Analyzing the Impact of Environmental Auditing on Sustainability Reports: A case study

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Abstract

Global companies face increasing environmental challenges considering climate change and increasing pressure from governments and civil society to achieve sustainability. In this context, environmental auditing emerges as an important tool to enhance transparency and achieve environmental improvements. Unilever is one of the companies striving to improve its environmental performance, making it a model for studying the impact of environmental auditing on its sustainability. Environmental auditing helps ensure transparency and accountability in environmental reporting, which is an integral part of companies' annual reports.

This study aims to analyze the impact of environmental auditing on Unilever's environmental performance and environmental disclosure during the period from 2020 to 2023. The study focuses on three main aspects: carbon emissions, water consumption, and waste generation, and analyzes the relationship between these variables and environmental auditing. The study also explores the impact of environmental auditing on the credibility and quality of environmental disclosure in the company's sustainability reports.

Methodology: The study relied on a quantitative approach to statistical data analysis using correlation and regression tests to test hypotheses.

The study findings: showed that environmental auditing led to a significant reduction in carbon emissions and waste, while having no significant impact on water consumption. The credibility and quality of environmental disclosure in sustainability reports were also improved. The study also indicates that environmental auditing contributes significantly to improving environmental performance and transparency in disclosure, but there is a need to develop additional strategies to improve water consumption efficiency.

Key words: Environmental Auditing, Sustainability Reporting, Carbon Emissions, Water Consumption, Waste Management, Unilever, Environmental Disclosure

تحليل أثر المراجعة البيئية على تقارير الاستدامة :دراسة حالة

مستخلص

تواجه الشركات العالمية تحديات بيئية متزايدة في ظل تغير المناخ وتزايد الضغوط من الحكومات والمجتمع المدني لتحقيق الاستدامة، وفي هذا السياق، تبرز المراجعة البيئية كأداة مهمة لتعزيز الشفافية وتحقيق تحسينات بيئية، وتُعد شركة يونيليفر من الشركات التي تسعى جاهدة لتحسين أدائها البيئي، مما يجعلها نموذجًا يُحتذى به لدراسة تأثير المراجعة البيئية على استدامتها، وتساعد المراجعة البيئية على ضمان الشفافية والمساءلة في إعداد التقارير البيئية، وهو جزء لا يتجزأ من التقارير السنوية للشركات.

تهدف هذه الدراسة إلى تحليل تأثير المراجعة البيئية على الأداء البيئي لشركة يونيليفر والإفصاح البيئي خلال الفترة من ٢٠٢٠ إلى ٢٠٢٣.

وتركز الدراسة على ثلاثة جوانب رئيسية: انبعاثات الكربون، واستهلاك المياه، وتوليد النفايات، وتحلل العلاقة بين هذه المتغيرات والمراجعة البيئية، كما تستكشف الدراسة تأثير المراجعة البيئية على مصداقية وجودة الإفصاح البيئي في تقارير الاستدامة الخاصة بالشركة.

المنهجية: اعتمدت الدراسة على منهج كمي لتحليل البيانات الإحصائية باستخدام الارتباط والانحدار لاختبار الفرضيات.

أظهرت نتائج الدراسة أن المراجعة البيئية أدت إلى انخفاض ملحوظ في انبعاثات الكربون والنفايات، دون أن تُحدث أي تأثير يُذكر على استهلاك المياه، كما تحسنت مصداقية وجودة الإفصاح البيئي في تقارير الاستدامة، وتشير الدراسة أيضًا إلى أن المراجعة البيئية تُسهم بشكل كبير في تحسين الأداء البيئي وشفافية الإفصاح، إلا أن هناك حاجة إلى تطوير استراتيجيات إضافية لتحسين كفاءة استهلاك المياه.

الكلمات المفتاحية: المراجعة البيئية، تقارير الاستدامة، انبعاثات الكربون، استهلاك المياه، إدارة النفايات، يونيليفر، الإفصاح البيئي

I. Introduction

The world has recently witnessed increased interest in environmental and sustainability issues, and companies are now required not only to generate profits but also to fulfill their environmental and social responsibilities. In this context, sustainability reports have become a key tool for showcasing organizations' efforts to achieve sustainable development, attracting growing interest from investors, regulators, and the public. However, the effectiveness of these reports depends largely on their credibility and transparency, which raises questions about the reliability of the information provided, especially in the absence of independent review processes.

Environmental auditing is a pivotal tool for ensuring the accuracy and objectivity of sustainability reports, as it provides an impartial assessment of a company's environmental activities and reveals its compliance with approved environmental standards (Roy, 2002). However, the relationship between environmental auditing and the quality of sustainability reports still requires further research and analysis, especially given the differences in auditing practices and reporting frameworks across companies and sectors.

With escalating environmental challenges and societal pressures to achieve sustainable development, multinational companies have become increasingly committed to providing clear and comprehensive environmental and social reports. Sustainability reports are an essential tool for highlighting an organization's commitment to sustainability principles and enhancing stakeholder confidence. However, the credibility of these reports remains questionable unless they are subject to independent environmental audits that ensure the accuracy and impartiality of the information.

Unilever, as one of the world's leading sustainability companies, is a suitable model for studying the impact of environmental audits on the quality and transparency of sustainability reports. Accordingly, this study aims to explore the relationship between environmental audits and the quality of sustainability reports through a case study of Unilever, focusing on how audit procedures impact the content and transparency of reports. This contributes to developing a theoretical and applied understanding of this vital aspect of corporate sustainability management.

II. Problem Statement

Environmental auditing is a fundamental pillar in evaluating corporate sustainability initiatives and ensuring the credibility of sustainability reports. However, many multinational companies face challenges in effectively integrating it into their strategic sustainability frameworks. Some companies use sustainability reports as a marketing tool rather than a means to truly assess their environmental performance. Furthermore, there remains a gap in developing consistent methodologies to measure the direct impact of environmental auditing on the quality, credibility, and effectiveness of sustainability reports.

Conversely, companies may face obstacles such as the high cost of establishing environmental audit programs and the difficulty of keeping up with changing environmental standards. Nevertheless, these challenges are part of the transformation toward more sustainable strategies that are aligned with global standards.

Despite the increasing reliance on sustainability reports as an indicator of corporate environmental performance, the absence of effective environmental auditing processes can lead to reports that lack transparency and reliability. Accordingly, this study addresses the main question:

"To what extent does environmental auditing affect the content and credibility of Unilever's sustainability reports?"

This question leads to several sub-questions, including:

1. Is there a relationship between environmental auditing and low carbon emissions in sustainability reports.
2. Is there a relationship between environmental auditing and improved water efficiency.
3. Is there a relationship between the environmental audit and the decrease in the volume of waste generated by the company's operations.
4. To what extent does Environmental audit improve the credibility and quality of environmental disclosure in Unilever's sustainability reports.

III. Objectives of the Study

Environmental audits contribute to enhancing companies' environmental performance and mitigating potential risks resulting from environmental violations. These processes also support building investor and customer confidence, which positively impacts on a company's reputation and contributes to increasing its market value so the main aims of the study would be:

1. Investigating the relationship between environmental auditing and low carbon emissions in sustainability reports.
2. Analyzing the relationship between environmental auditing and improved water efficiency.
3. Determining the relationship between the environmental audit and the decrease in the volume of waste generated by the company's operations.
4. Investigating the improvement of Environmental audit on the credibility and quality of environmental disclosure in Unilever's sustainability reports.

IV. Importance of the Study

This study aims to provide recommendations that contribute to enhancing the effectiveness of environmental auditing processes and balancing economic and environmental sustainability requirements. The study also seeks to achieve the following objectives:

- Enhancing corporate transparency: By understanding the role of environmental auditing, companies can improve the reliability of their sustainability reports.
- Improving sustainability performance: Identifying effective environmental auditing practices helps companies achieve global sustainability goals.
- Supporting regulatory compliance: The study findings help regulators develop more effective policies to standardize environmental auditing standards and procedures.
- Enhancing investor and stakeholder confidence: Reliable sustainability reports enhance investor confidence and improve companies' reputation in the markets.
- Guiding corporate strategies: The findings provide a framework for large companies to improve their environmental strategies in line with stakeholder expectations and sustainable development requirements.

V. Literature review

Previous studies have been divided into several groups as follows:

5.1.Environmental Auditing and Related Accounting Practices

Bay and Sole (2006) conducted a study examining the relationship between environmental auditing programs and other organizational characteristics in S&P 500 companies. The study relied on data collected from two primary sources. The environmental auditing data were drawn from the Corporate Environmental Profiles Database (CEPD), published by the Investor Responsibility Research Center (IRRC), which provides an analysis of how companies are influenced by environmental auditing programs and the role of industry factors in decisions to adopt these programs. The results showed that companies operating in sectors with high environmental impact are more likely to adopt environmental auditing programs in response to regulatory and societal pressures. The study's findings also confirmed the importance of institutional pressures in motivating the public sector to adopt environmental auditing. This view was supported by Ricca (2009), who explained that the implementation of environmental auditing in the government sector is influenced by international pressures from organizations such as the International Organization of Supreme Audit Institutions (INTOSAI) and the United Nations, although limited financial and human resources represent a major obstacle to the effective implementation of these processes.

For his part, Chiang (2010) noted that accounting guidelines related to environmental auditing, such as AGS-1010, did not lead to radical changes in auditing practices. Auditors continued to rely on traditional guidelines when assessing environmental risks in financial reports, highlighting a gap between the theoretical framework and the practical application of environmental auditing. This highlighted the importance of auditors' role in providing objective assessments of the financial statements of companies whose activities relate to critical environmental issues. It also revealed practical challenges facing the auditing profession in achieving better standards that maintain public confidence.

In addition, Shamsadini et al. (2023) identified seventeen key factors influencing the execution of environmental audit programs. Among the most

influential factors were enhancing companies' environmental efficiency, compliance with environmental legislation, and obtaining environmental performance system certifications such as ISO 14001. The study's results also showed that the worsening problems of environmental pollution and the destruction of natural resources have threatened the sustainability of polluting communities and institutions. Governments and Environmental Protection Agencies (EPAs) have responded by developing diverse environmental control initiatives, including environmental auditing (EA), which remain under-represented and under-implemented In emerging economies due to the Absence of systematic audits of the factors influencing its adoption.

5.2. Environmental disclosure and its impact on auditing and accounting quality

Several studies have examined the relationship between environmental disclosure and audit quality. For example, Yao et al. (2020) analyzed whether organizations with high levels of environmental disclosure are less likely to receive substandard audit opinions and higher audit fees, focusing on the impact of the adoption of environmental disclosure measures in 2008. The study's results showed that environmental disclosure enhances audit quality by reducing the likelihood of issuing substandard audit opinions and contributing to lower audit fees due to lower financial and regulatory risks associated with environmental issues. The results also indicated that companies operating in highly polluting industries, those with strong internal controls, or those receiving less public attention are more likely to be scrutinized for their environmental disclosures.

In the same context, Hichri (2023) explained that environmental auditing contributes to improving the quality of integrated financial reporting by enhancing levels of accountability and transparency, leading to increased accuracy of information provided to stakeholders and investors. On the other hand, Jamousi and Jarboui's (2023) study concluded that media coverage plays an important role in enhancing the effectiveness of environmental audit committees and its positive impact on the quality of environmental disclosure, as the results showed that the media puts pressure on companies to disclose their environmental information with greater transparency.

As a crucial step towards corporate sustainability and improving accountability and transparency, (Pramukti, 2024) underlined the

significance of incorporating environmental considerations into audits. In order to address today's environmental issues and expanding regulatory obligations, it also emphasizes the necessity of developing environmental auditing procedures.

5.3. Disclosure of sustainability and social responsibility and their impact on financial performance

Environmental, social, and governance (ESG) disclosure contributes to improving corporate financial performance, but the nature of this impact varies by sector, as research on sustainability and social responsibility disclosure has demonstrated (A. Buallay, 2020; Buallay, 2022). While disclosure may have a negative impact on the banking sector due to high compliance costs and the limited impact of sustainability initiatives on short-term financial performance, it has a positive impact on the industrial sector by improving resource efficiency and enhancing the company's reputation with investors.

Amid growing stakeholder interest in corporate ESG practices, studies such as Pulino et al. (2022) and Aydoğmuş et al. (2022) have investigated the impact of ESG disclosure on corporate value and profitability. These studies have concluded that increased disclosure contributes to increased company value and improved profitability. Companies with high ESG ratings attract long-term capital and gain investor confidence, which supports financial stability and reduces market volatility.

5.4. The impact of digital finance and a culture of integrity on ESG performance

Digital finance contributes to improving environmental performance by enhancing the ability to track and analyze environmental data, helping companies improve their compliance with regulations and reduce the environmental impact of their operations. Studies such as Ren et al. (2023) and Bao et al. (2024) have demonstrated how digital finance and a culture of integrity improve corporate performance in the areas of environmental, social, and governance (ESG).

In this context, an atmosphere of integrity promotes ethical management practices and drives companies toward implementing more effective sustainability plans, which contributes to improving ESG practices. Zhang and Zhang (2024) and Meng et al. (2023) also noted that environmental

disclosure plays an important role in promoting technological innovation and improving corporate reputation, particularly by attracting investors and providing incentives for companies to develop environmentally friendly technologies.

5.5. ESG Disclosure and its Impact on Investment Decisions

Studies such as (Koundouri et al., 2022; Lokuwaduge et al., 2017) have addressed the issue of environmental, social, and governance (ESG) disclosure in both Europe and Australia, focusing on its impact on investment decisions. These studies have emphasized the importance of improving ESG indicators to attract investments and reduce financial risks associated with environmental and social issues. Chulián et al. (2024), Kurniawan et al. (2024), and Velte (2024) also addressed the challenges related to preparing sustainability reports, focusing on the role of corporate governance in enhancing such reports. These studies indicate that in order to enhance the credibility of ESG disclosure among stakeholders and investors, it is necessary to improve regulatory controls and ensure the independence of auditors.

VI. Theoretical framework

6.1. The concept of sustainability

Sustainability has emerged as one of the most prominent social movements of the past four decades. However, many face challenges in accurately defining the concept of sustainability due to its multiple applications. In the 1987 Brundtland Commission report, "Our Common Future," sustainable development was defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs (United Nations General Assembly, 1987, p. 43).

According to Shrivastava (1995), sustainability can contribute to avoiding long-term risks such as resource depletion, fluctuating energy costs, product liability, pollution, and waste management.

Brinkman (2023) defines sustainability as the conservation of the world's terrestrial resources for future generations. The broad concept of sustainability is not new; humanity has been concerned with resources throughout the ages. Sustainability, as previously defined, is an approach that aims to meet the needs of the present without compromising the ability

of future generations to meet their needs. This approach involves conserving natural resources and reducing long-term environmental risks such as resource depletion, pollution, and waste, to achieve a sustainable balance between environmental, economic, and social dimensions.

6.2. sustainability reports

Sustainability reporting has become a common practice in the last decade (Ganda Institute, 2020), with a growing desire to enhance transparency and accountability in the private sector. Companies and the goods and services they provide face potential health and environmental risks, placing pressure on them to generate accurate data on their sustainability achievements and impacts, as well as to review and make these data publicly available. In this context, sustainability reporting is an effective mechanism for generating data and measuring companies' progress towards achieving the global Sustainable Development Goals. These reports can help companies and organizations measure their performance across various dimensions of sustainable development, set targets, and support the transition to an inclusive, low-carbon, and resource-efficient green economy (United Nations).

Schaltegger et al. (2006) define sustainability reporting as an external reporting process where management sets sustainability-related goals, collects data, and presents sustainability information, typically in the form of published evidence or digital copies.

In addition to the previously discussed environmental and social benefits, sustainability reporting offers significant economic benefits to companies. According to Rubley et al. (2017), disclosure of CSR information is economically beneficial, as it can improve companies' credit ratings and motivate the financial sector to respond to disclosure requirements and regulations.

6.3. Environmental auditing

Environmental auditing, also known as sustainability auditing or environmental accounting, is a tool for assessing a company's environmental record and its compliance with established environmental standards (Pramukti, 2024). Gray (2010) suggested that environmental reporting

should consider the impact of economic actions, highlight areas requiring improvement, and enhance accountability and transparency. Environmental auditing is not limited to financial indicators alone; it also encompasses aspects such as resource use, emissions, waste management, and the ecological footprint (Broggi and Lagacio, 2025; Mahmoud et al., 2018; McAdami and Davos, 2025). According to Pramukti's definition (2024b), environmental auditing is a systematic assessment of an organization's sustainability performance and its compliance with established environmental rules. This includes analyzing the environmental impact of various operations, identifying opportunities for improvement, and ensuring transparency and accountability in environmental reporting. Through this assessment, environmental auditing goes beyond traditional financial indicators to also include resource use, emissions, waste disposal, and the impact of these activities on the environment. ISO/DIS 14010[1] provides an overview of environmental auditing, while ISO/DIS 14011 provides a more comprehensive explanation of environmental management system auditing.

According to this standard, environmental auditing is defined as a systematic and documented verification procedure whereby audit evidence is objectively collected and evaluated to determine the compliance of specified activities, events, conditions, or environmental management systems with audit criteria, with the results reported to the client (ISO/DIS 14010).

In its most common context, environmental auditing is defined as a set of processes performed at the request of an organization's management to analyze its environmental performance. Although this definition is considered the prevailing one, the term "environmental audit" refers to a variety of efforts, activities, and initiatives (Anon, 1991). While some companies use the term to refer to initiatives that rely primarily on expert judgment, more advanced programs feature a systematic and empirical approach aimed at verifying compliance with environmental laws and the framework established for addressing environmental obligations.

[1] ISO 14010:1996 - Guidelines for environmental auditing — General principles

VII. Research gap and hypotheses development

7.1. Research gap

Despite the significant increase in the number of studies examining sustainability reports and environmental disclosure, most have not examined how direct environmental auditing affects the quality and transparency of these reports. Rather, the majority of research has focused on evaluating the content of reports or examining the impact of environmental disclosure on investor decisions. Furthermore, many studies have examined environmental auditing from a legal or administrative perspective, without linking it to the substance and structure of sustainability reporting, especially when applied to specific companies such as multinational corporations.

Regarding empirical studies of leading global companies such as Unilever, the literature lacks in-depth studies that compare sustainability reports over several years, before and after environmental audits, and systematically analyze the relationship between them using quantitative and qualitative analysis tools. Therefore, this research gap can be explained as follows: "Few studies have examined the direct relationship between environmental auditing and improving the quality of sustainability reports, combining quantitative and qualitative analysis with practical application for a global company such as Unilever, which has a long history of environmental disclosure and independent auditing.

7.2. hypotheses development

Based on the problem of the study and its objectives, the following hypotheses can be formulated:

7.2.1. Main hypotheses:

- H1: There is a statistically significant relationship between environmental auditing and low carbon emissions in sustainability reports.
- H2: There is a statistically significant relationship between environmental auditing and improved water efficiency.
- H3: There is a statistically significant relationship between the environmental audit and the decrease in the volume of waste generated by the company's operations.

- H4: Environmental audit contributes to improving the credibility and quality of environmental disclosure in Unilever's sustainability reports.

VIII. Scope and Limitations

In this study, a set of boundaries was defined to clarify the temporal, spatial, and thematic framework. This was to ensure clarity and precision in the scope of the research and to achieve a methodological focus consistent with the study's objectives. These boundaries were defined in accordance with the nature of the research problem, the available data, and the available research capabilities, while ensuring that they did not affect the depth of the analysis or the credibility of the results. A detailed explanation of these boundaries is provided below:

- Time limit: The study covers the period from 2020 to 2023.
- Spatial limit: The study focuses on Unilever as a model for a multinational corporation.
- Objective limit: The study is limited to analyzing the impact of the environmental audit on environmental performance indicators only (CO_2 , water, waste), without addressing other social or economic indicators.
- Data: The study relies on analyzing the content of publicly published sustainability and environmental auditing reports, without relying on internal interviews or field questionnaires.

IX. Methodology of the study

This study is based on the Quantitative Analytical Approach to test the relationship between environmental audit and quality of environmental disclosure in Unilever's sustainability reports. This approach relies on collecting quantitative data from published reports and analyzing them using appropriate statistical tools to derive relationships and effects between variables.

9.1. Study Variables and Their Measurement Method

This study consists of a set of variables that were identified according to the nature of the research problem and its objectives. The variables were classified into independent variables and dependent variables.

The independent variable is environmental audit, which indicates whether the environmental indicators included in sustainability reports have undergone an independent audit or auditing by an external entity such as

PwC. This variable was measured in a binary manner, with a value of (1) if the environmental data were assured, and a value of (0) if they were not subject to auditing.

The dependent variables were three main indicators of environmental performance:

- Carbon emissions (CO_2 emissions), measured in tons of CO_2 per year and including direct emissions (Scope 1) and indirect emissions from energy (Scope 2).
- Water consumption (Water consumption), measured in cubic meters per ton of production (m^3/ton), to measure the efficiency of water resource use.
- Waste generated, measured in kilograms per ton of production (kg/t), measures waste management efficiency.

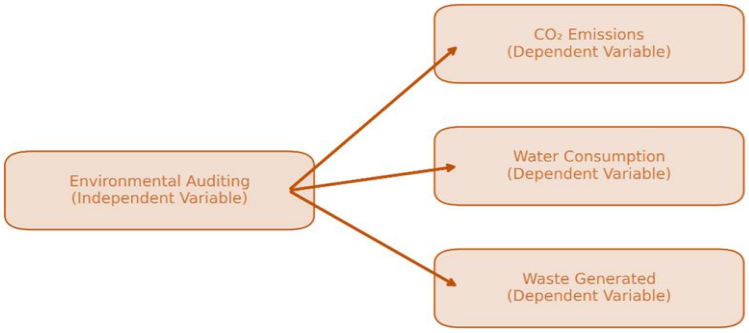


Figure 1: variables of the study
Source: the author

9.2. Type of the Study

This study is a descriptive-analytical study, which seeks to describe the company's behaviour in terms of environmental disclosure and then analyse the impact of environmental auditing on the quality of this disclosure over a specific period.

9.3. Method of the Study

The documentary method was used to analyse the content of Unilever's sustainability reports and environmental audit reports, in addition to

quantitative statistical analysis to test hypotheses using tools such as: Correlation coefficient and Simple regression analysis

9.4. Data Collection Tools

The study relied on published secondary data, extracted from Unilever's annual sustainability reports from 2020 to 2023 and PwC's independent environmental audit reports for the same period.

9.5. Case of the study

Unilever serves as a prime case study for this research, chosen due to its reputation as a global leader in producing reliable and audited sustainability reports. Unilever is one of the world's largest multinational consumer goods companies, specializing in consumer goods and offering a wide range of products in the food, beverage, personal care, and cleaning sectors. The company was founded in 1929 as a result of the merger of two companies: Lever Brothers (UK) and Uni Margarine (Dutch). Its headquarters are currently in London, UK, and it is listed on several global stock exchanges, including the London Stock Exchange and Euronext Amsterdam[2].

Unilever is considered one of the first companies to incorporate environmental sustainability principles into its operational strategy, beginning its environmental reporting in the 1990s and gradually evolving to become more comprehensive and transparent. The company issued its first formal sustainability report in 1996 and has since continued to issue annual reports that include information on energy use, carbon emissions, water, and waste. In 2010, the company launched an ambitious plan known as the Unilever Sustainable Living Plan (USLP), which aimed to double the size of its business while simultaneously reducing its environmental impact and improving social aspects. Since 2021, the company has begun disclosing its carbon emissions across its entire value chain, including Scope 3 emissions, a move uncommon among its competitors[3].

9.6. Statistical analysis tools

This study relied on a set of quantitative statistical analysis tools, aiming to test the relationship between environmental auditing and the quality of environmental disclosure as reported in Unilever's sustainability reports

[2] Unilever Sustainable Living Plan 2010 to 2020
[3] Our Climate Transition Action Plan | Unilever

from 2020 to 2023. The analysis tools varied between descriptive and inferential, as follows:

- *Descriptive Analysis*: Descriptive analysis was used to provide a comprehensive overview of environmental data related to carbon emissions (CO_2), water consumption, and waste production over the specified period of the study. This was accomplished by presenting numerical values in statistical tables, in addition to using graphs (such as line and bar charts) to illustrate annual changes in environmental performance.
- *Correlation Analysis:* Pearson's Correlation Coefficient was used to measure the strength and direction of the relationship between the environmental audit variable (measured as a binary scale: 1 = audited, 0 = not audited) and the dependent variables represented in the environmental performance indicators. This analysis contributed to understanding the extent to which the presence of an environmental audit is linked to improved environmental values in reports.
- *Simple Linear Regression Analysis:* Simple Linear Regression Analysis was employed to test the study's hypotheses, constructing a statistical model that illustrates the impact of environmental auditing on carbon emissions, water consumption, and waste production. The model results were interpreted using regression coefficients, the coefficient of determination (R^2), and p-values to determine the significance of the relationship between the variables.

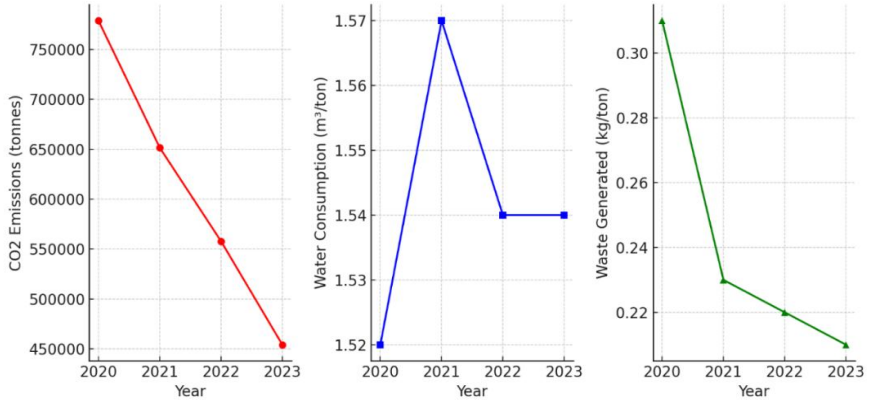
X. Empirical findings and discussion

10.1.Environmental auditing Data (2020-2023)

The table below represents annual environmental data extracted from Unilever's official sustainability reports from 2020 to 2023, as well as PwC's environmental audit reports for the same period, which represent the dependent variables in this study. The data include CO_2 Emissions per ton, water consumption per cubic meter per ton of production, and waste generated per kilogram per ton of production. These indicators represent the most important outputs of environmental performance that have been analyzed to measure the impact of the environmental audit.

Year	*CO_2 Emissions (tons)*	*Water Consumption (m^3/ton production)*	*Waste Generated (kg/ton production)*
2020	717,399	1.52	0.34
2021	651,491	1.57	0.31
2022	557,826	1.54	0.31
2023	454,254	1.54	0.28

Source: the author based on Unilever's sustainability reports



Graph 1: ***Environmental Data***
Source: The author based on Unilever's sustainability reports

10.2. Analysis of Environmental Auditing and Sustainability

Both Pearson Correlation and Simple Linear Regression Analysis were used to test the first three hypotheses regarding the impact of the environmental auditing on Unilever's environmental performance during the period 2020 to 2023. The results were as follows:

Table2: Correlation Analysis Between Environmental Auditing and Sustainability

Variable	**Correlation Coefficient**	**P-Value**
CO_2 Emissions	-0.998 (Strong Negative)	0.002 (Statistically Significant)
Water Consumption	0.188 (Weak Positive)	0.812 (Not Significant)
Waste Generated	-0.875 (Strong Negative)	0.125 (Not Statistically Significant)

Source: The author using SPSS v23

Table3: Regression Analysis Results

Variable	R^2 (Variance Explained)	P-Value	Conclusion
CO_2 Emissions	0.996	0.002	Strong impact, emissions are decreasing significantly
Water Consumption	0.035	0.812	Weak and not statistically significant impact
Waste Generated	0.766	0.125	Strong impact, but not statistically significant at 5% level

Source: The author using SPSS v23

Based on the previous tables the results can be shown as following:

10.3. Hypotheses test results

(H1): There is a statistically significant relationship between environmental auditing and low carbon emissions in sustainability reports.

- Correlation coefficient: -0.998 (very strong inverse relationship)
- P-value: 0.002 (statistically significant at 5%)
- Coefficient of determination (R^2): 0.996 (explains 99.6% of the change in emissions)

Discussion:

There is a strong inverse correlation between environmental auditing and carbon dioxide emissions, with a correlation coefficient of -0.998 at a significance level of 0.002. This indicates a strong negative relationship between the variables and confirms the effectiveness of environmental auditing in reducing carbon emissions. This accepts the hypothesis, which states: "There *is a statistically significant relationship between environmental auditing and low carbon emissions in sustainability reports*."

The ratio of explained variance (R^2) between environmental auditing and carbon dioxide emissions also reached 0.996 at a significance level of 0.002, indicating that 99.6% of the change in carbon dioxide emissions is attributable to the implementation of environmental auditing, while the remaining percentage is due to other factors, further strengthening the validity of the hypothesis itself.

(*H2): There is a statistically significant relationship between environmental auditing and improved water efficiency.*

- Correlation coefficient: 0.188 (very weak correlation)
- P-value: 0.812 (not statistically significant)
- Coefficient of determination (R^2): 0.035 (explains only 3.5% of the change)

Discussion:

The results showed a weak direct correlation between environmental auditing and water consumption rates, as the correlation coefficient reached (0.188) at a significance level of (0.812), which is a statistically insignificant relationship. This rejects the hypothesis, which states: "*There is a statistically significant relationship between environmental auditing and improved water efficiency".*

The percentage explained variance did not exceed (3.5%), which indicates the weakness of the impact and the absence of a significant effect of environmental auditing on water consumption.

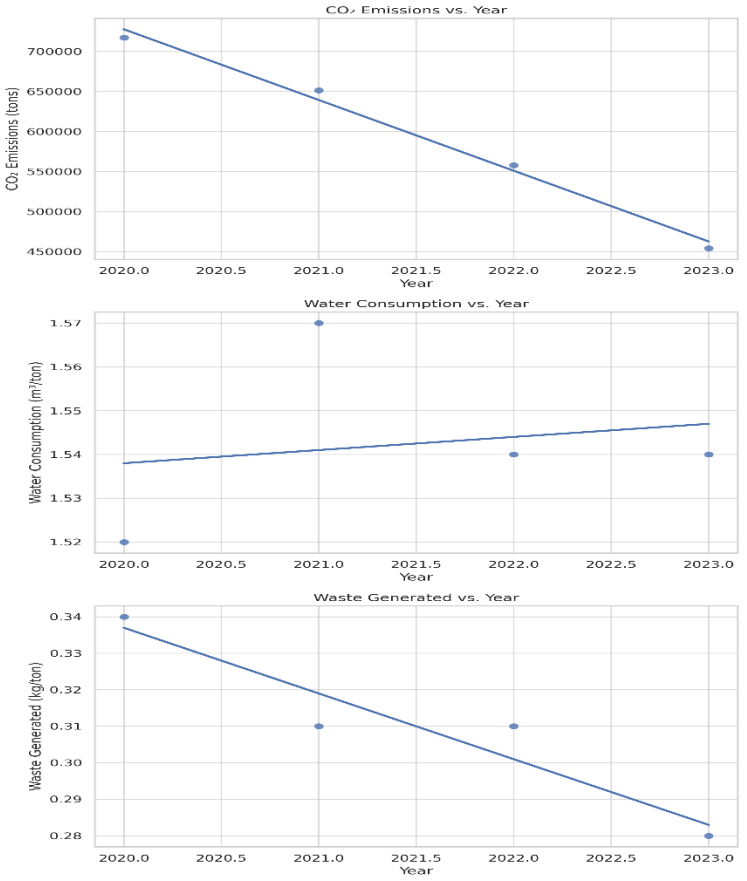
(H3): There is a statistically significant relationship between the environmental audit and the decrease in the volume of waste generated by the company's operations.

- Correlation coefficient: -0.875 (strong inverse relationship)
- P-value: 0.125 (not statistically significant at 5%)
- Coefficient of determination (R^2): 0.766 (explains 76.6% of the change in the amount of waste)

Discussion:

The results showed a strong inverse correlation (-0.875), but the significance level (0.125) indicates that this relationship is not statistically significant at the 5% level, which rejects the hypothesis which states: "There is a statistically significant relationship between the environmental audit and the decrease in the volume of waste generated by the company's operations".

The coefficient of determination (R^2) reached (0.766), meaning that 76.6% of the change in the amount of waste can be explained by the environmental audit, although this result is not statistically significant, indicating the presence of a strong but statistically uncertain impact according to the approved significance levels.



Graph 2: statistical analysis
Source: The author based on Unilever's sustainability reports

H4: Environmental audit contributes to improving the credibility and quality of environmental disclosure in Unilever's sustainability reports.

This hypothesis was tested based on a content analysis of Unilever's sustainability reports from 2020 to 2023, as well as PwC's environmental audit reports for the same period.

Table 4: the percentage of change during the audited years

Percentage change	***CO_2 Emissions***	***Water Consumption***	***Waste Generated***
Percentage change in 2020 compared to 2008	75% reduction	49% reduction	96% reduction
Percentage change in 2021 compared to 2008	77% reduction	47% reduction	96% reduction
Percentage change in 2022 compared to 2008	79% reduction	48% reduction	96% reduction
Percentage change in 2023 compared to 2008	82% reduction	48% reduction	96% reduction

Source: The author based on PwC's reports

The results showed the following:

- An improvement in the accuracy and detail of environmental disclosures was observed in the years when environmental indicators were independently reviewed.
- The audited reports included more specific and documented data, an annual comparison of performance, and detailed disclosures about the data sources and methodologies used.
- Statements emphasizing that data is subject to limited assurance by a third party were also used, enhancing the transparency and quality of disclosure.

Discussion:

The results indicate that environmental auditing plays an important role in improving the quality of environmental disclosure in sustainability reports, in terms of accuracy, comprehensiveness, and reliability. It also contributes to raising the level of transparency towards stakeholders, which supports the credibility of published information. Thus, the fourth hypothesis which states: "*Environmental audit contributes to improving the credibility and quality of environmental disclosure in Unilever's sustainability reports",* is qualitatively and analytically supported, even if it is not digitally tested as in other hypotheses, but evidence based on the content of the reports and temporal comparison confirms its validity.

XI. Conclusion and Final Remarks

This study aimed to analyze the impact of environmental auditing on the quality of environmental disclosure and sustainability performance in

Unilever's reports from 2020 to 2023. Using a combination of quantitative and qualitative methods, the study examined the extent to which independent environmental auditing contributed to improving environmental performance and increasing transparency in published reports.

The results of the statistical analysis showed a strong and statistically significant inverse relationship between environmental auditing and carbon emissions, indicating that the presence of an independent environmental audit effectively contributed to reducing these emissions over the four years. Regarding water consumption, the relationship was weak and statistically insignificant, indicating that the impact of the audit in this area was limited. The waste produced also showed a strong inverse relationship, but it did not reach the 5% statistical significance level, although it was close to the 10% significance level.

The results of the qualitative analysis of the content of sustainability reports and environmental audit reports also revealed that the auditing contributed to improving the quality of environmental disclosure by increasing data accuracy, clarifying the methodologies used, disclosing data sources, and ensuring that the indicators were subject to independent review. This enhances the credibility of published information and increases stakeholder confidence in a company's environmental performance.

Accordingly, it can be concluded that environmental auditing is an effective tool for improving environmental disclosure and driving environmental performance, particularly regarding carbon emissions. However, its impact on other indicators such as water and waste may require further refinement and study, particularly over longer periods and in different contexts.

Considering the study's findings, the need to provide a set of practical recommendations that contribute to enhancing the effectiveness of environmental auditing and improving the quality of environmental disclosure is highlighted. It also highlights the importance of proposing future research paths to expand the scope of scientific knowledge on the impact of environmental auditing in different contexts and on various indicators. The following is a presentation of the study's recommendations, followed by a proposal for future studies.

XII. Recommendations

Based on the study results, the researcher recommends expanding the scope of environmental auditing to include all environmental performance indicators in a balanced manner, with a focus on indicators that have shown weak impact, such as water consumption and waste management. It is also recommended to develop more comprehensive and clear environmental auditing standards to enhance the quality of environmental disclosure and the accuracy of published data. It is also important to promote reliance on independent environmental auditing as a formal mechanism to increase the credibility of environmental information and stakeholder confidence. Furthermore, modern technologies such as artificial intelligence and big data analysis should be employed to support environmental auditing processes and improve their effectiveness. Finally, it is recommended to raise awareness among companies and employees of the importance of environmental auditing through specialized training programs and workshops.

XIII. Future Research

The researcher suggests conducting future studies that compare the impact of environmental auditing on environmental performance and disclosure across different economic sectors to identify sectoral differences. It is also recommended to conduct analytical studies that link the quality of environmental disclosure supported by environmental auditing to companies' financial performance, including investor confidence and market value. Furthermore, long-term studies exceeding four years are recommended to monitor the sustainable impact of environmental auditing on environmental performance. It is also important to explore the determinants and factors that influence the effectiveness of environmental auditing, particularly regarding indicators that have not shown significant improvement. It is also proposed to study the use of digital technology to enhance the efficiency and reliability of environmental auditing.

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