Article Type: Literature Review

What Is Known About Environmental Cost Accounting? Systematic Literature Review

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Abstract

Research aims: This study evaluates articles dealing with environmental cost accounting to learn a valuable lesson.

Design/Methodology/Approach: This study used the review procedure by Hoque (2014) with several analyzes employed in the prior research by Anggraini et al. (2022). Articles were then reviewed and identified by entering the keywords "environmental" AND "cost" AND "accounting" in the Scopus database. After applying several criteria, this study utilized 45 articles for further analysis.

Research findings: Four discussion themes can be further identified. The four topics discussed in this article included environmental cost accounting measurement, implementation, environmental performance, and environmental cost accounting disclosures.

Theoretical contribution/Originality: Given the importance of environmental cost accounting applied in companies, to the best of the author's knowledge, there has been no literature review research on environmental cost accounting. Furthermore, this research explains what lessons can be drawn.

Keywords: Environmental cost accounting; Environmental performance; Environmental cost disclosure; Literature review

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Introduction

Companies need the information presented in the financial statements for operational purposes in the future. This information is required for various objectives, such as planning and controlling company finances, evaluating performance, and verifying creditworthiness and taxes owed (Gale & Stokoe, 2001). In addition, the company's financial statements focus on cost control. Cost control relates to environmental and accounting aspects. Specifically, environmental cost accounting is an aspect that emphasizes the recognition and reclassification of environmental impacts and costs in helping to make better decisions (Gloria et al., 2013). The application of environmental cost accounting is also a step taken by the company in designing an environmentally friendly accounting system and helps to collect information related to cost reclassification for the environment: material flows, social responsibility, and cost accounting related to sustainable development (Zeng et al., 2019; Gloria et al., 2013).

Environmental costs, as an environmental accounting component, refer to uncertain costs that depend on the situation (Al-Mawali, 2021). For example, companies that produce products, both manufacturing and mining companies, can generate residual production waste (Zeng et al., 2019). If the waste is not managed correctly, it causes pollution in the company environment and outside the company. Zeng et al. (2019) explained that apart from the environmental impact, the pollution produced by the company can disturb the surroundings, thus affecting the ecological environment. Therefore, companies must develop to understand and study environmental cost accounting to control environmental costs.

Many researchers have studied environmental cost accounting in the context of environmental performance (Al-Mawali, 2021; Ulupui et al., 2020; Kumar et al., 2021). Their studies concluded that the concept of environmental performance indicates significant environmental impacts. Predominantly, the environmental performance has been theorized into two aspects: process vs. results and internal vs. external, affecting the environment and corporate image, influencing the relationship between the company and its stakeholders, giving monetary impact, and aiming to process and product improvement (Henri & Journeault, 2010). Furthermore, environmental cost accounting also needs specific standards in financial reporting to produce consistent and comparable information for investors, regulators, and other stakeholders (Gloria et al., 2013).

Based on the phenomena described above, this study aims to review articles on environmental cost accounting to understand the study of environmental cost accounting. To that end, the research questions to be discussed are:

***RQ_1**: What are the trends of environmental cost accounting studies in terms of theme, year, publication quality, and journal name?*

***RQ_2**: What can be learned from these articles?*

Moreover, environmental cost accounting is vital to study since the company's success is not only about aspects of financial profit for a certain period but also about sustainable operations (Henri & Journeault, 2010). Furthermore, companies should pay attention to the social and environmental aspects of business operations as they are responsible to shareholders and other stakeholders, such as the community and government, who will also be affected. Thus, this research is expected to provide knowledge for companies, governments, and the public that environmental aspects can be controlled by optimal environmental cost accounting management.

This research further provides several contributions. First, environmental cost accounting is essential to be applied in the company. Environmental cost accounting also plays a role not only in limiting the impact of environmental costs on company performance but also in emphasizing the obligation to apply environmental costs in all company operational activities. The second is the contribution of knowledge which, as far as the author's

knowledge, there is no literature review on environmental cost accounting. Third, this study also explains what lessons can be learned in environmental cost accounting.

The remainder of this paper is organized as follows. Section 2 represents the methodology used to review the articles. Section 3 presents the distribution of articles by year, the publication's quality, the journal's name, and the keywords' analysis. This section also displays the themes in this literature review. In addition, the implementation of environmental cost accounting was then concluded in section 4. Finally, the conclusions and limitations of this study are expressed in section 5.

Literature Review

Environmental Cost Accounting

Bucior and Szadziewska (2021) described environmental cost accounting as a cost accounting system oriented to properly allocating costs. It is based on systematic causal analysis. Environmental cost accounting also incurs production costs associated with emissions, waste disposal, and other wastes that cause these costs. Letmathe and Doost (2000) also stated that environmental cost accounting shows the actual costs of inputs and business processes. With environmental cost accounting, the company ensures compliance with the law, which will save the company's operational costs. In addition, environmental cost accounting can be helpful as a measure of cost and service quality.

Furthermore, Letmathe and Doost (2000) asserted that environmental cost accounting helps establish an internal pricing system that evaluates inputs, processes, and products at their actual costs. The procedure for implementing environmental cost accounting then creates decision-oriented information for the company's planning, controlling, and monitoring external and internal environment. Aside from procedures, environmental cost accounting enhances understanding of business processes. Companies that use environmental cost accounting will also be helped to find steps and attitudes that must be taken when facing problems related to environmental protection.

Environmental cost accounting is also not new in companies but is attracting public attention (Le & Nguyen, 2019). Le and Nguyen's (2019) research elucidated environmental cost accounting as a valuable tool for managing, measuring, and providing information about environmental performance. The environmental information provided includes financial information. Some studies, such as El Ghoul et al. (2018), have emphasized environmental cost accounting and analyzed external costs. These external costs could affect a party in the research context: the community.

Research Method

This section explains the research process and the search for articles used in this study. This study followed the literature review procedure in Hoque's (2014) study, with several

analyses employed in a previous study (Anggraini et al., 2022). This study also employed the application of the procedures by Hoque (2014), detailed in Figure 1.

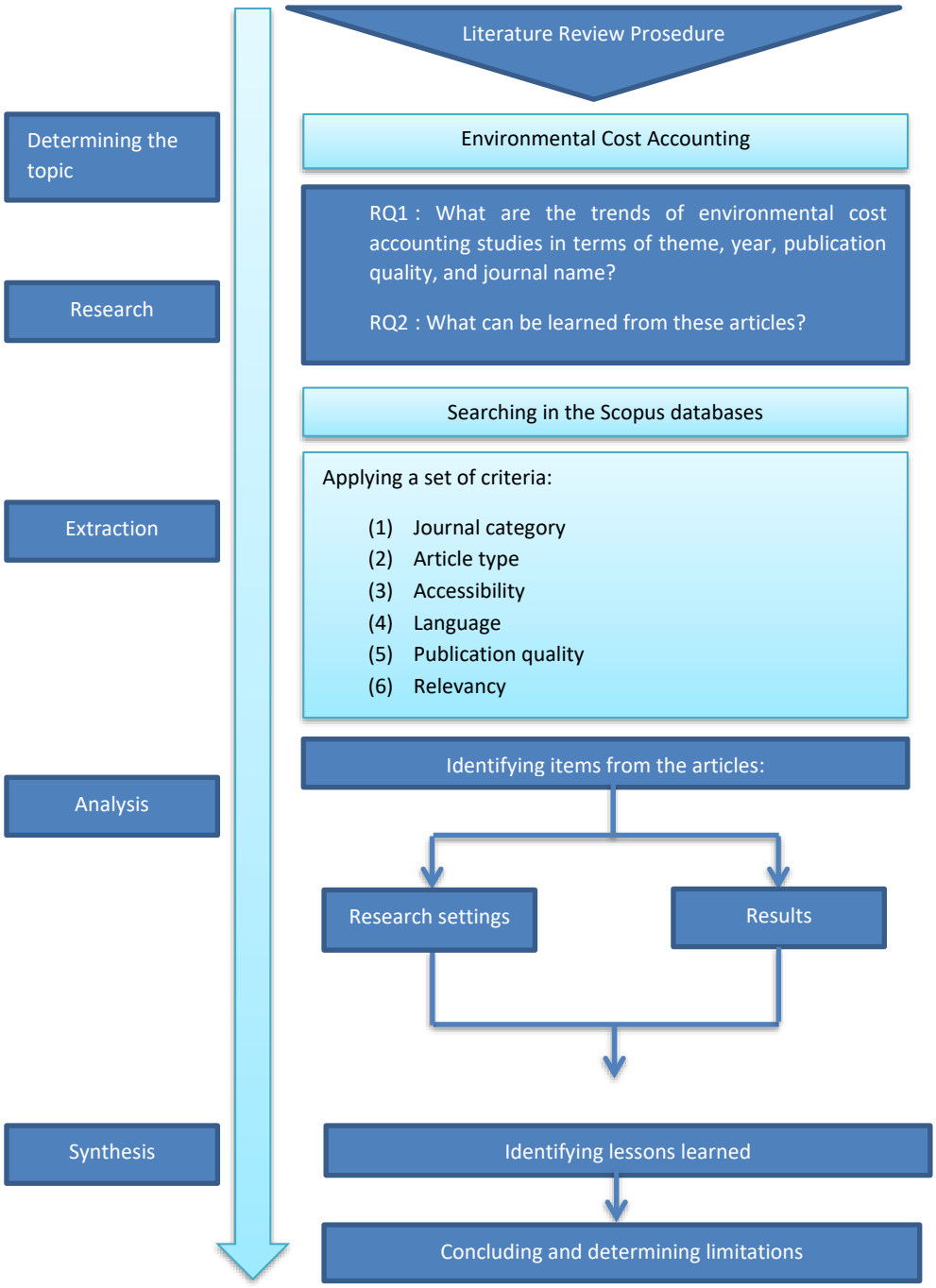


Figure 1 Literature Review Process Adopted from Hoque (2014) and Anggraini et al. (2022)

The first step was determining the research topic, i.e., environmental cost accounting. As indicated in section 1, this study focused on two research questions. The second step was to collect research articles taken from the Scopus database. Relevant articles were then reviewed and identified based on journal category, article type, accessibility, language, quality, publication, and relevance.

This study used three keyword combinations in the Scopus database search engine, describing the topic under investigation: "environmental" AND "cost" AND "accounting." The articles obtained were then extracted with several criteria: journal category, article type, accessibility, language, publication quality, and relevance. Articles that met the keyword criteria were then filtered using the business, management, and accounting category journals. The accessibility criteria employed were those that could be downloaded, and the language in the selected articles was English. In determining the ranking of journals and publication quality, the researcher utilized the website https://www.scimagojr.com/. Not relevant articles to the research topic were then deleted. The final number of articles that met the criteria was 45 out of the initial 78. The researcher also used articles published from 2018 to 2022. After that, the researcher conducted additional analysis to map the distribution of keywords used by the article utilizing VOSviewer software.

Result and Discussion

Article Frequency Distribution by Year

The frequency distribution of articles by year is depicted in Figure 2. Of the 45 articles reviewed, two articles (4.44%) were published in 2022. On the other hand, the most published articles were in 2021, with 19 (42.22%). Meanwhile, the articles published in 2020 were as many as 18 articles (40%). Furthermore, five articles were published in 2019 (11.11%), while in 2019, only one article was published (2.22%).

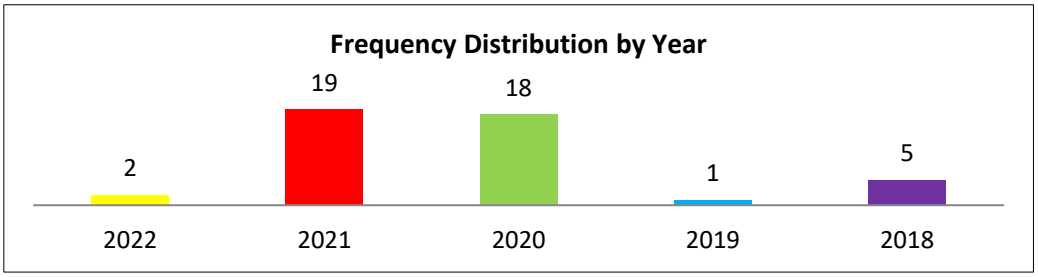


Figure 2 Distribution of Articles Frequency by Year of Publication

Article Frequency Distribution by Publication Quality

The frequency distribution of articles by publication quality is shown in Figure 3. Of the 45 articles reviewed, 18 (40%) were published in high-quality journals, with an index of

Q1 in Scimago. The middle-quality journals were four articles (8.88%) and three (6.67%) for Q3 and Q2, respectively. It can be seen from Figure 3 that several journals were outside the index from Scimago. In addition, 20 articles (44.44%) were not indexed on the website https://www.scimagojr.com/.

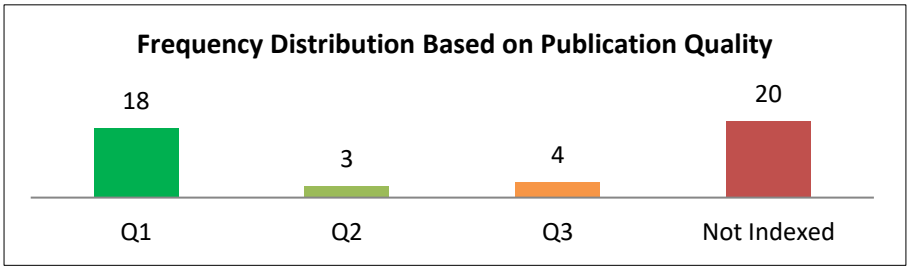


Figure 3 Distribution of Article Frequency Based on Publication Quality

Article Frequency Distribution by Journal

The frequency distribution of articles was based on the journals identified in this study. In this case, the Journal of Cleaner Production published the most articles related to environmental cost accounting, 11 out of 45 articles (24.44%). It is because this journal contained many research topics regarding environmental cost accounting. The Journal of Asian Finance, Economics, and Business ranked second, publishing four out of 45 articles (8.88%). Then, Business Strategy and the Environment came in third, publishing three out of 45 articles successfully reviewed (6.67%). Furthermore, the Journal Bus Ethics published two out of 45 articles that met the criteria (4.44%). Besides, the other journals shown in Figure 4 published 1 of 45 articles each (2.22%).

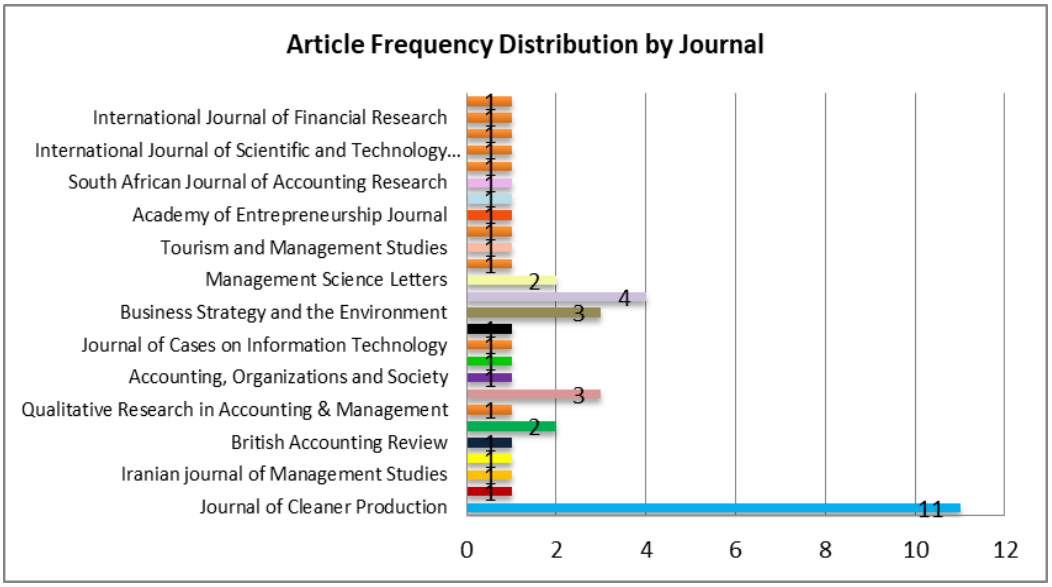


Figure 4 Distribution of Article Frequency by Journal

Keyword Analysis

The keyword analysis results were used to review the 45 articles in Figure 5. The frequency of words in article keywords is indicated by the circle's size where the word is located. The colors in Figure 5 represent how often these words appear together in an article's keywords. Several keywords were identified by VOSviewer related to environmental cost accounting. Keywords that often appeared, for example, were "environmental performance," "financial performance", "environmental cost accounting," "green accounting," and "social cost disclosure.".

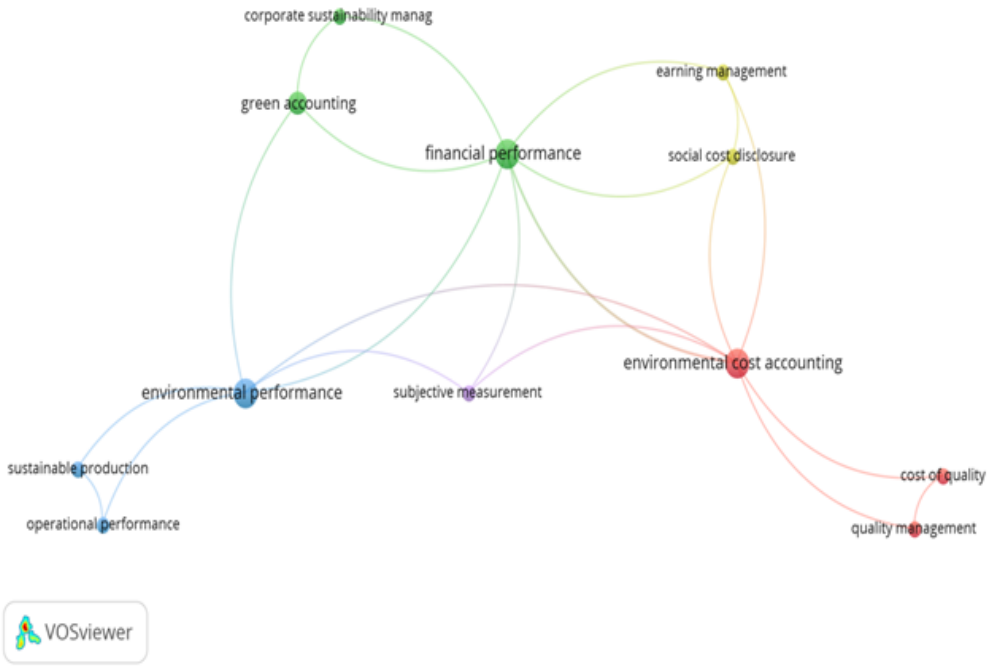


Figure 5 Keyword Analysis

Figure 6 illustrates four topics discussed further in this article: the definition and benefits of environmental cost accounting, implementation, environmental performance, and environmental cost accounting disclosure. In the first discussion, the definition and benefits of environmental cost accounting were the most common in this research review. The second discussion was about the implementation of environmental cost accounting. The emphasis of the second discussion of implementation was on the green accounting application. Then, the third discussion discussed environmental performance, focusing on environmental performance after the environmental accounting implementation. The fourth discussion focused on environmental cost accounting disclosures investigated from the company's social cost disclosures. Then, this study discussed environmental cost accounting with a more specific discussion theme.

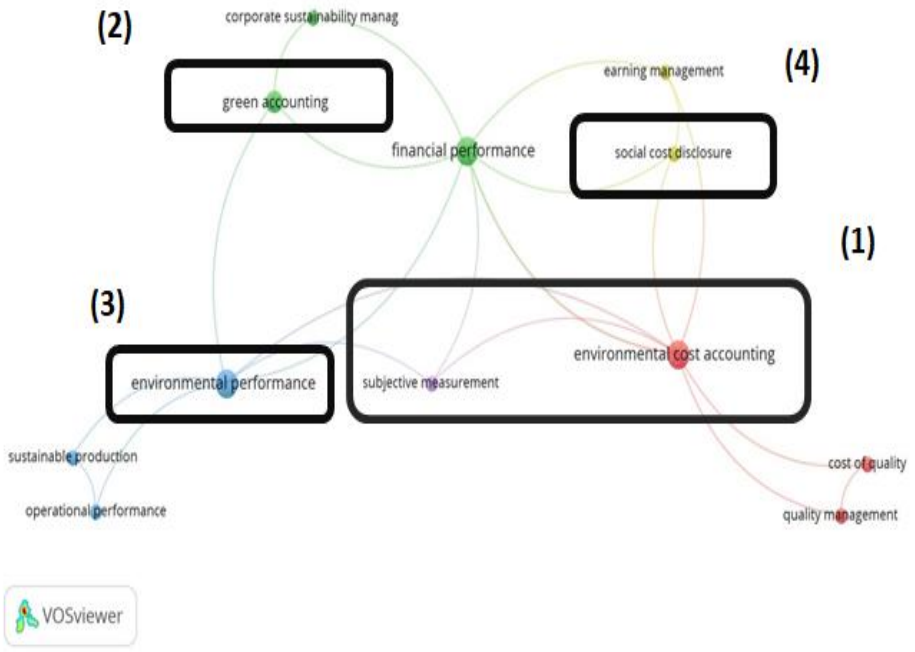


Figure 6 Analysis of the Main Discussion Based on Keywords

Research Findings by Theme:

Measurement

Environmental cost accounting measurement quantifies the confirmed results of environmental costs (Zeng et al., 2019). Environmental cost accounting measurements are carried out by identifying and calculating the amount, quantity, and unit price by analyzing specific units of measurement and attributes. Zeng et al. (2019) also explained that some environmental costs could not be measured in currency, so companies have not found suitable or adopted measurement methods from other companies that can be applied. Therefore, some companies can only estimate the environmental costs so that the environmental costs contained in the financial statements do not fully reflect the environmental damage.

In addition, Meiryani et al. (2019) revealed that before applying environmental cost accounting rules, accounting measurements and environmental cost accounting reporting systems only assessed revenues, costs, resources, and liabilities. The measurement did not measure the business's burden on the environment. Besides, research by Apte et al. (2022) stated that the measurement of environmental cost accounting is part of corporate accountability. Environmental accountability also includes public scrutiny of environmental performance and its public disclosure (Şimşek & Öztürk, 2021). Furthermore, environmental cost accounting measurements can be carried out by analyzing the Product Life Cycle (LCA), environmental quality management, and other

programs or activities that can keep the environment under control (Şimşek & Öztürk, 2021; Rieckhof & Guenther, 2018).

If applied in companies, environmental cost accounting has several advantages (Basuki & Irwanda, 2018; Gunarathne et al., 2021; Al-Naser et al., 2021). Some of these advantages include reducing expenses by identifying and analyzing environmental costs. Basuki and Irwanda (2018) also elucidated that environmental cost accounting measures essential information related to additional costs concerning environmental problems by examining the costs of certain products and processes contained in overhead costs. Furthermore, the research uncovered that PT. INKA (Persero) had not carried out specific environmental cost measurements since costs related to environmental costs were still recorded under general and administrative costs.

Several other studies related to environmental cost accounting measurements have also been disclosed (Kumar et al., 2021; Amaladas, 2021; Bucior & Szadziewska, 2021; Collatto et al., 2021). A study by Collatto et al. (2021) uncovered that applying MEED (Measurement and Evidencing of Environmental Debt Method) could facilitate the measurement of environmental cost accounting since the method can inform the assessment of external costs and environmental obligations. In addition, Amaladas (2021) used the contingent valuation method for environmental cost accounting measurements. These methods were utilized to plan, evaluate, and control the organization's environmental aspects. The contingent valuation method was also employed to incorporate environmental impacts as costs into the company's accounting system. Mukah (2021) also asserted that physical indicators could measure environmental impacts and the aggregation of material flows by weighting by weight of materials and pollutants, indicating the significance of materials that impact the environment.

Implementation

In recent decades, environmental problems have been a severe issue experienced throughout the world. Along with the increasing number of environmental threats that are progressively real to the human future, environmental problems are rising (Tran et al., 2020; Rashidi, 2021; Atia et al., 2020). It is the focus of companies, especially those engaged in industry and mining, to pay attention to the surrounding environment. Several companies in these fields have begun to apply environmental cost accounting as a form of corporate responsibility for the environment.

In Vietnam, the automobile industry found several factors influencing the application of environmental cost accounting (Tran et al., 2020). The application of environmental cost accounting carried out in the company was motivated by the willingness and awareness of managers to reduce production costs, reactions to environmental problems, compliance with laws, and procedures and processes in the work environment. In this case, compliance with the law supports implementing policies, such as tax incentives, which require companies to apply environmental cost accounting.

Similar to the automobile industry in Vietnam, environmental cost accounting has also been applied to Vietnamese brick companies (Le & Nguyen, 2019). However, different results were found in the application in the brick company. Previous research (Le & Nguyen, 2019) reported that implementing environmental cost accounting in Vietnamese brick companies was relatively low. The results also showed that environmental cost accounting had not provided managers with the environmental cost information for environmental management activities. In addition, the application of environmental cost accounting is not yet widespread in several countries in Southeast Asia, such as Vietnam. These findings align with the research of Thuneibat et al. (2021), describing the application of environmental cost accounting in the Jordanian mining industry. Their study revealed that environmental cost accounting was qualified for internal decision-making processes and external communications. Furthermore, Thuneibat et al. (2021) uncovered low awareness of environmental and economic performance, so it has not been able to increase the effectiveness of environmental accounting practices.

In Malaysia, the application of environmental cost accounting in public companies was still moderate (Razak et al., 2020), in which its application was limited to large companies. The study also explained that companies applied environmental cost accounting due to coercive pressure from the government and shareholders. Here, the government plays a crucial role in encouraging companies to adopt environmentally responsible practices. The same result was stated by the research of Jamil et al. (2015) that the level of application of environmental cost accounting was still low in Malaysia. Companies tended not to focus on implementing environmental cost accounting without pressure from the government related to setting guidelines on environmental management accounting procedures and practices. Besides, research by Wang et al. (2018) analyzed the environmental impact of coal power plants in China. In practice, an effective way to reduce the environmental burden is to improve facilities for emission reductions, raise pollutant emission standards, and strengthen the process management of coal power plants.

In Indonesia, Yogiswari et al. (2021) reported implementing environmental cost accounting at the Wangaya Hospital Bali. The research showed that Wangaya Hospital had implemented environmental cost accounting for medical waste management during the COVID-19 pandemic. Some accounts also revealed that these activities embody the concept of sustainable development. Apart from the environmental aspect, Wangaya Hospital has sought to prevent pollution by managing waste or conducting tests related to environmental pollution.

Basically, the application of environmental cost accounting is consistent with the concept of green accounting, suggesting that companies in their production processes prioritize efficiency and effectiveness in the sustainable use of resources (Endiana et al., 2020). Related to that, the concept of green accounting requires companies to harmonize innovation with environmental functions to benefit the community. The application of green accounting is also concerned with the idea of saving land, materials, energy, and ecosystems. Moreover, prior research (Endiana et al., 2020) agrees with the concept of environmental cost accounting. It is stated that the application of green accounting aims

to improve the efficiency of environmental management by assessing from the perspective of environmental costs and benefits or effects resulting from environmental protection.

Environmental Performance

Environmental performance is a voluntary mechanism carried out by the company, focusing on environmental impacts due to business operations, interactions with stakeholders, and forms of accountability to the law. Companies have widely used the application of environmental cost accounting as a tool to help manage environmental performance (Razak et al., 2020; Derila et al., 2020; Ulupui et al., 2020; Okafor, 2018; Rini & Adhariani, 2021). Further, environmental performance is a mechanism for companies to voluntarily have environmental concerns carried out by stakeholders and supervised by legal organizations (Derila et al., 2020; Haleem et al., 2021). Endiana et al. (2020) found that environmental performance affected the company's financial position. Information on the company's environmental costs was significant and sufficient to support financial performance. Companies with sustainable principles also tended to pay attention to environmental cost accounting in line with their attention to environmental management.

Moreover, Ulupui et al. (2020) showed that one of the tools used by companies to manage environmental performance was MFCA (Material Flow Cost Accounting). The implementation of MFCA could reduce environmental costs along with increasing the effectiveness of the company's performance. Ulupui et al. (2020) also mentioned that green accounting encouraged companies to comply with government regulations and policies. Therefore, if a company implements green accounting, it will result in good environmental performance, often with an increase in its financial performance (Endiana et al., 2020; Andries & Stephan, 2019). The relationship between environmental and financial performance can be seen in revenues and costs. In addition, Mazahrih (2019) argued that environmental information enables stakeholders to evaluate a company's efficiency with the utilization of economic resources, commitment to environmental preservation, and the ability to make decisions that can improve environmental performance.

On the other hand, Nuzula (2019) found that profitability did not affect environmental costs. ROA and NPM, as measures representing the relationship between these two variables, indicate that environmental costs would not provide monetary feedback in the short term. Here, the costs incurred are expenses that will generate returns in the coming year so this concept will follow the company's sustainability principles. Stipić (2018) also argued that environmental cost accounting is a necessary tool in applying the concept of sustainable development and is designated as a tool for measuring conservation and adverse environmental impacts. Thus, the vital role of environmental cost accounting in implementing sustainable development strategies by company management is a requirement to improve company performance. Also, the objective of environmental management is to improve the company's environmental performance (Taygashinova &

Akhmetova, 2019). Therefore, it is necessary to carry out environmental control by focusing on specific environmental instruments.

Disclosure

Environmental disclosure has proven to be important in environmental management practices by companies (Jebur, 2021). Ahmed (2019) revealed several reasons for the environmental cost disclosure, viewed from internal and external objects. Internal objects include how companies maintain competitiveness, comply with regulations related to the environment, achieve the objectives of decision-making, and provide employee satisfaction and productivity. Meanwhile, external objects are seen from the company's CSR actions toward local communities, good relations with external stakeholders, decision-making for external users, and customer satisfaction.

Ahmed's (2019) findings further demonstrated the lack of environmental cost disclosure to manufacturing companies in Palestine. It was due to the company's low awareness of the importance of environmental management and its future impact on the company. In Yemen, Dhaif Allah et al. (2021) examined environmental cost accounting disclosures. The study outlined the requirements for the disclosure of environmental information in financial statements based on IFRS and IAS. In this case, environmental cost accounting disclosures in Yemeni industrial companies were restricted and regulated by the government. In addition, the environmental cost accounting disclosure in textile companies in Iran has been described in the research of Ghaemmaghami et al. (2018). Their study explained that large companies disclosed environmental and social information more than small companies. Furthermore, Ghaemmaghami et al. (2018) found that many companies in Iran have not benefited from the disclosure of environmental and social information.

Research on environmental cost accounting disclosures has also been conducted in Nigeria (Ojiakor et al., 2018; Ogan & Akunbowale, 2021). A study by Ojiakor et al. (2018) showed that no regulation was used as a standard for companies to disclose environmental costs. Meanwhile, without the environmental cost disclosure in motorcycle engine manufacturing companies in Nigeria, environmental costs were difficult to be identified by managers for consideration in making environmental management decisions. It also affected the reliability of the accounting information presented concerning the form of responsibility to the environment. The same results are shown in Ogan and Akunbowale (2021) that the environmental cost accounting disclosure that occurred in Nigerian manufacturing companies was still voluntary, even though there is already a law regulating it. These laws and regulations provide guidelines for assessing environmental impacts resulting from the company's business operations when carrying out projects related to the environment.

In developing countries, several companies have also begun to focus on environmental cost accounting disclosure (Ekundayo & Josiah, 2020). Several companies have been registered with the Global Reporting Initiative (GRI), which is an organization that aims to develop sustainable reporting frameworks for business. GRI also guides companies to

make disclosures from an economic, environmental, and social perspective, impacting their business. According to disclosure theory, high environmental performance will result in increased environmental cost accounting disclosures (Utomo et al., 2020). In Indonesia, Utomo et al. (2020) further explained that the company's disclosure was still deficient as no rules regulate how much the company must disclose environmental information items. Although environmental cost accounting disclosure is mandatory, no standard guideline handles it. Therefore, according to GRI, the environmental cost accounting disclosure indicators are voluntary.

Lesson Learned

This section discusses some lessons that can be drawn from analyzing the findings of articles on environmental cost accounting. It includes lessons for governments and companies to help them deal with future environmental cost accounting issues. Expansion of knowledge about the role of environmental cost accounting is also a tool that provides reliable information about environmental impacts. Therefore, companies must recognize environmental costs as product production costs (Bucior & Szadziewska, 2021). Product production costs also become crucial in terms of control and management.

On the other hand, companies need to inform environmental cost accounting information in environmental reporting under legislation (Razak et al., 2020). In addition, the allocation of environmental cost accounting is one of the strategic policies companies can apply, thereby improving financial performance (Endiana et al., 2020). It is related to the company's policy of allocating costs for environmental activities, investment, and funding. The allocation of environmental cost accounting must also be adjusted to the needs of consumers and consider the company's capabilities.

Furthermore, companies need to implement green accounting as a form of implementing the PROPER program (Endiana et al., 2020). The PROPER program encourages corporate governance in environmental management as a form of the Ministry of Environment's efforts to overcome environmental problems. However, the findings of Utomo et al. (2020) exposed that the disclosure of companies in Indonesia was still deficient as no rules govern how much companies must disclose environmental information items. Therefore, the government, in this case, the Indonesian Accounting Association (IAI), must make accounting policies and standards related to green accounting the legal basis for corporate accounting (Endiana et al., 2020). In this case, a clear environmental cost accounting policy is assumed to increase disclosure in Indonesian companies.

This study then provides an overview for future research. First, future studies can be conducted to determine whether the benefits of implementing environmental cost accounting in Indonesia are seen from different industrial sectors. Second, the low level of disclosure is an obstacle to implementing environmental cost accounting in Indonesia. Thus, future studies can investigate the factors influencing the application of environmental cost accounting. Future research can also consider the constraints of implementing environmental cost accounting caused by technical, financial, and time and investigate the obstacles or reasons for not implementing environmental cost accounting.

Conclusion

This literature review aimed to review articles on environmental cost accounting to understand the study of environmental cost accounting. This study focused on articles that met the criteria, obtaining 45 out of 78 initial articles. In addition, the researcher used articles published from 2018 to 2022.

As a result, the distribution of articles based on publication quality was dominated by Q1 database-indexed and non-indexed journals. The grouping of article keywords resulted in four discussion themes. The four topics discussed further in this article were the definition and benefits of environmental cost accounting, implementation, environmental performance, and environmental cost accounting disclosure.

In this case, environmental cost accounting is not new in the company but is attracting public attention. In recent decades, environmental problems are also a severe problem experienced throughout the world. However, some countries have not even implemented environmental cost accounting. It is based on the absence of pressure from the government regarding establishing guidelines on environmental management accounting procedures and practices. Therefore, developed and developing countries should enact laws establishing legal principles and policies regarding environmental cost accounting disclosures as a clear direction and guidance for companies. For this reason, future studies are expected to evaluate companies before and after implementing environmental cost accounting.

Meanwhile, several limitations exist in this study. First, this study only used articles accessed using Scopus. Second, this research only utilized the keywords "environmental," "cost," and "accounting," which then produced limited search results. Third, some articles accessed through the Scopus database were inaccessible and could not be included in this research review.

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