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# The impact of big data analytics on sustainable auditing in Jordanian commercial banks

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## *ABSTRACT*

This study examines the impact of big data analytics, specifically its dimensions of descriptive, predictive, and prescriptive analysis on sustainable auditing practices in Jordanian commercial banks. A descriptive analytical approach was employed to achieve the research objectives. The study population consisted of 12 Jordanian commercial banks with participants including data analysts, auditors, IT staff, and sustainable auditing consultants. 300 questionnaires were distributed, of which 277 were successfully retrieved and analyzed using SPSS. The results indicate that big data analytics significantly influences sustainable auditing practices in Jordanian commercial banks. The findings suggest that as technological advancements accelerate, increased investments in big data analytics are essential for enhancing auditing processes and achieving sustainability objectives in the banking sector. This underscores the growing importance of big data as a critical tool in modern financial management and auditing. Adopting BDA in sustainable auditing faces challenges, including data security concerns, high implementation costs, and the need for specialized expertise. Overcoming these obstacles requires strategic investments in technology, workforce training, and regulatory support. The findings of this study provide valuable insights for auditors, financial institutions, and policymakers seeking to enhance sustainable auditing practices through big data analytics (BDA). The integration of BDA in Jordanian commercial banks can lead to several practical benefits such as enhanced audit efficiency and accuracy, improved regulatory compliance, cost reduction and resource optimization.

**Contribution/Originality:** This study explores the intersection of big data analytics (BDA) and sustainable auditing within Jordanian commercial banks, an area that remains underexplored in the existing literature. Limited studies have specifically examined its contribution to sustainability-focused auditing practices in the banking sector of Jordan while prior research has addressed the role of BDA in financial reporting and risk assessment.

## 1. INTRODUCTION

In today's rapidly evolving digital landscape, big data analytics (BDA) has emerged as a transformative force, reshaping decision-making processes and driving strategic innovation across diverse sectors. In the banking industry, BDA has revolutionized how institutions process vast amounts of data, enabling more efficient operations, enhanced customer segmentation, robust risk management, and strategic planning. For instance, banks leveraging

BDA are better positioned to achieve regulatory compliance, mitigate risks, and promote financial stability while enhancing operational efficiency (Dagilienė & Klovienė, 2019).

This technological shift also holds significant implications for auditing practices, particularly as sustainability becomes a cornerstone of financial accountability. BDA, with its ability to provide deep insights and streamline processes has the potential to align auditing practices with environmental, social, and governance (ESG) criteria often referred to as "green accountable auditing". This approach integrates data-driven insights to create more transparent, efficient, and sustainable financial processes (Sun, Li, Lu, & Guo, 2024). For Jordanian commercial banks which are increasingly under scrutiny to meet regulatory and environmental standards. BDA offers a compelling opportunity to transform traditional audit processes into sustainable frameworks that prioritize compliance, risk management, and resource optimization.

The power of BDA lies in its three core dimensions: descriptive, predictive, and prescriptive analytics. Descriptive analytics provides clarity on historical data uncovering trends and patterns to improve reporting. Predictive analytics forecasts future developments, enabling banks to anticipate risks and anomalies proactively. Meanwhile, prescriptive analytics identifies optimal solutions to address identified challenges, offering actionable recommendations for improvement (De Santis & D'Onza, 2021). These capabilities empower banks to refine their strategies, optimize resource allocation, and enhance their competitive edge in a data-driven market (Bi et al., 2020; Shukla & Mattar, 2019).

In Jordan, the application of BDA in sustainable auditing is still in its initial stages but holds immense potential. Jordanian commercial banks operate within a relatively compact financial sector, characterized by a growing need for transparency and stricter regulatory adherence compared to global counterparts (Hezam, Anthonysamy, & Suppiah, 2023). These institutions can improve sustainability performance, meet local and international regulatory standards, and position themselves as leaders in environmentally and socially responsible banking by adopting BDA.

The integration of BDA in Jordanian banking remains underexplored despite its promising prospects. This gap underscores the importance of investigating how BDA influences sustainable auditing in this context. This study aims to shed light on how Jordanian banks can leverage BDA to enhance decision-making, optimize resources, and align with global sustainability trends by examining its impact. Such insights are crucial for enabling these institutions to thrive in an increasingly data-centric and environmentally conscious market.

This paper will bridge the knowledge gap through the examination of descriptive, predictive, and prescriptive analytics impacting the practices of sustainable auditing given that few studies have been conducted in terms of what role BDA plays in sustainable auditing within Jordanian banks. These elements viewed from the Jordanian perspective will be very significant since localized recommendations could also be very unlike those globally made on account of economic, regulatory, and cultural issues. At the same time, understanding the benefits and challenges associated with BDA in sustainable auditing is of prime importance for Jordanian banks to continue setting up more technology-driven strategies. It would help in formulating an informed strategy on the part of policymakers and industry professionals in integrating BDA across audits (Biglari & Pourabedin, 2022).

The core issue of this study can be broken down by addressing the following questions: Each of which stems from the primary research question, prompting a series of more detailed inquiries.

What is the impact of big data analytics (BDA) in its dimensions: (descriptive analysis, predictive analysis, and prescriptive analysis) on sustainable auditing in Jordanian commercial banks?

This main question initiates the subsequent further questions.

1. Do descriptive analysis have an impact on the sustainable auditing in Jordanian banks?
2. Do predictive analysis have an impact on the sustainable auditing in Jordanian banks?
3. Do prescriptive analysis have an impact on the sustainable auditing in Jordanian banks?

The current study explores dimensions, such as descriptive, predictive, and prescriptive of sustainable auditing practices within Jordanian commercial banks. This study is looking forward to discovering which aspects of BDA are most valuable in contributing to sustainability auditing and can recommend ways that might drive improved data-driven auditing practices through evidence.

This research has added to the limited literature on BDA in Jordan's banking sector, hopefully providing regional financial institutions with key insights in their stride toward sustainability. Second, this study has provided practical recommendations that could help Jordanian banks apply BDA to achieve sustainable auditing and raise the level of transparency to improve risk management and compliance. It finally gives valuable insight to policymakers regarding what technological advances are needed to propagate auditing in a sustainable manner and align Jordan's banking sector with standards already globally adopted in ESG and regulatory compliance.

## 2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

The demand for big data originated as a result of the necessity for companies to analyze the enormous quantity of data that is collected, particularly because traditional information systems are unable to handle this enormous amount of data. As a result, big data analytics is considered to be a current breakthrough in the advancement of technology (Saidat, Abdelrahim, Alkhodary, & Qasaimeh, 2023).

Given the scope of the area and the number of people who utilize big data, it has become the primary concern of a significant number of researchers and accounting thought leaders as well as those who are accountable for systems of information in organizations in recent times. According to Joshi and Marthandan's (2018) definition, "it is a considerable amount of semi-structured or structured information that is challenging to cope with by employing traditional approaches and tools but instead needs advanced methods to cope with and assess it." (Joshi & Marthandan, 2018). According to the definition provided by the International Organization for Standardization, "it is a collection of information or a set of data that have distinctive characteristics such as size, speed, inclusion variation and reliability with preciseness of data that are incapable of being processed effectively by applying conventional approaches to benefit from them (Youssef, Shata, & Al-Zahraa, 2023)."

The International Telecommunication Union described it as "information sets with diverse characteristics requiring massive amounts of methods of analysis to gather, organize, analyze, and handle them under real-time constraints." In other words, it includes data sets that have characteristics that are not uniform (Youssef et al., 2023). The information presented above makes it abundantly evident that the increase in the amount of data is not a recent phenomenon. Nonetheless, the unanticipated increase in the diversity, quantity, speed, and diversity of venues for collecting this data necessitates the utilization of contemporary and efficient technical means in order to take advantage of it and process it. As a result, big data can be defined as a diverse collection of data that can be obtained from a variety of sources. This data can be texts, numerals, graphs, pictures, audio clips, and video clips (Qasaimeh, Yousef, Gasaymeh, & Alnaimi, 2022).

Furthermore, big data is distinguished by its diversity and speed of accessibility, making it challenging to process using traditional databases. By storing, analyzing, and then managing it in such a way that information becomes valuable to stakeholders and assists in rationalizing decision-making, this necessitates the utilization of technology approaches that are both new and efficiently effective (Al-Naimi, Al Abed, Farooq, Qasaimeh, & Alnaimat, 2023).

Sustainability auditing is the process of harmonizing traditional financial auditing practices to meet specified environmental, social, and governance criteria that will provide an extended view on the general sustainability performance of an organization (Salijeni, 2019). Auditing in this regard scrutinizes not only the financial health of an organization but also the impact the organization exerts on the environment, social responsibility, and governance practices that allow companies and stakeholders to make better decisions on long-term risks and opportunities (Shukla & Mattar, 2019). Sabauri (2024) says that starting in 2024, sustainable auditing will be

indispensable for those organizations that intend to demonstrate their concern for responsible practice in key areas of concern, such as climate impact and resource efficiency, among others. Similarly, audits which include ESG can help a company enhance its level of transparency and acquire the trust of its stakeholders while moving them closer to regulatory expectations and global sustainability goals.

The researcher highlights how important it is for ESG-inclusive audits to align with both regulatory standards and global sustainability goals. However, the study doesn't fully explore the difficulties organizations might face in making this alignment work. For example, in the case of Jordanian commercial banks, where resources, regulations, and technological capabilities are not on par with global standards, it's unclear how exactly they can integrate ESG considerations through big data analytics (BDA).

The International Federation of Accountants (IFAC) defines sustainable auditing as "it gives organizations the ability not only to present their financial results but also their ESG performance." This wider scope would help the organization identify and manage those risks that may link up with environmental and social problems, like regulatory development, resource depletion, and social disparity with a guarantee of the enterprise's future competitiveness and sustainability (Vintilă & Dănăilă, 2024).

Big data analytics enables sustainable auditing. It allows organizations to implement advanced integrated tools that can handle large amounts of data with increased efficiency and accuracy. BDA will go deeper and become more reliable with its dimensions of descriptive, predictive and prescriptive analytics (Al-Gasaymeh, Qasaimeh, Alrawashdeh, Alsmadi, & Alzoubi, 2023). Thus, it enables the organization to keep pace with the monitoring and reporting about both financial and non-financial aspects, including ESG factors. Descriptive analytics enables auditors to summarize and analyze historical data for better insight into past performance regarding the usage of resources, observance of regulatory compliance, and carbon footprint. Predictive analytics goes a step further by providing auditors with the ability to forecast potential risk or regulatory compliance issues based on emerging trends. Thus, it allows proactive risk management. Prescriptive analytics, as the name suggests, uses insights gained from analytics to prescribe certain actionable recommendations that an organization may follow in implementing sustainability measures with regard to regulatory standards and stakeholder expectations. Collectively, these BDA dimensions empower sustainable auditing not only to assess a company's financial integrity but also to assess its commitment toward broader ESG objectives (Patel & Shah, 2023).

Recent studies related to integrating BDA into sustainable auditing practices are discussed in the following section.

Aziz, Long, and Wan Hussain (2023) study the impact of big data analytics capabilities on performances in Malaysian banks. In this study of 162 bank managers, the findings indicate that the implementation of advanced data analytics contributed to improved market and operational performance. These enhancements were driven by the increased efficiency of financial data processing and the expertise of accounting and finance professionals in leveraging analytical tools for strategic decision-making. Conclusively, it recommended that investment in training programs was necessary for banks to increase the level of proficiency in BDA among bank employees with even more emphasis on developing predictive and prescriptive analytics competencies that would provide an enabling platform for better decision -making and competitive advantages. This research considers the unique challenges and opportunities in a developing economy by focusing on Jordanian commercial banks. It provides localized study insight into how BDA can be effectively adopted to enhance sustainable auditing, offering practical recommendations that are more relevant to the Jordanian context compared to the findings of Aziz et al. (2023).

He, Hung, and Liu (2023) used the banking case study to explore big data analytics as a facilitator for better customer segmentation and marketing to competitively advance. The longitudinal examination indeed showed that BDA tools perform descriptive analytics in segmentations and predictive analytics to forecast product affinity, yielding higher response rates from customers. The case study revealed that intuitive, real-time insights from BDA have empowered banks to contextualize marketing campaigns to the needs of customers and therefore enhance

customer and brand loyalty. The authors recommended that banks continue refining how they apply BDA in marketing to better adapt to the dynamic customer preferences and market demands.

Galeotti, Lombardi, Paoloni, and Roberto (2022) investigated the effect of big data on management of non-financial data in sustainability reporting and accounting. The authors conducted a qualitative literature review and concluded that descriptive analytics had the potential to improve transparency, accuracy of disclosures on sustainability disclosure and, in particular, the reporting of non-financial data. This study suggested that organizations were strongly encouraged to broaden the use of big data tools for managing non-financial data to further improve their practices on sustainability reporting based on these findings.

Al-Dmour, Saad, Basheer Amin, Al-Dmour, and Al-Dmour (2023) conducted an empirical study of Jordanian banks to investigate factors affecting the adoption of big data analytics and bank performance. Data was collected from 235 managers through questionnaires. The organizational factors significantly predicted BDA adoption which influenced bank performance positively based on their findings. Indeed, the findings showed that descriptive analytics enable better decisions while predictive analytics have useful insights about ways to improve performance. The authors suggested that Jordanian banks enhance their BDA practices by fostering an organizational culture that actively supports and promotes the adoption and integration of Big Data Analytics.

Zhu and Yang (2021) explored the impact of BDA on sustainability and financial performance in Southeast Asian banks. A cross-sectional research design was adopted and quantitative survey data were collected from 317 respondents in 37 banks across six ASEAN countries. Based on their findings, it emerged that the adopting banks performed superior, particularly in green human resource practices on both environmental and financial performances. With BDA in place, these banks could streamline resource utilization and further the sustainability goals. The authors emphasized the importance of prioritizing employee training in green HR and sustainability initiatives to fully leverage BDA capabilities, particularly in enhancing operational efficiency, tracking environmental impacts and reducing carbon footprints.

Ali, Salman, Yaacob, Zaini, and Abdullah (2020) studied the predictive analytics of Islamic banks in Malaysia in relation to social and environmental sustainability. The results indicated that predictive analytics significantly influenced the social and environmental performance metrics using a sample from 407 executives. In addition, there was a view on how organizational culture could influence such a relationship. The results showed an insignificant moderating influence. Therefore, these authors suggested that Islamic banks adopt flexible cultural practices with predictive analytics in order to maximize the social and environmental benefits arising from BDA integration.

Bi et al. (2020) designed a risk assessment framework for banking audits, incorporating big data analytics and fuzzy set theory to realize better accuracy in risk evaluation in Chinese commercial banks. The study used model-based analysis where BDA could make dynamic risk assessments overcoming some deficiencies in traditional approaches of data sampling in a static status. This innovative approach brought evidence that banks were in a better position to monitor emerging risks and pick up abnormal data patterns with the use of predictive analytics. The evidence gathered enabled the authors to conclude that integrating BDA with fuzzy logic models would empower banks to conduct real-time risk monitoring effectively, thereby enhancing stability and security in banking operations.

Hung, He, and Shen (2020) discuss how big data analytics might be leveraged from a commercial bank to inform better strategies for supply chain finance and marketing. The study found evidence that the bank indeed embraced descriptive and predictive analytics to enhance supply chain relationships, especially around marketing efficiency and risk management. The BDA would provide targeted marketing and risk reduction strategies using the analysis of customer segmentation and transaction data, thereby establishing more loyal and engaged customers. The authors suggested commercial banks use predictive analytics to come up with the best approaches for customer relationship management with prescriptive analytics in service differentiation, thus allowing them to move on to better market positioning. The recommendation by the authors to leverage predictive analytics for

customer relationship management (CRM) and prescriptive analytics for service differentiation offers valuable insights into improving market positioning for commercial banks.

Ali et al. (2020) investigated the contribution of big data analytics towards the financial and sustainable performance of banks within ASEAN. Having conducted a survey among 319 employees working in 35 banks, they found that those with green commitment and using BDA have higher sustainability scores which were related to improved financial performances. These banks were able to incorporate BDA in green innovations and HR training to generate an environmentally conscious and productive banking space. The authors recommended that banks increase their usage of prescriptive analytics to monitor and optimize green initiatives ensuring that the workforce has acquired adequate training in green practices to maximize the full benefits of BDA.

Shukla and Mattar (2019) sought to identify and discuss the most influential impediments to adopting big data analytics within auditing systems for sustainability and their dynamics-interrelations. The organizational, technical, and regulatory issues in BDA adoption were mapped by using interpretive structural modeling. They found that technical and regulatory obstacles have been the significant impediments towards fully allowing the potentiality of both predictive and prescriptive analytics to be realized in sustainable auditing practices. Organizations were advised to invest in training programs, upgrading infrastructure, and fostering cooperation between stakeholders in support of the effective integration of BDA in reducing such barriers.

Hazen, Skipper, Ezell, and Boone (2016) put forward a theory-driven agenda for big data and predictive analytics application in sustainable supply chain management with implications for banking. Based on the review of extant literature, they argued that predictive analytics in supply chains will be able to drive financially significant environmental and social sustainability metrics. Therefore, they recommended that future research directions pursue the development of concrete predictive analytics models for sustainability, calling on organizations to adopt these theories to model environmental outcome variables in bank supply chains.

## 3. RESEARCH HYPOTHESES

The main hypotheses of the study are as follows:

*$H_0$: There is no statistically significant impact at level ($\alpha \leq 0.05$) of big data analytics in its dimensions (descriptive analysis, predictive analysis and prescriptive analysis) on sustainable auditing in Jordanian banks.*

The principal hypothesis delivers the foundation for the following sub hypotheses:

*$H_{01}$: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of descriptive analysis on sustainable auditing in Jordanian banks.*

*$H_{02}$: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of predictive analysis on sustainable auditing in Jordanian banks.*

*$H_{03}$: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of prescriptive analysis on sustainable auditing in Jordanian banks.*

### 3.1. The Study Models

The model, depicted in Figure 1 illustrates the research variables along with their associated dimensions, providing a comprehensive framework for understanding the relationships and interactions within the study, showing the independent variable, big data analytics, in terms of descriptive analysis, predictive analysis, and prescriptive analysis whereas the dependent variable is the sustainable auditing.

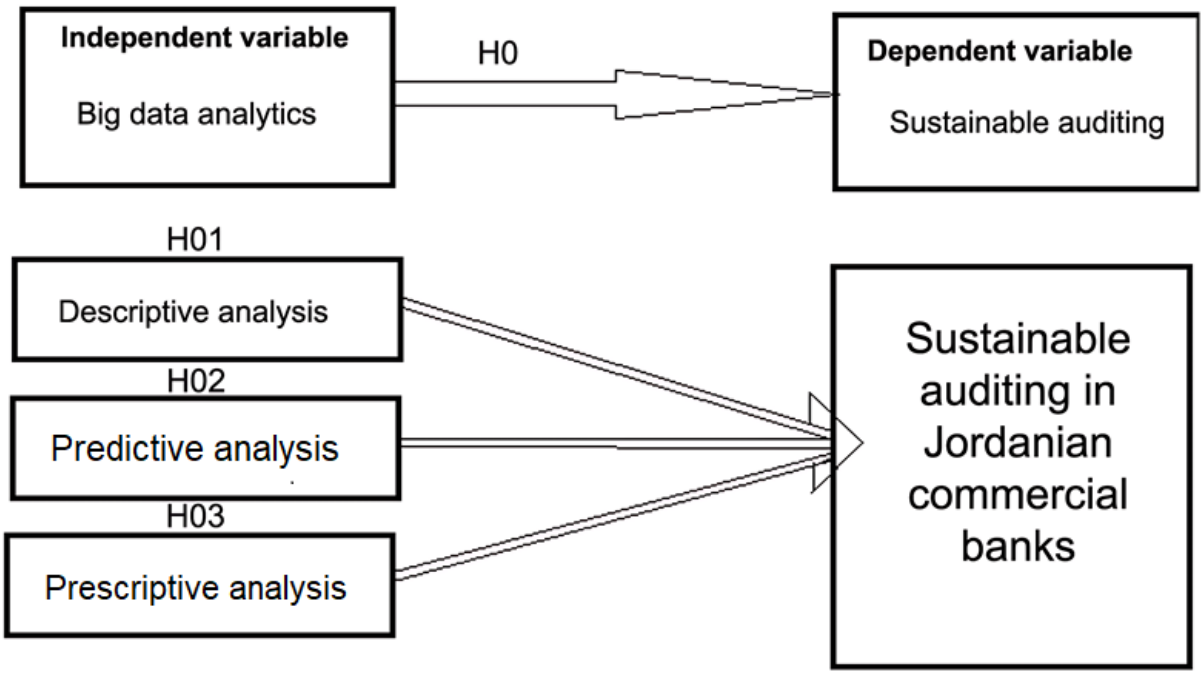


**Figure 1.** Study model.

### *3.2. The Study Method*

The most significant methodology adopted for this study in achieving its intentions and answering the research questions is the descriptive analytical approach. This approach is more relevant to applied and field research by its very nature. Thus, it is quite efficient for the analysis of relationships in specific contexts. In fact, it focuses on how big data analytics influence sustainable auditing practices in commercial banks. Quantitative data shall be collected through structured questionnaires and existing data sets to describe big data analytics implementation and assess the aftermath on the efficacy of auditing practices. Therefore, the approach shall allow deep analysis of patterns and trends of data, hence providing valuable insights into the impacts that big data analytics have on the operations of auditing processes.'

### *3.3. Study Sample and Community*

The targeted respondents in this study were chief information officers, data analysts, sustainable auditing consultants, and IT employees who work at Jordanian commercial banks. This instrument of data collection was through questionnaires of 300 with each of the Jordanian commercial banks given 25 questionnaires. This was done electronically with the use of online survey tools in cooperation with the human resource departments at the head offices of the banks.

The researcher was capable of retrieving 277 questionnaires or a response rate of 92.3% from which all could be statistically analyzed. The description of the demographic characteristics of the respondents is shown in the Table 1.

Table 1 shows a great share of the sample size with post-secondary educational backgrounds. 86.6% of total respondents have a bachelor's degree in their field, 8.3% have attained a master's degree level, and 15.21 .5% have a doctorate. It ascertains a higher level of attainment of education from respondents which is highly needed in understanding intricate information related to data analytics and the process of sustainable auditing. These respondents specialized in such relevant areas as data science (49.8%), business analytics (35.0%), and information technology (14.5%). They were strongly founded in their analytical skills, which was of importance to the focus of this study.

**Table 1.** Demographic and professional characteristics of participants in the study.

| Variables | Target group | n=277 | Percentage |
|---|---|---|---|
| Academic qualification | Bachelor's | 240 | 86.6% |
| | Master's | 23 | 8.3% |
| | PhD | 14 | 5.1% |
| Total | | 277 | 100% |
| Scientific specialization | Data science | 138 | 49.8% |
| | Business analytics | 97 | 35.0% |
| | Information technology | 40 | 14.5% |
| | Other | 2 | 0.7% |
| Total | | 277 | 100% |
| Job title | Chief information officer | 16 | 5.8% |
| | Data analyst | 190 | 68.6% |
| | IT staff | 46 | 16.6% |
| | Sustainable auditing consultant | 25 | 9.0% |
| Total | | 277 | 100% |
| Years of experience | Less than 5 years | 62 | 22.4% |
| | 5 year- less than 10 | 83 | 30.0% |
| | 10 years - less than 15 | 69 | 24.9% |
| | 15 years - less than 20 | 48 | 17.3% |
| | 20 years and above | 15 | 5.4% |
| Total | | 277 | 100% |
| Number of professional certificates | One certificate | 29 | 10.4% |
| | Two certificates | 19 | 6.9% |
| | More than two certificates | 8 | 2.9% |
| | None | 221 | 79.8% |
| Total | | 277 | 100% |

Furthermore, the distribution of job titles was highly representative of key roles in the banking industry. Data analysts constituted the highest portion at 68.6%. IT staff followed at 16.6% while sustainable auditing consultants constituted 9.0% showing that this sample effectively covers big data and its applications in auditing. The chief information officer role is strategic enough to be influential in the transformation of auditing practices though less at 5.8%.

The experience level ranged from the largest group of 30.0% having experience ranging from 5 to less than 10 years. This would mean that there is a strong mix of relatively fresh insights into seasoned expertise which is good for a study such as big data analytics. This distribution also reflects that 79.8% of them do not hold professional certifications because of the exorbitant expense and intensive time taken for such certification or perhaps because professional certification within these fields is still in its infancy in Jordan. In general, the demographic features of the surveyed as depicted in Table 1 offer an in-depth insight into the responding community that assures the well-equipped status of the sample for informing valuable insights about big data analytics implications for sustainable auditing practices with respect to academic background, professional specialization, and practical experience.

### *3.4. Data Collection Sources*

Data for this study were collected to investigate the relationship between big data analytics and sustainable auditing practices in Jordanian commercial banks. Both primary and secondary sources were utilized to ensure a comprehensive analysis.

Primary data were collected through structured questionnaires distributed to employees across 12 Jordanian commercial banks. The participants included auditors, data analysts, IT staff, and sustainability consultants, selected using stratified random sampling to ensure representation. 300 questionnaires were distributed with 277 responses received for statistical analysis.

These sources were thoroughly examined to gain a deeper understanding of recent developments and discoveries in the field, contributing to the theoretical framework of the study and informing the design of the research instruments.

In contrast, primary data were collected using a specially designed questionnaire tailored to align closely with the central themes of the research. The questionnaire aimed to capture participants' perspectives from the banking industry on the application and implications of big data analytics in auditing practices. It was structured into two major sections to address the study's key objectives.

#### *3.4.1. Demographic Data*

This section consists of five questions aimed at gathering key demographic information about the respondents, including their academic qualifications, field of study, job title, years of professional experience, and number of professional certifications. These questions are designed to provide a comprehensive overview of the personal and professional backgrounds of participants from Jordanian commercial banks.

#### *3.4.2. Study Variables*

This section includes 25 statements designed to assess the key variables of interest in the study. Of these, 15 statements focus on exploring the dimensions of big data analytics with five statements for each sub-dimension. The remaining 10 statements aim to evaluate sustainable auditing practices. Respondents' perceptions and their level of involvement will be assessed by measuring the extent to which they agree with the statements. Responses will be captured using a five-point Likert scale ranging from strongly agree (5) to strongly disagree (1). Based on the calculated mean values of the responses, the data will be categorized into three levels of importance for more detailed and insightful analysis.

The use of inputs acquired through both primary and secondary research sources seeks to understand thoroughly how the analytics developed around big data can leverage better practices and improvements within the financial industries of banks through efficient sustainability auditing.

**Table 2.** Level of relative importance and associated arithmetic mean limits.

| Relative importance level | Low | Medium | High |
|---|---|---|---|
| Arithmetic mean limits | 1.00 - < 2.33 | 2.33 - < 3.66 | 3.66 - 5.00 |

Table 2 shows the level of relative importance and associated arithmetic mean limits of the study sample that vary from low level ( 1.00-<2.33) to high level (3.66 - 5.00).

### *3.5. Study Instrument Reliability Test*

Table 3 underscores the robustness and reliability of the measurement tools used to explore how big data analytics impacts sustainable auditing in the banking sector, thereby instilling confidence in subsequent statistical analyses conducted for this research.

**Table 3.** Cronbach's alpha coefficient values for the study tool.

| No. | Variables | Item no. | Alpha |
|---|---|---|---|
| 1 | Big data analytics (Overall) | 15 | 0.970 |
| 2 | Descriptive analysis | 5 | 0.929 |
| 3 | Predictive analysis | 5 | 0.910 |
| 4 | Prescriptive analysis | 5 | 0.912 |
| 5 | Sustainable auditing | 10 | 0.955 |

The reliability test for the questionnaire of the study is aimed at achieving coherence and consistency in the level of responses made by participants. In this case, the reliability will be judged according to the alpha coefficient ranges between 0 - 1. A value greater than 0.70 reflects that the measuring instrument has a high degree of stability. Therefore, the responses are sufficiently consistent to be reliable for rigorous statistical analysis.

According to Table 3, all scores are considerably higher than the threshold of 0.70, while coefficients range from 0.910 to 0.970. This testifies that the questionnaire maintains very strong reliability for every one of the major components big data analytics in general, and descriptive, predictive and prescriptive analyses, and sustainable auditing. The high values for alpha for each dimension do reflect the ability of the current questionnaire to accurately gauge reliability in terms of reflecting the impact on sustainable auditing by big data analytics in the context of commercial banks in Jordan. In this regard, a strong basis in reliability forms a critical underpinning foundation in the subsequent data analyses undertaken toward ensuring that the findings established were valid and reliable enough to be relied upon and replicated.

### *3.6. Data Analysis and Hypothesis Testing*

The description of variables of the study was made in an attempt to explore the impact of big data analytics dimensions on sustainable auditing in Jordanian commercial banks by calculating the arithmetic means and the standard deviation of those variables and their dimensions and determining the level of their relative importance.

### *3.7. Description of Study Variables*

This section aimed to investigate the impact of big data analytics on sustainable auditing at Jordanian commercial banks. For this purpose, it calculates arithmetic means and standard deviations of these variables and dimensions in addition to assessing their level of relative importance.

Table 4 shows participants highly appreciate the role of big data analytics in sustainable auditing. The overall arithmetic mean for big data analytics is 4.187 with a standard deviation of 0.559.

There is a strong consensus on the part of the respondents about its significance. Under the overarching category, the descriptive analysis dimension received the highest in terms of interest-an arithmetic mean of 4.199 with a standard deviation of 0.589, suggesting that this is the most immediately impactful aspect of big data analytics within the auditing process.

At the same time, predictive and prescriptive analyses also garnered great importance but with a little more variation in responses, each having standard deviations of 0.569 and 0.577, respectively. The arithmetic mean for predictive analysis is 4.179, which, although high, appears a bit more conservative since there is some recognition that predictive modeling comprises complexities and challenges. Prescriptive analytics also appear with an arithmetic mean of 4.183 indicating that it's increasingly important for any firm looking to make useful insights from its analytics practice.

As a single measure, sustainable auditing had arithmetic mean of 4.171 a standard deviation of 0.578, which shows high agreement on the importance of its implementation and underscores the vital role of auditing practices that include sustainability principles informed by data analytics.

Overall, these results show there is a perceived and significant interest in applying big data analytics in multiple directions to make auditing processes more effective and sustainable for commercial banks in Jordan. Findings highlight the importance of advanced data analytics in auditing functions as drivers for efficiency, accuracy, and sustainability in financial practices. This goes in line with global trends where data-driven decision-making becomes central to strategic financial operations.

**Table 4.** Descriptive statistics in study variables.

| No. | Variable/Dimension | Arithmetic mean | Standard deviation | Rank | Relative importance |
|---|---|---|---|---|---|
| 1 | Big data analytics | 4.187 | 0.559 | - | High |
| 2 | Descriptive analysis | 4.199 | 0.589 | 1 | High |
| 3 | Predictive analysis | 4.179 | 0.569 | 3 | High |
| 4 | Prescriptive analysis | 4.183 | 0.577 | 2 | High |
| 5 | Sustainable auditing | 4.171 | 0.578 | - | High |

### *3.8. Multicollinearity Test*

There are correlations between the independent variables in the study but very high correlation values herald the existence of the problem of multicollinearity which is considered one of the most prominent problems associated with regression models, specific to these variables. This problem appears when there is a high linear correlation (perfect or almost perfect) between the independent variables and thus inaccuracy in measuring the explanatory relationships between them which makes it impossible to perform the parameter estimation process as it inflates the value of the coefficient of determination R2 beyond its actual value (Guajarati, 2004).

To detect this problem, the variance inflation factor (VIF) and the tolerance coefficient of the independent variables were measured. The variance inflation factor value higher than 10 indicates the presence of multicollinearity problems while its occurrence within the range (1-10) indicates the absence of this problem. Moreover, the value of the permissible variance being higher than the value of 1 confirms the existence of this problem, while its occurrence within the range (0.1-1.0) confirms the absence of this problem (Guajarati, 2004).

**Table 5.** Multicollinearity test results.

| Independent variables | VIF | Tolerance |
|---|---|---|
| Descriptive analysis | 6.642 | 0.151 |
| Predictive analysis | 6.599 | 0.152 |
| Prescriptive analysis | 7.689 | 0.130 |

It is clear from Table 5 that the data are free of the problem of multicollinearity as all values appeared within the specified range as the values of the (VIF) ranged between 6.599 - 7.689 and values of the ( tolerance) ranged between 0.130 - 0.152.

### *3.9. Hypothesis Test Results*

The hypotheses of the study have been developed to investigate the impact of big data analytics on sustainable auditing in Jordanian commercial banks. This is in terms of the influence its three dimensions of descriptive, predictive, and prescriptive analyses have. In light of the above, the influence can be thoroughly explored through the hypothesis and sub-claims below.

## 4. RESULTS OF THE MAIN HYPOTHESIS

*$H_0$: There' is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of big data analytics in its dimensions (descriptive, predictive, and prescriptive analyses ) on the sustainable auditing in Jordanian banks.*

**Table 6.** Regression analysis and model summary for testing main hypothesis.

| Model | R | $R^2$ | F | Sig. F | Independent variables | B | Standard error | β | T | Sig. T |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.929 | 0.863 | 577.318 | 0.000 | Descriptive analysis | 0.233 | 0.056 | 0.237 | 4.121 | 0.000 |
| | | | | | Predictive analysis | 0.129 | 0.058 | 0.127 | 2.209 | 0.028 |
| | | | | | Prescriptive analysis | 0.591 | 0.062 | 0.590 | 9.530 | 0.000 |

Table 6 shows the correlation value (R) between the variables reached 0.929 which is a high power value, and the coefficient of determination (R-square) reached 0.863 which represents the "explanatory power" of the hypothesis.

Furthermore, Table 6 shows that the big data analytics, emphasizing its relationship to sustainable auditing in Jordan commercial banks. There was a very strong association of big data analytics with effective sustainable auditing, with an R value of 0.929 while the variation in the effectiveness of sustainable auditing was explained at about 86.3% by big data analytics as indicated by an $R^2$ of 0.863, reflecting a strong predictive power. The ANOVA test also revealed that there was a significant variance in the impact of big data analytics on sustainable auditing, F=577.318, Sig. F=0.000. Thus, it is clear that "there is a statistically insignificant impact at the level of significance ($\alpha \leq 0.05$) of big data analytics in its dimensions of descriptive, predictive and prescriptive analyses on sustainable auditing in Jordanian banks" which is consistent with research by Shukla and Mattar (2019) and Bi et al. (2020) who emphasized that prescriptive tools help organizations generate optimal solutions to complex problems. This aligns with the idea that prescriptive analytics provides actionable recommendations that support decision-making and sustainability goals.

### *4.1. Testing of Sub-Hypotheses*

*$H_{01}$: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of descriptive analysis on the sustainable auditing in Jordanian commercial banks.*

Table 6 shows that descriptive analysis is associated with sustainable auditing; B = 0.233; its impact was significant on sustainable auditing, T = 4.121, Sig. T = 0.000. Consequently, it is crystal clear that "there is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of descriptive analysis on sustainable auditing in Jordanian banks".

*$H_{02}$: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of predictive analysis on sustainable auditing in Jordanian commercial banks.*

Table 6 above shows that the predictive analysis associated with sustainable auditing; B = 0.129; its impact was significant on sustainable auditing, T = 2.209, Sig. T = 0.028. Consequently, it is crystal clear that "there is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of predictive analysis on the sustainable auditing in Jordanian commercial bank".

*$H_{03}$: There is no statistically significant impact at the significance level ($\alpha \leq 0.05$) of prescriptive analysis on the sustainable auditing in Jordanian commercial banks.*

Table 6 above shows that the prescriptive analysis associated with sustainable auditing; B = 0.591; its impact was significant on sustainable auditing, T = 9.530, Sig. T = 0.000 which means that we should reject the null hypothesis and accept the alternative hypothesis. There is a statistically significant impact at the significance level ($\alpha \leq 0.05$) of prescriptive analysis on sustainable auditing in Jordanian banks.

## 5. CONCLUSION

The research aimed to investigate the effect of big data analytics in its dimensions, namely, descriptive, predictive, and prescriptive analyses on sustainable auditing in Jordanian commercial banks. The results indicate a statistically significant impact of big data analytics on sustainable auditing in Jordanian commercial banks. Big data analytics thus stands out as very vital in its role as the key driver of efficiency and reliability in data handling, hence engendering confidence from customers and investors.

From the above discussion, it is quite clear that a lot of importance has been attached by Jordanian commercial banks to improved sustainable auditing practice. This really reflects a high state of awareness and understanding on the part of management in these banks as to the importance of sustainability in auditing. It enhances financial

performance and aids in safeguarding assets and resources. Most importantly, this trend is about achieving better financial performance along with giving a feel-good factor to the investors and other stakeholders. The fact that banks take serious measures to achieve sustainable auditing increases confidence among such parties that the bank is increasingly a viable option for investment.

This result revealed a statistically significant impact of big data analytics on the issue of sustainable auditing in Jordanian commercial banks. Big data analytics thus stands out as very vital in its role as the key driver of efficiency and reliability in data handling, hence engendering confidence from customers and investors. The study recommended an increase in investment in human capital, as this is paramount to enforce efforts towards big data analytics in commercial banks. Jordanian commercial banks also have to invest more in big data technologies, which are increasingly becoming imperative, considering the rapid pace at which technology is evolving. In addition, it contributes to increased efficiency while reducing most costs normally spent on audits, thus enabling institutions to serve their clientele in safe and efficient ways.

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