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Received: 02/02/2026  
Revised: 12/04/2026  
Accepted: 13/04/2026

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# Big Data Analytics (BDA) And Its Impact on The Performance of Commercial Banks in Aden: Challenges and Opportunities

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**Abstract**— The banking sector is one of the largest generators of big data, leading to significant challenges in managing this data and leveraging the strategic opportunities it presents. This study aims to identify the challenges and opportunities facing the adoption of big data analytics in commercial banks in Aden. The study employed quantitative research and descriptive analysis, surveying managers and technology experts in Aden. It identified the main challenges to adopting big data in the banking sector and offered several recommendations on utilizing big data analytics as a key opportunity within the Yemeni banking sector.

**Keywords**— *Big Data Analytics, Challenges, Opportunities, Commercial Bank, Aden.*

## I. INTRODUCTION

Data is a key component of all businesses and plays a vital role in the banking sector, which is the largest data-generating sector (Nikam & Bhoite, 2020). The banking sector is directly linked to social media, digital screens, and Android applications, which produce enormous amounts of data daily (Azretbergenova and Syzdykova, 2021). "Big Data analytics" refers to the process of searching for hidden patterns and ideas that contribute to improving the business through the process of examining a large set of data over a period of time. These patterns contribute to many benefits for the organization, such as increasing productivity, improving customer service, and creating a competitive advantage for companies (More & Moily, 2021).

Commercial banks need to develop big data analytics tools if they want to keep pace with the rapid changes in the banking market (Aziz et al., 2024). Numerous studies conducted in developing countries such as Malaysia, Kenya, and Saudi Arabia confirm that big data has a significant impact on business success (Azretbergenova and Syzdykova (2024) and Abu Zaineh (2024)). Adding BDA to the banking sector helps to better understand customers and facilitates dealing with a large number of clients (Ebrahimi et al., 2022).

Big data technologies have become a challenge to the banking sector. The three most notable of these issues include data quality, poor digital infrastructure, and the expensive nature of supplying digital systems in monetary terms (Siew & Farouk, 2023). Most banks are relying on cloud-based solutions to address the limitation of digital infrastructures, but this raises questions on the security and privacy of data. The studies also found that the perception of their likelihood is influenced by their age and the extent of exposure to positive experiences. <human>Among them, depending on the age and the degree of exposure to positive experiences, the perception of their likelihood is also affected (Siew and Farouk, 2023; Ebrahimi et al., 2022).

## II. Literature Review

### Big-Data Definition and Concept

Big data has been defined by different authors in different aspects. According to Watson, it is extremely big, quick, and varied data sets that demand emerging technologies and approaches to gathering, computation, and illustration to assist in the improvement of decision-making and provide the company with an edge (Watson, 2017). Equally, Cronenberg (2018) and Hasaeen and Darwish (2020) typify Big Data as the storage, management, analysis, and utilization of large and complex data. Andrea et al. (2016) point out that Big Data is very huge data sets that are not handled using conventional software or tools. Asuncion et al. (2015) also add that most of the studies concur on the V-characteristics of Big Data: volume, velocity, variety, veracity, and value. Big Data can be defined as data that is too large and complicated to be captured, stored, managed, or analyzed with traditional database software. The definition is not fixed, and the size that is deemed as big relies on the capabilities of the users and the available tools to the users. Aziz et al. (2024).

### BDA challenge dimensions.

The Big data analytics is making a big impact on the business, but it is hard to persuade banks to follow. Literature identifies three major categories of such challenges:

**Technical Issues:** According to the research carried out in Malaysia and Kazakhstan, the need to merge the legacy system with the modern analytics tool can be quite troublesome, and the gaps in data acquisition lead to the inability to create a clear picture of the customer (Siew & Farouk, 2023; Azretbergenova and Syzdykova). Technical problems are also represented by issues with data quality and the high cost of digital infrastructure (Siew and Farouk, 2023; Akter et al., 2016).

**Human resource issues:** The shortage of qualified personnel in BDA can be taken as a significant issue since commercial banks lack highly qualified people in BDA or data scientists capable of analyzing data properly (Aziz et al., 2024; Rialti et al., 2019).

**Security and privacy concerns:** Since the financial data of customers is sensitive, the problem of cybersecurity and the vulnerability of the database protection programs are still present. Despite the use of cloud computing solutions, the issue of data security and privacy remains since the information is sensitive (Ebrahimi et al., 2022; Sun et al., 2020).

### BDA Opportunities Dimensions.

Studies conducted by different countries like Saudi Arabia, Kenya, Palestine, and Malaysia reveal that there are many

strategic opportunities that BDA in the banking sector may present. These opportunities are:

**Strategic Decision-Making:** BDA improves data-driven and evidence-based decision-making, which results in greater accuracy in economic predictions (Abu Zaineh, 2024; Alzaidi, 2018).

**Risk Management and Fraud Detection:** BDA has been demonstrated as one of the most important benefits of it since it can monitor daily operations in real-time, allowing them to detect the pattern of fraud and reduce the financial risk (Ebrahimi et al., 2022; Hassani et al., 2018; Isaac, 2019).

**Operational Efficiency and Competitive Advantage:** Banks are capable of preserving their commercial worth in the quickly shifting business environment, attain customer satisfaction, and render their in-house products more efficient (Ndambo, 2016; Aziz et al., 2024; Akter et al., 2016).

#### i. Methodology

The research design that is used in this study is the descriptive-quantitative research design to assess the effects of BDA on commercial banks in Aden.

**Population and Sampling:** The targeted population was technology specialists and department managers of four commercial banks in the headquarters of Aden. The purposive sampling technique was employed to make sure that the participants had the required technical background on BDA. The sample size was 54 respondents.

**Data Collection Instrument:** A structured questionnaire was used to collect data. The instrument was created according to the existing literature (e.g., Siew and Farouk, 2023; Aziz et al., 2024) and checked by academic professionals to guarantee its validity and reliability.

**Data Analysis:** Arithmetic means, standard deviations, and Pearson Correlation Coefficient were used to analyze the data. The statistical significance was tested at the level of  $p < 0.05$ .

#### ii. Results and Analysis

An overview of the study's participant sample is given by this analysis.

##### Gender

According to the results, the majority of participants are male (a percentage), while females make up 22.2%. The results in the table below indicate that the majority of commercial bank employees in Aden are male.

Table 1 Distribution of gender

Gender	Frequency	Percentage (%)
Male	42	77.8
Female	12	22.2
Total	54	100

##### Qualification

From the data in Table (2), we note that the educational background of commercial bank employees in Aden is high, as most of them hold a bachelor's degree or higher.

Table 2 Distribution of qualification

Qualification	Frequency	Percentage(%)
Bachelor's degree	39	72.2
Higher Diploma	3	5.6
Master's	9	16.7
PhD	3	5.6
Total	54	100.0

##### Job Title Distribution

The study accurately represented all job titles, and we note a strong representation of technical staff with experience in BDA.

Table 3 Distribution of Job Title

Job Title	Frequency	Percentage(%)
Department Head	10	18.5
Director of Administration	10	18.5
Employee	29	53.7
General Manager	2	3.7
Senior management	3	5.6
Total	54	100.0

##### Specialize Distribution

The study included relevant technical disciplines such as IT, IS, and Cybersecurity, along with some financial and administrative disciplines such as business administration, banking, and finance.

Table 4 Frequency Distribution of Respondents by specialize

Specialize	Frequency	Percentage(%)
Business Administration	8	14.8
Cybersecurity	7	13.0
Finance and banking	7	13.0
Information systems	16	29.6
Information technology	16	29.6
Total	54	100.0

##### Experience Distribution

These data show that while some individuals have little experience, most commercial bank employees in Aden have medium to high levels of work experience. This is in line with commercial banks' tendency to hire new graduates and young workers.

Table 5 Frequency Distribution of Respondents by experience

Experience	Frequency	Percentage (%)
11-20 years	16	29.6
21 to 30 years	6	11.1
5 to 10 years	10	18.5
Less than five years	20	37.0
More than 30 years	2	3.7
Total	54	100.0

**Axis One Challenges associated with using big data analytics in commercial banks**

Table 6 Arithmetic Means, Standard Deviations for " Challenges associated with using big data analytics in commercial banks"

No.	Statements	Mean	Std. Deviation	Sig.	Rank	Impact of Degree
1	There is a lack of human competencies specialized in data analysis.	4.39	.811	.000	1	Very High
2	The bank has difficulties integrating data from different sources.	4.30	.861	.000	2	Very High
3	There is concern about data security and privacy.	4.15	.878	.000	4	High
4	The bank's technical infrastructure is insufficient to process big data.	3.83	1.209	.000	9	High
5	Lack of clear strategies for using big data.	3.89	1.110	.000	7	High
6	Difficulty accessing data in a timely manner.	3.96	1.228	.000	6	High
7	Poor quality of some available data.	3.80	1.294	.000	10	High
8	Resistance to change by some employees.	3.98	1.296	.000	5	High
9	The costs of implementing analytics are high.	3.89	1.076	.000	8	High
10	Lack of adequate administrative support.	4.22	.904	.000	3	Very High
Overall Mean for Axis 1 (Challenges)		4.04	.600	0.000	-	High

The survey results indicate a consensus among study participants regarding the assessment of the challenges facing BDA in commercial banks in Aden, with average responses for all challenges ranging between 3.83 and 4.39, suggesting the existence of real challenges hindering BDA implementation in commercial banks.

The three highest-ranked challenges were:

1. There is a lack of human competencies specialized in data analysis (mean = 4.39, SD = .811)
2. The bank has difficulties integrating data from different sources. (mean = 4.30, SD = 0.861)
3. Lack of adequate administrative support. (mean = 4.22, SD = 0.904)

Descriptive statistical analyses generally show that the most urgent barriers to big data analytics implementation are related to a lack of specialized personnel, integration

challenges, and insufficient administrative support, while issues with data quality, infrastructure, and cost continue to be moderate but significant barriers that need to be resolved to guarantee the successful adoption of big data in the banking industry.

The "Sig." Column represents statistical significance (often referred to as the p-value). It measures the probability that the observed results occurred by random chance. The value .000 indicates that the results are highly significant. Statistically, this means the p-value is less than 0.001 ( $p < 0.001$ ), which is well below the standard academic threshold of 0.05.

**Axis Two Ways to overcome challenges that hinder the use of big data analytics in commercial banks**

Table 7 Arithmetic Means, Standard Deviations for " Ways to overcome challenges that hinder the use of big data analytics in commercial banks"

No.	Statements	Mean	Std. Deviation	Sig.	Rank	Impact of Degree
1	Training employees on data analysis.	4.37	.996	.000	1	Very High
2	Digital infrastructure development.	4.06	1.235	.000	5	High
3	Strengthening information security policies is essential for effective implementation.	3.96	1.045	.000	8	High
4	Collaborating with data analytics companies can accelerate adoption.	3.93	1.130	.000	10	High
5	Develop strategic plans for using big data.	3.96	1.081	.000	9	High
6	Improve data quality before analyzing it.	3.98	.901	.000	7	High
7	Establish specialized working groups in data analysis.	4.25	.945	.000	2	Very High
8	Providing easy-to-use analysis tools for employees.	4.06	.998	.000	6	High
9	Involving senior management in seminars and courses that emphasize the importance of using data analytics in banks.	4.07	.887	.000	4	High
10	Understanding cultural challenges	4.22	.965	.000	3	Very High
Overall Mean for Axis 2 (Solution)		4.08	.545	0.000	-	High

The three highest-ranked solutions were:

The table above presents the results of the study on solutions to overcome the challenges facing banking in commercial banks. The average responses ranged between 3.93 and 4.37, and there was strong agreement among participants on a number of strategic solutions.

The three highest-ranked solutions were:

1. Training employees on data analysis (mean = 4.37, SD = 0.996)
2. Establish specialized working groups in data analysis. (mean = 4.25, SD = 0.945)
3. Understanding cultural challenges. (mean = 4.22, SD = 0.965)

In general, the results of the statistical analysis show that the participants strongly agree on a set of strategic solutions, the most important of which are training employees, understanding the nature of the challenges, involving senior management in big data analytics seminars, and creating specialized teams in BDA so that they can remove the obstacles that prevent the adoption of big data analytics in leasing banks.

### Axis three Opportunities to use big analytics in commercial banks

Table 8 Arithmetic Means, Standard Deviations for "Opportunities to use big analytics in commercial banks"

No.	Statements	Mean	Std. Deviation	Sig.	Rank	Impact of Degree
1	Promoting innovation in commercial banking services	4.24	.910	.000	3	Very High
2	Improve risk management	4.04	1.098	.000	10	High
3	Make the most of data generated from daily transactions	4.09	1.103	.000	6	High
4	Ability to easily monitor employee performance	4.33	.890	.000	1	Very High
5	Improvements in internal processes	4.26	.975	.000	2	Very High
6	Enhancing dealing with a large number of customers	4.17	.885	.000	4	High
7	Support strategic decision making	4.07	.988	.000	7	High
8	Improving economic analysis and forecasting	4.07	1.043	.000	8	High
9	Combating and preventing fraud	4.09	1.069	.000	5	High
10	Providing diverse and comprehensive data sources	4.06	1.054	.000	9	High
<b>Overall Mean for Axis 3 (Opportunities)</b>		4.14	.518	0.000	-	High

The results indicate a high degree of agreement among respondents regarding BDA opportunities in the banking sector, with average responses ranging between 2.3 and 4.3. This demonstrates an awareness among participants of the reality of BDA opportunities and their importance in enhancing overall performance and utilizing them as a tool to improve customer relations and gain a competitive advantage. The top three opportunities were:

1. Easy monitoring of the performance of the employees (mean = 4.33, SD = 0.890)
2. Betterment of internal processes (mean = 4.26, SD = 0.975)
3. Innovation in commercial banking services (mean = 4.24, SD = 0.910)

### Pearson's Correlation Coefficient (r)

Table 9 Pearson's Correlation Coefficient

Independent Variables	Pearson Correlation (r) with Bank Performance	Sig. (2-tailed)	Result
Opportunities to use Big Data	0.791**	.000	Strong Positive
Ways to Overcome Challenges	0.642**	.000	Moderate Positive
Challenges of Big Data Analytics	-0.584**	.000	Moderate Negative

The findings indicated that big data analytics is a significant source of performance improvements in Aden Bank's performance by impacting three areas associated with it. There was a high positive correlation between leveraging analytical opportunities and bank performance ( $r = 0.791$ ,  $p < 0.01$ ). A positive correlation was also established between the strategic solutions variable and the overall performance enhancement ( $r = 0.642$ ,  $p < 0.01$ ) as well as a negative correlation between the presence of challenges and the performance improvement processes ( $r = -0.584$ ,  $p < 0.01$ ), as such challenges significantly restrict the performance improvement processes.

## Discussion

The results of the research are consistent with the literature on the topic, as the absence of specialized human competencies and challenges related to the integration of data are identified as the main obstacles to the adoption of BDA, which is similar to the findings of Aziz et al. (2024) and Siew and Farouk (2023). There is a positive line of correlation between leveraging BDA opportunities, namely, in employee performance monitoring and internal process improvement, and overall bank performance ( $r = 0.791$ ), which confirms that there is a strong positive correlation between the two and the two theories of competitive advantage by Ndambo (2016) and Akter et al. (2016). Moreover, the importance of the lack of adequate administrative support is high, and it implies that organizational culture can be considered a key barrier to work in Aden, as was discovered by Ebrahimi et al. (2022). These findings support the fact that although managers in Aden see BDA as an effective decision-making tool, its implementation requires considering the technical and human aspects that have been found in prior studies. Finally, the research justifies that BDA has a significant positive impact on banking performance in the case of strong training and leadership support.

## Conclusion

The research has reached the conclusion that BDA has an important effect on enhancing the performance of commercial banks in Aden. The results are that despite a variety of human, technical, and organizational issues, commercial banks have understood the value of BDA and the actual possibilities that it offers, including the support of decision-making, enhanced risk management, and detection of fraud. These difficulties can only be overcome through regular training and development of employees. On the whole, the analysis shows that the implementation of the BDA can give commercial banks a viable chance in case it is successfully implemented.

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