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Big Data, Blockchain and Artificial Intelligence for True Cost Accounting in the Oil and Gas Sector: Evidence from Nigeria

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Abstract

The identification and allocation of various costs of production stages and measure of the impacts are complex and challenging. Prior studies have advanced that he application of disruptive technologies of big data, blockchain, artificial intelligence, and cloud accounting are the new innovative true cost accounting. Consequently, this study examined the effect of big data, blockchain, artificial intelligence, and cloud accounting on true cost accounting in the oil and gas sector in Nigeria. Survey field research was adopted, using structured questionnaire administered to experts among the practicing accountants in the sector. The study obtained that application of cloud accounting ensure clear, simple, and easy estimation of true cost accounting-TCA in the oil and gas sector in Nigeria. To ensure true cost accounting accuracy, timeliness, and reduction of complexities, the used of big data, blockchain, artificial intelligence, and cloud accounting is advised in the oil and gas sector in Nigeria

Keywords: *Artificial intelligence; Accuracy; Big data; Blockchain; Cloud accounting; Timeliness; True cost accounting*

JEL Classification: *L86, M40*

1.1.Introduction

The advent and adoption of disruptive technologies have been on the increase as a result of increasing corporate business expansions and volume of financial reports that are need on fast a record of time. The use of traditional and manual costing and financial reporting are gradually giving way for the application of new information technologies and software system applications. One of the needs for the application of new technologies is to improve the estimation and measurement of costs and the impact on the internal and external environment. True cost accounting has become significant driver of holistic cost measurement in the oil and gas sector that disruptive technologies become imperative to enhance the speed, accuracy, and credibility of financial reports. True cost accounting is a new innovativeness in identifying and estimating real costs of specific products or services. According to Gusc et al. (2022), true cost accounting estimates holistically the direct costs of raw materials, labour and the cost if possible effect of natural and social environment in which the companies operates.

Baker et al. (2020) posited that the oil and gas sector in estimating trues cost accounting, considers the financial figures and the impact on the entire environment where they operate, the holistic consideration and estimation of the monetary aspect of these impacts are considered as the true cost accounting in the oil and gas sector. According to D'Onza et al. (2016), true cost accounting approach for the oil and gas operational activities in Nigeria based on a broad scope of information covering all perspectives of the oil and gas operational chain both internal and external. Michaike et al. (2022) noted that true cost accounting in the oil and gas sector transients beyond a single discipline rather covers all aspects of technical and accounting to critical assets using true cost accounting application. The application of new innovative technologies of Big Data, blockchain, artificial intelligence, cloud accounting no doubt strengthens the true cost accounting application in the oil and gas measures of various monetary value of various operational impacts on the companies from the internal perspective and society from the external angle.

The problem of true cost accounting in oil and gas sector is complex and problematic, as there are diverse areas to consider in measuring the monetary impact of operational activities on the internal and external environment. The

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problem of true cost accounting in the oil and gas sector is deepened considering the heterogeneity of various costs challenges and measuring implications of the operational activities on the environment. Gusc et al. (2022) noted that the problem of true cost accounting and the possible challenges of errors and inaccurate data processes tools could be mitigated with eth application of new information technologies associated with true cost accounting. Agur et al. (2020) posited that new information technology and innovations in the software applications and adoption of selected disruptive technologies like Big Data, Internet of Things (IoT), cloud accounting, Blockchain, artificial intelligence have revolutionized and significantly impacted on the dynamics and time true cost accounting.

The application and benefits of disruptive technologies of big data, blockchain, artificial intelligence, and cloud accounting in the oil and gas production and cost allocation are novel in the Nigeria oil and gas sector, the application of these digital system are significant the way they operate. The technical feasibility of big data infrastructures measured all aspects of true cost accounting impacts analysis of data, identifies pattern, allocates various costs to cost involved in the oil and gas production activities objects, and equipped to reduce negative effects of the challenges (Gusc et al., 2022). The use application of artificial intelligence was to aid in the identification of barriers concerning financing, and potential standardisations of various costs practices as issues to be handled before the real adoption of standards. Blockchain technology becomes handy to enable creation of protocols for all the various product production from extraction, processing, and refining of the oil and gas costs and assures secures the accurate data sharing between all involved parties (Michalke, 2022).

The application of big data, blockchain, and artificial intelligence in true cost accounting is capable to enhance true cost accounting analysis better and beyond the normal methods of financial estimates but combines technical and new accounting processing innovative to critically estimate and measure true cost accounting for the oil and gas sector comprehensively and ensure speed and accurate information required for decision-making (Brodny & Tutak, 2021). Alsharif (2019) reported that there is a close relationship between the application of big data, cloud accounting, artificial intelligence, and blockchain with timely and reliable financial reporting of true cost accounting. The application of big data, artificial intelligence, blockchain, and clouding accounting tends to provide the modernization financial reporting and insight resolving complexities in reporting impact of oil and gas in monetary the impact of these on economic, social, and environmental processes through sustainability reporting requirements that the companies are require to meet.

There are dearth of studies that had explored the significance of true cost accounting and application of Big Data, blockchain, artificial intelligence in the oil and gas sector operational estimations based on the wide-ranging oil and gas operations in the emerging literature in Nigeria. While there are vast studies of financial performance measures, the application of true cost accounting in the measurement of monetary impacts of oil and gas operation on the internal and external are scarce and under-researched in the literature. Apparently there a gap in the literature on the need for comprehensive true cost accounting in the oil and gas sector in Nigeria for accurate and timely true cost accounting for managerial and investors decision-making.

Empirical evidence the significance of big data, blockchain, and artificial intelligence in improving true cost accounting in the oil and gas sector in Nigeria is obviously under-researched, as wide space in the literature is still open in this direction. In addressing this gap, this study considers big data, blockchain, artificial intelligence, and cloud accounting application in true cost accounting a novel initiative to provide adequate measures and estimate that will enhance accuracy, timeliness and at the same time reduce true cost accounting complexity of the accounting field in the oil and gas sector. Consequently, in adding to the body of literature, the significance disruptive technologies in enhancing accurate and timely true cost accounting and financial reporting, this study investigated the effect of big data, blockchain, artificially intelligence cloud accounting on true cost accounting of oil and gas sector in Nigeria. In carrying out the investigation, this study proposed the following:

Research Question: Investigate the effect of big data, blockchain, artificial intelligence, and cloud accounting on true cost accounting of the oil and gas sector in Nigeria.

Research Question: How do big data, blockchain, artificial intelligence, and cloud accounting effect true cost accounting of the oil and gas sector in Nigeria?

Hypothesis (Ho1): Big Data, blockchain, artificial intelligence, and cloud accounting do not significantly affect true cost accounting of the oil and gas sector in Nigeria.

The other aspects of the study were carried out in this manner: In section two, the study considered literature review and theoretical framework. Methodology was presented in section three, while data presentation, results, and discussions in section four. In section five, the study considered summary, recommendations, and limitation of the study.

2. Literature Review and Theoretical Framework

True cost accounting: Companies and organization have the need to estimate the associated cost comprehensively incurred for the present and future true cost accounting as it affects the internal and external activities. Baker et al. (2020) defined true cost accounting (TCA) as a management model that evaluates the true cost involved in operational activities. Similarly, D'Onza et al. (2016) noted that true cost accounting is a new innovation in financial estimation that includes external costs that are not ordinarily included in the conventional accounting and financial costs of the society. In the oil and gas sector, it involves financial costs plus social and eco-costs. True cost accounting timeliness is the consideration of the real-time and availability of the data on a

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time they are need in speedily manner. It entails timely provision of data in relation to oil and gas operation for estimation based on the monetized impacts and in the oil and gas company.

Gusc et al. (2022) opined that true cost accounting is a comprehensive method to account for existing cost of operations and future, internal and external effects, by discounting them in a single price for cost accounting in a particular period of a company. True cost accounting provides a better understanding of the complex economic, social, and environmental procedures through which sustainability should be achieved (Baker et al., 2020). With the use of true cost accounting application, current product, and services prices can be adjusted to accommodate the internal and external impacts all through the entire product or services lifecycle (Michalke, 2022; Gaugler et al., 2020).

Hence, a true and consistent managerial decision could be enthused by putting right prices that will not have unnecessary effect on the consumers of the products or services. According to Janvrin and Weidenmier (2017); Knauer et al. (2020), there are factors that must be considered in estimating true cost accounting, (i) Ability to critically consider and identify cost centers and all the costing areas and processes including wastes, the industry the company operates this will enhance true cost accounting procedures. (ii) Ability to establish cost object and streamline extent of effects of waste and their implications and the associated cost effects. (iii) Estimate all the possible effects, life cycle assessment and the (iv) monetize all the identified effects into monetary terms in relation to the effect on the social and ecological effects.

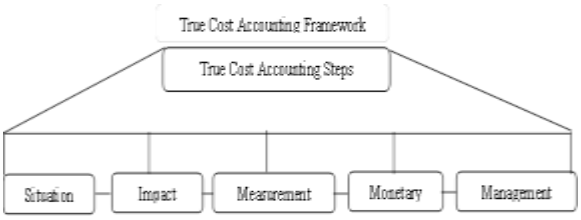

Figure 3.1: True Cost Accounting Steps
Source:

In figure 3.1, the true cost accounting framework considered 5 steps that are significant in estimating cost and the management perspective after the estimations. These steps include thus:

Situation: This considers the true situation of the manufacturing companies and possible cost attributable to the identified stakeholders. Cost in this aspect include cost associated with processes, wastes management cost, the type of manufacturing. Based on these, true cost could be estimated.

Impact: Here the impact of the scope of externalities of wastes and by-products management on the stakeholders as identified.

Measurement: The measurement of all the identified impact based on the defined scope and cost implications of the impact of waste and by-products generated within the manufacturing process.

Monetary: In this perspective, the monetization of all inputs are considered in relation with the social and environmental impact compared with required standards.

Management: Management involvement comes in taking appropriate decisions based on the accurate and reliability of the estimations resulting from the other four steps.

True cost Accounting Complexity

Dealing with diverse elements that are interrelated with each other could be complex and the interrelationship between social, economic, and environmental and the measurement the oil and gas operations impact on each of them could be complex and problematic (Michalke et al., 2022). According to Moll and Yigitbasioglu (2019), the estimation and measurement of the impact into a single and comparable unit lead to complications and consequences using the application of true cost accounting. Neofytou et al. (2020) noted that the adoption of big data, blockchain. Artificial intelligence improves accuracy and reliability of true cost accounting in measurement and analysis of the impacts. The true cost accounting is concerned with the extent by which important and relevant cost evaluation would be trusted and relied upon. The extent to which cause and effect chain among various operational activities and their effect could be identifies (Shi & Li, 2020). Across the entire oil and gas sector's operational activities life cycle of product and services, diverse measuring metrics are used in measuring the impacts, hence, there is no common and accepted measuring metrics and standardization, as many creating true cost accounting complexities (Bosman, 2020; Samadi, 2017).

True Cost Accounting Accuracy: True cost accounting accuracy reflects possible improvement and outcome when big data, blockchain, artificial intelligence and cloud accounting are introduced in monetization, measurement, and evaluation of direct impacts on the sustainability, the social, economy, and environment. The preference and expectation of the stakeholders and the outcome of the true cost accounting could differ in estimating the damages of pollutions from operations using manual true cost accounting valuations, however, the application of big data, blockchain, artificial intelligence as well as cloud accounting tends to have changed the narratives, promising more true cost accounting accurate and timeframe reduction (Miichalke at al., 2022; Shi & Li, 2020).

True Cost Accounting Timeliness: In the oil and gas sector, the application of big data, blockchain, artificial intelligence, and cloud accounting brings great improvement in the true cost accounting timeliness, considering the time differences and time lag gathering and processing data and estimations (Neofytou et al., 2020; Ogaluzor, 2019). The application of these disruptive technologies improves and ensure timely sustainability reporting the effects of oil and gas sector operations on social, economic, and environmental. According to (Pieper et al., 2020), there is a time lag in the

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measurement and real-time monetizing the impact of the pollutions/byproducts disposals and others wastes emanating from product production cycle.

Big Data: Big Data in this instance handle large and complex data that could be complex handling using traditional processing methods or application software. Generally, big data can be classified into various forms, the structured data, semi-structured and unstructured data (Richins et al., 2017; Wang et al., 2020). In the oil and gas sector, the application of big data ensures the data processing in terms of analyzing and storage of large data, using a micro-toll made to identify data patterns and system enabler in order to design smart solutions. Big data is accepted to handle storage and processing of large data in various field including the oil and gas sector, collecting many different data from various sources and characteristics of volume, value, variety, velocity, and veracity.

Block Chain: Blockchain is concerned with the decentralization of financial and ledger of all transaction across interrelated networks. The application of blockchain, the users in the oil and gas sector can confirm transactions without using the central clearing authority in making transfers and other related financial processing issues (Valerie et al., 2019). Similarly, Williamson et al. (2020) reported that blockchain is a decentralized, distributed, and unrestricted digital ledger that is employed to record and process transactions across diverse computers such that the record cannot be easily be altered, retroactively without the modification of all successive blocks and the agreement of the network and related sequences.

Artificial Intelligence: Artificial intelligence is concern with the capability of computers or computerized robots to perform tasks generally related with human mental intelligence (Wu & Wang, 2020). According Yadav et al. (2020), the application of artificial intelligence in the oil and gas sector is significant in handling mental and intellectual accounting jobs in place of human beings based on specific programmed software and information available to the robots. It is a machine that mimic human intelligence to function tasks and can iteratively improve themselves based on the extent of information they collect made available. In the oil and gas sector, artificial intelligence could perform some categories of data processing using reactive machines, limited memory, theory of mind, and self-aware systems (Zhang et al., 2020; Chukwudi et al., 2048).

Cloud Accounting: Cloud accounting is one of the disruptive technologies software that is considered similar to the traditional, on-premises, or self-install accounting software hosted in remote servers. Accounting to Brodny and Tutak (2021), cloud accounting is a system that manages all corporate accounting tasks but the software is runned and controlled through remote server, like the Xero and quickbook online. Bonou et al. (2016) revealed that cloud accounting is connected with accurate and timely true cost accounting in the oil and gas sector, suggesting that it provides the sector with the automation of various true costing activities by handling various tasks, reducing time, and ensure cost savings.

Theoretical Review: In this section, the study considered four theories and underpinning the study on theory of disruptive technology based on the significant position of disruptive technologies of big data, blockchain, artificial intelligence, and cloud accounting replacing traditional accounting processing and enhancing true cost accounting in the oil and gas sector in Nigeria.

Theory of Disruptive Technology: The theory of disruptive technology was developed by Clayton Christensen in the year 1960 in an attempt to describe new comers to the market with new ideas overtook the market and displaced the established market participants and established businesses (Ali et al., 2013). According to David (2015), Christensen posited that new technologies otherwise the disruptive technologies are total displaced old and established technologies and shook up the entire business operations and information processing and reporting. The theory of disruptive technology suggested that new technologies had overtaken existing manual system called the "incumbent" and completely reshaped the business and financial reporting landscape. One of the assumptions of theory of disruptive technologies is that the incumbents could accelerate innovations to retain their positions and businesses instead of been taken by the new entrants. The study also assumes that innovations are constant as human being are insatiable in nature, always seeking for new ideas, new technologies, and new ways of solving problems.

Grounded Theory: The grounded theory was developed by two Sociologist Barney Glaser and Anselm Strauss in the year 1960 as Glaser was associated with descriptive statistics, Strauss was known for symbolic interactions as both Glaser and Strauss worked together the empirical research in relation with a consideration of the experience of terminally ill patients popularly known as the Awareness of Dying Study (Alex et al., 2014; Dessureault & Benito, 2012). According to Dilek et al. (2015), the grounded theory was concerned with the generation of theory which was grounded in data has had been systematically collected and analyzed. The grounded theory suggested that technologies could uncover things and solve problem as social relationship behavior of group of individuals and innovative solution of problems in social sciences. There some basic assumptions of the grounded theory. It assumes that human actions in connection with social circumstances, rules, and conditions, and shared meaning attributed to all kind of the objects of knowledge.

It considers the construction of analytic codes and categories from data and use constant comparative analysis that concerns with making comparisons. Despite the credence accord to grounded theory by some supports (Greenman, 2017; Kayser et al., 2018). Some other studies have criticized grounded theory that its postulation tend to produce large volume of data difficult to manage, questioning the rationale of the production of large data when there are lack adequate skilled researchers in using grounded theory methods.

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Cost Effective Theory: Cost-effective theory was proposed by an American economists, Nobel Prize laureate, and academician Oliver Williamson in the year 1932. Oliver Williamson became more popular as the leader of new institutional economics (NIE) and founder of Transaction Cost Economics –TCE (Liu & Vasarhelyi, 2014). The cost-benefit theory is concerned with economic analysis that requires comparing of alternatives course of action in relative to costs implications and outcomes of various courses of action in every business or non-business decisions (Gulin eat al., 2019). According to Muhannad and Seif (2019), cost-effective theory effective examination of various alternative is essential when it involves costs and the possible consequences. Muller et al. (2015) noted that, unlike cost-benefit analysis, cost-effective theory suggested that the show price of product and services estimates the effect of economic actions and activities on the social and environment.

Stakeholder Theory: The stakeholder theory was developed by an economist, Milton Friedman in the year 1984, who posited that the stakeholders' importance and interests are beholders only to shareholders of the companies by the management (Shukla & Jaiswal, 2013). Friedman posited that the managers concentrate all corporate and strategic efforts towards meeting shareholders' wealth maximization at the expense of the other stakeholders (Taghizadeh et al., 2013). Parviainen et al. (2017) noted that the stakeholders equally have invested interest in the companies, and make significant contribution in the growth and stability of the companies. The stakeholders account for multiple segment who make impactful contribution towards the going concern possibilities of the company. Smith (2018) noted that the stakeholders include the employees, the government, the lenders, suppliers, host community, the trade union, and the other customers with the society inclusive.

The stakeholder's theory assumes that without the stakeholders, the companies will lose acceptance and legitimacy of its operations and will be less recognized. It assumes that the stakeholders deserve transparency, reliable and credible accounting information about the companies to enable them take an informed and useful decision. The supporters of the stakeholder theory suggested that the managers should be fair in dealing with each of the stakeholders in the companies, suggesting that this is only natural since the success or failure of the companies will equally affect the stakeholders (Teece, 2010; Vanberg, 2018). On the contrary, some studies criticizes the postulation of the supporters of the stakeholders. Questioning the rationale of equally treatment between the shareholders and stakeholders, since only the shareholders are the residual; risk bearers should deserve more preference in pursuance of their interest.

2.3. Empirical Review

Gusc et al. (2022) investigated effect of big data, artificial intelligence, and blockchain on true cost accounting processes in Netherlands, Germany, and Poland. The study employed survey field research approach, using structured questionnaires administered to energy sector employees in the selected countries of Netherlands, Germany, and Poland. The regression research regression analysis targeted the technical application of big data, blockchain, and artificial analysis in true cost accounting in the energy services. The result of the analysis revealed that the application of big data, blockchain, and artificial intelligence had a positive effect on true cost accounting in the energy sector. The study recommended need for the expansion uses of the disruptive technologies in the sector.

Michalke et al. (2022) studied the implications and effect of true cost accounting on food production and manufacturing companies in German. The study employed survey research design, using structured interviews administered to experts in disruptive technologies and the application of same in true cost accounting processes. The regression of the analysis revealed that disruptive technologies had a positive effect on the true cost accounting in the food production and pricing models in Germany.

Agur et al. (2020) investigated the impact of digitalized accounting system on cost measurement and assessment in emerging economies. The study employed primary data, making use of questionnaires administered to selected financial experts. Based on the regression analysis carried out using retrieved questionnaires, the study found that digitalized accounting system had a significant implications and impact on cost estimations and measurement in some countries in developing economies.

Baker et al. (2020) studied the benefits and effect of true cost accounting processes using big data and artificial intelligence in food production and processing system. The study used questionnaires sourced through primary data and questionnaire administered to a selected respondents. From the population, the study analyzed retried questionnaires using regression analysis. The result of the regression analysis revealed that true cost accounting is beneficial and was positively affected by big data and artificial intelligence in the food production and processes.

Gaugler et al. (2020) assessed the influence of globalization and digitalized system of the agricultural and food production on effective cost estimation and reporting. The study employed primary data using interviews and questionnaires served to few experts in a fully digitalized production processes. The study employed regression analysis in the study and the result revealed that the uses of artificial intelligence and cloud accounting were instrumental to time financial reporting as well as quick measurements of the impacts of the production cycle on the stakeholders.

Pieper et al. (2020) studied the effect of digital system and application of big data and blockchain in the calculation of external impacts of true cost accounting on food pricing and animal product processing. The study employed structured questionnaires and the retrieved responses were analyzed using descriptive statistics and multiple regression analysis. The result reported a positive effect of the big data and blockchain on the true cost accounting processes.

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Giehl et al. (2020) examined the implications and effect of disruptive technologies on energy transformation. The study employed survey research design, using selected respondents perceptional responses the significance of disruptive technologies on energy transformation. The regression analysis revealed that disruptive technologies had a positive effect on cost estimation and measurement of impact of operations on the sustainability of economic, social, and environment in the selected units of study.

Gielen et al. (2019) studied disruptive technologies and renewal energy on energy transformation. The study explored the uses of quantitative a primary sourced data obtained from selected respondents using both structured interviews and questionnaires. The regression analysis conducted revealed mixed results. However, the joint statistical analysis showed that disruptive statistics of big data, artificial intelligence, and machine learning jointly had a positive effect on energy transformation and distribution.

Moll and Yigitbasioglu (2019) examined the influence of internet-related disruptive technologies on costing and measurement of fixed and overheads towards accurate and timely financial reporting of the accountants' job schedules. The study employed survey filed, using data sourced from structured questionnaires administered to the respondents. The result of the analysis revealed that internet-related technologies had a positive influence on costing and measurements of fixed and overhead in the companies operations.

Muhannad and Seif (2019) studied accounting analysis using big data, artificial intelligence, and machine learning and its effects on cost estimations and measurement of Jordanian industries. Based on data sourced from primary sources, regression analysis was carried out. The result revealed that big data and artificial intelligence had a positive effect on cost estimation and measurements in improving reliability of information reporting.

Kayser et al. (2018) examined the impact of data science and innovational challenges of big data on value creation of manufacturing companies. The study employed structured questionnaires and interviews administered to selected respondents through online analysis of questions. The validated respondents' questionnaires were analyzed and the implication of the results were impressive. However, the results revealed that data science and innovations had a positive impact on value creation in the manufacturing companies who applied bid data in their data processing and financial reporting.

3. Methodology

Design: A field survey research design was adopted for the study, using primary data sourced using sell-structured questionnaires administered through online platforms (e.g. Survey-monkey, Google form, and face-to-face administration.

Population & Sample Size: 25 listed oil and gas sector in the oil and gas sector formed the population of the respondents from any part of Nigeria having access to the Internet among the strata and spectrum of accounting firms and practicing accountants in the oil and gas sector with a clear understanding of the dynamics and good knowledge of big data, blockchain and artificial intelligence, and cloud accounting in the data processing and in true cost accounting. The retried validated questionnaires from the online and physically administered copies were total of 356.

Using Yaro Yamane formula:
$N=N/1+n(\varrho)^2$
Where
N = sample size
N = Population
ϱ = Level of significance
$n = 3{,}250/1+3250(0.05)^2$
$n = 3250/1+8.125$
$n = 356$

Method of Analyses: The study employed both descriptive statistics and inferential analysis for the data analyses with interpretations, and elaborate regression analysis.

Reliability of Instrument: Pre-test, reliability, and validity of the instrument will be carried out using appropriate tests Cronbach Alpha. For the descriptive statistics, some tests like Hausman tests, Heteroskedasticity test, and Normality test were carried out. Acceptance or rejection was based on a 5% level of significance. The results of the re-test revealed that the instrument was considered reliable since each of the results of the Cronbach's Alpha values was between 0.776 – 0.928 which is above acceptable threshold of 0.70.

Table 32.1: Reliability Test

S/N	Variables	No of items	Cronbach's Alphas
1	True Cost Accounting (TCA)	5	0.812
2	TCA Accuracy	5	0.866
3	TCA Timeliness	5	0.911
4	TAC Complexity	5	0.928
5	Big Data	5	0.789
6	Block Chain	5	0.871
7	Artificial Intelligence	5	0.902
8	Cloud Accounting	5	0.776

Source: Filed Work (2022).

Model Specifications

$$Y_i = \alpha_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \mu_i \text{ ---------- (1)}$$

$$TAC_i = \alpha_0 + \beta_1 BD_{1i} + \beta_2 BC_{2i} + \beta_3 AIT_{3i} + \beta_4 CLA_{4i} + \mu_i \text{ ------ (2)}$$

Where

TCA = True Cost Accounting, BD = Big Data, BC = Bloch Chain
AIT = Artificial Intelligence, CLA = Cloud Accounting,
α = constant, β = Coefficient of the Model,

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i=cross-sectional, μ = Error term.

4. Presentation and Discussion of Findings

4.1 Descriptive statistics

4.1.1 Respondents' Educational Qualifications

Table 4.1: Respondents Educational Qualifications

Respondents Qualifications	Occurrence	% (Percentage)
NCE/OND Holders	72	20.22
BSc/HND Holders	115	32.30
MSc/M.Phil	48	13.48
PhD	11	3.09
Others	110	30.91
Total	356	100

Source: Field Survey (2022)

From Table 4.1, the respondents' qualifications revealed that the highest percentage of respondents represented a total of 115 (about 32.30%) BSc/HND holders. This was followed by 110 respondents (about 30.91%) which are others; next is the NCE/OND holders showing 72 (about 20.22%); MSc/M. Phil showed 48 participants (about 13.48) and lastly the Ph.D. holders participants 11 (about 3.09%).

4.1.2. Respondents' Professional Qualification

Table 4.2: Respondents's Professional Qualifications

Respondents Qualifications	Occurrence	% (Percentage)
FCA/ACA; FCCA/ACCA. FCMA/ACMA; FCTI/ACTI	185	51.97
Others	171	48.03
Total	**356**	**100**

Source: Field Survey (2022)

From Table 4.2, the respondents' professional qualifications revealed that (about 51.97%) had FCA/ACA; FCCA/ACCA. FCMA/ACMA; FCTI/ACTI professional qualification from the stated category. The remaining participants with other unspecified professional qualifications were (about 48.03%). In other words, the majority of the participants were chartered accountants who have good knowledge of cost accounting.

3.1.2. : Respondents' Responses Opinions.

Table 4.3: True Cost Accounting in the Oil and Gas Sector.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Total	% of Total Agree	Mean (Std.)	Rank
The application of information technologies and other Internet of Things (IoT) available to the use of the oil and gas sector allows for improvement of timeliness in ease true cost accounting estimations to ensure accuracy, timeliness, and elimination of complexities of wastes, by-products management inputs, and estimations.	0 [0.0]	6 [1.7]	16 [4.5]	169 [47.5]	165 [46.5]	356 [100]	334 [93.82]	4.38 (0.65)	5
There is a true cost accounting in respect of the accuracy of measurement of values and monetization of inputs in the oil and gas sector in Nigeria.	3 [0.8]	21 [5.9]	8 [2.2]	62 [17.4]	262 [73.6]	356 [100]	324 [91.01]	4.57 (0.86)	2
Complexity is eliminated with the application of cloud accounting to ensure clear, simple, and easy estimation of true cost accounting-TCA in the oil and gas sector in Nigeria.	4 [1.1]	21 [5.9]	16 [4.5]	40 [11.2]	275 [77.2]	356 [100]	315 [88.48]	4.58 (0.91)	1
The application of artificial intelligence streamlines the estimation patterns, qualification, and monetization of inputs and eliminates subjectivity that exists to ensure the accuracy of true cost	1 [0.3]	27 [7.6]	25 [7.0]	37 [10.4]	266 [74.7]	356 [100]	303 [85.11]	4.52 (0.94)	3

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accounting in the oil and gas sector in Nigeria.									
Good knowledge and application of Big Data, Blockchain, artificial intelligence, and cloud accounting in the ensure accuracy, timeliness, and elimination of complexity in true cost accounting in the oil and gas sector in Nigeria	3 [0.8]	31 [8.7]	16 [4.5]	71 [19.9]	235 [66.0]	356 [100]	306 [85.96]	4.42 (0.98)	4

Source: Field survey, 2022

In the above Table 4.3, "The application of information technologies and other Internet of Things (IoT) available to the use of the oil and gas sector in Nigeria allows for improvement of timeliness in easy true coat accounting estimation" appears to be the least supported statement by the participants, {Average Score = 4.38; SD = 0.65} with 93.82% percentage of total Agree. Close to this in responses is the statement that says "Good knowledge and application of Big Data, Blockchain, artificial intelligence, and cloud accounting in the ensure accuracy, timeliness and elimination of complexity in true cost accounting in the oil and gas sector in Nigeria" {Average Score = 4.42; SD = 0.98} with 85.96% percentage of total Agree.

The most supported statement is observed to be "Complexity is elimination with the application of cloud accounting to ensure clear, simple and easy estimation of true cost accounting-TCA in the oil and gas sector in Nigeria." {Average Score = 4.58; SD = 0.91} with 88.48% of percentage of total Agree. The other statement "There is an indication that the application of blockchain reduces negative challenges of true cost accounting TCA in respect of the accuracy of measurement of values and monetization of inputs."{Average Score = 4.57; SD = 0.86} and "The application of artificial intelligence streamlines the estimation pattern, qualification and monetization of inputs and eliminates subjectivity to ensure accuracy of true cost accounting in the oil and gas sector in Nigeria" {Average Score = 4.52; SD = 0.94} have their percentages of total agree equal 91.01% and 85.11% respectively.

4.1 Regression Analysis

4.1.1 Big Data, Blockchain, Artificial intelligence, and cloud accounting. and True cost accounting: Main Model

For robustness check and to examine the effect of Big Data, Blockchain, Artificial intelligence, and cloud accounting on True cost accounting indicator in this particular study, we estimated and present the regression results of the estimated model that regressed the aggregated True cost accounting-TCA on Big Data-BD, blockchain-BC, and artificial intelligence-AIT in this subsection in Table 4.4.

Table 4.4: Model Summary and ANOVA

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.297	0.088	0.081	0.31337

ANOVA

	Sum of Squares	Df	Mean Square	F-Statistics	P-value.
Regression	3.350	4	1.117	11.370	0.000
Residual	34.567	352	0.098		
Total	**37.917**	**356**			

Source: *Author's Computation, 2022; underlying data from Field Survey.* ***Note:*** *Predictors are (Constant), BD = Big Data, BC = Blockchain, and AIT=Artificial intelligence. The dependent variable is TCA = True cost accounting and CLA=Cloud Accounting*

Interpretations

In Table 4.4, the estimated F-statistics revealed =11.370; p-value = 0.000. By implication, the estimated values of a joint effect of the Big Data, Blockchain, Artificial intelligence, and cloud accounting on True cost accounting TCA was found to be significant at 0.05 level of significance selected for the study. In addition, the value of the adjusted R^2 showed 0.081 which implied that about 8.1 percent of variations in True cost accounting TCA are collectively explained by Big Data, Blockchain, Artificial intelligence, and cloud accounting. Thus all these implied that the estimated regression model that investigated the relationship between Big Data,

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Blockchain, Artificial intelligence, cloud accounting, and True cost accounting TCA is good. Estimation Results of the effect of Big Data, Blockchain, artificial intelligence, and cloud accounting on True cost accounting TCA:

$$TCA_i = \alpha + \beta_1 BD_i + \beta_2 BC_i + \beta_3 AIT_i + \beta_4 + \beta\varepsilon_i$$
$$TCA_i = 3.235 + 0.081BD_i + 0.149BC_i + 0.022AIT_i + 0.127CLA\varepsilon_i$$
T-Stat. = 2.962 + 4.512 + 0.508 + 0.613

Table 4.5: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients	T	P-value	Collinearity Statistics	
	Coef.	Std. Error	Beta			Tolerance	VIF
(Constant)	3.235**	0.235		13.788	0.000		
BD	0.081**	0.027	0.157	2.962	0.003	0.919	1.088
BC	0.149**	0.033	0.232	4.512	0.000	0.981	1.019
AIT	0.022	0.044	0.027	0.508	0.612	0.907	1.102
CLA	0.127**	0.241	0.134	0.613	0.001	0.910	1.078

Source: *Author's Computation, 2022; underlying data from Field Survey.* ***Note:*** *Predictors are (Constant), BD = Big Data, BC = Blockchain, AIT = Artificial intelligence. And CLA = Cloud accounting. The dependent variable is TCA = True cost accounting.*

Interpretation

Based on the main model of the study in Table 4.5, (TCA_i = *3.235 + 0.081BD_i + 0.149BC_i + 0.022AIT_i +0.127CLA + ε_i*), the result from the study revealed that each of the coefficients of Big Data, blockchain, artificial intelligence, and cloud accounting were positively signed and in tandem with the study expectations (β_1 = 0.081; β_2 = 0.149; β_3 = 0.022; β_4 = 0.127) > 0. This implied that a unit change in Big Data, blockchain, artificial intelligence, and cloud accounting will bring about a percentage increase of 0.081, 0.149, 0.022, and 0.127 respectively on True cost accounting in oil and gas sector in Nigeria.

The estimated coefficients of the estimated regression model that investigates the relationship between Big Data, Blockchain, Artificial intelligence, and cloud accounting. and True cost accounting Table 4.5, revealed that the unstandardized coefficient of Big Data BD is positive and significant at 0.01 level of significance {β = 0.081; t = 2.962; P-value = 0.003}, which simply implied that Big Data BD had a positive and significant effect on True cost accounting TCA. In other words, it means that every unit increase in Big Data BD will bring result in True cost accounting TCA increases by 0.081 units. Also, the unstandardized coefficient of Blockchain BC is positive and statistically significant at 0.01 level of significance {β =0.149; t = 4.512; P-value = 0.000}, which also implied that Blockchain BC significantly influenced True cost accounting TCA; and that for every unit increase in Blockchain BC, there is 0.149 unit increase in True cost accounting TCA. Furthermore, the unstandardized coefficient of Artificial intelligence AIT is also positive but statistically insignificant {β = 0.022; t = 0.508; P-value= 0.612}, which implies that the effect of Artificial intelligence AIT on True cost accounting TCA is insignificant. While the result of the Big Data BD, Blockchain BC, and cloud accounting were the explanatory variables that had a positive effect on True cost accounting TCA.

In addition to the estimation in Table 4.5, the study considered the results of the Collinearity Statistics columns and variance inflation factor. In the collinearity tolerance, the study showed an indication of no harmful effect of multicollinearity in the estimated regression model. Also, the variance inflation factor, the result of the VIF values were less than 3 {VIF < 3} with their corresponding tolerance values (i.e. VIF reciprocals) above 0.10. Finally, consequent to the results of the estimations, and at a level significance of 0.05, *Adj.R^2 = 0.081; F-Statistic* is 11.37, while the *P-value of the F-Statistics is* 0.000), which is less than 0.05. The study failed to accept the null hypothesis and instead accepted the alternative. This showed that Big Data, Blockchain, and artificial intelligence exerted a positive effect on true cost accounting of the oil and gas sector in Nigeria. Consequent to the results obtained, some previous studies obtained similar results Gusc et al. (2022); Michalke et al. (2022); Agur net al. (2020); (Baker et al., 2020). Other studies include that of Gaugler et al. (2020), Pieper et al. (2020); and the study by (Giehl et al., 2020).

5. Conclusion and Recommendations

The study examined the effect of big data, blockchain, artificial intelligence, and cloud accounting on true cost accounting of oil and gas companies in Nigeria. The study surrogated true cost accounting using true coat accounting accuracy, true cost accounting timeliness, and true cost accounting complexity as measures of true cost accounting. In addressing the problem of true cost accounting of oil and gas sector in Nigeria, the study employed primary data, using survey-filed structured questionnaire in soliciting respondents' perceptional responses, the possible effect of true cost accounting in the oil and gas sector. The results of the analysis

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from the descriptive statistics, the study found that the most supported statement was observed to be "Complexity is elimination with the application of cloud accounting to ensure clear, simple and easy estimation of true cost accounting-TCA in the oil and gas sector in Nigeria".

The inferential analysis revealed mixed results. While the each of big data, blockchain, and cloud accounting had a positive effects, while artificial intelligence exerted an insignificant effect. However, the statistics of the combined explanatory variables jointly revealed a positive significant effect. The study then concluded that big data, blockchain, artificial intelligence, and cloud accounting had a positive significant effect on true cost accounting in the oil and gas sector in Nigeria.

Recommendations: The application of disruptive technologies in the true cost accounting is significant and advised since the complexities of costs allocation and measures would be multitasking using manual methods considering possible inherent errors and time-consuming. The management of these companies are advised to embrace the adoption and applications of big data, blockchain, artificial intelligence, and cloud accounting because of the assurance of accurate data analysis and measure of true cost accounting impacts and precise allocations of all facets of the oil and gas productions costs to cost while reducing negative challenges.

Contribution/Limitations: The study provided a novelty insights the significance and application of big data, artificial intelligence, blockchain, and cloud accounting identifications of various true costs accounting, analysis and allocations of impacts of these costs to cost objects as well the reduction of complexities in cost allocations in the oil and gas sector in Nigeria. The study was limited in using perception metrics from the operators and accountants who may be economical with some vital information. Future studies could extend the frontiers and explore other options of obtaining quantitative data from the companies for true costs accounting and further analysis.

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