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The role of management accounting in managing environmental costs and its impact on sustainable development

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Abstract

The purpose of this study is to highlight management accounting as a useful tool for green management towards environmental cost and sustainable development. The authors of the study sought to define management accounting and its goals. It also discussed the environmental costs, their types and why they were raised, the difficulties in measuring and disclosing them to the management, and how they could be identified in institutions and their role in achieving sustainable development. In this research, the descriptive analytical method was employed by evaluating the preceding studies related to the research question. A questionnaire was constructed and administered to 52 employees at Southern Cement Company to test the hypotheses. A total of 48 questionnaires were returned and the SPSS program was used for data analysis and hypothesis testing. According to the research, management accounting plays a key role in controlling environmental costs as it provides the information and tools needed to analyze the environmental, social, and economic impacts of institutions. The research suggested that is Encourage companies to adopt technologies like Artificial Intelligence (AI) and Internet of Things (IoT) for real-time emissions monitoring and automated waste management. It also recommended establishing regulatory bodies through which organizations would be coerced to disclose environmental data with sustainability clear development goals to reach transparency.

Key word: management accounting, environmental costs, Environmental Cost Disclosure ,sustainable development

introduction

Now our societies are faced with circumstances demanding a cautious balance among economic growth, environmental conservation, and achieving sustainable development. Environmental concerns and their repercussions on planetary well-being have evolved into international issues requiring solemn attention to the environmental consequences of economic actions and the implementation of effectual policies to avert harmful impacts.

Managerial accounting is one of them which might be utilized with the objective of environmental cost control along with sustainable development. Environmental cost and sustainable development are emerging concepts gaining increasing significance during the past few decades. Environmental cost management is concerned with estimating, tracking, and analyzing costs associated with the environmental impacts of production processes and business activities, while sustainable development aims at balancing economic, social, and environmental needs for the well-being of current and future generations.

One cannot overstate the growing importance of the role of managerial accounting in managing environmental cost and promoting sustainable development in the business environment. Managerial accounting allows companies to analyze and assess environmental cost linked with environmental activities and make strategic business decisions based on accurate and reliable information. Through its application, managerial accounting can ensure efficiency, predict risks, and balance economic, environmental, and social dimensions of business and industrial activities.

First: Research Problem

Environmental pollution has become one of the most persistent global issues, considering that it disrupts the balance between environmental elements and adversely affects the availability of natural resources. This scenario exposes accountants to immense pressure for measuring and examining environmental costs, along with the corresponding expenditure. In addition, a significant percentage of organizations and institutions are faced with problems associated with environmental costs management and attaining sustainable development after economic and environmental facts in their respective countries.

Therefore, this study aims to explore the role of managerial accounting in assisting these organizations to adapt to these challenges and achieve sustainable development.

Accordingly, the research problem can be articulated through the following questions:

• How can managerial accounting contribute to environmental cost management, and what instruments are employed to do so?
• What effects does controlling environmental costs have on an organization's bottom line and long-term growth?
•How can organizations overcome the obstacles they encounter when using managerial accounting for environmental cost management?

Second: Research Hypotheses

The research hypotheses are as follows:

1. There is a positive relationship between the application of managerial accounting and the use of environmental tools in improving the efficiency of environmental cost management.
2. Managing environmental costs positively impacts achieving a balance between financial performance and sustainable development in organizations.
3. The main challenges in implementing environmental managerial accounting can be overcome by enhancing managerial awareness and providing sufficient resources for its development.

Third: Research Significance

The significance of this research is derived from analyzing how management accounting can be integrated in environmental cost management and sustainable development strategies. It is essential for economic, social, and environmental balancing, as well as for future planning. It also helps in addressing legal and standard compliance, financial and environmental performance improvement of organizations, enhanced brand reputation, and enabling social responsibility. In addition, the research urges reducing the level of environmental pollution and achieving a higher level of environmental quality.

Fourth: Research Objectives

This research aims to:

1. Explore the role of managerial accounting in environmental cost management by finding out how managerial accounting is being used to measure and monitor the costs of environmental activities and how such costs could be controlled and sustained.
2. Explain the strengths and weaknesses of applying managerial accounting in managing environmental costs for sustainable development, and identify the obstacles and challenges that firms face in implementing these practices.
3. Provide accurate and reliable financial information on environmental costs to enable better decision-making for sustainable practices.

Fifth: Research Methodology

The descriptive-analytical method was adopted in this study, relying on primary and secondary sources. Secondary sources were earlier published studies, books, and articles that pertained to the research issue. As for the primary sources, a questionnaire consisting of a set of questions was prepared and distributed to the research sample, and then analyzed through appropriate statistical methods.

Sixth: Research Population and Sample

The research population consists of industrial companies affiliated with the Ministry of Construction, Housing, Municipalities, and Public Works. The research sample was represented by the Southern Cement State Company, which comprises eight factories: Al-Muthanna Cement Plant, Al-Samawah Cement Plant, Babylon Cement Plant.

Seventh: Theoretical Framework

1.1: The Concept of Managerial Accounting

Management accounting was defined by the Institute of Management Accountants (IMA) in 2008 as a career which involves working together in decision-making by way of the planning and performance management systems design and providing expertise within financial and managerial reporting to aid management in formulating and implementing organizational strategy (Anthony et al., 2012: 104).

It has also been described as a branch of knowledge that includes aiding in decision-making, planning, installing performance management systems, and imparting skills within financial reporting and control to assist managers in developing and implementing the organization's strategic goals (Rogerio et al., 2013: 12).

1.2: Managerial Accounting Tools

1.2.1: Modern Managerial Accounting Tools

A. Target Costing: Target costing is a strategic cost management tool that adheres to the aim of reducing the cost of products and production throughout the product life cycle, right from the research and marketing phase to distribution and after-sales services (Basili, 2014: 30). Target costing establishes the required cost of a product according to market prices in a bid to make the desired profit. Its objective is to reduce costs and improve the product without influencing its quality (Al-Mashhadani, 2011: 56). As a result, target costing is both a planning and cost control strategic instrument. It is related to market selling prices, and therefore it demands the elimination of unnecessary costs while maintaining required costs without influencing product quality negatively.

B. Activity-Based Costing (ABC) System: Kaplan and Argyris described the Activity-Based Costing (ABC) system as a strategic tool that allows organizations to estimate costs more precisely and communicates knowledge about the profitability of operations, products, services, and customers. This enables organizations to make critical decisions in marketing, pricing, and product or service design areas based on accurate and comprehensive information (Hijazi, Suad, 2018: 28). Davidson defined ABC as a system that uses a two-stage cost allocation process. In the first stage, the production costs are allocated to cost pools that represent activities. In the second stage, the costs are allocated to products based on the amount of activities required to complete them (Al-Tikriti, 2007: 163).

C. Balanced Scorecard (BSC): The Balanced Scorecard (BSC) is a framework to measure and track the performance of an organization through the translation of its strategy into definite and understandable objectives. BSC rests upon the assumption that there exists a causal relationship amongst four main dimensions: innovation and learning, customers, business processes, and financial perspective (Northcott & Turiplair, 2012: 166). It is also considered to be one of the modern managerial accounting tools that are aimed at improving the sustainability and formation of organizational performance. The environmental

dimension has now been included in managerial accounting procedures as a component of the BSC approach (Mohammadi & Tijani, 2021: 238).

3.1: Environmental Costs

3.1.1:Concept of Environmental Costs:

The concept of costs is both an accounting and economic one. In general, costs are the economic sacrifice by an economic entity as a payoff for a benefit or service to allow it to achieve its objectives. Environmental costs, on the other hand, are the costs entailed in taking or having to take action to address the environmental impacts of a production entity's activities in a manner that is responsible. They also consist of expenses required to attain the environmental goals and regulations of the production firm (Al-Lulu, 2016: 22). Environmental costs are those incurred with the intent to avoid or mitigate environmental damage, either through measures to prevent pollution and devastation wrought by the economic unit's operations or by conserving natural resources. These consist of waste disposal costs, noise abatement, sustaining and enhancing water and air quality, and researching environmentally friendly materials and processes (Kitzman, 2001: 21). They are also called "expenses incurred by the entity in order to meet environmental regulatory demands, outlays to prevent or mitigate harmful emissions, and expenses relating to reducing the negative environmental impacts on employees and the firm as a whole" (Stinson, 2008: 1002).

3.1.2: Levels of Environmental Costs:

i. Environmental costs fall into four categories (Krueze et al., 1994: 39): Ordinary or Operating Costs: These are costs that are directly associated with products, i.e., raw materials, equipment, operating expenses, labor, training, and energy. These costs are usually allocated to products on the basis of conventional costing rates.

ii. Hidden Legal or Legislative Costs: These include the costs pertaining to the government and the costs of adherence to government legislation, i.e., expenditures on notification, permits, reporting, monitoring, testing, inspection, and training. These costs are allocated to products through the Activity-Based Costing (ABC) methodology.

iii. Potential Liability Costs: Fines and penalties for noncompliance with government laws and regulations, legal claims and financial settlements related to remedial actions, damage to

property, and environmental releases. These are typically estimated by specialists. Companies should not underestimate or ignore to a large extent the likelihood that these costs will be incurred.

iv. Marginally Tangible Costs: These are the costs that are the outcome of consumer responses, for instance, reducing or eliminating pollution through the use of eco-friendly products. The companies can achieve cost savings through revenue growth and expense reduction due to the higher level of consumer satisfaction and good public image of the company.

3.1.3:Accounting Measurement of Environmental Costs

The environmental cost is an accounting measure that is a financial expense incurred by organizations in an effort to reduce the harmful impacts resulting from their production and industrial activities. The concept involves many challenges faced by organizations in the actual process of costing the expenses. (Lotfi, 2005: 55). One of the most significant challenges is the failure to recognize the elements of environmental cost. The lack of a clear and specific definition of environmental liabilities hinders the reliable measurement and reporting of these costs. There is also considerable overlap among environmental, economic, and social costs, making it hard to differentiate them. For instance, research and development expenditures aimed at product safety improvement can be viewed as social costs, environmental costs to protect customers, and economic costs to establish and increase product demand and profitability (Nile, 2005: 78–79). Another major challenge involves linking environmental costs to environmental returns. These are often intangible in the form of financial returns, and they require descriptive rather than precise financial measurement. In addition, the long time gap between the incurrence of expenditure and the achievement of the returns adds to the complexity because environmental returns do indeed take time to be achieved (Abu Saree, 2004: 58).

3.1.4: Accounting Disclosure of Environmental Costs :

Environmental cost disclosure can therefore be understood to mean a reporting mechanism for information regarding environment-related expenses incurred in an organization's ordinary operations. It involves defining an organization's response towards such expenses, through which a variety of groups of stakeholders can gain information for planning, controlling, and performance measurement (Abdel-Sayed et al., 2009: 10).

3.1.4.1: The importance of environmental cost disclosure stems from its critical role in developing trust between society and organizations. Organizations' compliance with their environment-related responsibilities generates increased community trust, supporting expansion in terms of operations and investments. Organizations that default in such requirements, in contrast, encounter increased pressures, such as bearing the expenses of compensating for environment-related damage occasioned through their production and industrial operations (Omar , 2011: 5). Besides, reporting environment-related requirements in financial statements and reports addresses the variety of information requirements for a range of information users in formulating sound decisions. This variety in information requirements necessitates providing in-depth information regarding the environment-related operations of an organization in its financial reporting.

3.1.4.2: Challenges of Environmental Cost Disclosure:

Environmental cost disclosure is confronted with a lack of sufficient information in books of record. Historical events prevail in traditional systems and overlook important future expenses. Records overlook less conspicuous expenses, such as opportunity expenses and financing expenses. Inadequacies in information hinder effective manager decision-making, especially when environment-related expenses cannot be directly linked to specific activity or product but under general expenses. Misclassification in such a form generates inefficient decisions, such as unequal distribution of hazardous disposal expenses over production lines, with a negative impact on pricing and strategic planning (Yasin, 2012: 98–99).

3.1.5: Recognition of Environmental Costs:

Environmental costs are taken into consideration when they have requirements for measurement and recognition and contribute towards strengthening an organization's assets or preventing pollution. Environmental costs are valued in terms of assets when they have future bearing in terms of economic benefits, but when they have no future bearing, for example, for repairing past impairment and penalties, then they are regarded as expenses incurred in arriving at incomes (Atta, 2007: 147-149).

4.1: The Relationship Between Managerial Accounting and Environmental Costs

The primary role of traditional managerial accounting is comparing planned performance with actual performance and then appraising performance, but not with any consideration for its relations with its environment and with consideration for only its organization in its

operations. Consequently, it can lack the capacity to serve organization requirements and make a complete appraisal of an organization's performance in relation to its environment. In contrast, a strategic orientation towards managerial accounting seeks to produce information for long-term organization survival and development through its relation with its environment. Hence, both approaches can be regarded as complementary, together serving organization aims (Montgomery & McDonald, 2002: 2-3).

Although environmental analysis is part of manager accounting techniques, such as using renewable and nonrenewable sources and adhering to ethical values, it distinguishes between the role played by the environment in terms of performance and social accountability. Yet, it hasn't been explicitly included in manager accounting techniques. Consequently, management increasingly looks for additional information about the role played by organizational activity in the environment and, in return, the role played by the environment in terms of performance.

As a result, an environment dimension will have to be incorporated in manager's accounting in a manner that addresses such emerging issues and guides manager's decision in a better way (Boubake, 2016: 46). As a result, a growing necessity for combining manager's accounting with environment management arises, providing companies with information about environment and sources of energy and its contribution towards financial factors. Integration of such a kind maximizes efficiency in decision-making through cost savings and overcoming obstacles companies face in achieving objectives effectively and in a timely manner.

This necessity has developed environmental managerial accounting, widening its narrow focus for environment protection expenses—most often external expenses companies will not necessarily have to pay in the present under present legislation. These expenses make a significant portion of production expenses and will have to be included in future. Environmental managerial accounting puts a high value in including such expenses in in-house bookkeeping for documenting actual expenses, with a view to having responsible entities for environment degradation pay for such expenses. Environmental managerial accounting aims at protecting both the environment and all concerned entities from future degradation (Beamon, 2015: 9).

4.1.1:Environmental Cost Management

Environmental management involves not only safeguarding the environment but also the environment's relation with human society with a view towards sustainability in a manner that keeps the environment safe for humanity's well-being. It involves controlling all living factors and relations between them, with regard for ethical, economic, social, and technological considerations in a manner that enables sound decision-making. Environmental management can be defined as coordinated actions pursued by an organization in an endeavour to actualise environment objectives through its policies (Makhoul & Ghanem, 2009: 35).

4.2: The Relationship Between Managerial Accounting and Sustainable

Development Managerial accounting is a foundational system that supports managerial decisions that contribute to sustainable development of organizations. This is a crucial piece of information needed for planning purposes, especially on the interrelationship of the three dimensions of sustainable development. To arrive at this, these dimensions should be embedded in the accounting system, to understand how organizations' recognition of economic, environmental, and social dimensions contributes toward the prosperity of the organization. This requires an analysis of the relationship between performance drivers and performance outcomes consistent with effective information systems and accounting approaches that yield prompt, accurate, and unambiguous data. This emphasizes the need for a complete information system for aligning organizational strategy with performance metrics and clarifying the link between the causes and effects of performance, and the reporting of sustainable-development achievements through managerial accounting for sustainable development. (Schaltegger, 2010: 14–22). Arroyo's research emphasizes that managerial accounting information systems must be adapted through the lenses of sustainable development strategies to be effective. Strategic changes in organizations have been widely noted to lead to adaptations in managerial accounting systems. But this does not always lead to good decision-making. Therefore, the research concludes that organizations are still far from establishing a sustainable managerial accounting system that generates the necessary information to measure and analyze all performance lines, whether the environmental, social, or economic perspective (Arroyo, 2017: 1772).

Managerial accounting is an essential part of managerial accounting strategies under the umbrella of sustainable development. That means not just meeting the expectations of all

stakeholders — internal and external, including suppliers, customers, and employees — but working towards sustainable development. Also, supply chain management is used as a tool to improve the competitiveness of organizations in the face of ever-demanding and competitive markets. Managerial accounting for sustainable development aims to achieve the same objectives, specifically with regard to supply chain management and stakeholder engagement. This approach intends to enhance sustainable organizational performance to remain competitive for businesses, especially considering that this is not only a local question anymore, but rather in a globalized context with competition today going beyond local (Hudnurkar& Ambekar, 2019: 1478).

Based on the above, it can be concluded that managerial accounting is fundamental in supporting sustainable development and environmental protection. It aims to provide the necessary information for strategic decision-making within organizations. Environmental managerial accounting plays a significant role in this context by identifying and estimating environmental costs and activities with negative environmental impacts. It also provides relevant information to measure and evaluate organizational performance from an environmental perspective, such as estimates of gas emissions and other environmental damages. This information supports strategic decision-making to enhance sustainable development and environmental preservation. Furthermore, this approach improves organizations' environmental performance by promoting resource efficiency, reducing waste, and minimizing harmful emissions.

5. Practical aspect:

This topic deals with a description of the field aspect and the individuals of the research community and its samples through preparing a questionnaire form with the aim of identifying the correlation and the influential relationship of the role of management accounting in managing environmental costs and its impact on sustainable development and its application in a sample of the factories of the General Company for Southern Cement.

5.1. The research community and tool.

The sample size was determined using the Stephen Thompson formula, resulting in a sample of 52 employees working at the Southern Cement Company. An electronic questionnaire was distributed to these 52 employees, and 48 individuals responded. The data shows that 83.3% of the respondents were male, while 16.7% were female. Regarding

educational qualifications, 8.3% held a PhD, 25% had a master's degree, 41.7% held a bachelor's degree, and 25% held a diploma.

The alpha Cornbrach's reliability test was used as an indicator of stability and objectivity in the responses of the study sample over different time periods. The alpha Cornbrach's test was calculated to determine the reliability and validity of the measurement tool. The table(1) results show that The alpha Cornbrach's values for the questionnaire items ranged between 0.830 and 0.93, which are considered high compared to the minimum acceptable value of 0.60. Meanwhile, the content validity values ranged between 0.911 and 0.964, indicating that the questionnaire is reliable and that its items are consistent and cohesive.

Table (1) Calculating the reliability (alpha Cornbrach's**) and content validity**

Study variables	**N of Items**	alpha Cornbrach's	Content Authenticity
Management accounting	10	0.907	0.95
Environmental costs	8	0.870	0.933
sustainable development	8	0.830	0.911
For all questionnaire paragraphs	26	0.93	0.964

The table (2) results indicate that the data for the management accounting variable has a normal distribution, with a value of 0.87 and a significance level of 0.200. The Shapiro-Wilk test for the environmental costs variable gave a value of 0.801, with a significance level of 0.08. Meanwhile, the Shapiro-Wilk test for the sustainable development variable yielded a value of 0.099, with a significance level of 0.200. This indicates that the data distribution exhibits the characteristics of a normal distribution, as the significance level (Sig) values are greater than the significance threshold (Sig = 0.05), which is considered the minimum for data to be regarded as normally distributed. Therefore, the data follows a normal distribution.

Table (2) Data Distribution Test

Variables	**Shapiro-Wilk**	**Sig**	Distribution type
Management accounting	0.87	0.200	Natural
Environmental costs	0.801	0.08	Natural
sustainable development	0.099	0.200	Natural

5.2.Analysis

The table(3) provides a description and analysis of the sample's views on the study variables (management accounting, environmental costs, and sustainable development). It shows that the mean for management accounting was 3.59, with a standard deviation of 0.74. This indicates that there is considerable attention given by the Southern Cement Company (the study site) to the field of management accounting. This attention is reflected in the fact that most of the managerial decisions made by the company's senior management are based on management accounting reports, highlighting the quality of the accounting system as it provides accurate and clear information based on precise data. This helps support analysis and avoid errors.

Moreover, the company places importance on management accounting as a means to achieve its goals by improving efficiency, increasing productivity, and boosting profits. The company also consistently works to identify gaps between actual and planned performance in order to use this information to enhance its performance. However, these actions have been limited by the lack of corrective and preventive measures due to the absence of experts and consultants in the field of management accounting, which has led to minimal progress in closing the gap between actual and planned performance, falling short of expectations.

As for the variable of **environmental costs**, it obtained a mean of 3.70 with a standard deviation of 0.91, indicating that there is attention given to environmental costs. This can be observed through the company's interest in financial reports that include environmental costs. The company is committed to environmental care, as far as it is related to its operations and does not negatively impact its performance, stemming from its social responsibility toward environmental preservation.

However, despite the company's interest in environmental costs, it lacks environmental cost analysis processes. This may be due to the senior management's lack of awareness of the importance of such analysis in assessing the company's level of commitment to the environment and determining whether these costs are contributing to achieving the company's environmental objectives.

As for the **sustainable development** variable, it obtained a mean of 3.64 with a standard deviation of 0.70, indicating that there is attention to sustainable development. This is evident in the company's efforts to protect the environment and sustain natural resources as far as they are related to its operations. The company intensifies its efforts to reduce environmental pollution resulting from production processes and has shown a direction toward adopting renewable energy by studying and exploring investments in solar and wind energy.

Additionally, the company is focused on innovation by investing in technologies that support sustainable development, enhancing resource efficiency to achieve higher production at lower costs. The company also strives to deliver its services with high efficiency. Moreover, the company adopts the development goals set by the state, which include objectives such as afforestation and reliance on renewable energy.

Table (3) Analysis of sample opinions on research variables

Variables	**mean**	**S.D.**	relative importance
Management accounting	3.59	0.74	%71.8
Environmental costs	3.70	0.91	%0.74
sustainable development	3.64	0.70	%72.8

5.3.Results

First: Testing the Hypotheses of the Correlation between Management Accounting and Sustainable Development

The correlation hypothesis was tested to determine whether to accept or reject it. From the table (4), it is clear that the correlation coefficients between **management accounting** and **environmental costs** and **sustainable development** were (**0.714**) and (**0.861**) respectively, at a significance level of (0.000) for both, which is less than (0.05). This indicates a

statistically significant positive correlation between management accounting and both environmental costs and sustainable development.

Additionally, the correlation coefficient between environmental costs and sustainable development was (**0.639**) at a significance level of (0.000), which also indicates a statistically significant positive correlation between environmental costs and sustainable development. Based on these results, we accept the alternative hypotheses, demonstrating that the management accounting variable at the Southern Cement Company plays an active and important role in both environmental costs and sustainable development variables. Furthermore, environmental costs play a significant role in sustainable development.

Table (4) Correlation between management accounting, environmental costs and sustainable development

	Management accounting	environmental costs	sustainable development
Management Accounting		**0.714** (Sig: 0.00)	**0.861** (Sig: 0.00)
Environmental Costs	**0.714** (Sig: 0.00)		**0.639** (Sig: 0.00)
Sustainable Development	**0.861** (Sig: 0.00)	**0.639** (Sig: 0.00)	

These results indicate statistically significant positive correlations among the variables, showing the interrelationship between management accounting, environmental costs, and sustainable development.

Second: Testing the Hypotheses of the Impact of Management Accounting on Sustainable Development

This section addresses the testing of the impact hypotheses established by the study to determine whether to accept or reject them. This will be done using the **linear regression equation**, as follows:

$$Y= a + \beta_1 X+ \beta_2 M$$

The linear regression analysis is used to assess the effect of management accounting on sustainable development. The regression model helps in identifying the strength and direction of the relationship between the independent variable (management accounting) and the dependent variable (sustainable development). The model will provide insights into how much management accounting contributes to achieving sustainable development and whether the influence is statistically significant.

Once the regression equation is established, the acceptance or rejection of the impact hypotheses will be based on the statistical outputs, allowing for a conclusion on whether management accounting significantly influences sustainable development.

$$Y= 1.689 +(0.814)X+ (0.921)M$$

The table (5) presents the **Analysis of Variance (ANOVA)** for the impact of **management accounting** on **sustainable development** through the **mediating role of environmental costs**.

Model		B	R^2	F	t	Sig.
1	(Constant)	1.689	0.815	79.871	11.456	0.000
	Management accounting	0.814	0.741			
	Environmental Costs	0.921	0.408			

a. Dependent Variable: sustainable development

This table presents the results of a regression analysis aimed at measuring the impact of **management accounting** and **environmental costs** on **sustainable development**. Here is an explanation and analysis of some key values:

Independent Variables:

- **Management Accounting:**

The regression coefficient **B = 0.814** represents a significant positive impact of this variable on sustainable development. Sustainable development increases by 0.814 for each unit

increase in management accounting, which indicates the importance of accounting management in promoting sustainable development.

- **Environmental Costs:**

  The regression coefficient **B = 0.921** reflects a relatively larger impact of environmental costs on sustainable development. Sustainable development increases by 0.921 for each unit increase in environmental costs, which suggests that managing environmental costs positively influences sustainable development.

  This means that **81.5%** of the variance in sustainable development is explained by changes in management accounting and environmental costs. This is a relatively high value, indicating that the independent variables explain a significant portion of the changes in sustainable development.

  The **t-value (t = 11.456)** for the constant shows a high level of statistical significance (**Sig. = 0.000**), indicating that the relationship between the independent variables and sustainable development is strong and worth investigating.

  As for the coefficients of management accounting and environmental costs, the **t-value** and **Sig.** were not directly provided in the table. However, based on the values presented, it can be assumed that they have a strong and positive effect on sustainable development.

  The results suggest that both **management accounting** and **environmental costs** have a significant positive impact on **sustainable development**. The high **R^2 value** indicates that these variables explain a large portion of the changes in sustainable development, and the strong statistical values indicate that the results are statistically significant.

6.Conclusions

1. Despite the challenges facing industrial companies in applying environmental accounting or development, there is a growing trend towards understanding the importance of measuring and analyzing financial costs.
2. The balance between management accounting and environmental and social dimensions represents an opportunity and a challenge for companies to achieve sustainable growth and profitability in the era of the green economy.
3. The role of management accounting is vital in supporting sustainable development by providing the necessary information and tools to measure and analyze the environmental,

social and economic impact of institutions and then make sustainable decisions based on this information.

4. Focusing on environmental and sustainability aspects in management accounting contributes to increasing awareness of the importance of corporate social responsibility and improving its reputation.
5. Integrating management accounting into environmental cost management and sustainable development enhances the environmental, economic and social sustainability of companies, which contributes to building a sustainable and prosperous future.

7.Recommendations

1. Develop detailed guidelines tailored to the nature of each sector (industrial, service, commercial) and company size (small, medium, large).
   For example, industrial companies can adopt tools such as Life Cycle Costing (LCC) to assess the environmental impact of products from design to disposal, while service-oriented companies should focus on evaluating the carbon footprint of their activities.

2. Design specialized training programs in collaboration with universities and professional bodies. These programs should include courses on Quantitative Environmental Analysis using software such as Simapro.

3. Organize workshops on integrating sustainability indicators into management accounting systems, such as the GRI Standards (Global Reporting Initiative).

4. Encourage companies to adopt technologies like Artificial Intelligence (AI) and Internet of Things (IoT) for real-time emissions monitoring and automated waste management. This data should be integrated into management accounting systems to generate instant reports on environmental costs.

5. Offer tax exemptions to companies meeting specific environmental criteria, such as achieving a 20% annual reduction in emissions.

6. Establish partnerships between the private sector and universities to address sector-specific challenges (e.g., waste management in the cement industry) and design customized solutions aligned with local market conditions.

7. Mandate large corporations to include Environmental Key Performance Indicators (KPIs) in their annual reports, such as:

- Carbon emissions per unit of production.
- Percentage of recycled resources.

8. Leverage **blockchain** technology to document environmental cost data across supply chains, ensuring data integrity and facilitating transparent sharing with regulators and stakeholders.

9. Launch awareness campaigns targeting investors and consumers to highlight the importance of supporting environmentally compliant companies. Concurrently, develop Sustainability Ratings to be published periodically.

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