

<https://doi.org/10.59298/NIJCRHSS/2025/5.1.11300>

## **Big Data and Financial Reporting Quality of Banks Listed in Nigerian Exchange Group**

**Ejiofor Emmanuel Onyeka, Ubogu Festus, Agbasi Evelyn and Lawren Edeh**

Department of Accounting, Tansian University, Umunya, Anambra State, Nigeria  
Email: [emmaejiofor7@gmail.com](mailto:emmaejiofor7@gmail.com)

### **ABSTRACT**

The purpose of this study was to investigate the impact that big data has on the quality of financial reporting for companies that are listed on the Nigeria Exchange Group. Some of the specific aims of the study included conducting an investigation into the impact that the volume of data, the variety of data, and the velocity of data have on the quality of financial reporting. The method of research utilised in this study was a survey design. A total of twelve deposit money banks that were listed on the Nigeria Exchange Group as of the 31st of December 2023 were included in the study's population. One hundred twenty members of the top management staff at twelve different banks were given well-structured questionnaires to fill up. The sample size ranged from twelve to twenty. For the purpose of determining the total number of respondents, ten employees were selected from each of the banks on the basis of their responses. Only one hundred of the questionnaires were returned, which is equivalent to 83 percent of the total number of questionnaires that were sent during the study. The obtained data were examined using descriptive statistics, correlation, and regression analysis, which led to the empirical conclusion that demonstrated that the volume of data, the diversity of data, and the velocity of data all have a positive and substantial effect on the quality of financial reporting in Nigerian companies that are publicly traded. According to the findings of the survey, businesses should make the administration of big data a top priority in order to enhance the accounting information they provide.

Keywords: Big Data, Nigeria Exchange Group, financial reporting

### **INTRODUCTION**

Within the realm of accounting, a significant transformation has been documented, particularly with the introduction of big data. The term "Big Data" refers to collection of data that is both extensive and intricate, and which can be simply analysed using conventional data processing technologies [1]. It was the opinion of [2] that big data encompasses a great deal more than just accounting and financial data. According to Bag et al.'s research from 2020, it encompasses any digital data that is made available in real time, in significant quantities, and in a variety of formats. These enormous datasets are becoming more and more common in the accounting profession as a result of the fact that organisations create enormous volumes of financial data that need to be analysed and evaluated [2]. Accounting professionals now have access to new chances to improve their decision-making skills and get insights into financial data as a result of the use of Big Data in accounting. Accountants are now able to analyse massive datasets in real time, recognise patterns and trends, and make forecasts about future financial performance [3]. This is made possible by the use of advanced analytics and machine learning techniques. Since the harsh experience of global financial crises and multiple company failures that were found to be engineered by low quality financial reports, there has been an increase in the quantity of decision makers who are looking for quality accounting information. Particularly pertinent is the fact that [2], indicated that in order to guarantee quality accounting information, it is necessary to fulfil the components of qualitative features of financial reporting, which include timeliness and relevance. As a follow-up to this, [4] confirmed that forty-four companies which are listed on Nigeria Exchange Group were subject to sanctions because they did not present their audited annual reports in a timely manner, which endangers their corporate reputation and portrays a sign of negativity on quality financial reporting.

### **Statement of the problem**

The advent of big data is a scenario that leaves the users of financial information in a state of dilemma, knowing the difficulty confronted with having to analyse voluminous financial and none financial information before making an informed decision. The stakeholders had battled with over flocked financial and none financial information analyses needs for a while before taking decision until this recent advent of artificial intelligence (AI) application in all facet of human endeavor. The question of whether AI can utilise big data to enhance financial reporting quality remains unanswered, and that prompts the researchers to enforce action to establish the set goals of this study. The purpose of this project then, is to investigate the extent to which big data could assist listed companies in Nigeria in presenting quality financial information in order to avoid sanctions for non-compliance. This is being done in an effort to find a solution to the problem [3].

### **Objectives of the study**

The main objective of the study is to investigate the effect of big data on the financial reporting quality of the banks listed on Nigeria exchange group listed. In which case, the specific objectives are to investigate the effect of;

1. Data velocity on the financial reporting quality of banks listed on Nigeria Exchange Group
2. Data variety on the financial reporting quality of banks listed on Nigeria Exchange Group.
3. Data volume on financial reporting quality of banks listed on Nigeria Exchange Group.

### **Research Questions**

The study has its research questions formulated to synchronize with the objectives as presented below;

1. What is the effect of data velocity on the financial reporting quality of banks listed on Nigeria Exchange Group ?
2. To what level is data variety affect the financial reporting quality of banks listed on Nigeria Exchange Group ?
3. To what extent is the data volume affect the financial reporting quality of banks listed on Nigeria Exchange Group ?

### **Research hypotheses**

The study hypotheses were constructed to align with the research questions and are presented in their null forms as below;

- Ho1 - Data velocity has no significant effect on the financial reporting quality of banks listed on Nigeria Exchange Group.
- Ho2 - Data variety has no significant effect on the financial reporting quality of banks listed on Nigeria Exchange Group.
- Ho3 - Data volume has no significant effect on the financial reporting quality of banks listed on Nigeria Exchange Group.

### **Scope of the study**

The study was anchored on investigating the effect of big data on the financial reporting quality of banks listed on Nigeria Exchange Group. With the application of questionnaire that helped to generate primary data, it made a resolution to settle on descriptive survey design. However, management of the deposit money banks were the respondents to the questionnaires.

### **Significance of the study**

The study would be useful to management and other stakeholders of deposit money banks in Nigeria as they will realize the relevance of big data and their unavoidable importance to decision making in modern day business and decision making.

### **Limitation of study**

The study is limited to the amount of information presented in the questionnaire. However, there could be other vital information on big data which could not be contained in our questionnaire and would not be within our disposal because its outside the content of the questionnaire. However, the study suggests that other prospective researchers on this area can add open ended questions to obtain certain information at the door steps of the users, which are unknown to the scholars.

## **LITERATURE REVIEW**

### **Conceptual review**

#### **Big data**

Big data refers to a big volume of information that is processed at a high pace and in a variety of ways. These methods allow for efficient and effective information processing, which may be used for decision support and process automation. Large amounts of data are characterised by their speed, diversity, and volume, and some authors also assert that they are credible. Not only do they include a vast quantity of data, but they also contain a variety of methods that are utilised in the process of analysing it. Additionally, visualisation programs make it possible to investigate unstructured data, which contributes to an increase in the accuracy and reliability of decision-making and prediction. According to [5], there is a dependable source of financial data that may be used to enhance company decision-making in accounting. The term "big data" refers to a collection of technologies and methods that are utilised for the purpose of analysing massive amounts of complex data. There is a substantial amount of diverse data that has been gathered from a variety of sources, and it is not possible to process this data using conventional

methods. Additional methods of valuing intangible assets, including those that are not represented on the balance sheet, can be obtained through the use of big data. At the same time, they can be utilised in the process of valuing assets that are difficult to value, or they can be of assistance in the process of selecting an acceptable method of depreciation [6]. According to [7], it can be utilised to acquire a more comprehensive understanding of corporate procedures, which can lead to a reduction in expenses incurred as a result of errors or the establishment of optimal product prices. According to [8], the use of big data results in an increase in the competitiveness of the organisation; however, it is essential for the existing accounting system to collaborate with this emerging technology. When it comes to matters of investments or financial reports, big data can be utilised to produce financial reports and overviews, as well as to estimate the amount of profit. They have the capability of collecting data about taxpayers, which can then be utilised to make predictions regarding the possibility of tax evasion [9]. Because of big data, it is now possible to collect and record accounting data in a more efficient manner, and as a result, it can be utilised more effectively in management. It has the potential to be utilised in the administration of budgets within managerial accounting. This will result in an improvement in the quality and usefulness of accounting data in the field of financial accounting. When it comes to reporting, it might be of assistance in the process of developing and enhancing accounting standards. It makes it possible to make adjustments to audit procedures and results in improved utilisation of data and information. It has the capability to give ongoing audits, contributes to the reduction of audit risks, makes it possible to conduct audits that are more efficient and effective, and also offers new evidentiary information that was not accessible during earlier time periods [10]; [11]. Big data makes it possible to discover suspicious recorded accounting data, and it is utilised to analyse the maturity of receivables and payables, gross margins and sales, investment, and other expenses and costs [12]. Big data also makes it feasible to predict expenses and costs. Using the framework of fraud prediction, big data can be utilised to forecast the behaviour of organisations based on the examination of their previous data. This may be accomplished by using the framework. Big data makes it possible to handle data in real time, including accounting, financial, and other types of data. According to [13], they make it easier to retrieve accounting data that is accurate, comprehensive, and easily accessible displays the size of the global market for big data analysis, including a forecast for the period up until 2028, and displays a list of selected research papers. Taking into consideration the findings of [14], it is reasonable to expect that the market for big data analysis will expand in the years to come. It was noted by [15] that big data is not only characterised by vast numbers, but also by the fact that the value that is contained inside the data is substantial, which is of great importance for the growth of businesses. New concepts for accounting information are presented by these enormous numbers, high values, a great deal of variety, and data arriving in a timely manner with a high velocity. This study is centred on accounting based information. According to the opinion of [16], the fundamental aspects of big data management are volume, velocity, and variety.

#### **Data Volume**

The term "data volume" refers to the advancements and developments that have occurred in the technology and procedures that are used to manage the growing amount of data. Big data technologies generate a large amount of data, and the rate at which this data is growing is also enormous [17]. The volume means the amount of data that is produced by these technologies. This article discusses the advancements and developments that have taken place in the technology and procedures that are used to manage the growing amount of data. [18], expressed the opinion that the world is home to an unfathomable quantity of digital information, which is expanding at an alarming rate and is having an impact in every corner of the globe. The term "data volume" refers to the magnitude of the data as well as the rate at which it is growing. The most important aspect of big data is the amount of data that is being collected [19]. By the year 2020, each individual human being will have generated around 1.7 megabytes of data every second, and there will be more than 3.7 billion people accessing the internet [20]. The amount of data that is currently available for analysis is expanding at a rate that is exponential. According to [21], the amount of data that was generated all over the world in 2021 was seventy nine zettabytes, and it is anticipated that this number will double by the year 2025. According to [22] and [23], businesses have started to collect and analyse vast amounts of data in order to improve their expertise and make more informed decisions. Companies are motivated to process data in real time and provide judgements that are based on evidence as a result of the rising use of digital devices, which has led to an unprecedented rate of data collection [24]. The accountant has access to a vast quantity of data that can be utilised in their work [25]. According to [26], volume is considered to be processing data, but [8] established a connection between the data processing stage and the comprehensiveness of accounting information. It was demonstrated by [27], that the volume of data does not improve the authenticity and usefulness of the data. Both accounting measurement and budgeting might benefit from the data sources that are presented by the number of data.

#### **Data Variety**

The term "data variety" refers to the advancements and developments that have been made in technology that cope with a wide range of data. According to [28], the term "data variety" refers to the process of gathering information from a range of sources in order to have a better understanding of an issue and to make judgements that are more

intelligent and well-informed. According to [29], big data refers to the variety of information sources, types, and formats that are associated with it. Data variety, on the basis of this, refers to the complexity, diversity, and heterogeneity that are associated with data. It is possible to find big data in a variety of shapes, types, and natures. Unstructured data, such as videos, photographs, and customer evaluations, are included in this category [30]; [31]. Structured data, such as numbers, and semi-structured data, such as log data and XML data for example, are also included. As more data is collected from a wider number of sources, the diversity of data that is collected also rises [32]. According to [33], diversity in data is generated not only from within an organisation but also from outside sources. One of the most important aspects of big data is variety, which can be defined as the diversity of data that is collected [34]. Variety is considered to be an essential component. Data is now available in a variety of formats, including emails, PDFs, images, videos, audio, and posts on social media platforms [35]. This is in contrast to the past, when structured data could only be acquired. Unstructured data is abundant, despite the fact that accountants are accustomed to working with structured data. According to [36], technological improvements provide businesses with access to data that extends beyond the business transactions of the company. It has been suggested by [37] that the reduction of bias and errors that result from the analysis of restricted amounts of data can be achieved by the collection and integration of data from a variety of sources. According to [27], businesses that consistently gather data from a wide variety of sources have the potential to enhance the quality and confidence of the data by minimising the factors that contribute to bias and inaccuracies that are caused by a limited number of data. Companies that are able to handle data in a variety of formats have the potential to offer meaningful and important insights [38]; [39]. According to [6], the processing of various forms of data helps businesses lessen the amount of uncertainty they experience while making decisions.

#### **Data Velocity**

The term "data velocity" refers to the enhancements and advancements that have been made in technology that are able to deal with the rapidity of incoming data. According to [39] and [24], the proliferation of digital devices has led to an increase in the rate of data collection, which in turn has necessitated an increased demand for data analysis in real time. According to [40], big data is defined as the rate at which businesses collect and process data in order to stay up with the pace of the industry. Within the context of this study, the term "data velocity" refers to the rate at which data is received and acts upon in real time. Big data is being generated at a faster rate than data generated through traditional means, and as a result, it is flowing strongly as a result of active involvement with the themes of persons, clients, and beneficiaries [41]. An almost instantaneous availability of data is accomplished. Each and every department of the organisation, including accounting, is impacted by this. In the event that data is accessible in real time, it is possible to improve the timeliness of the presentation and creation of business accounting information. Despite the fact that timely utilisation of data makes it possible to perform real-time processing in order to continually fix problems [42]; [43], the impact of this utilisation on the timeliness of accounting information is extensive. The greater the velocity rate, the faster the data can be captured and processed, and the more useful and long-lasting the data collected will be in terms of value. This is because speed is directly proportional to the velocity rate. In addition to being a component of the processing stage [43], velocity has a significant and favourable impact on the timely delivery of accounting information [44]. Consequently, the impact of velocity may be evaluated directly in relation to the timeliness of accounting information being provided.

#### **Financial reporting quality**

The term "quality of financial reporting" refers to the correctness with which investors are informed about the organization's anticipated future cash flows through the use of financial reporting. The accuracy of the forecast of future cash flows is the foundation upon which the quality of financial reporting is built. This allows investors to make informed judgements. When it comes to making predictions, the dependability or correctness of accounting information is the aspect that is being emphasised. According to [45], the quality of financial information is defined as the degree to which accounting information accurately reflects the operating performance of the company, is helpful in predicting future performance, and evaluates the worth of the organisation. According to [46], [47], [48], and the [49], the fundamental idea behind the quality of financial reporting is that certain companies are superior to others in terms of communicating the accounting information that they claim to disclose. [46] asserts that these many interpretations of the quality of financial reporting serve the same aim, which is to provide individuals with the ability to evaluate the value of accounting information [46]. It is the evaluation of the course of action with regard to other criteria or priorities that constitutes a value judgement. Taking this into consideration, the quality of the financial reporting is the characteristic that constitutes accounting information that is both relevant and valuable. Reliability, relevance, timeliness, and comparability are the characteristics that define good financial accounting information. All of these characteristics are necessary for efficient decision-making. This study, on the other hand, employs timeliness as a metrics for evaluating the quality of accounting information. According to [20], the concept of timeliness emphasises the need of ensuring that accounting reports are prepared in a timely manner. Users will not profit from using outdated information when making decisions [50]; [51]. Therefore, accounting information must be supplied as and when it is actually required to be produced. According to [17], it is

imperative that all accounting information be reported on time in order to guarantee that it is of a high grade. According to [7] and [52], timely presentation of information involves making it accessible to those who make decisions before the information loses its ability to impact those judgements. In the event that information is either not available at the time it is requested or becomes available later than anticipated, it loses its relevance and becomes useless. It is not possible for information to be relevant solely based on its timeliness; yet, a lack of timeliness can lessen the relevance that the information might have otherwise had. In the context of this investigation, the term "timeliness" refers to the anticipated amount of time that accounting information will be accessible and available to a variety of consumers. Through the utilisation of big data, it is possible to accelerate the process of achieving timeliness. In his study, [22], found that the computerisation of accounting systems has a substantial influence on the quality of accounting information. Due to the fact that a rapid delivery of information with a certain degree of precision is preferable to a high degree of accuracy with delay, the value of information decreases when it is delayed [51]. Furthermore, the large amount of data that is available might result in reports that are more complete and comprehensive; but, it also brings paradoxes, such as the fact that decision-makers may become overwhelmed by an excessive amount of information. The effective navigation of these difficulties requires the implementation of appropriate governance and policies [53]. Large amounts of financial data may be processed and analysed with the assistance of big data analytics, which enables businesses to recognise patterns and trends that might otherwise go unnoticed under different circumstances. One of the ways that big data is helping to improve financial reporting is by automating operations that are considered to be quite routine. Software that makes use of machine learning algorithms is able to automatically classify financial data and identify potential problems, which frees up auditors to concentrate on more difficult duties [54]. It is also possible for businesses to uncover potential instances of fraud or other financial irregularities with the use of big data. Companies are able to uncover patterns that may indicate fraudulent activity or other sorts of financial malfeasance by conducting an analysis of enormous amounts of financial data. Another way that big data is having an effect on financial reporting is by enhancing the speed at which financial statements are generated and the accuracy of those statements. Business organisations are able to generate financial statements more quickly and with fewer errors if they automate a significant number of the manual activities that are related with financial reporting. organisations who use this technology are likely to experience significant benefits in terms of enhanced accuracy, more efficiency, and increased transparency [55]. In general, the impact of big data on financial reporting is enormous, and it is likely that these organisations will do so. As the technology behind big data continues to advance, it is highly probable that we will witness even more cutting-edge applications of this technology in the realm of financial reporting.

### **Theoretical Review**

#### **Legitimacy theory**

It is on the basis of the fact that the activity of an organisation is proper, right, and good in accordance with the socially constructed system of norms, values, and beliefs of the society that legitimacy theory is developed [56]. A alternative point of view is presented by [17], who argue that legitimacy theory is a result of a social compact that exists between an organisation and the surrounding society. According to [57], the social contract is comprised of the many sorts of expectations that the society has regarding the manner in which an organisation ought to carry out its activities. Companies have been forced to adopt the usage of technology in order to handle and analyse data for the purpose of decision making by stakeholders. This is particularly significant because the arrival of artificial intelligence and the vast volume of data has compelled this adoption. Utilising big data in an appropriate manner will legitimise businesses in the eyes of society. The management of the interactions between the various stakeholders, which are of crucial importance to the existence and continuity of the organisation, is the focus of legitimacy theory. It is worthy to mention that legitimacy is assumed problematic because the societies' expectations change over time and are uncertain [58], therefore the organisation must in compliance with the societal change expectations, especially in the aspect of large data for analysing financial information, change in order to keep abreast with their legitimacy.

#### **Empirical review**

The contribution explores the impact of specific technologies, namely artificial intelligence, big data, blockchain, and cloud computing, on the accounting profession. It adds to the ongoing discussion concerning the integration of technology in accounting by providing relevant content. The objective of the overview article is to provide a theoretical definition of artificial intelligence, big data, blockchain, and cloud computing. This will be achieved by conducting a comprehensive analysis of relevant research publications and subsequently offering appropriate recommendations. While digital tools have the capability to substitute for certain accounting tasks, it is crucial for accountants to view them not as a source of concern, but rather as a helpful tool in their profession. To remain competitive in the digital era, it is recommended that accountants acquire new skills and traits or enhance their present ones. It is crucial to prioritise the education of employees in companies and also to update the curriculum in educational institutions, particularly in the area of digital technologies and information and communication technology skills. These fields have a significant impact on modern accounting.

A study conducted by [59] examined the impact of big data on the accuracy of accounting information in certain Nigerian companies. The study especially examined the impact of data volume, data diversity, and data velocity on the timeliness of accounting information. The study utilised a survey research approach and included a population of 157 enterprises that were listed on the Nigeria exchange group. A purposive sampling method was used to choose a sample size of 20 firms. From each firm, five respondents were picked, resulting in a total of 100 respondents. Primary data was gathered through the use of a meticulously designed questionnaire. The collected data were examined using descriptive statistics and regression analysis. The results indicate that data volume, data variety, and data velocity have a substantial beneficial impact on the timeliness of accounting information. The study found that the characteristics of data utilised by companies have a substantial impact on the promptness of the dissemination of accounting information.

Using cloud computing, [60], investigated the impact that the implementation of accounting procedures in Nigeria had on the effectiveness of them. A well-structured questionnaire was given to deposit money banks in Nigeria as part of the research project in order to accomplish this goal. A frequency analysis and an ordinary least square regression were utilised in the analysis of the data. As a result of the data, the research concluded that cloud computing demonstrated a substantial beneficial link with the efficiency of accounting processes in Nigeria. In addition, the model's other variables showed that technical progress and security efficiency represented a strong association with the effectiveness of accounting methods in Nigeria. This was discovered by the model's other variables. Cost-effectiveness uncovered a substantial inverse link between the two variables. The authors, [61] investigated the use of artificial intelligence, data analytics, and big data in the field of accounting. He adopted ex post facto research design. Based on the findings of the study, it was determined that accounting professionals could only stay ahead of the competition in a corporate climate that is always changing by utilising big data, data analytics, and artificial intelligence solutions. An investigation into the effects that big data and data analytics have had on accounting was carried out by [62]. In order to investigate the impact that big data has on accounting, the research utilised an approach known as a literature review. According to the findings of the study, big data has the potential to enhance risk analysis, enhance the quality of accounting information, and enable the provision of real-time information that can assist in decision making. Study by [4] investigated how big data and accounting are beginning to intersect. During the course of their exploratory research, they described areas in which big data could make accounting problems more manageable in terms of data limits. Large amounts of data and data analytics should be incorporated into the accounting profession, according to the findings of the study, because of the potential impact that they could have on a variety of accounting-related fields.

In the year 2020, [63], conducted research on the quality dimensions of big data. A review of the existing works was the primary focus of the study. He employed survey research, according to the findings of the study, it was discovered that the fundamental qualities of big data comprised timeliness, accuracy, completeness, consistency, and uniqueness. In addition, the research discovered additional aspects that are pertinent to big data, such as trust, trustworthiness, and confidentiality. Furthermore, the study discovered that the quality of data is reliant on the types of data, the sources of data, and the applications that use the data. When it comes to the big data economy, [64] conducted study on the topic of turning information quality into firm performance he used ex post facto research design. They found a connection between business value, user pleasure, and firm success. A total of 302 individuals from a variety of organisations in France and the United States of America provided their responses. Information quality was found to have a considerable beneficial impact on company performance, according to the findings of the study. The study also indicated that information quality encompassed completeness, currency, and accuracy. [65], conducted research on the prospects that big data presents for the practice of accounting and finance. It covered the primary themes that have been found in previous research on big data as well as the gaps that have been found in the accounting and finance literature as a result of these themes. According to the findings of the study, there are six aspects of big data that scholars have paid very little attention to. Risk and security, data visualisation and predictive analytics, data management, and data quality were all included in this category.

## **METHODOLOGY**

### **Research design**

This study adopted a survey research design. This design will enable the researcher to collect data from the source (respondents) directly using questionnaires.

### **Population of the study**

The study covered the money deposit banks listed on the Nigerian Exchange Group as at 31<sup>st</sup> December 2023. There were twelve banks listed on the exchange group for the period which included Access Bank, Eco Bank, First Bank of Nig, First City Monument Bank, Fidelity Bank, Guarantee Trust Bank, Stanbic IBTC, Sterling Bank, United Bank for Africa, Wema Bank, and Zenith Bank.

### **Sample size and sampling technique**

All the banks were studied because they have applied the use of big data in their operations and questionnaire were distributed to ten management staff of each of the banks under study, the respondents selected were accountants

with knowledge about utilizing big data within banks. One hundred and twenty structured questionnaires were distributed to the respondents. However, only hundred respondents were returned which amounted to eighty three percent of the population.

**Nature and source of data collection**

The data used for the study was primary data collected from the respondents using an appropriate and relevant instrument for its collection.

**Method of data collection**

The study applied the use of well-structured questionnaire in collecting the data from respondents. The questionnaire were structured in a way that the first segment contain questions targeted to obtain the bio-data of the respondent, while the second segment of the questionnaire contains questions on the research questions, prepared in a 5 likert scale model.

**Reliability Test**

The reliability test on big data and the financial reporting quality on NIgerian firms listed was tested using Cronbach Alpha test. The result of the cronbach test on the variables show that financial reporting quality questions have Cronbach Alpha of 0.811. Data velocity has Cronbach Alpha of 0.782. Data volume has Cronbach Alpha of 0.729, whereas Data variety has a Cronbach Alpha of 0.818.

**Table 1: Cronbach Alpha Test Results**

S/N	Variable	No. of Items	Cronbach's Alpha
1	Financial reporting quality (FRQ)	5	0.811
2	Data Variety (DTVRY)	5	0.818
3	Data Velocity (DTVLT)	5	0.782
4	Data Volume (DTVLM)	5	0.729

Source: Researcher's compilation (2024)

**Model Specification**

The model was specified to accommodate the dependent and independent variables of the study in a linear relationship and they are presented as follows;

$$FRQ = f(DTVRY, DTVLT, DTVLM) \dots\dots\dots (1)$$

$$FRQ = \beta_0 + \beta_1 DTVRY + \beta_2 DTVLT + \beta_3 DTVLM + \mu \dots\dots\dots (2)$$

Where:

FRQ = Financial Reporting Quality

DTVRY = Data Variety

DTVLT = Data Velocity

DTVLM = Data Volume

$\beta_0$  = Constant

$\beta_1, \beta_2, \beta_3$  = coefficient of determination

$\mu$  = Stochastic Term

**PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA**

**Descriptive analysis**

The descriptive analysis is the summary of the data distribution pattern using measures of central tendency.

**Table 2 Descriptive Statistics**

Variables	QAI	DVM	DVY	DVCT
Obs	100	100	100	100
Mean	4.8500	3.9900	4.5700	4.6900
Std. Deviation	0.50000	0.33318	1.08484	0.58075
Minimum	1.00	1.00	1.00	1.00
Maximum	5	5	5	5
Skewness	-5.238	-6.875	-2.654	-2.998
Kurtosis	35.627	68.326	5.933	15.039

Source: Researcher's compilation (2024)

The survey data was evaluated using descriptive statistics to examine the relationship between big data and the quality of financial information in selected Nigerian enterprises, as shown in Table 1. The analysis showed that the average quality of financial information is 4.8500. -The standard deviation of 0.50000 is significantly different from its mean, indicating a high degree of variability in relation to its average. The variable's data exhibits negative skewness and is characterised by a long tail on the left side, with a value of -5.238. The kurtosis score of 35.627 exceeds the benchmark of 3, indicating that it is classified as leptokurtic. Furthermore, the mean value of the data volume is 3.9900, with a standard deviation of 0.33318. The standard deviation indicated a minimal variation from the mean value. The skewness of -6.875 indicates a distribution with a long left tail, as it has a negative sign. The kurtosis value of 68.326 is more than 3, which classifies the distribution as leptokurtic. Table 2 also shows that the data variety has an average value of 4.5700 and a standard deviation of 1.08484, suggesting a significant level of variability. The range of values ranges from 1 to 5, with 1 being the least and 5 being the maximum. The distribution is negatively skewed with a skewness coefficient of -2.654 and has a kurtosis value of 5.933, indicating that it is leptokurtic as the kurtosis value exceeds 3. Finally, the data velocity has a mean value of 4.6900. This value is significantly higher when compared to the maximum scale of measurement, which is 5. The standard deviation was 0.58075. This indicates a greater range of values from the average. The data velocity exhibits a negative skewness, characterised by a lengthy left tail, with a value of -2.998. The kurtosis value of 15.039 exceeds the prescribed threshold of 3. Therefore, this can be classified as leptokurtic due to the fact that the Kurtosis value is greater than 3.

### Normality Test

The normality test was conducted to ascertain if the data set were normally distributed or not. The test was conducted with the use of Shapiro Wilk test as presented on the table 3.

**Table 3 Shapiro-Wilk W test for normal data**

Variable	Obs	W	V	z	Prob>z
FRQ	100	0.98952	0.749	-0.635	0.73722
DTVRY	100	0.96612	2.421	1.942	0.20605
DTVLT	100	0.97275	1.947	1.464	0.07160
DTVLM	100	0.92138	5.617	3.792	0.10007

**Source: Researcher's compilation (2024)**

The result from the Shapiro Wilk W test conducted indicated that all the variables have probability value higher than 5% critical level, which shows that the data are normally distributed.

### Correlation Analysis

The test was done to ascertain the degree and direction of relationships amongst the dependent and independent variables of the study. The result of correlation is presented on table 4 below.

**Table 4 Correlation Matrix**

	FRQ	DTVLM	DTVRY	DTVLT
FRQ	1.0000			
DTVLM	0.719**	1.0000		
DTVRY	0.550**	0.212*	1.0000	
DTVLT	0.743**	0.610**	0.363**	1.0000

**Source: Researcher's compilation (2024)**

The findings presented in table 4 display the correlation matrix used to analyse the relationship between big data and the quality of accounting information. The analysis revealed that the data volume (DTVLM) has a positive and statistically significant impact, as indicated by a coefficient of 0.719. It was discovered that a higher amount of data will result in an improvement in the quality of accounting information for companies in Nigeria. Furthermore, the data variety (DTVRY) has a substantial and positive correlation with a value of 0.550. This means that for every one unit rise in data variety, there would be a corresponding increase of 0.550 units in the quality of accounting information among Nigerian firms. Furthermore, the data velocity (DTVLT) exhibits a positive correlation, with a



coefficient of 0.743, suggesting that a rise in data velocity will result in an improvement in the quality of accounting information. All of the independent variables have a positive association with themselves. Specifically, the data volume has a significant positive relationship with data variety, with a correlation coefficient of 0.212 and a probability value of 0.035. This significance is observed at a 5% level. Furthermore, there was a strong positive correlation of 0.610 between data volume and data velocity, and data variety and data velocity also showed a substantial beneficial impact. The outcome of these explanatory variables indicated the lack of multicollinearity, as the recorded values of the explanatory variables did not exceed the threshold of 0.7.

**Multicollinearity Test**

The test of multicollinearity checks if the independent variables were high correlated among themselves in any form, supposing the correlation test was not able to indicate that, the study therefore employed the use of Tolerance value and variance inflation factor (VIF). The result is presented thus;

**Table 5: Multicollinearity Test**

Tolerance	VIF	1/VIF
.627	1.17	0.856503
.868	1.11	0.902470
.570	1.06	0.945522
Mean VIF   1.11		

**Source: Researcher’s compilation (2024)**

The tolerance values for data volume, data variety, and data velocity are 0.627, 0.868, and 0.570, respectively. All three variables have tolerance values greater than 0.10, indicating the absence of multicollinearity among the variables. The Variance Inflation Factor (VIF) values for data volume, data variety, and data velocity are 1.17, 1.11, and 1.06, respectively. The Variance Inflation Factor (VIF) for all three variables was below 10, indicating the absence of any multicollinearity presence among the variables.

**Regression analysis and Test of hypotheses**

**Table 6- Regression Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.8700	.757	.750	.25024

- a. Predictors: (Constant), DTVLM, DTVRY, DTVLM
- b. Dependent Variable: FRQ

**Table 7- Analysis of Variance**

Model		Sum of Squar	Df es	Mean Square	F	Sig.
1	Regressio	1n8.73	83	6.246	99.747	.000 <sup>b</sup>
	Residual	6.012	96	.063		
	Total	24.75	099			

**a. Dependent Variable: FRQ**

**b. Predictors: (Constant), DTVLM, DTVRY, DTVLM**

The result model summary table 6 provides an explanation of the combined impact of big data and the quality of financial reporting on the companies listed on the Nigerian exchange group. The table displays the coefficient of determination R Square (R<sup>2</sup>), with values of 0.757 and 0.750 for the unadjusted and adjusted values, respectively. The findings indicated that around 75% of the variability in the independent variables (data volume, data variety, and data velocity) together accounted for the dependent variable (quality of accounting information in Nigerian enterprises). The remaining 25% corresponds to the error term. Similarly, Table 7 elucidates the analysis of variation, specifically indicating the statistical significance of the entire model. The table displayed the degree to which the independent variables collectively accounted for the dependent variable. The F-statistic value is stated as 99.747. The significance of this number is at a 1% level, indicating that the model as a whole is statistically significant.

**Table 8. Coefficient of Variation**

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.133	.306		.436	.664
	DVM	.642	.095	.428	6.741	.000
	DVY	.151	.025	.328	6.076	.000
	DVCT	.312	.057	.362	5.437	.000

**a. Dependent Variable: QAI**

**b. Predictors: (Constant), DVM, DVY, DVCT**

**Hypothesis one - Data velocity has no significant effect on the financial reporting quality of firms listed on Nigeria exchange group PLC.**

According to the data in table 4.5c, it is evident that Data velocity (DTVLT) has a noteworthy positive coefficient on the quality of accounting information. The coefficient value is 0.312, with a t-statistic of 5.437 and a p-value of 0.000. Based on the findings, it was observed that an increase in data velocity has a positive impact on the quality of accounting information in Nigerian firms. Specifically, a unit increase in data velocity corresponds to a 0.312 unit increase in accounting information quality. The speed at which data is processed has a notable and favourable impact on the accuracy of financial reporting in Nigerian companies. This finding aligns with the research conducted by various scholars, including [61], [62], [35], [66], [28], [44], [27], who have all argued in favour of the positive influence of data velocity on the generation of reliable data. Thus, the direct effect of velocity on the timeliness of accounting information can be assessed. These findings are in direct opposition to the research conducted by [21], as well as [14].

**Hypothesis two - Data variety has no significant effect on the financial reporting quality of firms listed on Nigeria exchange group PLC.**

The coefficient for data variety (DTVRY) is 0.151, which is both positive and significant. The t-statistics is 6.076, and the p-value is 0.000, indicating a strong relationship with the quality of accounting information. Based on the findings, it was observed that an increase in data variety has a positive impact on the quality of accounting information in Nigerian firms, with a unit increase in data variety resulting in a 0.151 unit increase in quality. The quality of accounting information among Nigerian firms is positively influenced by a wide range of data. This is consistent with the research conducted by [44], [27], [23], [19], [32], and [17]. These studies have all suggested that companies that regularly gather data from multiple sources have the potential to enhance the accuracy and reliability of their data by mitigating biases and errors associated with limited data. [8] also states that having data available in different formats enhances the quality of accounting information. On the contrary, [21] present a differing viewpoint in their study, which focusses on the cost implications associated with utilising various methods of data collection.

**Hypothesis three - Data volume has no significant effect on the financial reporting quality of firms listed on Nigeria exchange group PLC.**

In addition, the result that was presented in table 4.5c above showed that the Data volume (DTVLM) has a substantial positive coefficient on the quality of accounting information. This coefficient has a value of 0.642, t-statistics of 6.741, and a p-value of 0.000. It was inferred that the quality of financial reporting by Nigerian companies would improve by 0.642 units for every unit that the volume of data increased by. The volume of data showed that there is a substantial positive association between the quality of accounting information across Nigerian companies. A number of researchers, including [23], [62], [61], [22], [15], [21], and [13], have found that this positive link lends credence to their conclusions. On the basis of the positive association, it was inferred that the quality of accounting information would improve as businesses began to gather and evaluate vast amounts of data. The conclusions of [44] and [17] are contradicted by this positive association, which contradicts those findings.

**CONCLUSION AND RECOMMENDATIONS**

**Summary of findings**

1. Data velocity has positive and statistical significant effect on financial reporting quality of firms listed on Nigeria exchange group
2. Data variety has positive and significant effect on the quality of financial reporting of firms listed on
3. Data volume has positive and significant effect on quality of Nigerian exchanging.

## CONCLUSION

The study utilised the ordinary least square method in conjunction with correlation analysis in order to evaluate the relationship between big data and the quality of financial reporting on companies that are listed on the Nigeria exchange limited. Taking into account the findings, the research came to the conclusion that the quality of financial reporting by Nigerian companies is greatly impacted by big data, which was measured by data volume, data variety, and data velocity. In light of this, it was inferred that big data may be utilised in financial accounting and reporting in order to improve the quality of accounting information used.

## RECOMMENDATIONS

The study sequel to the findings made the following recommendations for policy decision-making:

1. In order to improve the quality of accounting information, organisations should integrate unstructured data from a variety of sources into their accounting systems in real time.
2. In order to enhance the quality of accounting information, there should be sufficient investments made in big data, its administration, staff, and technology.
3. In order to enhance the quality of accounting information, organisations should place a high priority on the appropriate and dependable data type and volume, while also maintaining a competitive pace with the velocity of data.

## REFERENCES

1. Slezák, J. (2023). Artificial intelligence, big data, blockchain and cloud computing – Future accounting? *Trendy v podnikání - Business Trends*, 13(1), 16-33. [https://doi.org/10.24132/jbt.2023.13.1.16\\_33](https://doi.org/10.24132/jbt.2023.13.1.16_33)
2. Theodorakopoulos, L., Antonopoulou, H., Mamalougou, V., & Giotopoulos, K. (2022). The Drivers of Volume Volatility: A Big Data Analysis Based on Economic Uncertainty Measures for the Greek Banking System. *SSRN Electronic Journal*. doi:10.2139/ssrn.4306619
3. Aziz, A.O. (2023), Big data opportunities for accounting and finance practice and research. *Australian Accounting Review*, 28(2), 323-333. <https://doi.org/10.1111/auar.12218>.
4. Nnorom, N. (2021). Forty four companies to face NSE's sanctions over default filing. Vanguard News. <https://www.vanguardngr.com/2021/04/44-companies-to-face-nses-sanctions-over-default-filing/>
5. Zhang, W.E (2020), Big Data: Challenges and Opportunities in Financial Management. *Problemy Zarządzania – Management Issues*, 17 (585). 9-23. <https://doi.org/10.7172/1644-9584.85.1>
6. Moll, J., & Yigitbasioglu, O. (2019). The Role of Internet-Related Technologies in Shaping the Work of Accountants: New Directions for Accounting Research. *The British Accounting Review*, 51(6). <https://doi.org/10.1016/j.bar.2019.04.002>.
7. Leitner Hanetseder and Lehner (2022), Big data: The v's of the game changer paradigm. *IEEE 2nd international conference on data science and systems* (pp. 17-24).
8. Najafi, A., Soleimanpur, S., & Morady, M. (2022). The Impact of Information Technology Methods on Accounting Information Quality: Empirical Evidence from Iran. *Journal of Information and Organizational Sciences*, 46(1), 63-77. <https://doi.org/10.31341/jios.46.1.4>.
9. Pilipczuk, O., Cosenco, N., & Kosenko, O. (2019). Big Data: Challenges and Opportunities in Financial Management. *Problemy Zarządzania – Management Issues*, 17 (585). 9-23. <https://doi.org/10.7172/1644-9584.85.1>
10. Warren, J.D., Moffitt, K.C., & Byrnes, P. (2015). How Big Data will Change Accounting. *Accounting Horizons*, 29(2), 397-407. <https://doi.org/10.2308/acch-51069>.
11. Yoon, S. (2020). A Study on the Transformation of Accounting Based on New Technologies: Evidence from Korea. *Sustainability*, 12(20). <https://doi.org/10.3390/su12208669>
12. Chu and Yong , (2021) Financial accounting quality and its defining characteristics. *Sea: Practical Application of Science*, 2(3).
13. Cockcroft, S., & Russel, M. (2018). Big data opportunities for accounting and finance practice and research. *Australian Accounting Review*, 28(2), 323-333. <https://doi.org/10.1111/auar.12218>.
14. Statista (2022). Global big data analytics market size 2021-2029. <https://www.statista.com/statistics/1336002/big-data-analytics-market-size>.
15. Qiongge, L., (2020). Research on the impact of big data era on accounting development. *International Journal of Scientific Engineering and Science*, 4(6), 44-47.
16. Lancey, W.W. (2023), Big data consumer analytics and the transformation of marketing. *Journal of business research*, 69(2), 897-904
17. Nasrizar, M. M. (2015). Big data and accounting measurements. *Advances in Computer Science and Information Technology (ACSIT)*, 2(3); 295-305.

18. McNeely, C. L. (2015). Big data analytics and workforce issues: Prospects and challenges in the information society. *Journal of the Washington Academy of Sciences*, 101(3), 1-10.
19. Patgiri, R., & Ahmed, A. (2016). Big data: The v's of the game changer paradigm. *IEEE 2nd international conference on data science and systems* (pp. 17-24).
20. Carter, C.C. (2022), The Impact of Information Technology Methods on Accounting Information Quality: Empirical Evidence from Iran. *Journal of Information and Organizational Sciences*, 46(1), 63-77. <https://doi.org/10.31341/jios.46.1.4>.
21. Ogi, D., (2020). Big data statistics: how much data is in the world? <https://firstsiteguide.com>
22. Ghasemaghaei, M., & Calic, G. (2019). Can big data improve firm decision quality? The role of data quality and data diagnosticity. *Decision Support Systems*, 120, 38-49
23. Larson, D., & Chang, V. (2016). A review and future direction of agile, business intelligence, analytics and data science. *International Journal of Information Management*, 36(5), 700-710.
24. Gandomi, A., & Haider, M. (2015). Beyond the hype: big data concepts, methods, and analytics. *International journal of information management*, 35(2), 137-144.
25. Crookes, & Conway, E. (2022), Big data consumer analytics and the transformation of marketing. *Journal of business research*, 69(2), 897-904
26. Owais, S. S., & Hussein, N. S. (2016). Extract five categories CPIVW from the 9V's characteristics of the big data. *International Journal of Advanced Computer Science and Applications*, 7(3):87-90.
27. Ghasemaghaei, M. (2021). Understanding the impact of big data on firm performance: The necessity of conceptually differentiating among big data characteristics. *International Journal of Information Management*, 57, 102055.
28. Dimmick, M. (2017). How the variety in big data works as an Advantage – OpenGov Asia. <https://opengovasia.com/how-the-variety-in-big-data-works-as-an-advantage/>
29. Brown, O.O. (2022), The convergence of big data and accounting: innovative research opportunities. *Technological Forecasting and Social Change*, 173, 121171.
30. Lam, S. K., Sleep, S., Hennig-Thurau, T., Sridhar, S., & Saboo, A. R. (2017). Leveraging frontline employees' small data and firm-level big data in frontline management: An absorptive capacity perspective. *Journal of Service Research*, 20(1), 12-28.
31. Bazzaz Abkenar, S., Haghi Kashani, M., Mahdipour, E., & Jameii, S. M. (2021). Big data analytics meets social media: A systematic review of techniques, open issues, and future directions. *Telematics and informatics*, 57, 101517. <https://doi.org/10.1016/j.tele.2020.101517>.
32. Marr, B. (2016). *Big data in practice: how 45 successful companies used big data analytics to deliver extraordinary results*. John Wiley & Sons.
33. Grover, V., Chiang, R. H., Liang, T. P., & Zhang, D. (2018). Creating strategic business value from big data analytics: A research framework. *Journal of management information systems*, 35(2), 388- 423.
34. Spacey, O.E., (2023), Big data and accounting measurements. *Advances in Computer Science and Information Technology (ACSIT)*, 2(3); 295-305.
35. Rai, A. (2020). What is big data – characteristics, types, benefits & examples 2019. <https://www.upgrad.com/blog/what-is-big-data-types-characteristics-benefits-and-examples/>
36. Yaqoob, I., Hashem, I. A. T., Gani, A., Mokhtar, S., Ahmed, E., Anuar, N. B., et al. (2016). Big data: From beginning to future. *International Journal of Information Management*, 36(6), 1231-1247
37. Rubin, V. & Lukoianova, T. (2013). Veracity roadmap: Is big data objective, truthful and credible? *Advances in Classification Research Online*, 24(1), 4
38. Erevelles, S., Fukawa, N., & Swayne, L. (2016). Big data consumer analytics and the transformation of marketing. *Journal of business research*, 69(2), 897-904
39. Ghasemaghaei, M., Hassanein, K., & Turel, O. (2017). Increasing firm agility through the use of data analytics: The role of fit. *Decision Support Systems*, 101, 95-105.
40. Brown, Terry. (2022). <https://itchronicles.com/big-data/who-is-using-big-data-in-business/>
41. Younis, N. M. M. (2020). Big data and the future of the accounting profession. *Indian Journal of Science and Technology*, 13(08), 883-892. <https://doi.org/10.17485/ijst/2020/v013i08/149808>
42. Manyika, J., & Roxburgh, C. (2011). The great transformer: The impact of the internet on economic growth and prosperity. *McKinsey Global Institute*, 1(0360-8581).
43. Saboo, A. R., Kumar, V., & Park, I. (2016). Using big data to model time-varying effects for marketing resource (re) allocation. *MIS quarterly*, 40(4), 911-940.
44. Ahmad, I., Ahmed, G., Shah, S. A. A., & Ahmed, E. (2020). A decade of big data literature: analysis of trends in light of bibliometrics. *The Journal of Supercomputing*, 76(5), 3555-3571.
45. Hribar, P., Kravet, T., & Wilson, R. (2014). A new measure of accounting quality. *Review of Accounting Studies*, 19(1), 506-538.

46. Pounder, B. (2013). Measuring accounting quality: the SEC is developing a software model to measure the accounting quality of its registrants' filings. *Accounting professionals should be aware of the implications. Strategic Finance*, 94(11), 18-21.
47. Achim, A. M., & Chi<sup>2</sup>, A. O. (2014). Financial accounting quality and its defining characteristics. *Sea: Practical Application of Science*, 2(3).
48. El-Hewety, A. E. (2019). The impact of the accounting quality and information risk on the time of earning announcement. *Journal of Environmental Studies and Researches*, 9(2), 45-51.
49. Certified Finance Analysts, Accounting information quality. <https://www.cfainstitute.org>
50. Ladewi, Y., Susanto, A., Mulyani, S., & Suharman, H. (2017). Effect of organizational commitment on the quality of accounting information systems and their impact on the quality of accounting information. *Journal of Engineering and Applied Sciences*, 12(24), 7649-7655.
51. Qatawneh, A. M., & Bader, A. (2020). Quality of accounting information systems and their impact on improving the non-financial performance of Jordanian Islamic banks. *Academy of Accounting and Financial Studies Journal*, 24(6), 1-19
52. Putri, D. A. (2018). Analysis of the factors that influence timeliness of financial statement submission in consumption industrial companies listed in Indonesia stock exchange (IDX). *International Journal of Public Budgeting, Accounting and Finance*, 1(4), 1-12.
53. Gusc, J., Bosma, P., Jarka, S., & Biernat-Jarka, A. (2022). The Big Data, Artificial Intelligence, and Blockchain in True Cost Accounting for Energy Transition in Europe. *Energies*, 15(3), 1089. doi:10.3390/en15031089.
54. Belfo, F., & Trigo, A. (2013). Accounting Information Systems: Tradition and Future Directions. *Procedia Technology*, 9, 536- 546. doi:10.1016/j.protcy.2013.12.060
55. Bhimani, A., & Willcocks, L. (2014). Digitisation, Big Data and the transformation of accounting information. *Accounting and Business Research*, 44(4), 469-490. doi:10.1080/00014788.2014.910051.
56. Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, 20, 571 - 610.
57. Odubuasi, A. C., Ofor, N. T., & Ugbah, A. (2022). Risk committee effectiveness and financial performance indicator of quoted firms in selected African countries. *Journal of Financial Risk Management*, 11, 634-647. <https://doi.org/10.4236/jfrm.2022.113030>
58. Ashforth, B.E., & Gibbs, B.W. (1990). The double-edge of organizational legitimation. *Organization Science*, 1(2), 177-194.
59. Ayodele, F.G., Igbekoyi, O.E. & Dagunduro, M.E. (2023). Effect of big data on accounting information quality in selected firms in Nigeria. *International Journal of Research and Innovation in Social Science (IJRISS)*, VII(III), 789-806. DOI: 10.47772/IJRISS.
60. Awotomilusi, N., Dagunduro, M.E., & Osaloni, B.O. (2022). Adoption of cloud computing on the efficacy of accounting practices in Nigeria. *International Journal of Economics, Business and Management Research*, 6(12), 194-205.
61. Bose, S., Dey, S. K., & Bhattacharjee, S. (2022). Big Data, Data Analytics and Artificial Intelligence in Accounting: An Overview. *Handbook of Big Data Methods*, Forthcoming.
62. Herath, S. K., & Woods, D. (2021). Impacts of big data on accounting. *E-Business & Administration Review*, 12(2), 186-193.
63. Ramasamy, A., & Chowdhury, S. (2020). Big data quality dimensions: a systematic literature review. *JISTEM-Journal of Information Systems and Technology Management*, 17, 343-357
64. Wamba, S. F., Akter, S., Trinchera, L., & De Bourmont, M. (2018). Turning information quality into firm performance in the big data economy. *Management Decision*
65. Crookes, L., & Conway, E. (2018). Technology challenges in accounting and finance.

**CITE AS: Ejiofor Emmanuel Onyeka, Ubogu Festus, Agbasi Evelyn and Lawren Edeh (2025). Big Data and Financial Reporting Quality of Banks Listed in Nigerian Exchange Group. NEWPORT INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN HUMANITIES AND SOCIAL SCIENCES, 5(1):1-13 <https://doi.org/10.59298/NIJCRHSS/2025/5.1.11300>**