Big Data Analytics in Gaza's Higher Education: Identifying and Addressing Key Implementation Barriers

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Abstract

This research provides an in-depth investigation into the adoption of Big Data Analytics (BDA) technology in higher education institutions (HEIs) in the Gaza Strip, along with a detailed analysis of the barriers to its implementation. Using quantitative research methodology, data was collected from 305 participants. Principal Component Analysis (PCA) was employed to identify key barriers to BDA, including challenges related to infrastructure, security, resources, knowledge, and data characteristics. The study found that financial constraints, access pricing and conditions, significant investment costs, lack of BDA expertise, operational expenses, experience sharing, and resource development are the main barriers to BDA adoption. Additionally, the study shows that 65.3% of HEIs are using BDA technology, with a BDA readiness score of 66.68%. Regression analysis indicates that barriers related to security, finances, data characteristics, skills, and infrastructure negatively impact BDA practice and readiness. Based on these findings, proactive measures are recommended to address these barriers in the Gaza Strip. These measures include developing government initiatives, upgrading IT infrastructure, enhancing BDA skills, and promoting BDA technology awareness. The research advocates for further exploration of the specific challenges and opportunities faced by local universities and a deeper investigation into the potential benefits of BDA adoption. Overcoming these obstacles and fostering BDA integration could enhance data analysis capabilities, contributing to the growth and competitive strength of the Gaza Strip.

Keywords: big data, big data analytics, barriers of adaption big data analytics, Gaza strip

Introduction

The widespread adoption of the internet and related technologies such as social networking, cloud computing, e-banking, e-commerce, search engines, and the Internet of Things (IoT) has led to a significant surge in data. Additionally, many businesses rely on information systems and databases to manage a wide range of operations. These systems have evolved to improve interactions between customers and suppliers, strengthening their competitive advantage. This amalgamation of databases has resulted in extensive datasets commonly referred to as "big data" (BD) (Acharjya & Kauser, 2016; Alharthi et al., 2017; Bhadani & Jothimani, 2016; Lutfi et al., 2023; Yousef, 2023). Currently, the digital landscape contains over 44 zettabytes of data, highlighting the vastness of digital information (Statista, 2022). The term "big data" gained significant attention in academia and industry after 2011, driven by rapid advancements in information and communication technology (ICT) (Bedeley, 2014; Li et al., 2015; Lutfi et al., 2022). The business world largely regards Big Data Analytics (BDA) as an asset that facilitates rapid decision-making and significant revenue generation, as emphasized by (Wahab et al., 2021). Despite the early acknowledgment of the strategic importance of BD, the adoption of BDA

technology faces a variety of obstacles spanning hardware, software, policy, skills, and data complexity, as outlined by (Bhadani & Jothimani, 2016; Jeble et al., 2018).

Academic revolutions have occurred over the past 20 years because of advancements in ICT, which are remarkable in their wide-ranging breadth and the stakeholders they impact (Williams, 2016). The pressure on academic institutions to respond to regional, national, and global economic, social, and political change is growing. HEIs have adopted BDA technology with the promise of a variety of benefits, from better decision-making to individualized student experiences (Aseeri & Kang, 2023; Kalim, 2021).

HEIs in Palestine employed a total of 17,477 people during the academic year 2022–2021, including both male and female staff members. This workforce was distributed across various roles, with 7,367 individuals serving as educators, 611 in administrative positions, 16 as researchers, 999 in various administrative roles, 2,632 working as secretaries, 2,162 serving as teaching assistants, 1,072 in professional capacities, and 622 employed as technicians and artisans (PCBS, 2021). Additionally, the Palestinian Ministry of Higher Education and Scientific Research reported 1,996 other employees. Significantly, a substantial portion of these institutions relies heavily on databases, with many of their employees, including academics and administrators, depending on these databases for the efficient and accurate execution of their responsibilities. These databases play a pivotal role in supporting diverse university operations, ensuring smooth functionality, and facilitating well-informed decision-making processes, resulting in the accumulation of extensive volumes of data. According to the research conducted by Nazarenko and Khronusova (2017), the adoption of BDA technology should be considered by prestigious modern universities that prioritize educational quality. This approach enables the enhancement of effective decision-making in education through the integration of various information and communication technologies, as advocated by Kalim (2021). However, the value extracted from this data remains largely untapped, with current studies indicating that only a mere 0.05% of this data has undergone analysis (Barakat, 2016). This study aims to address the following questions to identify the factors hindering the realization of BD's potential in the HEIs of the Gaza Strip.

RQ1: What is the extent of BDA technology adoption within the HEIs?

RQ2: What are the barriers hindering the implementation of BDA in HEIs?

RQ3: To what extent is the HEIs ready to adopt BDA technology?

RQ4: How do BDA barriers affect BDA technology adoption in HEIs?

Literature Review

Understanding Big Data (BD)

The rapid strides made in ICT and the widespread adoption of social media have propelled the emergence of the concept known as BD. Initially defined by Roger Magoulas as a repository of extensive and intricate data (Ularu et al., (2012)), BD has engendered diverse interpretations within the scholarly realm. As proposed by Acharjya and Kauser (2016) and Balachandran and Prasad (2017), BD comprises extensive and intricate datasets that challenge conventional processing methods. In contrast, Sam and Chatwin (2018) characterize BDA as an innovative technology with the potential to generate business value through its unique capabilities in analytics, prediction, and decision support. Research conducted by Abdulkadri et al. (2016) and Bhadani and Jothimani (2016) underscores several critical dimensions and characteristics of BD, prominently including its substantial volume, diverse variety encompassing various data types and formats, and the rapid velocity at which data is generated, accumulated, and processed. BD Volume pertains to the considerable influx of data from diverse sources, BD Variety includes an extensive array of data types and formats, and BD Velocity often involves swift data generation, accumulation, and processing, sometimes in real-time or near-real-time. In this research, BD is delineated as a substantial dataset harboring numerous variables and high-velocity data. Mastery of BD analysis is indispensable for organizations seeking to leverage its advantages, make informed decisions, and gain competitive edges. These dimensions and attributes

underscore the unparalleled nature of BD and the challenges and prospects it brings to the forefront in terms of data management, analytics, and decision-making.

Understanding Big Data Analytics (BDA)

Understanding BDA involves delving into its foundational concepts, methodologies, challenges, and practical applications. This comprehensive exploration defines the boundaries of BDA's domain and reveals its transformative impact on information analysis, reshaping established paradigms in the process. BDA revolves around the extraction of patterns, trends, and insights from extensive datasets, guiding decision-making and enhancing business value. As highlighted by Lutfi et al. (2022), BDA's significance has steadily risen, gaining recognition from both scholars and practitioners for its potential benefits, challenges, and anticipated rewards. BDA requires advanced technologies, techniques, and algorithms to analyze diverse data types, including structured and unstructured data, often in real-time or near-real-time settings. Weibl and Hess (2018) intricately define BDA as a collection of methods and technologies used by enterprises to manage large volumes of complex data. This perspective is reinforced by Agrawal (2015) and Surbakti et al. (2020), who emphasize big data as an expansive dataset with immense potential for analysis, sharing, and the extraction of insightful revelations. Kalim (2021) identified several commonly used data mining techniques, including regression, nearest neighbor, clustering, and classification, each serving specific purposes in data analysis. Additionally, Kalim (2021) highlighted various tools and systems such as MongoDB, Hadoop, MapReduce, Orange, and Weka, which facilitate the management and mining of large datasets, leveraging algorithms for various data mining tasks. The exploration of BDA reveals its crucial role in deriving insights from extensive datasets through advanced technologies and methodologies. This foundational understanding addresses RQ1: What is the extent of BDA technology adoption within the HEIs? by showcasing the methodologies and technologies integral to BDA. Additionally, it provides a basis for evaluating RQ3: To what extent is the HEIs ready to adopt BDA technology? by highlighting the required technologies and skills.

Barriers to the Adoption of BDA

BDA technology provides organizations with invaluable data-driven insights, offering numerous benefits such as improving services, strengthening customer relationships, transforming business models, discovering new business opportunities, boosting operational efficiency, and gaining a competitive edge (Bhadani & Jothimani, 2016; Jeble et al., 2018; Surbakti et al., 2020; Ularu et al., 2012). According to Rogers (1995), several intrinsic characteristics of an innovation influence its diffusion: (1) Relative Advantage: How improved an innovation is over the previous generation, (2) Simplicity (or complexity): Whether an innovation is easy or difficult to use, and (3) Compatibility: Whether an innovation is compatible with current practices, values, and needs. In BDA technology, diffusion is hindered by various obstacles across its diverse components, including hardware, software, policies, skill sets, and data intricacies. To capitalize on the potential of big data, unconventional tools like parallel and cloud computing become indispensable in overcoming these barriers (Acharjya & Kauser, 2016). Extensive past research has delved deeply into the dimensions of these barriers. For instance, in a study conducted by Moktadir et al. (2019), researchers explored the primary impediments to BDA adoption in supply chain development within Bangladesh. Their findings underscored that the most substantial barriers encompassed insufficient infrastructure, challenges tied to data integration, concerns about data privacy, limited accessibility to BDA tools, and high investment costs. Their study revealed that in Bangladesh, the central hurdles obstructing BDA adoption are the absence of adequate infrastructure, the complexities tied to data integration, worries about data privacy, the constrained availability of BDA tools, and the financial burden of investment. Similarly, Park & Kim (2021) investigated the factors influencing the adoption of BD by Korean corporations and pinpointed influential aspects such as managerial support, security, privacy considerations, government backing, and policy frameworks. Correspondingly, Walker and Brown (2019) scrutinized a prominent South African telecommunications entity and identified top management support, human resource expertise, alignment of business and IT, and organizational size as pivotal organizational factors guiding the BDA adoption journey. In the pursuit of comprehending barriers to BDA adoption, Brohi et al. (2016)

highlighted a range of challenges including data storage and transfer complexities, scalability issues, data quality concerns, intricacies of data, timeliness, protection, privacy matters, trust considerations, data ownership questions, and transparency aspects. Similarly, a study undertaken in South Africa by Malaka and Brown (2015) exposed challenges like data privacy, return on investment, data quality, cost factors, data integrity, efficiency and scalability concerns, ownership and control matters, skill shortages, market priorities, training needs, and ambiguous processes as key hurdles to BDA adoption. In line with Agrawal (2015), a study conducted in China and India recognized data complexity, accessibility hurdles, regulatory approvals, organizational size, profitability considerations, and environmental uncertainties as the major obstacles hampering BDA adoption. Notably, numerous studies within developing nations, such as Lutfi et al. (2022), explored motivations for BDA adoption in Jordan, revealing influential factors like organizational readiness, top management support, security, complexities, and governmental backing. Moreover, Youssef et al. (2022) adopted a quantitative approach to scrutinize the factors influencing the adoption of BDA among retailers in the United Arab Emirates and Egypt. They concluded that concerns about security, external support, managerial backing, and a rational decision-making culture significantly impact BDA adoption in developed countries. The identification of barriers to BDA adoption provides insights into RQ2: What are the barriers hindering the implementation of BDA in HEIs? by detailing various obstacles identified in previous research. This also directly relates to RQ4: How do BDA barriers affect BDA technology adoption in HEIs? by explaining how these challenges impact the overall adoption process. Drawing from existing literature, this study categorizes the 44 sub-barriers to BD adoption into four distinct groups: technological hindrances, data-related challenges, legal considerations, financial obstacles, skill and knowledge shortages, and organizational factors, as outlined in Table 1.

Table 1. Barriers Influencing the Adoption of BDA in the Literature

No.	Sub-barriers	References
A. Technology Barriers		
1.	Absence of BDA tools, and data application capacities.	(Gómez & Heeks, 2016; Moktadir et al., 2019)
2.	Lack of infrastructural facility	(Moktadir et al., 2019; Rubinfeld & Gal, 2017; Sam & Chatwin, 2018; Surbakti et al., 2020; Wahab et al., 2021)
3.	Lack of interest in implementing new technology	(Moktadir et al., 2019)
4.	Network effects	(Moktadir et al., 2019; Rubinfeld & Gal, 2017; Sam & Chatwin, 2018)
5.	Storage and use of BD	(Brohi et al., 2016; Rubinfeld & Gal, 2017; Sivarajah et al., 2017)
6.	Technological and methodological challenges	(Khan, 2022; Rubinfeld & Gal, 2017; Schade, 2015)
B. Data Barriers		
1.	Complexity of data	(Brohi et al., 2016; Khan, 2022; Moktadir et al., 2019; Sam & Chatwin, 2018; Sivarajah et al., 2017; Surbakti et al., 2020; Youssef et al., 2022)
2.	Data Aggregation, Entry, and Integration	(Malaka & Brown, 2015; Moktadir et al., 2019; Schade, 2015; Sivarajah et al., 2017)
3.	Data quality issues	(Balachandran & Prasad, 2017; Brohi et al., 2016; Malaka & Brown, 2015; Moktadir et al., 2019)

No.	Sub-barriers	References
4.	Information Barriers	(Rubinfeld & Gal, 2017; Schade, 2015)
5.	data Variety	(Lutfi et al., 2023; Schade, 2015)
6.	data volume	(Gómez & Heeks, 2016; Schade, 2015)
7.	Velocity	(Lutfi et al., 2023; Schade, 2015)
8.	Data and Information Sharing	(Gómez & Heeks, 2016; Sivarajah et al., 2017)
9.	input/output data flow	(Sivarajah et al., 2017)
10.	data could be false or misleading	(Abdulkadri et al., 2016)
C. Legal Barriers		
1.	Data security and legal Concerns	(Balachandran & Prasad, 2017; Brohi et al., 2016; Gómez & Heeks, 2016; Lutfi et al., 2022; Moktadir et al., 2019; Rubinfeld & Gal, 2017; Sam & Chatwin, 2018; Youssef et al., 2022)
2.	Privacy	(Brohi et al., 2016; Gómez & Heeks, 2016; Malaka & Brown, 2015; Moktadir et al., 2019; Rubinfeld & Gal, 2017; Sivarajah et al., 2017; Surbakti et al., 2020)
3.	Data Protection	(Rubinfeld & Gal, 2017)
4.	Data Ownership and control	(Brohi et al., 2016; Malaka & Brown, 2015; Sivarajah et al., 2017)
5.	Foundation of laws and regulations	(Gómez & Heeks, 2016)
D. Financial Barriers		
1.	Lack of funding	(Moktadir et al., 2019; Sam & Chatwin, 2018; Sivarajah et al., 2017)
2.	High cost of investment and Return on Investment	(Malaka & Brown, 2015; Rubinfeld & Gal, 2017; Sivarajah et al., 2017)
3.	Access Prices and Conditions	(Rubinfeld & Gal, 2017)
4.	Lock-in and Switching Costs	(Rubinfeld & Gal, 2017)
E. Skills & Knowledge Barriers		
1.	Lack of skilled IT personnel	(Gómez & Heeks, 2016; Malaka & Brown, 2015; Moktadir et al., 2019; Sam & Chatwin, 2018; Sivarajah et al., 2017)
2.	Lack of facilities to research and develop BDA tools	(Moktadir et al., 2019; Sam & Chatwin, 2018; Sivarajah et al., 2017)
3.	Lack of training facilities	(Malaka & Brown, 2015; Moktadir et al., 2019)
4.	Sharing experiences between any two parties	(Schade, 2015)
5.	Aware of knowledge of BD	(Gómez & Heeks, 2016; Schade, 2015)
6.	Data Analysis and Modeling	(Sivarajah et al., 2017)
7.	Formats are completely understood by other systems	(Sivarajah et al., 2017)

No.	Sub-barriers	References
8.	Understanding the data architecture	(Abdulkadri et al., 2016)
F. Organizational Barriers		
1.	No policy to share data among organizations	(Gómez & Heeks, 2016; Moktadir et al., 2019)
2.	Semantic barrier	(Schade, 2015)
3.	Cultural and political issues	(Gómez & Heeks, 2016; Schade, 2015)
4.	Two-level entry	(Rubinfeld & Gal, 2017)
5.	Two-sided markets	(Rubinfeld & Gal, 2017)
6.	Foundational capabilities of relevance to BD	(Gómez & Heeks, 2016; Lutfi et al., 2023)
7.	Lack of top management commitment	(Lutfi et al., 2022; Youssef et al., 2022)
8.	Insufficient commitment or resistance to change of non-IT project stakeholders	(Weibl & Hess, 2018)
9.	Disabling data-collecting software	(Rubinfeld & Gal, 2017)
10.	Limited availability of BD for the public sector	(Balachandran & Prasad, 2017; Gómez & Heeks, 2016)

Table 1 lists various barriers to the adoption of BDA technology, as well as the sub-barriers that fall under each main barrier. The main barriers are grouped into six categories: technology, data, legal, financial, skills and knowledge, and organizational barriers. The technology category includes barriers such as the lack of availability of specific BDA tools, data science capabilities, and data application capabilities, as well as a lack of infrastructural facility and network effects. The data category includes barriers such as complexity of data, data aggregation, entry, and integration, data quality issues, and data volume. The legal category includes barriers such as data security and legal concerns, privacy, and data protection. The financial category includes barriers such as a lack of funding, high cost of investment and return on investment, access prices and conditions, and lock-in and switching costs. The skills and knowledge category includes barriers such as a lack of BDA expertise, lack of organizational readiness, and a lack of top management support. To gain a deeper understanding of how these barriers influence the adoption of BDA in the HEIs, we have developed the following hypotheses:

H1: Barriers associated with BD have a negative impact on BDA adoption in HEIs.

H2: Barriers associated with BD have a negative impact on the readdresses for BDA adoption in HEIs.

Research Methodology

The focus of this research is to explore the adoption of BDA technology within the Gaza Strip while investigating the impediments that hinder its effective utilization. To accomplish this goal, a quantitative research methodology was implemented, involving the design and distribution of an online questionnaire to 305 participants via email and social media. The questionnaire served as a pivotal instrument for gathering data and insights from respondents, providing valuable information on the status of BDA adoption and the challenges encountered within HEIs. It was organized into three main sections:

1. The first part of the survey assessed the extent of BDA technology utilization in the Gaza Strip (see Appendix A). This section aimed to measure the current adoption of BDA technologies within HEIs in the region. Understanding this is crucial as it establishes a baseline for BDA technology usage among educational institutions, enabling the assessment of readiness for deeper integration and

identification of areas needing improvement.

2. The second part of the survey evaluated the readiness of enterprises in the region to adopt BDA technology (see Appendix B). This section aimed to gauge the readiness of enterprises within the Gaza Strip to embrace BDA technology. It provided insights into organizational preparedness and receptiveness towards adopting innovative technologies like BDA.

3. The third part of the survey assessed six dimensions of barriers to BDA adoption, covering technology, data, legal, financial, skills and knowledge, and operational barriers (see Appendix C). This section aimed to identify and quantify the obstacles hindering the adoption of BDA technologies within HEIs in Gaza. Understanding these barriers is essential for devising tailored strategies to address challenges and promote more seamless adoption of BDA technologies.

This structured approach ensured comprehensive coverage of key aspects related to BDA adoption and barriers within HEIs, facilitating a thorough analysis of the research objectives. Respondents provided their input using a five-point Likert scale. Subsequently, statistical techniques like factor analysis and multiple regression were employed to analyze the collected data. Ensuring the questionnaire's reliability and construct validity was an integral part of the analysis process. The outcomes of this analysis were utilized to scrutinize the study's hypotheses and to formulate multiple regression equations. These equations are exemplified in equation (E1):

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_nX_n + e \quad (E1)$$

Explanation: Y: Dependent variable, X_i: Independent variable, b: Slope of the line, representing the influence of X on Y, a: Constant term, e: Error term

Sampling

This study focused on individuals working within both the public and private sectors in Gaza. The sampling approach involved a random selection of 305 respondents, as detailed in Table 2.

Table 2. Participant Demographics

Characteristics		Sample Number	Percentage %
Gender	Male	187	61.3
	Female	118	38.7
Education	Postgraduate	135	44.3
	Undergraduate	170	55.7
Experience/Years	Less than 5 years	95	31.1
	Between 5 and 10 years	76	24.9
	More than 10	134	43.9
Job Classification	Academic	141	46.2
	Administrative	164	53.8

Table 2 displays the characteristics of the sample employed in the study. A total of 305 respondents participated, with 61.3% being male and 38.7% being female. In terms of educational background, 44.3% of the respondents held postgraduate degrees, while the remaining 55.7% possessed undergraduate education. Concerning professional experience, 31.1% had less than 5 years of experience, 24.9% had between 5 and 10 years of experience, and 43.9% had more than 10 years of experience. The respondents were categorized based on their job classification: 46.2% were academics and 53.8% were administrative staff, 33.4%. These characteristics provide a comprehensive overview

of the sample utilized in the study. With professionals in HEIs in Gaza considered, 305 respondents provide a meaningful representation to garner insightful perspectives. This sample size ensures a comprehensive range of viewpoints across different sectors, experience levels, and educational backgrounds. Moreover, a sample size of 305 enables robust statistical analyses like factor analysis and multiple regression, ensuring the reliability and validity of the results. The sample encompasses a diverse mix of genders, education levels, job classifications, and years of experience, thereby enhancing the generalizability of findings to the broader HEIs population in Gaza.

Reliability Analysis

To gauge the reliability of the scale utilized in the study, the internal consistency was evaluated using Cronbach's alpha. This statistical measure assesses the reliability of a scale. For this study, the calculated Cronbach's alpha value was 0.88, signifying a strong level of consistency among the items within the instrument.

Reduction of Dimensionality in the BD Barriers Instrument

Principal Component Analysis (PCA) serves as a statistical technique to streamline the dimensions of a research instrument. Within this study, PCA was conducted to delineate the dimensions linked to the obstacles impeding BDA adoption in Gaza. This approach relies on both Eigenvalues and cross-loading patterns to ascertain the quantity of dimensions inherent in the instrument. Eigenvalues hold significant value; components possessing Eigenvalues surpassing one are more impactful, while those falling below one hold less relevance. Cross-loading denotes the distribution of items across two or more dimensions. The process involved applying component analysis and varimax rotation to 29 survey items from 305 participants, which are relevant to BD barriers dimensions. The findings revealed five dimensions with Eigenvalues exceeding 1.0. Additionally, four items were excluded from the analysis due to detected cross-loading: lack of specific BDA tools, lack of interest in applying new technology by the organization, lack of data storage facilities, and complexity of data. The remaining items and their estimated factor loadings with correlated factors are detailed in Table 3.

Table 3. Results of Factor Analysis

Factors	Items				
	1	2	3	4	5
Factor1: Infrastructure Barriers					
1. Bad Network infrastructure	.513				
2. Lack of software	.633				
3. Lack of Hardware	.599				
4. Data Aggregation	.557				
5. Data Integration	.825				
6. Data Performance and scalability	.840				
7. Lack of data entry team	.524				
8. No shared data within the organization	.595				
9. The data could be false or misleading	.746				
10. Lack of data format	.734				
Factor2: Security Barriers					

Factors	Items				
	1	**2**	**3**	**4**	**5**
1. Data Protection		.494			
2. Establishing information security mechanisms		.867			
3. Data privacy		.801			
4. laws and regulations related to BDA		.824			
Factor3: Financial Barriers					
1. funding for BDA			.679		
2. High cost of investment			.791		
3. Access Prices and Conditions list			.743		
4. The Cost/Operational Expenditures			.797		
Factor4: Skills & Knowledge Barriers					
1. aware of BDA				.673	
2. Lack of BDA skills				.581	
3. Research and develop BDA tools				.487	
4. Share the experiences				.689	
Factor5: Data Characteristics Barriers					
1. Data Variety					.734
2. Data volume					.847
3. Data Velocity					.690

Table 3 shows the results of the factor analysis conducted on the items measuring the barriers to BDA adoption. Five factors were identified, including infrastructure barriers, security barriers, financial barriers, skills and knowledge barriers, and data characteristics barriers. The items measuring infrastructure barriers included bad network infrastructure, lack of software, lack of hardware, data aggregation, data integration, data performance and scalability, lack of data entry team, lack of shared data within the organization, the possibility of false or misleading data, and lack of data format. The items measuring security barriers included data protection, establishment of information security mechanisms, data privacy, and laws and regulations related to BDA. The items measuring financial barriers included funding for BDA, high cost of investment, access prices and conditions, and cost/operational expenditures. The items measuring skills and knowledge barriers included awareness of BDA, lack of BDA skills, research and development of BDA tools, and sharing of experiences. Finally, the items measuring data characteristics barriers included data variety, data volume, and data velocity.

Results

This section presents the outcomes of the research study focused on the implementation challenges of BDA in HEIs. The results of various analyses, including the assessment of BDA practice, the impact of BDA barriers on readiness, and the relationship between readiness and practice, are discussed comprehensively. The section aims to provide a thorough understanding of the findings and their implications in navigating the hurdles of implementing BDA technology in the unique

context of HEIs.

Descriptive Analysis

In this section, we delve into the descriptive analysis of the research findings. This involves presenting and interpreting the collected data to gain insights into the current state of BDA adoption and the associated challenges, which address the research questions denoted as RQ1, RQ2, and RQ3. By analyzing the data from different perspectives, we aim to shed light on the extent of BDA technology practice and readiness, as well as the prominent barriers hindering its successful implementation. Through this analysis, we aim to provide a comprehensive overview of the situation on the ground, facilitating a deeper understanding of the dynamics surrounding BDA adoption in this specific context.

Practice of BDA Technology

Table 4 presents the results of a survey conducted to evaluate the extent of BDA technology implementation in HEIs. The survey included 11 questions derived from a literature review (Gómez & Heeks, 2016; Moktadir et al., 2019; Lutfi et al., 2022; Malaka & Brown, 2015; Sam & Chatwin, 2018; Sivarajah et al., 2017). Each question was answered using a five-point Likert scale. The table provides the mean value for each question, along with the percentage of respondents who agreed or strongly agreed with each statement. The results show that, overall, the organization has a high level of BDA technology practice, with most respondents agreeing or strongly agreeing that they can analyze BD, store the results of analyzing BD, share the results with others in the organization, and use BD to make decisions. The results also show that the organization provides technical assistance for BDA, and that the enterprise benefits from BD analysis to increase its competitiveness. Nevertheless, certain aspects of BDA technology practice in the Gaza Strip exhibit a lower level of development. Specifically, challenges are observed in terms of the ease and affordability of the BDA process, as well as the accessibility and usability of the technology for external parties or individuals. These areas require attention and improvement to enhance the overall effectiveness and inclusiveness of BDA practices in the region.

Table 4. BDA Technology Practice

No	Practice Factors	Mean	%	Rank
1.	You can analyze BD in this organization.	3.49	69.8	5
2.	You can store the result of analyzing the BD.	3.43	68.6	6
3.	You can store the reformulated result of BDA.	3.34	66.8	8
4.	This organization provides technical assistance for BDA.	3.66	73.2	2
5.	You can share the results of the BDA with others in the organization.	3.42	68.4	7
6.	BDA is easy and inexpensive.	2.68	53.6	9
7.	Anyone outside the organization can use BDA technology.	2.45	49	10
8.	The BDA process does not take a long time.	2.45	49	11
9.	The enterprise benefits from BD analysis to increase its competitiveness	3.83	76.6	1
10.	The organization uses BD to make decisions	3.58	71.6	4
11.	The organization uses BD in customer service, customer retention and acquisition.	3.60	72	3
The Gaza Strip BDA Practice Level is 65.33%				

Readiness for BDA Technology Adoption

Referring to Table 5, the findings demonstrate a keen interest among firms in embracing new technologies; however, their ability to do so is constrained by limited financial resources and restricted access to BDA expertise and training. Additionally, the absence of regulatory frameworks pertaining to BDA in the Gaza Strip, coupled with partial support from top management and an unwillingness to acknowledge potential risks, further hinders BDA adoption. Despite possessing a robust foundation in terms of data and IT infrastructure, various obstacles remain that must be tackled to fully harness the advantages of BDA technology.

Table 5. BDA Technology Readiness

No.	Practice Factors	Mean	%
1.	The Employees of this organization are aware of the importance of BDA	3.43	68.6
2.	This organization is interested in applying new technology	3.34	66.8
3.	The organization has a strong information network	3.70	74
4.	The organization has sufficient data storage facilities	3.46	69.2
5.	The organization has good data.	3.75	75
6.	There is a team in the organization to enter data.	3.89	77.8
7.	There is a mechanism within the organization to monitor the data.	3.59	71.8
8.	The organization's employees have exclusive rights to use, compile, select, structure, and re-format organizational Data.	3.49	69.8
9.	This organization has laws and regulations related to BDA	3.04	60.8
10.	The organization allocates sufficient funding for BDA	2.99	59.8
11.	The company has prepared data Access Prices and Conditions list	2.78	55.6
12.	Employees are trained in BDA skills	2.78	55.6
13.	There are facilities to research and develop BDA tools	2.91	58.2
14.	The data architecture in this organization is completely understood	3.51	70.2
15.	A culture exists in this organization that promotes BDA Practices	3.39	67.8
16.	Top management supports the adoption of BDA	3.35	67
17.	Top management accepts possible risks which may result from adopting BDA	3.28	65.6
The Gaza Strip BDA Readiness Level is 66.68%			

The results from the assessment of BDA readiness, as presented in Table 5, demonstrate that the HEIs has a robust information network, sufficient data storage infrastructure, and commendable data quality. Nevertheless, room for enhancement exists, including the allocation of sufficient funds for BDA initiatives, formulation of pricing and access conditions for data, and provision of training to cultivate BDA competencies. In aggregate, the HEIs attains a readiness level of 66.68% for the implementation of BDA technology. Addressing these identified shortcomings is crucial for the HEIs to maximize the potential benefits derived from the integration of BDA technology.

Barriers to the Adoption of BDA Technology

To respond to RQ2, participants were surveyed regarding the 29 obstacles in adopting BDA, which are discussed later in Table 6. Subsequently, the average responses were calculated and arranged in order of significance, as detailed in Table 6. According to the data presented in Table 6, the most significant barriers identified are "Funding for BDA" with a mean score of 4.03 and a high agreement percentage of 80.6%, followed closely by "Access Prices and Conditions list" with a mean score of 3.89 and an agreement percentage of 77.8%. Other noteworthy barriers include "High cost of investment" (mean score: 3.85, agreement: 77.0%), "Lack of BDA skills" (mean score: 3.85, agreement: 77.0%), and "Share the experiences" (mean score: 3.83, agreement: 76.6%). Barriers related to data complexities, such as "Data volume," "Data Variety," and "Data Velocity," also hold notable positions in the rankings, showcasing the challenges associated with managing and processing diverse data types. Additionally, challenges pertaining to technology infrastructure, organizational interest in new technology, data integration, and data privacy are identified as significant barriers. The provided data reveals the intricacies and varied factors that hinder BDA adoption within the Gaza Strip, shedding light on areas that require focused attention and intervention for the successful implementation of BDA technology.

Table 6. BDA Barriers

No.	Barriers Factors	Mean	%	Rank
1.	Lack of specific BDA tools	3.72	74.4	9
2.	Bad Network Infrastructure	3.28	65.6	16
3.	The organization is not interested in applying new technology	3.51	70.2	11
4.	Lack of software this organization	2.97	59.4	25
5.	Lack of Hardware this organization	3.34	66.8	14
6.	Lack of data storage facilities	3.22	64.4	19
7.	The complex data	2.72	54.4	29
8.	Data Aggregation	2.75	55	28
9.	Data Integration	3.12	62.4	20
10.	Data Performance and scalability	2.98	59.6	24
11.	Data Variety	3.58	71.6	10
12.	Data volume	3.49	69.8	12
13.	Data Velocity	3.28	65.6	17
14.	Lack of data entry team	3.00	60	22
15.	No shared data within the organization	3.25	65	18
16.	Data Protection	2.85	57	27
17.	The data could be false or misleading	3.00	60	23
18.	Lack of data format	3.05	61	21
19.	Establishing information security mechanisms	3.31	66.2	15
20.	Data privacy	2.91	58.2	26
21.	Laws and regulations related to BDA	3.48	69.6	13

No.	Barriers Factors	Mean	%	Rank
22.	Funding for BDA	4.03	80.6	1
23.	High cost of investment	3.85	77	3
24.	Access Prices and Conditions list	3.89	77.8	2
25.	The Cost/Operational Expenditures	3.83	76.6	5
26.	Aware of BDA	3.82	76.4	7
27.	Lack of BDA skills	3.85	77	4
28.	Research and develop BDA tools	3.80	76	8
29.	Share the experiences	3.83	76.6	6

The findings of this study are consistent with those of several other studies, underscoring financial constraints as a significant barrier. These challenges include insufficient funding, high investment costs, and strict access conditions (e.g., Rubinfeld & Gal, 2017; Moktadir et al., 2019). Additionally, like other research, this study also identifies shortages in skilled personnel and inadequate training facilities as recurring themes (e.g., Gómez & Heeks, 2016; Malaka & Brown, 2015).

Regression Analysis

To investigate the research hypotheses (H1 and H2), stepwise regression was employed to evaluate how barriers to BDA influence both BDA readiness and practice. Section 6.2.1 delved into the evaluation of BDA barriers on BDA preparedness, while Section 6.2.2 provided a comprehensive examination of the influence of BDA barriers on BDA readiness.

Influence of BDA Barriers on BDA Practice

To assess the first research hypothesis (H1), this study utilized a stepwise regression approach to explore how barriers to BDA impact the actual practice of BDA. The outcomes of this analysis are presented in Table 7.

Table 7. Influence of BDA Barriers on BDA Practice

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	4.175	.386		10.803	.000
1	Security Barriers	-.137-	.058	-.195-	-2.359-	.020
2	Financial Barriers	-.317-	.068	-.363-	-4.631-	.000
3	Skills Barriers	-.268-	.062	-.343-	-4.339-	.000
4	Data Characteristics	-.175-	.062	-.193-	-2.840-	.005

Where R=0.429, R^2=0.184, Adjusted R^2=.130, F value=3.381, Sig. F=0.008

The regression analysis indicates that the value of R is 0.429 and the p-value is 0.008, which indicates that BD barriers and BDA practice are positively related. The R Square = 0.184 states that 18.4% of the total variance in the dependent variable (BDA practice) is explained by BD barriers. Based on these results, the multi regression predicated as the equation (E2):

BDA Practice = 4.175 - .137 Security Barriers - .268 Skill Barriers - .317 Financial Barriers -.175
Data Characteristics + e   (E2)

The equation denoted as E2 suggests that addressing challenges related to security, financial considerations, data characteristics, and BDA skill barriers would have a negative impact on the adoption of BDA practices.

Influence of BDA Barriers on BDA Readiness

The outcomes of the regression analysis between barriers to BDA and the readiness for BDA are presented in Table 8.

Table 8. Influence of BDA Barriers on BDA Readiness

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	4.560	.442		10.326	.000
1	Security Barriers	-.165-	.058	-.233-	-2.846-	.005
2	Infrastructure Barriers	-.165-	.070	-.194-	-2.348-	.020
3	Financial Barriers	-.300-	.070	-.341-	-4.313-	.000
4	Skills Barriers	-.348-	.059	-.442-	-5.846-	.000

Where R=0.422, R 2=0.178, Adjusted R2=.123, F value=3.241, Sig. F=0.01

The analysis presented in Table 8 demonstrates that IT infrastructure barriers, security, financial, and skills barriers have an adverse impact on BDA readiness. This implies that as the levels of these barriers increase, the readiness to adopt BDA technology decreases. The regression analysis further reveals the significance of the relationship between BDA barriers and BDA readiness, with a value of R = 0.422 and a p-value of 0.01. Moreover, the R Square value of 0.178 indicates that BDA barriers can explain 17.8% of the variability in BDA readiness. Consequently, the multi-regression equation for predicting BDA readiness is as follows:

BDA readiness = 4.560 - .165 Infrastructure Barriers – .165 Security- .348 Skill Barriers - .300 Financial Barriers + e   (E3)

The equation labeled as E2 indicates that enhancing IT infrastructure, skills relevant to BDA, security measures, and addressing financial concerns will yield a negatively impact on the preparedness for BDA adoption in the Gaza Strip. However, it is important to note that the model only explains 17.8% of the variance in BDA readiness. Based on the outcomes of the preceding analysis, the associations between the independent variables (BDA Barriers) and the dependent variables (BDA Practice and BDA Readiness) are illustrated in Figure 1.
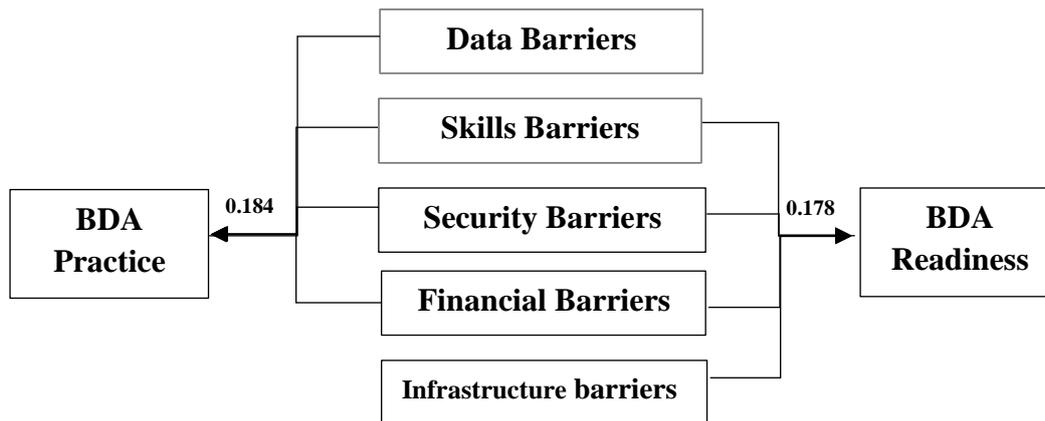
Figure 1. Barriers to BDA Adoption Model

Discussion

This study highlights several critical insights into the adoption and utilization of BDA technology within HEIs in the Gaza Strip. The assessment of BDA practices revealed a predominantly positive outlook among these institutions. They demonstrated a commendable ability to analyze Big Data, store and share results within their organizational frameworks, and utilize insights for decision-making processes. These capabilities highlight a foundational readiness to harness the potential benefits of BDA in enhancing operational efficiencies and strategic decision-making. However, the study also identified areas for improvement, particularly in enhancing the affordability and accessibility of BDA technologies. Financial barriers pose a significant challenge to HEIs in Gaza, primarily due to the socio-economic and political context of the region. These barriers include insufficient funding and high investment costs. HEIs in Gaza frequently encounter severe financial shortages due to constrained budgets and limited external funding opportunities. This constraint significantly impedes their capacity to invest in costly technologies such as BDA, which necessitate substantial initial investments in infrastructure, software, and training. Addressing these financial barriers is crucial for HEIs in Gaza to enhance their technological capabilities and overcome obstacles to BDA adoption. It requires targeted interventions, international support, and strategic investments aimed at fostering sustainable development and resilience in higher education amidst challenging socio-economic conditions. In contrast, obstacles related to IT infrastructure appear to have minimal influence on BDA, as suggested by the viewpoints of the survey participants. Based on these findings, it is recommended that organizations in the Gaza Strip focus their efforts on strengthening security measures, promoting skill development, and strategically investing in BDA. This approach can enhance the overall quality of their BDA initiatives.

Implications

The findings of this study have several implications for policy makers, educational leaders, and practitioners seeking to promote BDA adoption in Gaza's educational sector. Addressing financial barriers through targeted funding mechanisms and resource allocation strategies is imperative to facilitate sustainable investments in BDA infrastructure and capabilities. Enhancing regulatory frameworks to clarify data access conditions and promoting organizational readiness through leadership support and capacity building initiatives are crucial steps towards fostering a conducive environment for BDA adoption. Furthermore, fostering collaborations between academia, industry, and government entities can facilitate knowledge exchange and best practice sharing, mitigating barriers related to skills shortages and technological integration challenges. By prioritizing these strategic initiatives, stakeholders can leverage BDA technologies to drive innovation, enhance educational outcomes, and position Gaza's HEIs at the forefront of data-driven decision-making in the region.

Conclusion

This study has conducted a thorough investigation into the current state of BDA practices and the related barriers within the HEIs of the Gaza Strip. Additionally, it has assessed how these factors affect the readiness of institutions to adopt BDA technology. The study outcomes provide valuable insights into this domain. Initially, the investigation delineated five distinct dimensions of BDA barriers: infrastructure, security, financial, skills and knowledge, and data characteristics. Among these dimensions, the most pronounced obstacles within the Gaza Strip encompassed financial constraints, substantial investment costs, a dearth of BDA expertise, and limited knowledge sharing. Moreover, the study gauged the BDA practice level within the Gaza Strip at 65.3%, indicating a considerable level of adoption. Concurrently, the readiness to embrace BDA technology stood at 66.68%, highlighting potential for growth and further implementation. The regression analysis conducted revealed that security, financial factors, and skill barriers negatively influenced BDA adoption, explaining about 18.4% of the variances. On the other hand, barriers such as IT infrastructure, security, financial constraints, and skill limitations negatively affected BDA readiness, explaining around 17.8% of the variances. In contrast, barriers associated with data characteristics had relatively fewer notable effects. Derived from these findings, it is highly recommended that universities, collectives, and governmental bodies within the Gaza Strip proactively collaborate to dismantle existing BDA barriers. This can be facilitated through the development of a comprehensive governmental strategy that fosters widespread BDA technology adoption. Additional emphasis on enhancing IT infrastructure, augmenting BDA skill sets, and promoting awareness is essential. Future research endeavors should delve deeper into the specific challenges and opportunities encountered by local businesses in the context of BDA adoption. This will enable tailored interventions and targeted support mechanisms. Furthermore, exploring the potential advantages linked to BDA integration, including enhanced efficiency, competitive advantages, and improved decision-making capacities, can underscore the tangible value proposition of BDA technology for local enterprises, thereby motivating its broader adoption. In conclusion, addressing the identified barriers and fostering BDA adoption in the Gaza Strip can usher in advanced data analysis capabilities, furnishing businesses with a distinct competitive edge and contributing substantively to the region's overall growth and development. However, it is important to acknowledge the limitations of this study. Firstly, it concentrated solely on five specific factors affecting BDA adoption, potentially overlooking other significant factors that may also play a crucial role. Secondly, the scope of the research was confined to HEIs within the Gaza Strip, which may limit the generalizability of the findings to other regions or types of institutions. Therefore, caution should be exercised when applying these results to different contexts or broader populations.

References

Abdulkadri, A., Evans, A., & Ash, T. (2016). An assessment of big data for official statistics in the Caribbean: challenges and opportunities. Retrieved from https://hdl.handle.net/11362/39853

Acharjya, D. P., & Kauser, A. P. (2016). A survey on big data analytics: challenges, open research issues and tools. *International Journal of Advanced Computer Science and Applications*, 7(2), 511-518.

Agrawal, K. (2015). Investigating the determinants of Big Data Analytics (BDA) adoption in Asian emerging economies. *AMCIS 2015 Proceedings*. 25.

Alharthi, A., Krotov, V., & Bowman, M. (2017). Addressing barriers to big data. *Business Horizons*, 60(3), 285-292.

Aseeri, M., & Kang, K. (2023). Organisational culture and big data socio-technical systems on strategic decision making: Case of Saudi Arabian higher education. *Education and Information Technologies*, 1-26

Balachandran, B. M., & Prasad, S. (2017). Challenges and benefits of deploying big data analytics in the cloud for business intelligence. *Procedia Computer Science*, 112, 1112-1122.

Barakat, M. (2016). Challenges facing statistical agencies under the big data revolution: Case Study, Palestine. Retrieved from https://www.pcbs.gov.ps/papersar.aspx?lang=ar

Bedeley, R. (2014). Big Data opportunities and challenges: the case of banking industry. *SAIS 2014 Proceedings*. 2. https://aisel.aisnet.org/sais2014/2

Bhadani, A., Jothimani, D. (2016), Big data: Challenges, opportunities and realities, In Singh, M.K., & Kumar, D.G. (Eds.), Effective Big Data Management and Opportunities for Implementation (pp. 1-24), Pennsylvania, USA, IGI Global

Brohi, S. N., Bamiah, M. A., & Brohi, M. N. (2016). Identifying and analyzing the transient and permanent barriers for big data. *Journal of Engineering Science and Technology*, 11(12), 1793-1807.

Gomez, L., & Heeks, R. (2016). *Measuring the Barriers to Big Data for Development: Design-Reality Gap Analysis in Colombia's Public Sector*. (pp. 1-11). (GDI Development Informatics Working Papers; No. 62).

Jeble, S., Kumari, S., & Patil, Y. (2018). Role of big data in decision making. *Operations and Supply Chain Management: An International Journal*, 11(1), 36-44.

Kalim, U. (2021). The growing role of big data in education and its implications for educational leadership. *International Journal of Research and Innovation in Social Science*, 5(1), 257-262.

Khan, S. (2022). Barriers of big data analytics for smart cities development: a context of emerging economies. *International Journal of Management Science and Engineering Management*, 17(2), 123-131.

Li, J., Tao, F., Cheng, Y., & Zhao, L. (2015). Big data in product lifecycle management. *The International Journal of Advanced Manufacturing Technology*, 81(1), 667-684.

Lutfi, A., Alrawad, M., Alsyouf, A., Almaiah, M. A., Al-Khasawneh, A., Al-Khasawneh, A. L., Ibrahim, N. (2023). Drivers and impact of big data analytic adoption in the retail industry: A quantitative investigation applying structural equation modeling. *Journal of Retailing and Consumer Services*, 70, 103129.

Lutfi, A., Alsyouf, A., Almaiah, M. A., Alrawad, M., Abdo, A. A. K., Al-Khasawneh, A. L., Ibrahim, N, Saad, M. (2022). Factors Influencing the Adoption of Big Data Analytics in the Digital Transformation Era: Case Study of Jordanian SMEs. *Sustainability*, 14(3), 1802.

Malaka, I., & Brown, I. (2015). Challenges to the organisational adoption of big data analytics: A case study in the South African telecommunications industry. ACM International Conference Proceeding Series, Stellenbosch, South Africa, September 28–30, 2015.

Moktadir, M. A., Ali, S. M., Paul, S. K., & Shukla, N. (2019). Barriers to big data analytics in manufacturing supply chains: A case study from Bangladesh. *Computers & Industrial Engineering*, 128, 1063-1075.

M. A. Nazarenko and T. V. Khronusova, "Big data in modern higher education. Benefits and criticism," *2017 International Conference "Quality Management,Transport and Information Security, Information Technologies" (IT&QM&IS)*, St. Petersburg, Russia, 2017, pp. 676-679

Park, J.-H., & Kim, Y. B. (2021). Factors activating big data adoption by Korean firms. *Journal of Computer Information Systems*, 61(3), 285-293.

PCBS. (2021). Palestinian Central Bureau of Statistics, https://www.pcbs.gov.ps/Default.aspx

Rogers, E. M. (1995). Diffusion of innovation (4th ed.). New York, NY: The Free Press

Rubinfeld, D. L., & Gal, M. S. (2017). Access barriers to big data. Arizona Law Review, 59, 339.

Sam, K. M. & Chatwin, C. R. (2018). Understanding Adoption of Big Data Analytics in China: From Organizational Users Perspective, *2018 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Bangkok, Thailand, 2018, pp. 507-510

Schade, S. (2015). Big Data Breaking Barriers--First Steps On A Long Trail. International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences, 7(3), 691-697.

Sivarajah, U., Kamal, M. M., Irani, Z., & Weerakkody, V. (2017). Critical analysis of Big Data challenges and analytical methods. *Journal of Business Research*, 70, 263-286.

Statista. (2022). Electronic waste worldwide https://www.statista.com/statistics/1067081/generation-electronic-waste-globally-forecast/

Surbakti, F. P. S., Wang, W., Indulska, M., & Sadiq, S. (2020). Factors influencing effective use of big data: A research framework. *Information & Management*, 57(1), 103146.

Ularu, E. G., Puican, F. C., Apostu, A., & Velicanu, M. (2012). Perspectives on big data and big data analytics. *Database Systems Journal*, 3(4), 3-14.

Wahab, S. N., Hamzah, M. I., Sayuti, N. M., Lee, W. C., & Tan, S. Y. (2021). Big data analytics adoption: an empirical study in the Malaysian warehousing sector. *International Journal of Logistics Systems and Management*, 40(1), 121-144.

Walker, R. S., & Brown, I. (2019). Big data analytics adoption: A case study in a large South African telecommunications organisation. South *African Journal of Information Management*, 21(1), 1-10.

Weibl, J., & Hess, T. (2018). Success or failure of big data: Insights of managerial challenges from a technology assimilation perspective. Proceedings of the Multikonferenz Wirtschaftsinformatik (MKWI), 12-59.

Williams, P. (2017). Assessing collaborative learning: big data, analytics and university futures. *Assessment & Evaluation in Higher Education*, 42(6), 978-989.

Yousef, Y. A. (2023). Investigating the Role of Critical Success Factors in Achieving the Success of Agile Projects in the Gaza Strip. *CIT. Journal of Computing and Information* Technology, 30(2), 117-137.

Youssef, M. A. E.-A., Eid, R., & Agag, G. (2022). Cross-national differences in big data analytics adoption in the retail industry. *Journal of Retailing and Consumer Services*, 64, 102827.

Appendix A. BDA Readiness Measurement Questionnaire

Please use the checkmark (√) to indicate your level of approval on the following axes

	GIT Awareness	Strongly agree	Agree	Moderate	Disagree	Strongly disagree
R1	You can analyze BD in this organization.					
R2	You can store the result of analyzing the BD.					
R3	You can store the reformulated result of BDA.					
R4	This organization provides technical assistance for BDA.					
R5	You can share the results of the BDA with others in the organization.					
R6	BDA is easy and inexpensive.					
R7	Anyone outside the organization can use BDA technology.					
R8	The BDA process does not take a long time.					
R9	The enterprise benefits from BD analysis to increase its competitiveness					
R10	The organization uses BD to make decisions					
R11	The organization uses BD in customer service, customer retention and acquisition.					

Appendix B. BDA Practice Measurement Questionnaire

Please use the checkmark (√) to indicate your level of approval on the following axes:

	GIT Adoption	Strongly agree	Agree	Moderate	Disagree	Strongly disagree
P1	The Employees of this organization are aware of the importance of BDA					
P2	This organization is interested in applying new technology					
P3	The organization has a strong information network					
P4	The organization has sufficient data storage facilities					
P5	The organization has good data.					
P6	There is a team in the organization to enter data.					
P7	There is a mechanism within the organization to monitor the data.					
P8	The organization's employees have exclusive rights to use, compile, select, structure, and re-format organizational Data.					
P9	This organization has laws and regulations related to BDA					
P10	The organization allocates sufficient funding for BDA					
P11	The company has prepared data Access Prices and Conditions list					
P12	Employees are trained in BDA skills					
P13	There are facilities to research and develop BDA tools					
P14	The data architecture in this organization is completely understood					
P15	A culture exists in this organization that promotes BDA Practices					
P16	Top management supports the adoption of BDA					
P17	Top management accepts possible risks which may result from adopting BDA					

Appendix C. BDA Barriers Measurement Questionnaire

Please use the checkmark (√) to indicate your level of approval on the following axes:

	GIT Adoption	**Strongly agree**	**Agree**	**Moderate**	**Disagree**	**Strongly disagree**
B1	Lack of specific BDA tools					
B2	Bad Network Infrastructure					
B3	The organization is not interested in applying new technology					
B4	Lack of software this organization					
B5	Lack of Hardware this organization					
B6	Lack of data storage facilities					
B7	The complex data					
B8	Data Aggregation					
B9	Data Integration					
B10	Data Performance and scalability					
B11	Data Variety					
B12	Data volume					
B13	Data Velocity					
B14	Lack of data entry team					
B15	No shared data within the organization					
B16	Data Protection					
B17	The data could be false or misleading					
B18	Lack of data format					
B19	Establishing information security mechanisms					
B20	Data privacy					
B21	Laws and regulations related to BDA					
B22	Funding for BDA					
B23	High cost of investment					
B24	Access Prices and Conditions list					
B25	The Cost/Operational Expenditures					
B26	Aware of BDA					
B27	Lack of BDA skills					
B28	Research and develop BDA tools					
B29	Share the experiences					