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Enhancing sustainability accounting through Artificial Intelligence (AI): a case of Nigerian manufacturing companies

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ABSTRACT
This study evaluates the impact of artificial intelligence on the practice of sustainability accounting in Nigeria. Using a cross-sectional survey of ninety-one (91) respondents drawn from finance departments and management of manufacturing firms in Nigeria, a one-sample z-test of proportions was conducted to validate the study's hypothesis, which is: the proportion of stakeholders that perceive that AI improves sustainability accounting practices is less than or equal to 50% ($\alpha = 0.05$). Data analysis ($p \leq 0.05$) revealed that a significant proportion of respondents agree that sustainability accounting can be improved by artificial intelligence. The study concludes that artificial intelligence is very effective in sustainability accounting and can be useful for workloads like advanced analytics and natural language processing.

Keywords: Artificial intelligence, sustainability accounting, machine learning, deep learning, natural language processing, analytics.

I. INTRODUCTION

Sustainability has become a stark reality that organizations have had to factor into their strategic planning and execution in order to remain competitive. Very early studies like Robbins (1935), have identified the finiteness of factors of production, and posit that one of management's cardinal roles is to ensure that scarce resources are utilized in a way that ensures that maximises the value created by the organization. The reality of the finiteness of factors of production has never been more pronounced as it is in this dispensation, and this has prompted various responses from sustainability-promoter organizations. The United Nations (UN), for instance, has adopted a multidisciplinary and multifaceted approach to tackling the sustainability challenge with programmes like Sustainable Development Goals (SDGs), the Conference of Parties (COP) organized under the United Nations Framework Convention on Climate Change (UNFCCC), and the likes(Jones et al, 2017; Hickmann et al, 2021).

Sustainability accounting is the response of the financial accounting function to ensure that organizational stakeholders possess holistic information about the true state of the affairs of the organization. It must be noted that by adopting a holistic paradigm, the remit of the accounting function is expanded beyond regular financial metrics and reports into the integration of sustainability-related information. This ensures that the externalities (either positive or negative) that are created by the organization, and the effects of such externalities are captured in the performance reports given to the firm's stakeholders (Oyewo et al, 2022; Ikpor et al, 2022).

II. BACKGROUND

As the volume of data generated by organizations continue to increase astronomically, it becomes imperative that the accounting function must evolve and creatively utilize the power of technology in the production of performance reports. Also, in organizations that have digitalized their operations, most source documents required for audit trail are generated by these digital systems. It therefore follows that for efficiency, the systems that generate the organization's performance reports ought to be digitalized. The effects of this digital transformation touch all facets of the accounting function, including sustainability accounting (Krishna et al, 2022; Nkwede & Aniuga, 2023, Adebola et al, 2023; Ukpong, 2023).

It is in the light of these, that this study seeks to evaluate the effect of technology on sustainability accounting in Nigeria, and whether or not the stakeholders agree that investment in technological capabilities can be a booster to value derived from the practice of sustainability accounting in Nigeria. While studies like Oyewo et al (2022) have attempted to examine the impact of

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technology on sustainability reporting in the Nigerian context, this study creates new knowledge by narrowing the focus to the use of artificial intelligence (AI) capable tools in sustainability accounting in Nigeria.

III. LITERATURE REVIEW

Artificial Intelligence (AI), as a terminology, has been used to define a group of techniques and tools that utilises statistics, mathematics, and modern computing to perform tasks that relate to forecasting, analytics and pattern identification. Due to its effectiveness, AI is able to parse both structured and unstructured data, which is encountered in daily accounting workloads like document analysis, and transaction processing (Association of Chartered Certified Accountants, 2017;Solikin & Darmawan, 2023; Kapoor et al, 2022)

Two prominent techniques exist in AI: machine learning and deep learning. Machine learning is normally used to describe the use of tools like statistics, math and operational research in processing data, captured in tabular form. Machine learning techniques like regression, clustering and classification are used to generate insights from data. In deep learning, artificial neural networks are utilized to process vast volumes of data, structured or unstructured. In today's accounting, some workloads that have benefitted from deep learning include: using computer vision to scan invoices and other source documents, using natural language processing for classification of transactions(Association of Chartered Certified Accountants, 2017; Shimamoto, 2018)

AI impacts accounting by reducing errors and eliminating the use of man hours for mundane transactions processing tasks. Because of increase in computing power, AI is able to process far larger volumes of transactions than humans can, thereby giving organizations a boost in productivity. It appears that sustainability accounting, being a subset of accounting can benefit from the versatility that AI brings (Shimamoto, 2018; Liaras& Nerantzidis,2023; Peng et al, 2023).

IV. METHODOLOGY

Research design

This study adopted a quantitative research design, utilizing a cross-sectional survey of ninety-one (91) respondents who were picked from a stratified random sample of employees (of finance or related departments) and executive management of public companies in Nigeria that have adopted sustainability accounting. The respondents were given survey instruments in either electronic or printed form, depending on their preference. The primary question in the survey was "On a scale of 1 to 5, how much has artificial intelligence improved your organization's sustainability accounting practice?" This question was mapped to the research question of this study, which is: does artificial intelligence improve an organization's sustainability practice?" In order to ensure the Likert-scaled responses yielded plausible results, only respondents that selected scores from 3 to 5 were marked as providing confirmation that AI significantly improved their sustainability accounting practice. Respondents with scores below 3 were marked as not providing evidence that AI made any significant improvements to their sustainability accounting practice. The respondents were also asked other questions that aimed to provide insights about the major artificial intelligence techniques that have been deployed in their reporting entities' sustainability accounting process.

Research Hypothesis

In order to attain the objectives of this study, the research hypothesis was formulated thus:

H_0 = The proportion of stakeholders that perceive that AI improves sustainability accounting practices is less than or equal to 50%

H_1 = The proportion of stakeholders that perceive that AI improves sustainability accounting practices is greater than 50%

To test the hypothesis above, Minitab (version 18) was used to perform one-sample z-test of proportions at a significance level of 0.05. By using a hypothesized proportion of 50%, this study deemed a simple majority satisfactory to assess whether or not there was evidence against the null hypothesis.

V. FINDINGS

Based on results of data analysis, this study found the following:

- As seen in Figure 1, seventy-five (75) respondents (82.42%) opine that artificial intelligence has significantly impacted their sustainability accounting practice, while sixteen (16) respondents (17.58%) think artificial intelligence has not significantly impacted their firm's sustainability accounting practice.

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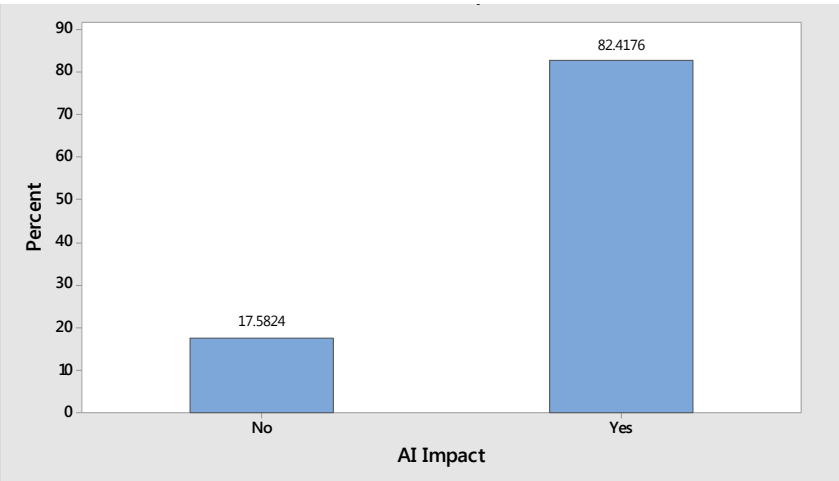

Figure 1 – Bar chart of responses grouped by opinion on AI impact in sustainability accounting.

- As seen in Table 1, the z-value is 6.18, higher than the critical value of 1.645 for a one-tailed test with 95% confidence, while the p-value of 0.000 is below the study's significance level (0.05). These indicate evidence against the null hypothesis.

N	Event	Sample p	95% Lower Bound for p	Z-Value	P-Value
91	75	0.824176	0.758538	6.18	0.000

Table 1 – Hypothesis test summaries

- The data shows that there are two main artificial intelligence techniques used in the preparation of sustainability reports in Nigeria: analytics and natural language processing.As seen in Figure 2, seventy-three (73) respondents (80.2%) say that the major use of AI is in analytics, while eighteen (18) respondents (19.78%) say their primary use of AI is natural language processing. None of the respondents indicated that they used artificial intelligence in any other workload like image processing.

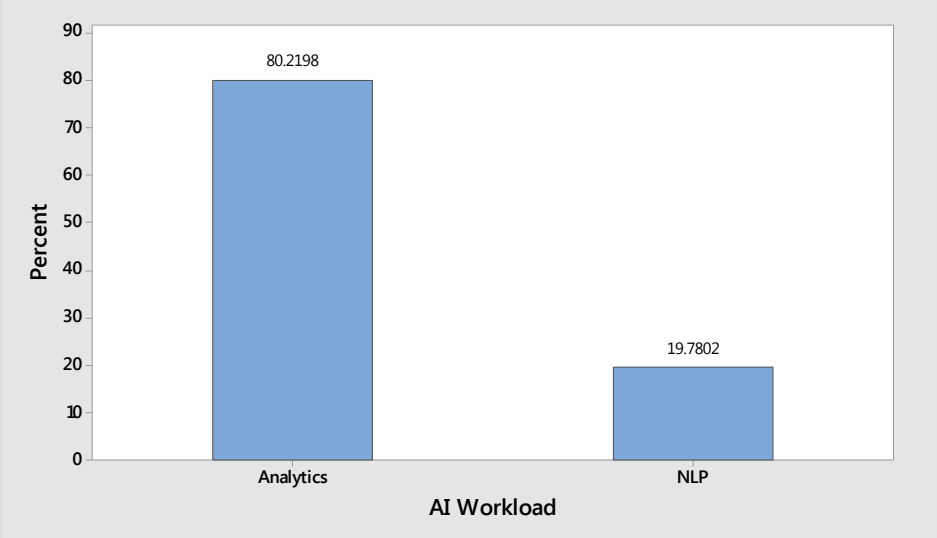

Figure 2 – Bar chart of AI techniques used in preparation of sustainability accounts

VI. DISCUSSION OF FINDINGS

Sustainability accounting requires disclosure of a lot of non-monetary informationin both structured and unstructured form, and in conformity with requirements that have been defined by sustainability accounting standards and regulatory frameworks(Peng et al, 2023).In addition to disclosure required by sustainability standards and frameworks, other stakeholders of reporting entities have disclosure requirements imposed on reporting entities either through moral suasion, pressure or some form of collective bargaining (Amran & Keat, 2014, Batra et al, 2022). While these requirements can make sustainability accounting an onerous task, the data suggests that artificial intelligence can help reporting entities comply with disclosure requirements and improve the efficiency of persons involved in the finance function in reporting entities.

The data also suggests that much of the workload for which Nigerian entities use artificial intelligence solutions pertain to analytics and natural language processing. Due to the power of deep neural networks, reporting entities in Nigeria appear to mostly use artificial intelligence to perform complex analytical procedures like forecasting, analytical reviews, trend monitoring, pattern matching and similar tasks that appear too convoluted for manual accounting systems. Also, because most of sustainability reporting is largely about disclosure in explanatory notes, natural language processing with techniques like Retrieval Augmented Generation (RAG) can be used to accelerate the preparation of sustainability reports (De Villiers et al, 2024).

VII. LIMITATIONS

While utmost care has been taken to ensure that the results of this study can be generalized easily, this study faces some noteworthy limitations:

- Geographical limitations: This study is limited to manufacturing companies in Nigeria. Particularly, respondents were picked from Lagos, Ogun and Abuja. Care should be taken when extending the results of this study beyond the aforementioned geographical locations.
- Methodological limitations: This study uses a cross-sectional survey design which captured the respondents' feedback at a point in time. While a longitudinal survey might yield clearer insights, especially by showing how respondents' views develop with the passage of time, financial and time constraints necessitated the use of a cross-sectional survey.

VIII. CONCLUSION AND AREAS OF FURTHER RESEARCH

This study concludes that for Nigerian firms, artificial intelligence has the capacity to enhance the practice of sustainability accounting, and that most firms that deploy artificial intelligence techniques utilise them for advanced analytics and natural language processing. Further study can reveal findings such as: challenges of deploying artificial intelligence in sustainability accounting in Nigeria, and whether a reporting entity's size affects its ability to use artificial intelligence in sustainability accounting.

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