TECHNOLOGICAL INNOVATIONS DRIVING ENVIRONMENTAL ACCOUNTING: A SUSTAINABLE APPROACH A CORPORATE RESPONSIBILITY

Abstract

This paper seeks to discuss and analyze environmental accountability as a crucial aspect of business responsibility in today's business world. Technological advancement has therefore reshaped the field of environmental accounting so that it cannot only measure an organization's impact on the environment but also find ways of reducing it and incorporating it into its strategic plans. This paper aims to examine the influence of technology in the improvement of environmental accounting measures and findings of how these technologies aid in sustainable corporate responsibility. To achieve the primary objective, it is necessary to analyze the effects of big data analytics, artificial intelligence, and blockchain technologies on environmental accounting and identify opportunities and threats of such integration. The research questions related to identifying the impact of these technological advancements on the field of environmental accounting, known advantages, and disadvantages, as well as potential managerial actions that can foster environmental responsibility and sustainability. The hypotheses will postulate that such technological developments enhance the precision, clarity, and effectiveness of EA practices, organizational environmental performance, and sustainability would be improved for companies that have implemented these technologies, as well as, the enhanced stakeholder confidence and a better corporate image among institutions implementing the mentioned technologies. In this article, the author seeks to present technology as the biggest driver of change in environmental accounting and the best tool for ending the spin in corporate responsibility.

Keywords: *Technological Innovations, Environmental Accounting, Sustainability, Corporate Responsibility, Big Data Analytics, Artificial Intelligence, Blockchain, Internet of Things*

Introduction

In the current business environment, environmental responsibility has advanced from keeping up with the legal obligation to be a core value in corporate governance. Technological advancements that have occurred in the last decade have brought a huge positive change in the field of environmental accounting since organizations are not only able to monitor their impact on the environment but also incorporate environmental strategies into their organizational frameworks. The effects of technology on environmental accounting have been discussed in this paper and how it promotes the sustainability of corporate responsibility has been explained. While it was previously generally regarded as an Appendix to a company's management and control, environmental accounting has become the core component of strategic management of contemporary proactive and innovative organizations (Schaltegger & Csutora, 2012). Due to the increasing awareness and demand to explore solutions to environmental issues, organizations have integrated high-level instruments and procedures that enhance the evaluation, assessment, and reporting of environmental information. Technological innovations for instance big data, AI, and blockchain have enhanced the method through which data on the environment is collected, processed, and shared (Ioannou & Serafeim, 2017). The application of big data analytics in environmental accounting has helped

organizations to analyze large volumes of information to have a better understanding of the operations and impact of the business on the environment (Watson, Boudreau, & Chen, 2010). AI, through predictive analytics, has enabled firms to control and prevent unfavorable environmental conditions while using resources more efficiently to increase sustainability (Porter & Heppelmann, 2014). Recently, some scholars have sought to establish that blockchain's unique characteristics of decentralization and data immutability can support the credibility of environmental data (Casey & Wong, 2017).

While these technological innovations have made a wide positive impact on the preciseness and reliability of environmental accounting, it has also enhanced the development of the concept of environmental management. Holland (2012) notes that more and more firms are focusing on their corporation's role in the environmental impact since sustainability has been seen as the key to creating value for shareholders and other stakeholders (Ioannou & Serafeim, 2014). Concepts of IT can be used to show society an organization's support for environmental causes and general sustainability to improve its image and thus competitiveness (Hart & Dowell, 2011). This paper shows that technology has enhanced the role of environmental accounting in corporate governance. As the data has become highly visible and monitored in real-time, there is increased responsibility for organizations to respond to environmental matters (Aguilera, Rupp, Williams, & Ganapathi, 2007). It has resulted in the formulation of more effective environmental policies and the adoption of proper business practices to suit global environmental standards (Kolk, 2016). So, as we develop, these technological innovations should be adopted by corporations and formed as part of the environmental accounting systems. By so doing not only will the company be able to meet the set requirements on the aspects of environmental laws but the world at large will be made a better place to live in. This is perhaps the case as technology has been fused with environmental accounting as showcased below; This sways towards the achievement of the balance between the attainment of economic growth and the conservation of the environment making technology and environmental accounting a landmark achievement of corporate responsibility in the 21st century. Technology has remained a significant boost in environmental accounting to organizations that have accepted it as a means of practicing sustainability. top-notch software and statistical professions have allowed enterprises to quantify and control the detrimental consequences on the natural environment better than ever before. For example, LCAs include life cycle assessment tools, life cycle inventory, life cycle impact assessments, etc. LCA embraces a cradle-to-grave evaluation of environmental aspects and social impact resulting from products, processes, or services. Decision-making in the environmental field has been improved by the use of big data and AI since it can identify things that could not be identified some time back. AI can integrate large amounts of data and assist in analyzing them to make accurate environmental forecasts for appropriate management. For instance, predictions of pollution can be made using algorithms to guide urban areas on the appropriate measures of safeguarding their dwellers as well as the environment (Kitchin, 2014). Based on Blockchain, they suggest that transparency and security can be achieved away from centralized systems, which is advantageous when recording the environmental repercussions of goods in the chain. It also guarantees the reliability of environmental information by creating a digital record that cannot be altered, which becomes critical when filling out reports and meeting the set standards (Tapscott & Tapscott, 2016). With the help of IoT, the quantitative and qualitative indices of the environment can be continuously monitored by using sensors and devices. Such a flow of data aids the companies in that it enables the tracking and subsequent control of resource utilization and waste production, calling for rectification if and when needed (Atzori, Iera, & Morabito, 2010). Technological changes have also impacted the way firms relate with their stakeholders on issues to do with the environment. Thus, digital technologies help

companies disclose information about their performance and sustainable activities to consumers, investors, and authorities (Servaes & Tamayo, 2013).

Technology has brought about increased systems of corporate liability, especially in the relationship between business and the environment. In the current global economy, two main concerns are unfolding, climate change, and resource depletion, and thus environmental accounting becomes significant. This paper discusses the manners in which advanced technologies are shifting environmental accounting techniques to sustainability in corporate responsibility. Environmental accounting as a subject is relatively young, it came into existence towards the end of the twentieth century, when environmental problems coupled with global awareness of business firms' impacts on the environment led to internalizing environmental costs (Gray, 1992). It encompasses the process of capturing, processing, presenting, and communicating information relating to the direct and indirect environmental effects of an organization's operations (Lewis, 2012). Environmental accounting has previously referred to the assessment of economic activities' impacts on the environment as well as mandatory reporting, it, however, shifted to include strategic environmental management. Sophisticated technologies used in today's society have greatly impacted environmental accounting. Technologies such as big data analytics, artificial intelligence, blockchain, and the Internet of Things are among the needed technologies enabling the changes to the environmental accounting landscape (Watson et al., 2010) These technologies improve opportunities for higher accuracy, and broader liability for collecting and analyzing the figures on environmental performance, and better visibility and communication about it. The analysis of big data can help in processing large amounts of environmental data, which can contribute to the improvement of decision-making methodology in cases of environmental management (Porter & Heppelmann, 2014). Young and Seringhaus (2008) and Ioannou & Serafeim (2017) identified another external benefit of applying AI and machine learning, which was to improve predictive modeling and simulation to help organizations have a sense of the risks in the environment. Sustainability data can be secured with the help of blockchain technology, but this information must be credible to the public; thus, credibility is a key factor addressed by blockchain technology in the process of preparing sustainability reports (Tapscott & Tapscott, 2016).

The Internet of Things remodels the monitoring of the environment by collecting the conditions in real time through connected sensors and other devices. This enables proper environmental planning and managerial control and even helps in quick response in case of environmental events (Atzori, Iera, & Morabito, 2010). Further, these technologies enable circular economy strategies, which take efficiency and waste as core logics of the organizations (Geissdoerfer et al., 2017). In this case, this research believes that technological developments are not just cherishes that aid in environmental reporting but agents of change in the course of sustainable corporate responsibility. They allow organizations to move to the next level of compliance and be active guardians of environmental health. This transition is justified based on the rationale that the sustainability of business over time is anchored on the state of the environment and the degree of business responsibility to society (ECCLES, IOANNOU & S, 2014). Moreover, as these technologies are adopted within corporations, the corporations themselves are redesigning their relations with the stakeholders. Any customer, investor, or regulator expects more transparency, and organizations have the capabilities with technology to meet these expectations (Servaes & Tamayo, 2013). It is in this context that the adoption of technological advances in the execution of environmental accounting is viewed as a focused effort for organizations that are serious about the idea of sustainable business practices.

The background of the study reflects on the importance of technological advancement in enhancing environmental accountants. They are proving the balanced approach to corporate responsibility that makes the ecological questions the core of the company's actions. As such, the study seeks to deepen the understanding of such dynamics to enhance technology's capability to promote sustainability and responsibility in the corporate world. Therefore, realized through technological advancement, it is possible to see the perfect harmony between environmental values adopted by the framework of accounting and corporate responsibility for the future. It is highlighted that many business initiatives are already operating using an environmental management system and can together advance towards change for the better and make a significant contribution to the generation of positive environmental impact. Thus, as corporations are progressing with more creative ideas, the possibilities of how technology can contribute to the improvement of environmental accounting and sustainability practices are very high and unexplored.

Statement of Research Problem

Technological advancements to be incorporated in environmental accounting also remain a rapidly growing field able to boost corporate sustainability activities. Nonetheless, there is an important research gap that consists of identifying best practices for the application of these technologies to facilitate environmental accounting and therefore, sustainable corporate responsibility. In this respect, the following research problem is articulated, leading to the mitigation of the existing gap between the existing technologies and their application on EA: Despite the phenomenal advancements in big data analytics, AI, blockchain, IoT, and many other innovations, there is a limited existing literature that consolidates each of these technologies as a whole into the context of environmental accounting (Tschakert, 2015). Furthermore, the literature presents a lack of concern with the organizational and behavioral issues companies encounter when implementing these technologies (Arvidsson, 2010).

The shortage of research becomes particularly alarming in the context of technological increases and possibilities that can be directed onto enhancement of the existing environmental accounting as well as influencing the culture of sustainable development of organizational activities. To fill the knowledge gap, further research is required to examine the processes by which technology impacts environmental accounting and economically consequent corporate responsibility (Ioannou & Serafeim, 2017). The main research question is to explore and understand how information technologies can promote green-ended patterns for environmental accounting practices to achieve corporate responsibility diffusion. This entails evaluating the contribution of such technologies to improving the quality, credibility, and openness of environmental information and their application in decision-making for sustainability. The second issue is the identification of factors likely to hinder the taking up of these technologies in environmental accounting. This entails also looking at the organizational, cultural, and technical factors that firms face and the management of these in the use of potential solutions (Melville, 2010).

The major objective of this study is to evaluate and propose a framework for integrating technological innovations in environmental accounting that enhance sustainable corporate responsibility by identifying the key organizational and behavioral factors influencing their adoption. The major research question is known as How technological innovations in environmental accounting can be effectively integrated to enhance corporate sustainability, considering the significant organizational and behavioral factors influencing their adoption.

Significance of the Study

This is useful for details it provides, since before this work data were scarce on the deployment of such technological supports in environmental accounts. The trio of blockchain, AI, and data analysis has the potential to optimize environmental accounting practices concerning the precision and credibility of environmental costs and consequences reporting (Bebbington & Unerman, 2020; Lamberton, 2021). In conclusion, it can be asserted that the outcomes obtained to fill the gap in the research will be significant for practitioners and policymakers to better understand particular technological innovations' suitability to accomplish the goals of sustainable development. For instance, the effects of applying blockchain could contribute to the generation of clear records of environmental information that would enhance the level of responsibility (Kouhizadeh & Sarkis, 2018), while the impact of using AI can result in the continuous monitoring and advanced analysis of the environmental parameters in real-time (Gholizadeh et al., 2022). Furthermore, the study is useful for the expansion of the theoretical database dedicated to the research of this phenomenon in the future. In this regard, the work adds to the understanding of technological applications in environmental accounts to support organizations on how to align and support sustainable development agendas, thus moving forward on the international strategic framework for sustainability (Elkington, 2018; Schaltegger et al., 2022). The following is a suggested framework for implementing technological innovations a contextualisation of the research will be useful as a ready reference source for the improvement of environmental accounting for academic researchers and those in practice.

Literature Review

Information and communication technologies in environmental accounting have been also identified as innovative incentives in the recent thrusts on business, responsibility, and sustainability. When organizations are placing efforts to attain environmentally sustainable goals and aims, the integration of technology into their accounting systems can play a significant role in environmental accounting because measurements, evaluation, and documentation of one's environmental status can be accomplished. Technology is a research focus in this literature review study that looks into how technological innovations can foster environmental accounting as a sustainable business management strategy. There has been the incorporation of the use of sophisticated software and systems for the collection, processing, and analysis of environmental accounting data. Mitchell (2017) indicates that advanced EMIS is helpful in monitoring, evaluating, and analyzing companies' resource use rates, waste generation, and emission levels in real-time. These systems help firms obtain precise and credible information on the environmental issues that remain vital in environmental management and auditing. Thus, the utilization of EMIS allows for the enhancement of efficiency and effectiveness of environmental accounting, as it can help to minimize the time and increase the accuracy when collecting the data on the environmental performance of the company. Also, big data analytics for environmental accounting has equally brought about changes in how firms undertake and report on their environmental stewardship. Big data IT solutions provide the capability to analytically master increased environmental flows and derive effective patterns for using and managing them which cannot be obtained by traditional accounting practices (Oliveira et al., 2019). This will help organizations acquire a better understanding of their environmental management and result in better decision-making and successful initiatives toward making changes for the better concerning their environmental impact. Thus, the technological advancements which have been outlined include data collection and analysis but innovations such as blockchain could revolutionize the credibility and transparency of environmental

accounting. Xu and Teixeira's (2019) work pointed out that blockchain can also facilitate environmental data and transactions, or disclosure that cannot be tampered with. Thus, through the use of blockchain-based environmental accounting systems, business entities can improve the reliability of environmental reports to show their sincerity in practicing corporate sustainability. towards increased innovations in the methods of measuring environmental impacts through accounting, the use of IoT devices in industrial processes is increasing. Internet of Things (IoT) sensors and devices ensure facility monitoring, supply chain networks, energy systems, and environmental factors such as energy efficiency, water, and air (Bolisani & Handzic, 2020). This stream of data from the environment created by IoT devices can be incorporated into the company's accounting system to provide real-time and holistic checks of the firm's environmental effects. Implementing AI and machine learning the effects in environmental accounting allow for better and more accurate analysis of the environmental and long-term effects predictive modeling and scenario analysis of business operations (Kamilaris et al., 2017). To sum it up, through the use of AI capacities, one can generate estimates of how a given company's operations will impact the environment given specific business decisions, and hence act as a tool to prevent adverse environmental effects.

In the Li et al. (2022) study, the authors note that the use of remote sensing technologies is increasing as a means of boosting environmental accounting activities. Techniques like satellite imagery and UAV are very helpful to monitor environments and ecological health as they are non-destructive and quite economical. These technologies can help get information on the use of land, the rates of deforestation, and the loss of bio-diversity which are important in assessing the impacts of corporate activities on the environment. Based on the hypothesis, the integration of remote sensing data into accounting systems can contribute to a better assessment of the company's environmental impact.

The revelation of augmented reality and virtual reality brings interesting possibilities regarding the involvement of its stakeholders in the environmental accounting processes. Wang et al., (2021) point out that, augmented reality and virtual reality platforms can be used in designing engagements to share real-time environmental data. As a result, environmental information, which is displayed in an Objectified Reality manner, can help enhance stakeholder engagements, hence a better way of managing the environment through the hope of utilizing AR and VR technologies. Also, circular economy trends have come forward to define new concepts of environmental accounting for many businesses. Circular economy strategies focus on the rate of resource utilization, waste generation, and product life cycle which in turn reduces negative externalities in the value chain (Stahel, 2016). Recording systems in line with the circular economy principles therefore help the companies to determine the impacts of embracing environmentally friendly production and consumption systems. In their study, Geissdoerfer et al. (2020) stress the need to include circular economy indicators, including material circularity index and resource efficiency as potential additions to the environmental management accounting systems. Huge progress is being witnessed in Geospatial technology and, thus, organizations are making spatially explicit environmental accounting allowing them to consider where their impacts and dependencies lie (Ma et al . , 2020). Environmental impact assessments of the company can also be easily run using GIS and spatial analytical tools since these technologies enable businesses to locate environmentally sensitive areas and determine the spatial distribution of the organization's operations. Such integration of the geographical information with their systems of accounts would also help the companies to identify the geographical locality of major strains on the environment and to apply specific corrective actions.

Theoretical Framework

The construction of the theoretical foundations concerning the contribution of technological advancements within the realm of environmental accounting in corporate responsibility is based on various concepts and theoretical theories. Environmental accounting is essentially the process whereby environmental data is quantified and reported to the stakeholders with an emphasis on using environmental data in the organizational decision-making system (Bebbington & Larrinaga, 2014). Thus, based on the institutional theory, stakeholder theory, and innovation diffusion theory, this framework synthesizes the reasons for the adoption and consequences of the implementation of technological innovations in practices of environmental accounting. Within institutional theory, it is possible to study institutional pressures and regulatory mechanisms that force organizations to implement environmental accounting (DiMaggio and Powell, 1983). Based on institutional theory, institutions are precisely formal or informal forces that exist in an organization's environment and exert institutional pressure to determine its actions and activities (Scott, 2014, p. 106). When it comes to environmental accounting, external pressure in the form of legal and reporting requirements implies a set of institutional forces that influence organizations to integrate better and more advanced technological tools to perform in conformity with the regulatory demands and accountability aspect to the stakeholders (Gibassier & Schaltegger, 2018).

Stakeholder theory focuses on stakeholders' interests and their pressure as the main drivers of organizations' actions and choices (Freeman, 1984). From stakeholders' perspective, firms are expected to be not only profit-motivated while responding to the interests of shareholders only, but also socially responsible and responsive to other stakeholders, such as customers, employees, communities, and various regulating agencies (Mitchell et al., 1997). Besides, as companies' performance regarding environmental responsibilities and sustainability becomes more scrutinized by stakeholders, organizations have the drive to use IT systems' technological tools to gather, process, and provide environmental information coherently and effectively (Bansal & Clelland, 2004).

Innovation diffusion theory offers insights into the process by which new technologies are adopted and disseminated within organizations and across industries (Rogers, 2003). According to this theory, the diffusion of innovations is influenced by various factors, including the perceived relative advantage, compatibility, complexity, trialability, and observability of the innovation (Rogers, 2003). In the context of environmental accounting, technological innovations such as advanced data analytics, IoT devices, and blockchain technology offer perceived advantages in terms of enhancing efficiency, accuracy, and transparency in environmental reporting, thereby driving their adoption among forward-thinking organizations seeking to gain a competitive edge (Zheng et al., 2021).

The theoretical framework incorporates insights from sustainability theories, which emphasize the interconnectedness between environmental, social, and economic dimensions of sustainability (Elkington, 1998). Environmental accounting, as a tool for measuring and managing environmental performance, aligns with the principles of sustainable development by promoting the integration of environmental considerations into business decision-making processes (Schaltegger & Burritt, 2018). Technological innovations serve as enablers for achieving sustainability objectives by facilitating the tracking, monitoring, and optimization of resource usage, emissions, and waste generation, thereby fostering a more sustainable approach to corporate responsibility (Graff Zivin & Neidell, 2021). Building upon the theoretical framework outlined, several additional concepts and theoretical perspectives contribute to understanding the role of technological innovations in driving environmental accounting within the context of corporate responsibility.

Resource Dependency Theory (Pfeffer & Salancik, 1978) offers insights into the relationship between organizations and their external environments, particularly regarding resource acquisition and dependence. In the context of environmental accounting, organizations rely on environmental resources and are subject to regulatory requirements and societal expectations regarding their environmental impacts. Technological innovations in environmental accounting can help organizations better manage their environmental resources, reduce dependence on finite resources, and mitigate risks associated with resource scarcity and environmental degradation.

Systems Theory (Bertalanffy, 1968) provides a holistic perspective on organizational processes and interactions within complex systems. Environmental accounting operates within the larger system of corporate governance, where decisions and actions have interconnected environmental, social, and economic implications. Technological innovations in environmental accounting contribute to enhancing the feedback mechanisms within this system, enabling organizations to monitor and adjust their environmental performance in response to changing internal and external factors.

The Theory of Planned Behavior (Ajzen, 1991) offers insights into the psychological factors influencing individual and organizational behavior. In the context of adopting technological innovations in environmental accounting, factors such as attitudes, perceived behavioral control and subjective norms play a significant role in shaping organizations' intentions to embrace new technologies. By understanding and addressing these factors, organizations can promote the adoption and integration of technological innovations into their environmental accounting practices more effectively.

The Concept of Legitimacy (Suchman, 1995) highlights the importance of perceived social acceptance and approval in shaping organizational behavior and practices. Companies seek legitimacy by conforming to societal norms and expectations, including those related to environmental responsibility. Technological innovations in environmental accounting can enhance companies' legitimacy by demonstrating their commitment to transparent and accountable environmental management practices, thereby enhancing their reputation and relationships with stakeholders.

Complexity Theory (Holland, 1995) provides insights into the dynamics of complex adaptive systems, emphasizing the non-linear and emergent properties of organizational processes. Environmental accounting operates within complex socio-technical systems, where technological innovations interact with organizational structures, processes, and cultures in unpredictable ways. Understanding the complexity of these interactions is essential for effectively implementing and leveraging technological innovations in environmental accounting practices.

Empirical Studies

Various technological determinations are centrally positioned in influencing environmental accounting practices across firms, as has been presented by recent theoretical findings on corporate social responsibility. Sophisticated operational environmental management information systems (EMIS) allow companies to monitor the use of natural resources, generation of wastes, and discharge of emissions in real-time and thereby they aid in the execution of effective environmental audits. Besides, the use of big data analytics enhances a better understanding of a firm’s environmental performance and enables it to make the right decision when it comes to the environment (Oliveira et al., 2019). Blockchain technology helps to

improve the want and credibility of environmental accounting practices by differentiating and legitimizing the environmental data (Xu & Teixeira, 2019), and IoT state-of-the-art devices make it possible to continuously track the real-time environmental parameters like power use and air quality (Bolisani & Handzic, 2020). Furthermore, the existing research stresses the positive influence of AI in enhancing the reliability of forecasting important environmental indicators for evaluating prospective consequences on the environment which in turn helps the corporations to minimize threats that may arise in the future (Kamilaris et al., 2017). In summary, all these technological innovations not only enhance the advancement of environmental accountancy practices but also add to the concept of sustainable corporation responsibility for environmental accountability that promotes economic and social development together with perpetuity in natural resources and environmental preservation.

The incorporation of these technologies into the environmental accounting corresponds to the overall sustainability framework and acknowledges the linkage between the environmental, social, and economic aspects. Based on big data analytics, blockchain, IoT gadgets, and AI, firms can improve the sustainability measurement, tracking, and reporting integration to adhere to compliance law and shareholders' expectations (Mitchell, 2017; Oliveira et al., 2019; Xu & Teixeira, 2019; Bolisani & Handzic, 2020; Kamilaris et al., 2017).

Empirical review points to the fact that these emancipating technological developments have positive effects on corporate responsibility and sustainability. Environmental sustainability can be recognized and managed through good practice environmental accounting as it assists a firm in pinpointing inefficiencies, and areas of suboptimal resource use, or environmental degradation in its operations (Mitchell, 2017; Oliveira et al., 2019; Bolisani & Handzic, 2020). Further, sustainable practices in organizations are also beneficial for improving business image, gaining credibility among consumers, and establishing a competitive advantage (Xu & Teixeira, 2019; Kamilaris et al., 2017). Thus, one can assert that empirical evidence supports the notion of technological change as an external factor that has a direct positive impact on environmental accounting as well as increased sustainable corporate responsibility. Whether it is aggregating information expanding the data analytics of a clear database or boosting efficiency within the financial credits, these innovations present useful methodologies essential to reducing and measuring the environmental impact effectively. Through the adaptation of these technologies, organizations stand in the position to not only meet the set standards but also support the execution of environmental goals at the international level and at the same time continually enhance the sustainability of their business endeavors.

Research Design

To support the hypothesis, a research questionnaire was developed to gather data about the aforementioned variables, including managers' attitude changes about the technological innovations of environmental accounting and their perceived corporate sustainability for the firm. Survey research design is found most relevant and suitable in testing H_1, since, in Leary's (2001) view, surveys probe the respondents' perspectives, patterns of living, conduct, and issues. Besides, prior research on CSR, environmental performance and corporate citizenship has employed survey research design assuming the most preferred causal research design (Khanna et al., 2009; Marshall et al., 2009; Wagner & Schaltegger, 2004). In survey research, the respondents from the selected company*,e Dangote Groups* give out information concerning themselves in the form of answering a set of questions or through an interview. This cross-sectional survey puts into application a random sample targeted at managers in multinational extractive firms. Leary (2001)

reveals that most of the surveys create a cross-sectional design of research in which only one set of respondents, or a cross-section of g the population, is used.

Data collection procedure and sample frame

The research population to test H_1 was the entire staff of the selected Organizations that were at the managerial level. The research sample was made up of 275 selected staff of Dangote Group in the guise of the managers operating within the extractive of the companies. The convenience sampling method was employed to gather the data since it offers fairly reasonable access to the sample data frame (Saunders et al., 2003). An advantage of this method is that it may help establish the validity and the ability to generalize the results of a survey better than with other methods available (Fowler, 2002; Nardi, 2003).

Pilot Survey

Piloting can be defined as the process of initially facing trial on several aspects of the research study including the questionnaire, sample, method of research as well and the research hypothesis (Blumberg, 2011). Literature shows that normally, a pilot study is performed to assess the reliability of the questionnaire, whether the range of options offered in questions is appropriate, whether the questions are clear to the respondent, duplicity if any in questions, to get an estimate of the likely response rate of the study, and most importantly, the probable cost and time that the study will take (de Vaus, 1993; Oppenheim, 1999

Data Analysis Techniques

To prove the hypothesis the use of the Pearson correlation coefficient and a general linear model (GLM) shall be made. Pearson product-moment correlation [r], often referred to as Pearson's correlation is a bivariate parametric measure of correlation good for use where the two variables are likely to be normally distributed. Pearson correlation coefficient is used to establish the extent of association or relationship between two variables but it cannot indicate the cause-and-effect relationship between the two variables. If the dependent variable is continuous and the independent variable is scale or categorical the use of GLM is implied. It is the basis for t-tests, ANOVA, ANCOVA, regression analysis, and most other multivariate procedures (Williams, 2006). For this study, GLM is used as an additional test while working in parallel with the Pearson Correlation test for hypothesis testing. Descriptive Statistics for Measuring Scale Items

Table 1: Descriptive Statistics for Selected Scale Items

Scale Items	N	Mean	Std Deviation	Skewness	Std Error	Kurtosis	Std Error
EA01	275	4.20	0.59	-0.07	0.15	-0.34	0.29
EA02	275	3.76	1.08	-0.83	0.15	0.31	0.29
EA03	275	4.42	0.80	-1.33	0.15	1.12	0.29

CR01	275	4.22	0.76	-1.41	0.15	4.12	0.29
CR02	270	4.04	0.90	-0.99	0.15	1.11	0.30

Study descriptive scale

Table 2: Summary of Descriptive Statistics for EA and CR

Statistics	Environmental Attitude	Corporate Reputation
Mean	3.8200	4.1055
Median	3.8000	4.1000
Std. Deviation	0.44369	0.49354
Variance	0.197	0.244
Skewness	0.144	-0.880
Std. Error	0.147	0.147
Kurtosis	-0.613	1.432
Std. Error	0.293	0.293
Minimum	2.90	2.50
Maximum	4.80	5.00
Valid No.	275	275

Researcher findings 2024

Results of the Hypotheses Testing

H_1: Technological innovations in environmental accounting significantly enhance corporate sustainability, and this effect is influenced by organizational and behavioral factors.

The results of the correlation indicate a positive relationship between environmental attitude and corporate reputation (Pearson correlation coefficient of 0.211, significant at the 1% level). The GLM analysis confirms that environmental attitude is a good predictor of corporate reputation with a significant linear relationship at the 1% level (R squared = 0.519, Adjusted R squared = 0.489).

Table 3: Results of Pearson Correlation for H_1

Correlation	Environmental Attitude	Corporate Reputation
EA	Pearson Correlation	1
	Sig. (2-tailed)	
	N	275
CR	Pearson Correlation	.211**
	Sig. (2-tailed)	.000
	N	275

Researcher findings 2024

Correlation is significant at the 1% level (2-tailed).

Table 4: Summary of General Linear Model (GLM) Result for H_1

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	34.643(a)	16	2.165	17.403	.000
Intercept	2696.329	1	2696.329	21672.275	.000
EA	34.643	16	2.165	17.403	.000
Error	32.099	258	.124		
Total	4701.800	275			
Corrected Total	66.742	274			

Researcher findings 2024

R Squared = .519 (Adjusted R Squared = .489), Dependent Variable: CR

Discussion of Findings

Thus, the technological developments in the field of environmental accounting and perceived corporate sustainability are positively and significantly related (Pearson correlation coefficient = 0. 211, $p < 0. 01$). From this, one can deduce that environmental attitudes have a strong connection with corporate reputation. The GLM analysis further supplements the arguments estimating that managers' environmental attitudes influence corporate sustainability, DP-. 000,_lin=. 259, p=. 014.

This is contrary to Davies et al. (2003) who state that a firm's reputation is brought by how employees of the organization view it. The analysis of employees' perceptions and behavior has a strong impact on a business's reputation (Fisher-Buttinger & Vallaster, 2008). This research is novel for linking environmental

attitudes to corporate reputation, for which the present study supports Helm (2010) while noting positive relations between employees' pride, job satisfaction, and corporate reputation.

Conclusion

The incorporation of technological developments into environment knowledge accountabilities reveals a major improvement in the quest to extend corporate responsibility in the environment. Due to advanced technologies, especially big data analytics, AI, blockchain, and IoT, companies and industries have greatly increased the ability to collect, analyze, and report environmental data more truthfully and efficiently to establish environment cost accounting. Many of these innovations help to improve compliance with environmental legislation and at the same time provide businesses with a chance to aim for sustainable development by integrating environmental objectives into the companies' strategic plans. At the same time, as more and more companies acknowledge the integration of sustainable development goals and stable business performance, the use of such technologies is becoming a necessity. The result of this research stresses the function of technology in the advancement of environmental accounting and, therefore change for a sustainable future. Thus, thanks to these achievements, not only can companies and their management meet intense current and future requirements for the regulation of the economic activity of organizations, but organizations can improve their business reputation and become leading players in achieving global environmental objectives set by society.

Recommendations

1. Adoption of Advanced Technologies: Companies need to incorporate and leverage enhanced technological tools like big data analytics, artificial intelligence, blockchain, and IoT to improve Environmental accounting. The said technologies yield important advantages in data accuracy, clarity, and effectiveness.
2. Employee Training and Development: To effectively gain these technological advancements and improve the organizational design, specific focus needs to be given to the training and development of organizations' human capital. This will help to solve the problem of a lack of adequately trained staff to work with those tools in the organization.
3. Integration with Corporate Strategy: Environmental accounting should be a tool for implementing the company's sustainable development strategy at every level of organizational activities. This approach will assist firms in gaining a competitive advantage in attaining their sustainability and business strategies.
4. Stakeholder Engagement: Management must ensure stakeholders such as the customers, investors, the government, and the public receive timely and accurate information on the firm's environmental compliance and sustainability activities. Stakeholders' engagement has shown that efficient and open communication can help improve the level of trust from the side of stakeholders.
5. Continuous Improvement: There should be periodic appraisal and updating of the environmental accounting practices to embrace technological innovations as well as better practices. Sustainability and corporate responsibility processes will be continually improved to keep the stakeholders abreast with the latest requirements.
6. Collaboration and Knowledge Sharing: Future research should engage companies, other industries, educational institutions, and technology providers to exchange hubs for sharing knowledge and the

benchmarks of environment accounting. Such an approach can foster creativity and result in increased diffusion of sustainable approaches across the various sectors.

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