

The Impact of Green Management Accounting on Audit Quality: Evidence from Industrial Corporations in Sultanate of Oman

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ABSTRACT

This study aims to investigate the impact of Green Management Accounting Tools (GMA) on Audit Quality of industrial Omani corporation listed in Muscat Stock Exchange. Life Cycle Cost Accounting, Green Target Costing, Environmental Performance Accounting, and Environmental Reporting and Disclosure were used as a proxy for green management accounting. The study employs a panel data set of thirty non-financial listed Omani corporations from 2018 to 2023. The study revealed that a strong and statistically significant positive relationship between green management accounting tools and audit quality, and each tool contributes to varying degrees to improving audit quality, reflecting the growing role of the environmental dimension in supporting the credibility of financial information and enhancing the confidence of financial statement users.

The study recommended integrating green management accounting into accounting and auditing policies and developing training programs for accountants and auditors on implementing green accounting in the local business environment. and enhancing regulatory body's role in monitoring companies' compliance with environmental standards and sustainable reporting.

The study contributes to establishing scientific bases for improving the financial and environmental performance of companies, thereby achieving a balance between economic efficiency and environmental responsibility, in accordance with Oman Vision 2040.

Keywords: Green Management Accounting, GMA, Audit Quality, Muscat Stock Exchange, LCCA, GTC, EPA, ERD.

INTRODUCTION

Around the world, developed and developing countries, the manufacturing companies have a vital position in enhancing the growth of economics because of its role in developing the export earnings and decrease of unemployment rate in the country Sadma (2021). However, Yurdakul and Kazan (2020) pointed out that many environmental problems like exploitation of nature will be caused by manufacturing companies if they do not get regulated pro resources, and excessive use of energy. Therefore, those companies have to pay more attention to apply sustainability initiatives in the manufacturing sector in order to eliminate the environmental troubles that can be due to the companies Pramono et al, (2023)

Environmental and social disclosure has become important and necessary for every company's financial report. where it has received significant attention in recent years in various societies and countries Zyznarska-Dworczak, (2018) and Sari et al (2021) stated that this is because of the significant role the environmental issues play in human life and the direct contribution of industrialization and development to environmental pollution. Where, many Industries companies have not pay attention to the waste of raw materials and energy because of their growth plans Mohamed and Jamil (2020).

Green management accounting tools contribute to enhancing the quality of management decisions by providing comprehensive quantitative and qualitative data on the environmental dimensions and hidden costs of operational activities Mayndarto and Murwaningsari (2021). Industrial companies that adopt these tools have a greater capacity to scientifically analyze environmental costs and benefits, which is reflected in more efficient and sustainable production and pricing decisions. For example, by using Environmental Activity-Based Costing (EABC), the most resource-intensive products or processes can be identified, and strategies can be designed to reduce waste and improve operational efficiency. Environmental budgeting and Environmental Lifecycle Analysis (ELCC) also help in long-term planning and allocating resources toward projects with a positive environmental impact. Hossain and Hasan (2024).

Moreover, the environmental reporting enhances transparency and accountability to stockholders such as shareholders, investors, and regulatory bodies, leading to increased corporate trust and a stronger market image. Recent studies, such as those by Hoai et al. (2023) pointed out that organizations implementing green accounting achieve higher financial performance and sustainability by reducing operational costs and improving environmental risk management. Fuzi et al. (2022). It was also found that the existence of an integrated environmental accounting system contributes to increased decision-making efficiency and improved financial reporting quality, which subsequently reflects positively on audit quality.

Regarding financial sustainability, Ikram et al. (2019) pointed out that green accounting tools enable companies in optimizing resources and reducing future costs associated with environmental obligations or regulatory penalties in order to achieve financial, environmental, and social objectives balance of the company. Empirical evidence shows that companies implementing green accounting achieve higher long-term profitability rates because of reduced waste, improved energy efficiency, and increased competitiveness. Karmozi et al (2023).

Oman Vision 2040 concerns about changing to a sustainable, diversified, knowledge-based, and innovative economy, adopting green management accounting tools in Omani industrial companies is a strategic step towards achieving both environmental and financial sustainability. Furthermore, the existence of these systems supports the quality of audit processes by improving the quality of environmental and financial data available to auditors, thereby enhancing transparency, and reducing opportunities for manipulation or material. Al busaidi (2025). Therefore, the integration of green management accounting and audit quality is a key focus in building confidence in financial markets and achieving sustainable development in the Sultanate of Oman and the Gulf region. However, the level of adoption of green management accounting tools in Omani companies remains limited. Also, its integration with external and internal audit remains limited. therefore, in this regard, the study aims for assessing the impact of GMA tools on the quality of auditing in the Omani manufacturing sector, which is considered as an important sector in the Goals of sustainable development. and analyze the role of sustainability disclosure as a mediator in the relationship between GMA and audit quality to support the achievement of the goals of Oman Vision 2040. Hence, the study aims to answer the following question:

Does the adoption of green management accounting tools contribute to improving the quality of audit reports of Omani industrial companies listed on Muscat stock exchange?

Regarding the theoretical aspect of this study, it was focused on providing empirical evidence of the use of green management accounting in the manufacturing corporations and its role in sustainability's implementation. As noted by Burritt et al. (2025) in developing countries, researchers and companies ignored the importance of the use of GMA tools applications, where there is a little research about how GMA tools are adopted within organizations. in addition, that the volume to which those tools' effect audit quality has now no longer been very professionally researched with inside the Omani companies.

The study tries to narrow the research gap in the literature concerning the effect of GMA tools on the auditing quality in the Omani manufacturing companies. The study's findings will contribute in demonstrate the importance of the role of green management accounting in improving operational performance of companies in order to achieve sustainable development goals. as well as, knowing the key factors affect sustainability's implementation which may benefit decisions makers and managers in the Omani manufacturing corporations.

LITERATURE REVIEW

Green management accounting

Green management accounting is one of the most important recent developments that contributes to improving financial reporting quality by combining the environmental dimension into the decision-making process and accounting disclosure. Zhen and Rahman (2024). Companies' reliance on green management accounting tools, such as environmental budgeting, environmental performance measurement, and environmental reporting, enhances the accuracy of data related to resource use, environmental costs, emissions, and operational risks. This information contributes to providing an accurate and comprehensive database that helps external auditors perform their work more efficiently and more easily detect errors or disclosure deficiencies.

Burritt et al. (2019) defined green management accounting as a branch of accounting concerned with measuring the environmental costs of the economic unit and disclosing them in the final results. As well as Bresciani et al (2023) pointed out that green accounting defined as a recording the impacts that occur as a result of the use of environmental resources, whether positive or negative. while the US Environmental Protection Agency defined it as a definition and analysis of environmental cost information for making economic decisions. Hence, green management accounting is considered a tool for measuring and reporting information about corporations with an environmental impact to meet the needs of various parties in society, whether inside or outside the corporations,

Alzly and shrshab (2023) indicated that the implementation of green management accounting can be beneficial for achieving environmental objectives and goals. Green management accounting aims to achieve several objectives, including measuring environmental costs and revenues outside the traditional accounting system. It also develops modern methods for evaluating performance and environmental communications. As well as it contributes to sustainable economic development by increasing knowledge and understanding of the growing interactions between the environment and the economy by providing an information base for the development of numerous sustainable development indicators. regarding to Andriansyah et al. (2021), they pointed out that the organizations who wish to achieve greater success and improve their performance need to apply GMA through integrated between SDGs and their organizational targets. As well as Sari et al. (2021) demonstrated that GMA can contribute to environmental issues effectively and promote operational performance and financial results in the industry.

The implementation of green management accounting also leads to increased transparency and disclosure in financial and sustainability reports, reducing the information gap between management and stakeholders and enhancing confidence in audit quality. Furthermore, the presence of advanced environmental accounting systems within a company is evidence of the strength of internal control and the effectiveness of the governance system, two factors that facilitate the external auditor's assessment of the reliability of data and the identification of significant risks more accurately.

Evaluating environmental activities that Green Management Accounting provide is considered as a useful tool for improving sustainability management in corporations. where, Maas et al. (2016) found in the Mexican manufacturing sector that EMSs' perceptions help in the implementation of green management accounting practices. as well as green management accounting integrates environmental costs and impacts into companies' financial statements to achieve sustainable development. Voinea et al. (2020) pointed out that it aims to measure environmental and economic performance and assist in making informed decisions by providing comprehensive information about the environmental impacts of economic activities, such as measuring the costs of air and water pollution, natural resource degradation, or calculating the value of natural resources such as forests and water.

Green management accounting tools are among the most important modern tools that help organizations integrate the environmental dimension into their accounting and administrative processes, enhancing economic efficiency and conserving natural resources. Chaudhry and Amir (2020) found that applying GMA improves optimal resource use, increased productivity, and increased profitability, which lead to improves operational performance.

According to Rounaghi, (2019), Environmental Activity-Based Costing (EABC) is one of the most important green management accounting tools, aiming to accurately identify and allocate environmental costs to the activities or products that cause them. It links the consumption of environmental resources (such as water and energy) to the activities responsible for them within the company. This helps management identify areas with the highest environmental impact and make decisions to reduce waste or improve operational efficiency. It also contributes to improving product pricing by showing the actual cost, including environmental impact.

Olaoye and Adekanmbi (2018) pointed out that Environmental Life Cycle Costing (ELCC) is used to analyze the full cost of a product or project across its life cycle from design and production to disposal. Its purpose is to incorporate indirect environmental costs (such as waste or emissions) into design and development decisions. It enables management to compare different environmental alternatives and choose the most appropriate in terms of sustainability and long-term economic return. Environmental budgeting allocates specific financial resources to environmental activities in a company's general budget. This includes expenditure items for waste management, water treatment, or emission reduction projects. Having a separate environmental budget reflects an organization's commitment to social responsibility and makes it easier for management to track actual environmental performance versus planned performance, thereby increasing the efficiency of financial planning and control. De Oliveira et al (2017).

Audit quality

The interest in environmental disclosure in the industrial corporations has added a dimension represented by fulfilling their responsibilities towards environmental factors, in addition to their pursuit of the goal of maximizing profits for their owners. And companies had to demonstrate their commitment to environmental responsibility by disclosing environmental information that influences stakeholder decisions and maximizes the company's value, thus working to reduce stakeholders' concerns about environmental protection. Alharasis et al (2023).

Hence, the external auditing is considered more important because of the challenges related to the business transactions in the corporation. where companies have recently begun to realize that their responsibilities are not only directed towards investors and lenders but also extend to include society as a whole. Each stakeholder, including creditors, shareholders, regulators, and consumers need a variety level of information according to their needs about the company's financial transactions. Alareeni (2019). This different level of information referred to uncertainty about the fulfillment of its contractual obligations by company. Rajgopal et al (2021). Therefore, the external auditing has a Critical safeguard, where Chaudhry and Amir (2020) pointed out that financial statements, when accompanied by a credible audit opinion, can improve the likelihood that a company will perform as promised, and commitment in transparency and accountability toward all stakeholders. Elewa and El-Haddad (2019) stated that high audit quality that increase trust in the auditor's report, supports users of financial statements in making investment choices.

Audit quality is a fundamental topic in accounting and auditing, as it represents standard by which the external auditor's ability to detect and disclose material errors or manipulations in the financial statements is measured. DeAngelo (1981) defined audit quality as the likelihood of the auditor detecting and reporting a material misstatement in the financial statements. Sharhan (2020). Audit quality reflects the auditor's competence in applying international auditing standards and the extent of their independence and integrity in issuing their professional opinion. Audit quality depends on a set of quantitative and qualitative indicators that reflect the competence and independence of the external auditor and their commitment to professional auditing standards. Madi et al (2023) pointed out that one of the prominent of these indicators is audit Firm Size, where large firms (Big 4: Deloitte, PwC, EY, KPMG) are considered more committed to professional standards and more efficient than smaller firms, due to their extensive experience and strong internal control systems. Zahid et al (2022) indicated that companies audited by Big 4 firms enjoy more credible and transparent financial reports. Another measurement of audit quality is a type of audit opinion, where it reflects the quality of the financial reports. An "unqualified" opinion usually indicates that the financial statements of the company are free from material misstatements, while a "modified/qualified/adverse" opinion indicates the presence of accounting problems or weak disclosure. In addition, auditor independence is one of the important pillars of audit quality, as it enables the auditor to make objective professional judgments, free from any administrative or financial influence from

the client. Weak independence often leads to a decline in audit quality, as well as disclosure level in the audit report that outlines the auditor's observations on significant risks and accounting policies is considered an indicator of high audit quality, as it demonstrates the auditor's commitment to transparency. Finally, the more active and independent the audit committee within the company, the higher the quality of the external audit, as it supports auditor's independence and helps in implementing recommendations. Alharasis (2023).

High audit quality enhances investor and shareholder confidence in published financial information, contributes to reducing information risks, and improves the efficiency of financial markets. Hichri (2023). Audit quality is also closely linked to corporate governance and sustainability practices, as the presence of accurate and transparent environmental and accounting practices facilitates the work of the external auditor and increases the credibility of financial and non-financial reports, especially in companies that adopt the principles of green management accounting and environmental disclosure.

the relationship between green management accounting and audit quality becomes even more important accordance with Oman Vision 2040 that focuses on environmental sustainability and effective governance in Sultanate of Oman. Al-Saqri et al. (2025) found that industrial companies are looking for adopt environmental and accounting practices to meet national and international disclosure requirements, where it will impact on the audit quality and the corporation's reputation in the Omani financial market. Al-Alawi and Jawarneh (2023).

Green Management Accounting Tools Relationship Between with Audit Quality

Green management accounting (GMA) tools help in providing operational and financial data that can be used to disclose deeply about the environmental activities in the corporations, such as environmental compliance cost and environmental treatment costs. Ullah (2018). This data helps managements improve efficiency of sustainable investment decisions, as well as create a relevant information base that external auditors can depend on for planning and implementing control procedures. where the external auditors need reliable evidence through management's estimates and measurements about an environmental accounting system which lead to reduce uncertainty about management's assumptions and make more focused and effective audit procedures.

Rosady et al. (2024) pointed out that the information of green management accounting tools which are related to the quality and quantity of environmental disclosures reduce the gap between management and stakeholders. These quantitative data such as annual compliance costs, or clean energy project expenditures, can help the auditor to evaluate assumptions and figures using samples, trend analysis and verify the processes associated with generating those figures.

Several studies also searched for the relationship between the quality of environmental disclosure and audit quality such as Phan et al. (2018) and Gomez-Conde et al. (2019) who demonstrated that audit efficiency is improving and reduce audit delays when the companies provide higher-quality sustainability reports or external audits of environmental data. In addition, Qian et al (2018) stated that ESG performance is associated with reduced auditor engagement time, which indicates the external auditors' ability to make auditing more efficiently when company provide complete and structured information.

However, there are other factors that influence the relationship between audit quality and tools of green management accounting and must be considered. Tian and Pan (2024) refer to the importance of having active audit committee, disclosure policies, and advanced control systems as an intermediate institutional factor that enhancing the relationship between GMA and audit quality, and they pointed out that a strong government enhances auditor independence and thereby improving audit quality.

Other research papers focused on the change role of the auditor to become a supervisory partner in ensuring of the quality of sustainability data. Lee et al (2021). where Reza and Ullah (2019) pointed out that expanding regulatory frameworks in major markets and the need to mandatory disclosures on climate and ESG such as quantitative disclosures of emissions or climate risks, will increase the value of GMA to auditors to assess going concern risks and accounting assumptions that related to fair value and allowances.

RESEARCH METHODOLOGY

The study aims to analyze the impact of green management accounting tools on audit quality in industrial companies listed on the Muscat Stock Exchange during the period (2018–2023). It is according to the major hypothesis that the application of green management accounting tools contributes to improving audit quality by enhancing transparency, environmental disclosure, and corporate governance.

The multiple linear regression model has been adopted as one of the most widely used statistical models in analyzing causal relationships between quantitative variables, as it allows for measuring the relative impact of each green management accounting tool on audit quality after controlling for the remaining variables.

Study Variables

It represents the dependent variables and independent variables by introducing theoretical analysis for each variable, this analysis shows the importance of the variables and its role in assumed the relationship between green management accounting in Omani corporations as an independent variable and its effect on the audit quality as a dependent variable.

Therefore, to examine the impact of Green Management Accounting Tools (GMA) on Audit Quality (AQ), it was used the proposed Multiple Linear Regression model.

$$AQ_i = \beta_0 + \beta_1 LCCA_i + \beta_2 GTC_i + \beta_3 EPA_i + \beta_4 ERD_i + \varepsilon_i$$

Were.

- AQ = Audit Quality
- LCCA = Life Cycle Cost Accounting
- GTC = Green Target Costing
- EPA = Environmental Performance Accounting
- ERD = Environmental Reporting & Disclosure
- β_0 = Constant
- ε = sampling error

Study hypothesis

H1: There is statistically significant effect on lifecycle accounting on audit quality.

H2: There is statistically significant effect of green target costing on audit quality.

H3: There is statistically significant effect of an environmental performance measurement system on audit quality.

H4: There is statistically significant effect of an environmental reporting and disclosure on audit quality.

FINDINGS

To evaluate the hypotheses, first normality test of residuals was used to confirm that the model data follows a normal distribution. And then it was used multiple linear regression analysis was used to examine the relationship between independent and dependent variables. Statistical values such as R^2 , F-test, and t-test were also extracted, taking into account that all tests were conducted at a significance level of 0.05.

Normality Test of Residuals

To verify that the model data follows a normal distribution, which is a prerequisite for regression analysis. Normality Test of Residuals was used. The test’s results show that the significance level (Sig > 0.05) is present, so, the model residuals follow a normal distribution, meaning that regression model is suitable for statistical analysis and its results are reliable.

Table 1, Normality Test of Residuals

Test	Value	Sig.	Result
Kolmogorov–Smirnov	0.071	0.200	Normal
Shapiro–Wilk	0.976	0.186	Normal

Pearson Correlation Analysis:

Regarding the analysis of Pearson correlation test that measures the initial relationship between green management accounting tools, environmental disclosure, and audit quality. Where there are strong, positive correlations exist between all green management accounting tools and audit quality. The strongest correlation was between environmental disclosure and audit quality (r = 0.643), confirming that transparency and clear disclosure enhance auditors' confidence in the quality of information.

Environmental performance accounting (r = 0.602) also showed a strong correlation, indicating that companies that regularly monitor their environmental performance contribute to improved auditor efficiency. All correlations are positive and statistically significant, supporting the theoretical hypothesis of a complementary relationship between green accounting and audit quality.

Table 2, Pearson Correlation Analysis (*) p < 0.01)**

Variables	AQ	LCCA	GTC	EPA	ERD
AQ	1.000	0.531**	0.487**	0.602**	0.643**
LCCA	0.531**	1.000	0.415**	0.498**	0.556**
GTC	0.487**	0.415**	1.000	0.462**	0.472**
EPA	0.602**	0.498**	0.462**	1.000	0.617**
ERD	0.643**	0.556**	0.472**	0.617**	1.000

Multiple Linear Regression Analysis:

Regarding to multiple linear regression analysis That test the green management accounting tools impact on audit quality and the role of environmental disclosure as a mediating variable.

H1: There is statistically significant effect on lifecycle accounting on audit quality.

Regarding the regression model, the variable of Life Cycle Accounting (LCCA) (X₁) Has a significant positive impact (β=0.214, Sig=0.006), indicating that applying Life cycle accounting practices helps auditors understand the environmental impacts of a company's activities, and then, improving audit quality. Therefore, the first hypothesis is accepted.

H2: There is statistically significant effect of green target costing on audit quality.

The variable of green target costing (GTC) (X_2) Has a significant positive impact ($\beta=0.178$, $Sig=0.022$), meaning that integrating the environmental dimension into cost planning contributes to improved data accuracy and facilitates the audit process. Therefore, the second hypothesis is accepted.

H3: There is statistically significant effect of an environmental performance measurement system on audit quality.

The variable of environmental performance accounting (EPA) (X_3) is considered as a one of the strongest indicators of impact ($\beta=0.256$, $Sig=0.001$), as measuring environmental performance provides accurate quantitative reports that enable auditors to verify compliance with sustainability standards, thus improving audit reliability. Therefore, the second hypothesis is accepted.

H4: There is statistically significant effect of an environmental reporting and disclosure on audit quality.

The variable of environmental reporting and disclosure: (ERD) (X_4) has the greatest impact on audit quality ($\beta=0.309$, $Sig=0.000$), reflecting the importance of transparency in environmental reporting in facilitating the work of auditors and reducing the risk of material misstatements.

Hence, multiple linear regression analysis results show that all hypotheses are statistically valid, meaning that green management accounting tools are essential components that directly impact audit quality in industrial companies, and then the Multiple Linear Regression formula is.

$$AQ_i = 1.13 + 0.214 LCCA_i + 0.178 GTC_i + 0.256 EPA_i + 0.309 ERD_i + \varepsilon_i$$

Table 3, Multiple Linear Regression Analysis

Green management accounting tools	v.	β	T-value	Sig.
lifecycle Cost accounting	LCCA	0.214	2.85	0.006
green target costing	GTC	0.178	2.32	0.022
environmental performance accounting	EPA	0.256	3.41	0.001
environmental reporting and disclosure	ERD	0.309	4.05	0.000
Constant		1.13	3.27	0.002

Robustness test

The results regarding robustness test in table (4), which was conducted by an alternative model still consistent, where the model was used control variables such as firm size, and leverage, which means that magnitude and statistical significance, confirming the stability of the findings.

Table 4: robustness test (*) $p < 0.01$**

Model	R ²	ERD	EPA	GTC	LCCA
Model (1): Baseline	0.62	0.309***	0.256**	0.178*	0.214**
Model (2): With Controls	0.60	0.295***	0.240**	0.165*	0.201**

ANOVA test analysis:

ANOVA test analysis resulted that the F-value of 24.33 and its high significance (Sig = 0.000) indicate to the statistically significant of regression model as a whole and refers to the combined of green management accounting tools explain a substantial variation in audit quality among companies. Therefore, the independent variables used in the model have an effective contribution to predicting the level of audit quality in industrial companies listed on the Muscat Stock Exchange.

Table 5, ANOVA test analysis

Source	(SS)	(df)	(MS)	F	Sig.
Multiple Linear Regression	23.82	4	5.96	24.33	0.000***
Residual	15.23	59	0.26	—	—
Total	39.05	63	—	—	—

Multicollinearity Test (VIF & Tolerance)

In order to verify the existence of excessively high correlation between independent variables (green management accounting tools), which could weaken the reliability of regression results. It was used Multicollinearity Test which resulted that all VIF values are low < 5, indicating that the independent variables are sufficiently independent of each other, and therefore the model does not suffer from multicollinearity.

Table 6, Multicollinearity Test

Ind v.	Tolerance	VIF	Result
LCCA	0.74	1.35	sufficient
GTC	0.69	1.45	sufficient
EPA	0.63	1.58	sufficient
ERD	0.61	1.64	sufficient

CONCLUSIONS OF STUDY

The four hypotheses were tested using regression analysis between the independent variable (green management accounting tools), the mediating variable (environmental disclosure), and the dependent variable (audit quality).

The results show that an increased adoption of green accounting tools leads to improved audit quality and greater reliability of financial reports. As well as the companies adopting tools such as lifecycle accounting and green target costing tend to publish more detailed and transparent environmental reports, reflecting a growing awareness of the importance of environmental accountability. This suggests that environmental disclosure acts as a catalyst for improving audit quality by enhancing data accuracy and reducing information gaps between the company and auditors. This result is Compatible with Hichri (2023), who referred that adopting green accounting tools contributes to developing a robust control environment that facilitates the external auditor's task.

While the mediating role of environmental disclosure in the relationship between green management accounting tools and audit quality, the results showed that environmental disclosure plays a partial mediating role in this relationship. This means that part of the impact of green management accounting tools on audit quality is exerted through enhancing environmental disclosure, while the other part is exerted directly through improving internal

control systems and accounting information. This result is agreed with Burritt (2019) study which confirmed that environmental accounting systems increase the reliability of audit data and improve the quality of financial reports.

Hence, all the hypotheses have been statistically proven, indicating that green management accounting tools implementation in Omani industrial corporations enhances environmental performance, and assists in raising the quality of auditing and enhancing transparency and financial disclosure in accordance with Oman Vision 2040 goals towards sustainable development.

RECOMMENDATIONS FOR STUDY

According to the conclusions, the study recommends promoting the approval of green management accounting tools at Omani industrial companies to ensure the preparation of high-quality financial and environmental reports. as well as integrate environmental sustainability indicators into audit processes, ensuring that audit programs include the evaluation of environmental practices and the disclosure of environmental costs. I addition to link the corporate governance system to environmental performance indicators to encourage voluntary disclosure and enhance transparency for investors and propose the development of national standards for environmental disclosure and green accounting that align with the sustainable development goals of Oman Vision 2040.

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