33	5	26	5	402.000	-0.735	-
Records of energy consumption	33	5	26	5	398.000	-0.758	-
Records of environmental obligations	33	5	26	5	341.500	-1.626	-
Records of environmental costs	33	5	26	5	303.500	-2.455**	0.09
Records of product and packaging recycling	33	5	26	4	288.000	-2.413**	0.31
Records of potential environmental obligations	33	5	26	4	292.000	-2.323**	0.30
Records of returnable packaging	33	5	26	5	406.000	-0.406	-

Note: Statistically significant at 5% (**)

Source: Authors

Table 6 The impact of including the environmental costs in the cost of goods sold on the approach the companies use to keep records of the activities with an environmental impact

	ECs are included in CCFP		ECs are not included in CCFP		U	Z	r
	Obs.	Med.	Obs.	Med.			
Records of waste	41	5	18	5	367.000	-0.059	-
Records of energy consumption	41	5	18	5	330.000	-1.028	-
Records of environmental obligations	41	5	18	4.5	267.500	-2.034**	0.26
Records of environmental costs	41	5	18	4.5	237.500	-2.773*	0.36
Records of product and packaging recycling	41	5	18	4	266.500	-1.892	-
Records of potential environmental obligations	41	5	18	4.0	241.000	-2.340**	0.31
Records of returnable packaging	41	5	18	5	353.500	-0.295	-

Note: ECs – the environmental costs, statistically significant at 1% (*) and 5% (**).

Source: Authors

were found in the record-keeping related to waste, energy consumption, returnable packaging, and environmental liabilities, which is expected to a certain extent, considering that most companies maintain these types of records regardless of whether they have implemented the ISO 14001 standard or not.

The results of the Mann-Whitney U test presented in Table 6 indicate a statistically significant difference between the companies that include and those that do not include environmental costs in CCFP, particularly in terms of the record-keeping related to environmental costs, potential environmental liabilities (a moderate effect), and actual environmental liabilities (a small effect). Specifically, the companies that integrate environmental costs into the cost calculation appear to be more effective in tracking environmental costs and more cautious in recording actual and potential environmental liabilities. These findings suggest that the inclusion of environmental costs in cost calculations may serve as a signal of a systematic approach to environmental management, in which accounting practices are used as a tool for strategic decision-making. In line with the theoretical framework, this demonstrates that the companies that recognize the financial dimension of environmental issues tend to behave more proactively in recording and planning for the environmental aspects of their operations. However, the observed effects mainly result from legal obligations, while the recording of preventive activities remains neglected. The research did not identify statistically significant differences in the other types of records, such as those related to waste, energy consumption, returnable packaging, and the recycling of products and packaging. Additionally, no statistically significant differences were found in the record-keeping practices of the companies of different sizes.

Overall, the results of the Mann-Whitney U test confirm that standardization through the ISO 14001, and the integration of environmental costs into CCFP have a positive impact on the development of the record-keeping practices pertaining to environmental costs and liabilities. However, the results also indicate that there is room for improvement, particularly in the identification and monitoring of preventive costs and the costs of external impacts, which are important for the implementation of a proactive environmental policy and reduction in the negative effects of companies' business operations on the environment.

CONCLUSION

Although some previous studies have examined companies' practices concerning their environmental accounting and the identification and inclusion of environmental costs in CCFP, the familiarity of

companies with different approaches to calculating environmental costs, and differences in recording the environmental aspects of business, the present study provides three contributions to the literature. First, the study contributes to the literature on the share of environmental costs in total costs, and the approaches to the identification and estimation of environmental costs. Second, the study contributes to the literature on the relative importance of environmental regulation for companies' records of the environmental impact of business activities. Third, the study contributes to the literature on the relationship between the efforts companies make to improve their competitive position and the records they keep on their environmental impact.

Based on the research results, the answers to the posed research questions can be formulated. The findings show that the Serbian companies do not recognize the importance of cost accounting in identifying, measuring, and allocating environmental costs, and their reporting as well. Most companies in Serbia do not record environmental costs as a separate category; instead, these costs are often hidden within general expenses. The sampled companies rely almost exclusively on actual cost accounting or a combination of actual and standard costs, whereas only one company applies the ABC method. Although nearly 70% of the companies that participated in the survey included environmental costs in CCFP, their share in total costs is, in most cases, less than 3%, with only six companies reporting a share higher than 10%. The most frequently recorded costs are internal failure costs, whereas external failure costs and prevention costs are rarely recorded. This indicates that companies generally implement a defensive environmental policy – recording error costs and almost exclusively considering the environmental costs they are legally obligated to report, while preventive activities are minimized in most companies. The results of the Mann-Whitney U test show that the companies applying the ISO 14001 and those including environmental costs in the final product cost calculation significantly more often keep records of environmental costs and potential liabilities, confirming the differences in recording practices depending on these factors. No statistically significant differences were identified in record-keeping related to waste, energy consumption, and returnable packaging.

Given that the cost accounting of the companies included in the sample is underdeveloped and relies on the traditional cost-accounting methods that do not recognize environmental costs as a separate category of costs, most environmental costs are hidden within general costs. It can be assumed that the amount of the environmental costs is higher for the companies included in the sample, given that they are considered major polluters and are legally obligated to submit data on pollution to the NRPS. The study results also show that the ISO 14001 implementation and the decision to include the environmental costs in CCFP significantly affect the records of potential environmental obligations, costs, and product and packaging recycling. No statistically significant differences were identified when keeping records of waste, energy use, and returnable packaging are concerned.

It can be concluded that the companies follow reactive environmental policy and pay little attention to the environmental issues. They mostly keep records of environmental impacts because they are legally obligated to do so, only identify the environmental costs that are clearly environmental and have already occurred, and rarely keep records of preventive costs. Given the amount of the environmental costs identified in the study by the respondents, it is likely that a good part of the environmental costs is unidentified, i.e. hidden in general costs. Companies apply underdeveloped cost accounting and almost solely use traditional cost-accounting methodologies. Possible reasons for the unfavorable situation in the Serbian companies are their voluntarism in the application of EMSs, insufficient incentives and the pressure from the state and the public, the inadequate and weak system of legal sanctions, and the inadequate implementation of the laws in the field of environmental protection.

The study has several practical implications. The review of previous studies provides a good basis for theoreticians and practitioners in their studies and projects related to environmental accounting and, more specifically, to identifying, measuring, and allocating environmental costs. The methodological framework developed in the study provides theoreticians with a useful instrument for their future research, and practitioners with guidelines for analyzing and improving the environmental accounting of individual companies. The results of the study show that policymakers should develop stronger and more focused approaches in order to legally obligate companies to keep records of their environmental impacts. Professional organizations and the public can also play important roles in these efforts by providing guidelines and exerting pressure. Finally, the results of the study are useful for companies to understand the importance of environmental accounting and the factors important for its implementation.

The study has several limitations. The sample size is potentially the most important limitation affecting the choice of the statistical tests and the results. In addition, the sample includes companies from only one country. A larger sample would possibly give different results. The respondents' subjective assessments are also a limitation. It is hard to fully identify and neutralize the answers that, intentionally or unintentionally, do not reflect the respondents' attitudes. Therefore, an effort has been made to obtain more detailed results by using the interview in addition to the questionnaire. Future studies should focus on identifying the specific factors affecting environmental costs and environmental accounting practices in developing economies and include a time dimension to analyze changes in these respects over time. A more advanced statistical methodology can also be used, like the regression analysis of the influence companies' characteristics have on the amount and structure of their environmental costs and the cost-accounting methodologies used.

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