

RESEARCH ARTICLE**CHALLENGES AND OPPORTUNITIES IN THE IMPLEMENTATION OF BIG DATA ANALYTICS IN MANAGEMENT INFORMATION SYSTEMS IN BANGLADESH**

Golam Mustafa MD. Nurullah Rabbani, Avishek Nath, Md Mehedi Hasan Emon*

*Independent Researcher**American International University-Bangladesh***Corresponding Author Email: emonmd.mhasan@gmail.com*

This is an open access journal distributed under the Creative Commons Attribution License CC BY 4.0, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited

ARTICLE DETAILS**Article History:**

Received 23 August 2023
Revised 26 September 2023
Accepted 30 October 2023
Available online 09 November 2023

ABSTRACT

This study aims to investigate the challenges and opportunities associated with the integration of Big Data Analytics (BDA) within Management Information Systems (MIS) in the context of Bangladesh, a developing economy with distinct characteristics. A mixed-methods approach was employed, combining survey data from 40 organizations and in-depth interviews with key informants to explore BDA implementation challenges and opportunities unique to Bangladesh. The findings reveal that organizations in Bangladesh encounter challenges related to limited technological infrastructure, data security and privacy concerns, skill shortages, and regulatory complexities. Despite these challenges, BDA offers significant opportunities, including economic and business growth, government support, local market understanding, and increased competitiveness. This study is limited by its focus on the Bangladeshi context and may not fully capture the diversity of challenges and opportunities in other developing economies. Future research should consider cross-cultural comparisons and sector-specific analyses. The insights generated by this research provide organizations in Bangladesh with a roadmap for navigating BDA implementation challenges while harnessing its potential for economic growth and market competitiveness. Policymakers and government bodies can use these findings to formulate policies that support BDA adoption and economic development. As organizations leverage BDA to understand local market dynamics and enhance customer experiences, there is potential for improved products and services that cater to the unique preferences of Bangladeshi consumers. This has implications for broader society in terms of enhanced consumer satisfaction. This study contributes to the literature by enriching our understanding of the complexities of BDA integration in developing economies. It highlights the need for tailored strategies, fosters innovation, and positions BDA as a catalyst for economic growth and competitiveness in Bangladesh. The research is limited to a sample of 40 organizations in Bangladesh, and the findings may not be fully generalizable to all industries and contexts within the country.

KEYWORDS

Big Data Analytics, Management Information Systems, Bangladesh, Developing Economy, Challenges, Opportunities, Economic Growth, Data Security, Regulatory Compliance, Government Support, Consumer Insights.

1. INTRODUCTION

Management Information Systems (MIS) play a crucial role in facilitating effective decision-making processes based on data for enterprises worldwide. These systems play a crucial role in improving operational efficiency, facilitating strategic advancement, and ultimately guaranteeing the competitiveness and long-term viability of enterprises (Szukits, 2022). In the setting of Bangladesh, an emerging economy characterized by a multifaceted corporate environment, the function of Management Information Systems (MIS) has been progressively transforming. The utilization of Big Data Analytics (BDA) as a vital decision support tool has acquired considerable pace as firms in Bangladesh commence their digital transformation path (Al-Qirim et al., 2017).

The increasing corporate landscape in Bangladesh serves as a significant factor that underscores the relevance of Management Information Systems (MIS). Bangladesh possesses a diverse range of businesses, encompassing agriculture, textiles, manufacturing, and services, each characterized by distinct data and information needs. Consequently, the

implementation of efficient Management Information Systems (MIS) emerges as not only a must but also a crucial strategic priority for enterprises operating in Bangladesh. This enables them to effectively manage data, derive valuable insights, and make well-informed decisions that are in line with the unique dynamics of their respective industries. In the current dynamic environment, Big Data Analytics (BDA) emerges as a transformative force. The utilization of Big Data Analytics (BDA) has the potential to revolutionize the operational practices of enterprises in Bangladesh, since it enables the processing and analysis of extensive and intricate information (Sivarajah et al., 2017).

Technology has the ability to significantly transform the process of decision-making by facilitating a more comprehensive understanding of data, revealing underlying patterns, and making predictions about future trends (Ahmad et al., 2023). Furthermore, Big Data Analytics (BDA) plays a crucial role in bolstering competitiveness and capitalizing on growth prospects in the international marketplace (Mikalef et al., 2019). The understanding of the value inherent in data is evident in Bangladesh through the momentum of digital transformation and the widespread

Quick Response Code**Access this article online**

Website:
www.actainformaticamalaysia.com

DOI:
10.26480/aim.02.2023.122.130

adoption of Big Data Analytics (BDA). Business Data Analytics (BDA) not only facilitates organizations in making informed decisions based on data, but it also allows them to effectively respond and adjust to the dynamic and evolving nature of the business landscape. Consequently, the integration of Big Data Analytics (BDA) into the Management Information System (MIS) architecture is gaining significant importance in Bangladesh, in line with the prevailing global patterns of data consumption and analytics.

The integration of Management Information Systems (MIS) and Big Data Analytics (BDA) is playing a pivotal role in driving the ongoing digital transformation in Bangladesh. As businesses persist in maneuvering through the ever-changing business landscape, these systems assume a crucial role in setting their future trajectory. It is imperative to analyze the distinct problems and opportunities that firms have when integrating Big Data Analytics (BDA) into their Management Information Systems (MIS) within the specific context of Bangladesh. By engaging in this process, individuals can acquire a more profound comprehension of the complexities associated with this change. Consequently, this knowledge can provide valuable insights to decision-makers and businesses, enabling them to efficiently traverse the intricate landscape of data analytics. When firms in Bangladesh endeavor to incorporate Big Data Analytics (BDA) into their Management Information Systems (MIS), they encounter a unique array of obstacles and opportunities in contrast to more advanced economies.

The aforementioned obstacles may originate from factors such as the technology infrastructure, regulatory environment, and human resource landscape at the local level. Concurrently, the utilization of Big Data Analytics (BDA) presents substantial potential for influencing the expansion of organizations and enhancing their competitive standing in the market. The primary objective of this study is to analyze and comprehend the intricate obstacles and potential advantages that are unique to the setting of Bangladesh when it comes to the implementation of Big Data Analytics (BDA) in the field of Management Information Systems (MIS). Within the dynamic business environment of Bangladesh, the utilization of Management Information Systems (MIS) holds significant importance in enabling decision-making based on data.

This research aims to explore the complexities associated with the integration of Big Data Analytics (BDA) into these systems. The main research purpose is to investigate the significant obstacles encountered by enterprises in Bangladesh during the implementation of Big Data Analytics (BDA) in their Management Information Systems (MIS). The primary goal of this purpose is to identify and examine the challenges and barriers that are unique to the setting of Bangladesh, so providing a deeper understanding of the intricacies involved in this undertaking. The secondary study purpose aims to explore the prospects presented by Big Data Analytics (BDA) in Bangladesh, which have the potential to significantly enhance the functionality and effectiveness of Management Information Systems (MIS). Therefore, the research inquiries are as follows:

RQ1. What are the major challenges encountered during the implementation of BDA in Bangladesh's MIS?

RQ2. What opportunities does BDA offer to enhance MIS within the unique context of Bangladesh?

The significance of this research is noteworthy for multiple stakeholders and makes a valuable contribution to the wider domain of Big Data Analytics (BDA) and Management Information Systems (MIS). This study provides valuable insights that are specific to enterprises in Bangladesh, which are essential for making well-informed decisions on the implementation of Big Data Analytics (BDA) within their Management Information Systems (MIS). The relevance of BDA resides in its capacity to effectively handle the distinct obstacles and capitalize on the opportunities it offers. The findings of this study can be utilized by decision-makers to formulate customized strategies, improve operational efficiency, and effectively compete in the global economy. Furthermore, the findings of this research can provide valuable insights for policymakers and government entities regarding the possible effects of Big Data Analytics (BDA) on the economic growth and innovation landscape in Bangladesh. This knowledge possesses the potential to inform the formulation of policies and efforts designed to bolster and streamline the implementation of Big Data Analytics (BDA) across diverse sectors, so making a valuable contribution to the economic advancement of the nation.

The findings derived from this research have broader implications outside the context of Bangladesh and can make a valuable contribution to the

global body of knowledge on Business Data Analytics (BDA) practices. The problems and opportunities highlighted in this study may have broader implications in similar circumstances, hence rendering the findings useful to businesses who encounter similar obstacles in the implementation of Big Data Analytics (BDA) within their Management Information Systems (MIS). This research contributes to the existing body of work on the integration of Big Data Analytics (BDA) into Management Information Systems (MIS), with a particular emphasis on the setting of Bangladesh. The aforementioned resource provides significant value to academics and scholars who possess an interest in comprehending the intricate nature of implementing Big Data Analytics (BDA) in economies that are in the process of rising. The findings of this study have the potential to make a significant contribution to the advancement of knowledge in the field, thereby serving as a source of inspiration for future research endeavors in this particular area.

This study is centered on examining the challenges and opportunities associated with the integration of Big Data Analytics (BDA) into Management Information Systems (MIS) in the specific context of Bangladesh. The objective of this study is to offer a thorough comprehension of the particular difficulties that companies face when incorporating Big Data Analytics (BDA) into their Management Information Systems (MIS), as well as the potential advantages that BDA offers for strengthening MIS in the context of Bangladesh. The main geographical area of interest in this study is Bangladesh. The difficulties and opportunities examined in this research are relevant to the business environment in Bangladesh, which possesses distinct characteristics such as its developing economy, diverse industry landscape, and regulatory framework. The study spans a wide array of sectors within the country of Bangladesh, so representing the diversified economic landscape of the nation. These industries include agriculture, textiles, manufacturing, and services. The objective of this study is to examine the specific data and information needs and obstacles encountered by businesses in several sectors.

2. LITERATURE REVIEW

The literature review provides a comprehensive overview of the conceptual framework, challenges, and opportunities associated with the implementation of Big Data Analytics (BDA) in Management Information Systems (MIS), with a specific focus on the Bangladeshi context.

In the context of developing economies such as Bangladesh, the incorporation of Big Data Analytics (BDA) into Management Information Systems (MIS) is an emergent and transformative phenomenon. Developing economies exhibit distinct obstacles inherent to their nature, encompassing restricted technology infrastructure, regulatory limits, and resource constraints (Bag et al., 2023; Rahnuma, 2023). Nevertheless, this particular context also offers a favorable terrain for the incorporation of Big Data Analytics (BDA) into Management Information Systems (MIS), hence holding the capability to effectively tackle and surmount these aforementioned obstacles. The technology landscape of Bangladesh has experienced notable changes, creating opportunities for the implementation of Big Data Analytics (BDA).

The proliferation of high-speed internet, extensive mobile connection, and the expanding prevalence of cloud computing infrastructure are factors that are fueling the significant expansion of data generation and storage within the nation (Botta et al., 2016; Gubbi et al., 2013; Lehr et al., 2023). The ongoing process of digital transformation is establishing the essential groundwork for the efficient integration of Big Data Analytics (BDA) within the Management Information Systems (MIS) of diverse enterprises in Bangladesh. The considerable obstacles encountered by developing countries, such as Bangladesh, are undeniably distinctive. The implementation of advanced data analytics has typically been impeded by technological limits and regulatory restraints. Nevertheless, it is within this particular framework that the genuine capabilities of Big Data Analytics (BDA) come to the forefront. Big Data Analytics (BDA) possesses the capability to effectively utilize data, irrespective of its format or origin, and transform it into practical and valuable insights. By adopting Big Data Analytics (BDA), enterprises operating in Bangladesh have the potential to overcome the challenges presented by restricted resources and infrastructure.

The dynamic technical environment in Bangladesh, characterized by enhanced connection and improved data accessibility, serves as a clear demonstration of the country's dedication to digital transformation. This indicates a transition towards a future that prioritizes data-driven approaches, enabling firms to utilize expanding data repositories to improve their decision-making capabilities and operational effectiveness. The integration of BDA (Big Data Analytics) into MIS (Management

Information Systems) is in line with this overarching shift, providing an opportunity to leverage the vast amount of data generated in Bangladesh (Lema and Rabellotti, 2023). The integration of Big Data Analytics (BDA) into Management Information Systems (MIS) in emerging economies such as Bangladesh represents a process of profound change. The endeavor is characterized by several obstacles, although these obstacles possess the potential for growth and development (Bühler et al., 2023). Innovative data analytics techniques can now be employed to alleviate the historical challenges posed by restricted infrastructure and regulatory constraints. The presented conceptual framework establishes a foundation for comprehending the potential of Big Data Analytics (BDA) within the setting of Bangladesh. In this environment, the nation's advancement is increasingly reliant on digital transformation and the effective utilization of data (Horani et al., 2023).

Bangladesh, akin to several developing economies, encounters a unique array of obstacles in regard to the integration of Big Data Analytics (BDA) into Management Information Systems (MIS). The aforementioned problems hold considerable importance and necessitate meticulous deliberation for organizations aiming to leverage the potential of Big Data Analytics (BDA) in their operational processes (Jahani et al., 2023). Primarily, the presence of infrastructure and technical limitations presents a significant obstacle. According to Haque Bangladesh encounters constraints in terms of its ability to access high-speed internet and data storage facilities (Haque, 2019). The presence of these constraints poses obstacles to the effective integration of Big Data Analytics (BDA) into Management Information Systems (MIS) (Haque et al., 2023). In order to tackle this difficulty, it is imperative for companies to allocate resources towards enhancing their technology infrastructure and guaranteeing the accessibility of vital resources. The complete utilization of Big Data Analytics (BDA) for making decisions based on data can only be achieved under such circumstances (Karim and Hosen, 2023). Ensuring the protection of data security and privacy is of utmost importance.

Robust data security and privacy protections are necessary due to the sensitive nature of some types of data, including financial and healthcare

information (Kafi and Akter, 2023; Rahman et al., 2023). Nevertheless, it is worth noting that the existing regulatory system in Bangladesh may not possess the necessary capabilities to effectively tackle these aforementioned challenges (Zheng et al., 2023). Organizations bear the burden of effectively managing these complex matters in order to adhere to data protection legislation and secure confidential information. This entails not only implementing sophisticated security measures but also keeping up-to-date with the dynamic landscape of data privacy rules. One additional key difficulty is the acquisition and retention of talented professionals who possess experience in Big Data Analytics (BDA) (Jain et al., 2023). Bangladesh is confronted with a scarcity of professionals in the fields of data science, data analysis, and big data analytics (Bukhari et al., 2023). Addressing this scarcity necessitates significant investment in training and development initiatives aimed at cultivating a proficient workforce capable of efficiently adopting Big Data Analytics (BDA) within Management Information Systems (MIS).

It is imperative for organizations to acknowledge the significance of human capital in this endeavor. The regulatory and compliance environment in Bangladesh has distinct and specific issues. In order to fully leverage the capabilities of Big Data Analytics (BDA), it is imperative to carefully contemplate the adherence to data protection regulations (Suppiah and Arumugam, 2023). Organizations are required to traverse the intricate regulatory hurdles, which frequently need the development of customized solutions that adhere to both the internationally recognized data analytics best practices and the unique demands of the Bangladeshi environment. The obstacles associated with the application of Big Data Analytics (BDA) in Bangladesh are diverse and complex. The challenges are technological restrictions, data security and privacy concerns, human resource constraints, and legislative complexities. The resolution of these difficulties is crucial for firms seeking to effectively utilize Big Data Analytics (BDA) within their Management Information Systems (MIS). The ultimate determination of the potential impact of BDA on decision-making processes and operational efficiency in the corporate environment of Bangladesh hinges upon the effective navigation of these obstacles (Dehkhodaei et al., 2023).

Evolution of Technological Landscape in Bangladesh	
Year	Technological Advancements and Events
2000	Limited internet access, primarily in urban areas
2005	Expansion of internet access to rural regions
2010	Introduction of 3G mobile networks, improving connectivity
2012	Growth of cloud computing infrastructure in the country
2015	Emergence of data centers, enhancing data storage capabilities
2018	Widespread adoption of 4G networks, further improving mobile connectivity
2020	Government initiatives for digital transformation and e-governance
2022	Increased use of smartphones and mobile apps

The table presents a sequential record of significant technological breakthroughs and events that have shaped the technological landscape of Bangladesh throughout the preceding twenty years. During the year 2000, internet accessibility was predominantly concentrated in urban areas, resulting in poor connectivity for rural regions. Nonetheless, a pivotal moment occurred in 2005 when there was a notable increase in the availability of internet connectivity in rural areas, thereby mitigating the disparity in digital access. The year 2010 marked a notable advancement with the implementation of 3G mobile networks, resulting in a substantial improvement in connectivity and the availability of high-speed internet. The year 2012 marked the initiation of the expansion of cloud computing infrastructure, which laid the foundation for the effective storage and administration of data. The year 2015 witnessed the emergence of data centers, which had a significant role in enhancing data storage capacity, a critical determinant for businesses and organizations.

The year 2018 witnessed a significant advancement with the extensive implementation of 4G networks, providing enhanced mobile connectivity that is characterized by increased speed and reliability. In the year 2020, the government undertook significant endeavors centered around digital transformation and e-governance, thereby exhibiting a dedication to the enhancement of government services and the promotion of digital innovation. By the year 2022, there was a discernible increase in the

utilization of smartphones and mobile applications, indicative of a technologically proficient populace and a transition towards services and solutions centered around mobile platforms. The aforementioned milestones collectively demonstrate the progress made by Bangladesh in terms of achieving digital inclusion, improving connectivity, and embracing sophisticated technology. These advancements have had a significant impact on several sectors such as education, commerce, governance, and communication (Andrews et al., 2012; Attaran, 2023; Michimi and Wimberly, 2010).

The use of Big Data Analytics (BDA) into Management Information Systems (MIS) in Bangladesh presents a unique set of problems that enterprises must address. To begin with, the nation encounters challenges pertaining to infrastructure and technology, such as restricted availability of high-speed internet and insufficient data storage facilities. The presence of these restrictions impedes the effective integration of Big Data Analytics (BDA) into Management Information Systems (MIS), creating a substantial obstacle for firms aiming to capitalize on data analytics (Mikalef et al., 2021). Addressing these infrastructure deficiencies is crucial for the successful implementation of Big Data Analytics (BDA). Furthermore, it is crucial to prioritize data security and privacy concerns. Data of a sensitive nature, such as financial and healthcare information, necessitates the implementation of strong data security and privacy

protocols.

The existing regulatory system in Bangladesh may not possess the necessary capabilities to effectively handle these problems, hence potentially exposing firms to data breaches and legal ramifications (Saeed et al., 2023). It is of utmost importance to effectively address these matters in order to maintain adherence to regulations and protect confidential information. Furthermore, the presence of a deficiency of qualified individuals possessing specialized knowledge in Big Data Analytics (BDA) is a substantial obstacle in terms of human resources. There is a scarcity of data scientists, analysts, and experts specializing in Big Data Analytics (BDA) in Bangladesh. Consequently, it is imperative to allocate resources towards training and development initiatives in order to cultivate a skilled workforce capable of proficiently integrating BDA within Management Information Systems (MIS) (Ashaari et al., 2021). One of the primary obstacles to overcome in the pursuit of data analytics maturity is the scarcity of adequately skilled individuals.

In conclusion, firms operating in Bangladesh may encounter distinctive hurdles due to the regulatory and compliance framework in place. The thorough evaluation of compliance with data protection rules is necessary to ensure the proper exploitation of big data analytics (BDA). It is imperative to effectively navigate through the intricate regulatory complexity, as a failure to do so can lead to significant legal and operational setbacks (Morales-Serazzi et al., 2023). The potential of Big Data Analytics (BDA) in Management Information Systems (MIS) holds promise, but, the unique problems faced by Bangladesh, such as limitations in infrastructure, apprehensions over data security, shortages in skilled personnel, and complex legal frameworks, require a careful and deliberate approach to ensure its adoption. The resolution of these difficulties has significant importance for companies aiming to fully leverage the potential of Big Data Analytics (BDA) within the context of Bangladesh.

The integration of Big Data Analytics (BDA) into Management Information Systems (MIS) in Bangladesh has a wide range of possibilities that have the potential to greatly influence the country's economic and business environment. To begin with, there exists significant potential for economic and business expansion. Big Data Analytics (BDA) enables firms to make informed decisions by effectively utilizing the vast amount of data available to them. Firms in Bangladesh have the potential to optimize their operations, enhance their competitiveness, and stimulate economic growth by acquiring knowledge about market trends and consumer preferences (Salam and Hoque, 2019). The utilization of data-driven insights has the potential to significantly impact and propel enterprises across all sectors. Furthermore, it is worth noting that the government of Bangladesh has acknowledged the significant importance of digital transformation and big data analytics (BDA).

Consequently, the organization has implemented strategies and measures with the objective of facilitating and promoting the implementation of Big Data Analytics (BDA) across diverse industries (Stylos et al., 2021). The provision of government backing offers enterprises the chance to utilize these efforts, therefore aiding the integration of Big Data Analytics (BDA) into their Management Information Systems (MIS). Engaging in partnerships with government-led initiatives can facilitate the implementation process and help to the advancement of data analytics on a national scale (Thongpapanl et al., 2018). Moreover, Big Data Analytics (BDA) offers firms the capability to comprehensively comprehend and adeptly traverse the intricacies of local market dynamics. Through the utilization of data, researchers can acquire significant insights into the distinct tastes and behaviors exhibited by customers in Bangladesh.

The acquisition of this contextualized comprehension has immense value in customizing marketing tactics and business methodologies to correspond with the distinct requirements of the Bangladeshi market, hence augmenting customer engagement and pleasure. The integration of Big Data Analytics (BDA) within Management Information Systems (MIS) in Bangladesh offers various prospects, including economic growth, government backing, and the potential to acquire valuable insights into local market dynamics. If appropriately utilized, these prospects have the potential to empower enterprises to flourish in a dynamic and data-abundant business environment, thereby making a significant contribution to the progress and competitiveness of the nation.

The study of the use of Big Data Analytics (BDA) in Management Information Systems (MIS) in the specific context of Bangladesh is an emerging area of research, characterized by a small yet expanding collection of scholarly literature. Numerous scholarly investigations have significantly enhanced our comprehension of the significance of Big Data Analytics (BDA) inside this distinct context. The primary aim of these

research endeavors has been to examine key facets pertaining to the adoption of Big Data Analytics (BDA) and its effects on companies. Several studies have examined the difficulties that organizations encounter when integrating Big Data Analytics (BDA) into their Management Information Systems (MIS). These studies have specifically identified hurdles including constraints in infrastructure, apprehensions over data security, and shortages in skilled personnel. Previous research has examined the economic prospects of Big Data Analytics (BDA) through an investigation into its contribution to fostering business expansion in the context of Bangladesh.

Nevertheless, even these excellent contributions, there remain notable deficiencies in the existing studies that necessitate attention. The available scholarly sources frequently offer incomplete perspectives, necessitating a more thorough examination to account for the distinct intricacies of the Bangladeshi setting. The primary objective of this study is to address the existing gaps by conducting a comprehensive and contextually relevant investigation into the obstacles and potential advantages related to the application of Big Data Analytics (BDA) in Management Information Systems (MIS) in Bangladesh. This study aims to enhance the current understanding of the subject matter by incorporating prior research and taking into account the unique features of Bangladesh's dynamic business environment. This study will serve as a valuable addition to the current knowledge base, thereby making a significant contribution to the wider field of Business Data Analytics (BDA) and Management Information Systems (MIS) in the context of Bangladesh.

3. MATERIALS AND METHOD

The study's research design was carefully constructed to facilitate a thorough and extensive examination of the obstacles and potential advantages associated with the integration of Big Data Analytics (BDA) into Management Information Systems (MIS) within the specific context of Bangladesh. This section provided a comprehensive overview of the study paradigm, data collection methods, sampling strategy, data collection instruments, data analysis methodologies, ethical issues, and the scope and limitations of the research. The research utilized an interpretivist paradigm, acknowledging the significance of comprehending the subjective experiences, viewpoints, and interpretations of persons engaged in the execution of BDA inside MIS in Bangladesh. The study aimed to investigate the intricacies of the Bangladeshi setting, recognizing that the adoption of BDA is influenced by the perspectives and understanding of individuals involved in the process. The research design incorporated the constructivist perspective, which underscored the collaborative development of knowledge between the researcher and participants.

This method recognizes the significance of social interaction and interpretation in the construction of knowledge, which is in line with the objective of comprehending the context-specific obstacles and prospects associated with Big Data Analytics (BDA) in the Management Information Systems (MIS) of Bangladesh. A combination of data gathering techniques was utilized to acquire a full understanding of the problems and opportunities related to the deployment of Big Data Analytics (BDA) inside Management Information Systems (MIS) in Bangladesh. Semi-structured interviews were done with many stakeholders, encompassing organizational leaders, IT professionals, data scientists, and subject matter experts. The interviews were conducted in a comprehensive manner, allowing for a detailed exploration of the topics discussed. The conducted interviews yielded valuable insights into the participants' experiences, viewpoints, and perceptions pertaining to the deployment of Big Data Analytics (BDA).

Field observations were undertaken in specific organizations to get insight into the practical obstacles and potential advantages as they manifested in real-life settings. This approach facilitated the acquisition of comprehensive and situation-dependent information. To enhance the interview and observation data, an analysis was conducted on pertinent documents, reports, and organizational data pertaining to the adoption of Big Data Analytics (BDA). The aforementioned analysis facilitated comprehension of the historical backdrop and revealed obstacles and prospects. The research utilized intentional sampling as a method for selecting businesses and individuals who possessed knowledge and competence in the deployment of Big Data Analytics (BDA) within Management Information Systems (MIS) in Bangladesh. The selection criteria encompassed a range of factors, such as the size of businesses, the industries they operate in, and their geographical locations.

This approach was adopted to ensure a comprehensive and diversified representation of the challenges and possibilities faced by different

entities. In order to enhance the process of data collecting, the researchers employed semi-structured interview guides and observation checklists. The semi-structured interview guidelines were customized to suit the unique circumstances of Bangladesh, encompassing inquiries that delved into the distinct obstacles and prospects associated with the installation of Big Data Analytics (BDA) in Management Information Systems (MIS). The development of checklists was undertaken in order to provide guidance for conducting field observations and to ensure the methodical gathering of data that is pertinent to the study objectives. Thematic analysis was employed to analyze the gathered data, facilitating the identification and interpretation of significant themes and patterns within the data.

The analysis procedure involved the use of coding and categorizing techniques to the data, utilizing the constant comparative method to ensure a rigorous and methodical approach to the interpretation of the data. The ethical issues encompassed the acquisition of informed consent from all participants, guaranteeing their comprehension of the research objectives, the utilization of data, and their entitlements as participants. The researchers ensured the preservation of anonymity and confidentiality, while also using robust data security procedures to safeguard the privacy of the participants. The primary objective of the research design was to acquire a thorough comprehension of the obstacles and potential advantages associated with the implementation of Big Data Analytics (BDA) inside Management Information Systems (MIS) in Bangladesh.

This was achieved by considering the distinct context and viewpoints of the many stakeholders involved. The study employed a combination of qualitative methodologies to provide in-depth and contextually relevant insights into the ever-changing environment. The research conducted in this study had a well-defined geographical and industrial scope, with a particular emphasis on firms located in Bangladesh. Furthermore, the study encompassed a diverse array of sectors within this context. The study's population consisted of organizations located in Bangladesh, with a sample size of 40 organizations. The sample technique employed in this study prioritized purposeful sampling in order to guarantee adequate representation.

4. RESULTS AND FINDINGS

4.1 BDA Implementation Challenges

One of the prominent and recurrent challenges faced by organizations in Bangladesh during the implementation of Big Data Analytics (BDA) within their Management Information Systems (MIS) was limited technological infrastructure. Respondents highlighted how the inadequacy of high-speed internet access and data storage facilities posed significant impediments to the seamless integration of BDA into their MIS. This challenge was particularly acute in rural areas, where the accessibility to high-speed internet remained scarce. Moreover, data security and privacy concerns were at the forefront of challenges encountered by participants. They shared extensive insights into the complexities and uncertainties surrounding data security and privacy within the context of Bangladesh's regulatory framework.

The absence of robust data protection laws led to apprehensions about the handling of sensitive data, especially in sectors dealing with financial and healthcare information. Consequently, the need for more comprehensive regulatory frameworks to ensure data security and privacy compliance was emphasized. Another major challenge that emerged was the shortage of skilled personnel with expertise in BDA. Participants commonly expressed difficulties in finding and retaining qualified data scientists, analysts, and BDA professionals. The scarcity of such specialized talents in Bangladesh necessitated a strategic focus on investing in training and development to address this crucial issue. Respondents elaborated on the measures taken by their organizations, including collaborating with academic institutions and conducting in-house training programs to build a competent workforce.

Additionally, the regulatory and compliance hurdles specific to Bangladesh were widely discussed. Participants provided detailed insights into the intricacies of aligning BDA implementation with the existing regulatory environment, particularly in sectors that handled sensitive data like healthcare and finance. The challenges related to data handling, storage, and transmission in compliance with the regulatory framework posed complex operational hurdles. Participants reflected on their experiences and the need for meticulous planning and legal counsel to navigate these complexities successfully.

Table 1: Challenges Encountered in BDA Implementation within MIS in Bangladesh

Challenge	Description
Limited Technological Infrastructure	Inadequate high-speed internet access and data storage facilities, particularly acute in rural areas.
Data Security and Privacy Concerns	Extensive concerns arising from the absence of robust data protection laws, emphasizing the need for comprehensive regulatory frameworks.
Skill Shortages	Challenges in acquiring and retaining skilled personnel with BDA expertise, leading to investments in training and development.
Regulatory and Compliance Hurdles	Complexities of aligning BDA implementation with the existing regulatory environment, especially in sectors handling sensitive data.

Source: The information in this table was generated from participant interviews conducted as part of this study.

4.2 BDA Implementation Opportunities

Participants highlighted several significant points regarding the economic and business growth realized through effective Big Data Analytics (BDA) integration. They noted that BDA empowered their organizations to make informed decisions by identifying market trends and consumer preferences more accurately. This precision in decision-making led to a substantial increase in economic and business growth. The participants provided concrete examples of how BDA-driven insights allowed them to capture new market opportunities and tailor their strategies for maximum impact. They emphasized that in a competitive business landscape like Bangladesh, the adoption of BDA was not only a strategic necessity but a driver of remarkable business growth. In recognizing the support from the government in Bangladesh, participants acknowledged

the role of specific initiatives and policies in facilitating BDA adoption within their organizations. The government's commitment to digital transformation and BDA was seen as a valuable asset in their journey to harness the potential of data.

However, participants also expressed concerns about bureaucratic processes that sometimes hindered the smooth implementation of these policies. They emphasized the need for more streamlined and efficient policy implementations, ensuring that the government's support translates into tangible benefits for organizations without unnecessary delays or obstacles. The significance of BDA in understanding local market dynamics and gaining valuable customer insights was a focal point for participants. They illustrated the impact of data analytics with specific examples of how it allowed them to tailor their marketing and product

strategies to the unique preferences and behaviors of Bangladeshi consumers. These tailored approaches were seen as instrumental in making marketing efforts more effective and product offerings more appealing to the local customer base. By recognizing and adapting to the distinct characteristics of the local market, organizations experienced improved customer engagement, loyalty, and ultimately better business performance.

Participants also stressed that BDA implementation significantly enhanced their organizations' competitiveness in the market. The ability to gather, analyze, and act on data-driven insights gave them a competitive

edge. They detailed how BDA helped in identifying gaps in the market, staying ahead of trends, and responding more swiftly to changing customer demands. This increased competitiveness contributed not only to market growth but also to better positioning in an increasingly dynamic business environment. Another opportunity identified by participants was the role of BDA in fostering innovation and product development. They described how data analytics enabled them to innovate and refine their products and services based on a deep understanding of customer needs and preferences. This innovative approach to product development allowed them to offer unique solutions and stay relevant in a rapidly evolving market.

Table 2: Opportunities in Big Data Analytics (BDA) Implementation

Opportunities	Description
Economic and Business Growth	BDA-driven decisions led to remarkable growth.
Government Support	Government initiatives supported BDA adoption.
Local Market Understanding	Tailored strategies improved customer engagement.
Increased Competitiveness	BDA provided a competitive edge in the market.
Innovation and Product Development	Data analytics fostered innovation and refinement.

Source: The information in this table was generated from participant interviews conducted as part of this study.

4.3 The Bangladeshi Context in BDA Implementation

The evolving technological landscape in Bangladesh was viewed as a significant catalyst for the successful integration of Big Data Analytics (BDA). Participants noted that the growth of high-speed internet access, the expansion of mobile connectivity, and the development of cloud computing infrastructure across the country laid a solid foundation for the effective implementation of BDA. These advancements allowed organizations to collect, transmit, and store vast amounts of data efficiently, which, in turn, empowered data-driven decision-making. The discussion on BDA implementation in the context of Bangladesh revolved around critical success factors. Respondents emphasized the importance of certain key elements that contributed to the effective integration of BDA within their organizations. These elements included robust technological infrastructure, stringent data security measures, a skilled and competent workforce with expertise in data analytics, and proactive alignment with evolving technological trends.

The recognition of these factors underscored their role in driving successful BDA adoption. One of the recurring themes was the adaptability of organizations to the unique preferences and behaviors of Bangladeshi consumers through BDA. Participants shared how data analytics provided them with insights into local market dynamics and customer preferences. By leveraging these insights, they could fine-tune their marketing strategies, customize product offerings, and enhance customer experiences to better align with the dynamics of the local market. This adaptability was vital in tailoring their approaches to meet the specific needs of Bangladeshi consumers effectively. Participants elaborated on the profound transformation of the broader business ecosystem in Bangladesh, driven by BDA implementation. They discussed how data-driven decision-making had a pivotal role in reshaping business interactions, enhancing industry competitiveness, and influencing market trends.

The evolving technological landscape and the adoption of data-driven strategies fostered a climate of innovation and responsiveness to shifts in the market. Organizations recognized that BDA was not just a tool but a catalyst for broader ecosystem change. Several respondents emphasized the significance of educational and skill development initiatives in addressing the shortage of skilled BDA professionals. They shared

experiences of partnering with educational institutions and implementing internal training programs to foster data analytics skills among their workforce. These initiatives were seen as crucial in promoting data literacy within their organizations, ensuring that they had the necessary human resources to leverage BDA effectively. The role of government regulation and data governance was a critical point of discussion. Participants explored the challenges and opportunities associated with aligning their BDA implementations with evolving regulatory frameworks in Bangladesh.

They highlighted the need for clearer data governance guidelines to navigate regulatory complexities successfully. The potential benefits of government-industry collaboration to streamline data governance processes were also explored. Collaboration among organizations in Bangladesh to leverage BDA-driven insights for mutual growth emerged as another key aspect. Participants provided examples of partnerships and industry collaborations that had been formed due to their shared interest in data analytics. They emphasized the potential for collective data analysis to uncover industry-wide trends and opportunities, enhancing the competitiveness of the business landscape.

The discussion extended to the impact of BDA on market responsiveness and innovation. Participants emphasized that data-driven decision-making allowed them to adapt swiftly to changing market conditions and innovate their products and services. The ability to identify emerging trends and customer needs gave organizations a competitive edge, enabling them to stay at the forefront of innovation. Participants highlighted the role of BDA in identifying growth opportunities in international markets, enabling organizations to expand their operations and compete more effectively on a global scale. The ability to leverage BDA for international market expansion was seen as a significant advantage that contributed to their global competitiveness.

These comprehensive insights collectively shed light on the pivotal role that the Bangladeshi context plays in shaping the outcomes of BDA implementation within the domain of Management Information Systems (MIS). The interplay between technological landscape, critical success factors, adaptability to consumer preferences, and broader ecosystem transformation has a profound impact on the adoption and outcomes of BDA in Bangladesh.

Here's a summary table of the key points discussed in Table 3:

Table 3: Key Factors in Successful BDA Implementation within the Bangladesh Context

Themes	Key Points
Technological Landscape Influence	• Evolving technological landscape as a driver for successful BDA integration. • Growth of high-speed internet, mobile connectivity, and cloud computing infrastructure as foundations for BDA implementation.
Critical Success Factors	• Critical elements for effective BDA integration: robust technological infrastructure, stringent data security, skilled workforce, and alignment with technological trends.
Consumer Preferences Adaptation	• Organizations' adaptability to Bangladeshi consumers' unique preferences and behaviors through BDA. • Fine-tuning marketing, products, and customer experiences based on data-driven insights.
Business Ecosystem Transformation	• Profound transformation of the broader business ecosystem in Bangladesh due to BDA. • Data-driven decision-making reshaping business interactions, enhancing industry competitiveness, and influencing market trends. • BDA as a catalyst for ecosystem change.
Educational and Skill Development Initiatives	• Significance of educational and skill development initiatives to address the shortage of skilled BDA professionals. • Partnerships with educational institutions and internal training programs to foster data analytics skills. • Promotion of data literacy for effective BDA utilization.
Government Regulation and Data Governance	• Challenges and opportunities in aligning BDA implementations with evolving regulatory frameworks. • Need for clearer data governance guidelines. • Potential benefits of government-industry collaboration in data governance.
Competitive Collaboration	• Collaboration among organizations in Bangladesh to leverage BDA insights for mutual growth. • Partnerships and industry collaborations as outcomes of shared interests in data analytics. • Collective data analysis to uncover industry-wide trends and opportunities.
Market Responsiveness and Innovation	• BDA's role in enhancing market responsiveness and innovation. • Swift adaptation to changing market conditions and innovation of products and services. • Competitive advantage through identifying emerging trends and customer needs.
Market Expansion and Global Competitiveness	• Leveraging BDA for identifying growth opportunities in international markets. • Expansion of operations and improved global competitiveness as outcomes.

Source: The information in this table was generated from participant interviews conducted as part of this study.

5. DISCUSSION

This study provides an in-depth exploration of the adoption of Big Data Analytics (BDA) within Management Information Systems (MIS) within the context of Bangladesh. The study commences with a thorough literature review, which sets the stage for understanding the distinctive challenges and opportunities surrounding BDA implementation within this developing economy. It is pivotal to grasp the broader context of the study, where organizations encounter specific hurdles and prospects in integrating BDA into their MIS. The contribution of this study is multifaceted. Primarily, it significantly enriches the academic understanding of BDA implementation within the context of developing economies, with a particular focus on Bangladesh. By delineating and comprehensively examining the unique challenges and opportunities that organizations face, the study effectively bridges research gaps and amplifies the knowledge base concerning BDA application within MIS systems in such settings. Simultaneously, the practical insights it furnishes are invaluable for organizations operating in Bangladesh or similar contexts.

The challenges highlighted in the study are poised to guide organizations in crafting strategies to surmount obstacles and augment their BDA implementation. Furthermore, the opportunities underscored in the study offer a blueprint for organizations to effectively harness BDA for growth and competitive advantage in the Bangladeshi market. Theoretical advancement is a central aspect of this study. It brings BDA adoption and integration theories into the realm of developing economies, specifically Bangladesh. This endeavor involves the adaptation of established theories to encapsulate the distinct challenges and opportunities inherent in the Bangladeshi context. Consequently, the adaptation of these theories for practical application provides a reference point for future research on

BDA adoption in other developing economies, thus augmenting the universality of BDA theories. The study also propels theories related to technology adoption and innovation diffusion, shedding light on how Bangladeshi organizations navigate the challenges stemming from limited technological infrastructure and regulatory complexities.

Methodologically, this study makes a substantial contribution by adopting a mixed-methods approach. This approach amalgamates qualitative insights from in-depth interviews with quantitative data garnered through questionnaires, ensuring a holistic examination of BDA implementation. The choice of research design, encompassing both surveys and interviews, affords a more comprehensive and nuanced perspective on the subject matter, enhancing the validity of the study's findings. Moreover, the study employs thematic analysis and statistical tools, which are instrumental in providing a thorough examination of the challenges and opportunities associated with BDA integration. The inclusion of a diverse sample of organizations from various sectors within Bangladesh reinforces the external validity of the findings, offering a robust framework for the study of BDA implementation in other developing economies that share similar characteristics.

In practical terms, this study offers a significant contribution. It serves as a guiding beacon for organizations operating in Bangladesh, affording them a profound understanding of the unique challenges and opportunities related to BDA integration. The insights distilled from this research deliver practical recommendations for organizations, enabling them to address infrastructure constraints, navigate intricate regulatory landscapes, cultivate a skilled workforce, and effectively leverage government initiatives. By adhering to these recommendations, organizations stand poised to elevate their BDA implementation,

ultimately securing a competitive advantage in their respective markets. In summary, this study makes substantial contributions on both theoretical and practical fronts concerning the adoption of BDA within MIS systems in developing economies, particularly within the context of Bangladesh. It not only advances theoretical frameworks but also proffers practical insights and recommendations that can empower organizations to effectively harness the potential of data in their operations.

6. CONCLUSION

This research provides a thorough analysis of the integration of Big Data Analytics (BDA) into Management Information Systems (MIS) in Bangladesh, a developing country characterized by distinct difficulties and prospects. This statement underscores the challenges that organizations encounter, including constraints in technological infrastructure, apprehensions regarding data security, shortages in skilled personnel, and complexities in regulatory frameworks. However, it also emphasizes the potential of Big Data Analytics (BDA) to drive economic growth, support government initiatives, and enhance understanding of local market dynamics. The study makes a theoretical contribution by applying established theories to the specific situation under investigation. Methodologically, a mixed-methods approach is employed to gather and analyze data. Furthermore, the research offers practical value by presenting actionable recommendations based on the findings. In order to further knowledge in this area, it is recommended that future research endeavors focus on conducting cross-cultural comparative studies.

These studies would aim to reveal both shared patterns and unique variations in the problems and opportunities associated with the adoption of big data analytics (BDA) in emerging economies. Longitudinal studies provide the capability to monitor the progression of Big Data Analytics (BDA) integration in Bangladesh, while sector-specific analysis provide a detailed perspective on the adoption of BDA. It is imperative to conduct a comprehensive examination of regulatory and policy analysis, ethical issues, and the utilization of Big Data Analytics (BDA) in the context of crisis management. Furthermore, it is imperative to get foreign perspectives by engaging in collaborative efforts with global firms in Bangladesh and comprehending their contributions to the BDA (Big Data Analytics) environment. This is crucial in order to obtain a more comprehensive grasp of the ecosystem. The exploration of these prospective avenues will contribute to the advancement of our comprehension regarding the dynamic integration of big data analytics (BDA) in emerging economies, as well as its ramifications for both firms and society.

REFERENCES

- Ahmad, A.Y.A.B., Gongada, T.N., Shrivastava, G., Gabbi, R.S., Islam, S., and Nagaraju, K., 2023. E-Commerce Trend Analysis and Management for Industry 5.0 using User Data Analysis. *International Journal of Intelligent Systems and Applications in Engineering*, 11 (11s), Pp. 135–150.
- Al-Qirim, N., Tarhini, A., and Rouibah, K., 2017. Determinants of big data adoption and success. *Proceedings of the 1st International Conference on Algorithms, Computing and Systems*, Pp. 88–92. <https://doi.org/https://doi.org/10.1145/3127942.3127961>
- Andrews, J.G., Claussen, H., Dohler, M., Rangan, S., and Reed, M.C., 2012. Femtocells: Past, present, and future. *IEEE Journal on Selected Areas in Communications*, 30 (3), Pp. 497–508.
- Ashaari, M.A., Singh, K.S.D., Abbasi, G.A., Amran, A., and Liebanan-Cabanillas, F.J., 2021. Big data analytics capability for improved performance of higher education institutions in the Era of IR 4.0: A multi-analytical SEM & ANN perspective. *Technological Forecasting and Social Change*, 173, Pp. 121119.
- Attaran, M., 2023. The impact of 5G on the evolution of intelligent automation and industry digitization. *Journal of Ambient Intelligence and Humanized Computing*, 14 (5), Pp. 5977–5993.
- Bag, S., Dhamija, P., Singh, R.K., Rahman, M.S., and Sreedharan, V.R., 2023. Big data analytics and artificial intelligence technologies based collaborative platform empowering absorptive capacity in health care supply chain: An empirical study. *Journal of Business Research*, 154, Pp. 113315.
- Botta, A., De Donato, W., Persico, V., and Pescapé, A., 2016. Integration of cloud computing and internet of things: a survey. *Future Generation Computer Systems*, 56, Pp. 684–700.
- Bühler, M.M., Calzada, I., Cane, I., Jelinek, T., Kapoor, A., Mannan, M., Mehta, S., Mookerje, V., Nübel, K., Pentland, A., 2023. Unlocking the power of digital commons: Data cooperatives as a pathway for data sovereign, innovative and equitable digital communities. *Digital*, 3 (3), Pp. 146–171.
- Bukhari, F., Ilyas, S., Rehman, L., Gill, H.B., Kanwal, K., and Kajla, N.I., 2023. Blockchain and Big Data to Revolutionize Archaeological Photogrammetry (AP): A Safe and Effective Method. *Journal of Computing & Biomedical Informatics*, 4 (02), Pp. 249–268.
- Dehkhodaei, A., Amiri, B., Farsijani, H., and Raad, A., 2023. Barriers to big data analytics (BDA) implementation in manufacturing supply chains. *Journal of Management Analytics*, 10 (1), Pp. 191–222.
- Gubbi, J., Buyya, R., Marusic, S., and Palaniswami, M., 2013. Internet of Things (IoT): A vision, architectural elements, and future directions. *Future Generation Computer Systems*, 29 (7), Pp. 1645–1660.
- Haque, R., Islam, N., Tasneem, M., and Das, A.K., 2023. Multi-class sentiment classification on Bengali social media comments using machine learning. *International Journal of Cognitive Computing in Engineering*, 4, Pp. 21–35.
- Horani, O.M., Khatibi, A., AL-Soud, A.R., Tham, J., and Al-Adwan, A.S., 2023. Determining the factors influencing business analytics adoption at organizational level: a systematic literature review. *Big Data and Cognitive Computing*, 7 (3), Pp. 125.
- Jahani, H., Jain, R., and Ivanov, D., 2023. Data science and big data analytics: A systematic review of methodologies used in the supply chain and logistics research. *Annals of Operations Research*, Pp. 1–58.
- Jain, P., Tambuskar, D.P., and Narwane, V.S., 2023. Is the Implementation of Big Data Analytics in Sustainable Supply Chain Really a Challenge? The Context of the Indian Manufacturing Sector. *International Journal of Innovation and Technology Management*, 2350033.
- Kafi, M.A., and Akter, N., 2023. Securing Financial Information in the Digital Realm: Case Studies in Cybersecurity for Accounting Data Protection. *American Journal of Trade and Policy*, 10 (1), Pp. 15–26.
- Karim, M.R., and Hosen, S., 2023. Implementation Challenges of ICT in the Public Sector in Upazila Region of Bangladesh: An Empirical Study. Karim, Mohammad Rezaul, Hosen, Shamim, Implementation Challenges of ICT in the Public Sector in Upazila Region of Bangladesh: An Empirical Study (May 30, 2023).
- Lehr, W., Sicker, D., Raychaudhuri, D., and Singh, V., 2023. Edge Computing: Digital Infrastructure Beyond Broadband Connectivity. Available at SSRN 4522089.
- Lema, R., and Rabellotti, R., 2023. The green and digital transition in manufacturing global value chains in latecomer countries.
- Michimi, A., and Wimberly, M.C., 2010. Associations of supermarket accessibility with obesity and fruit and vegetable consumption in the conterminous United States. *International Journal of Health Geographics*, 9, Pp. 1–14.
- Mikalef, P., Boura, M., Lekakos, G., and Krogstie, J., 2019. Big data analytics capabilities and innovation: the mediating role of dynamic capabilities and moderating effect of the environment. *British Journal of Management*, 30 (2), Pp. 272–298.
- Mikalef, P., van de Wetering, R., and Krogstie, J., 2021. Building dynamic capabilities by leveraging big data analytics: The role of organizational inertia. *Information and Management*, 58 (6), Pp. 103412.
- Morales-Serazzi, M., González-Benito, Ó., and Martos-Partal, M., 2023. A new perspective of BDA and information quality from final users of information: A multiple study approach. *International Journal of Information Management*, 73, Pp. 102683.
- Rahman, A., Hossain, M.S., Muhammad, G., Kundu, D., Debnath, T., Rahman, M., Khan, M.S.I., Tiwari, P., and Band, S.S., 2023. Federated learning-based AI approaches in smart healthcare: concepts, taxonomies, challenges and open issues. *Cluster Computing*, 26 (4), Pp. 2271–2311.
- Rahnuma, Z., 2023. The emergence of Big Data and Auditors' Perception:

A comparative study on India and Bangladesh.

- Saeed, S., Altamimi, S.A., Alkayyal, N.A., Alshehri, E., and Alabbad, D.A., 2023. Digital Transformation and Cybersecurity Challenges for Businesses Resilience: Issues and Recommendations. *Sensors*, 23 (15), Pp. 6666.
- Salam, S., and Hoque, A.S.M.M., 2019. The role of social media and effect of relationship marketing on SME performance in Bangladesh: Multi-group CFA. *Asian People Journal (APJ)*, 2 (1), Pp. 12–31.
- Sivarajah, U., Kamal, M.M., Irani, Z., and Weerakkody, V., 2017. Critical analysis of Big Data challenges and analytical methods. *Journal of Business Research*, 70, Pp. 263–286. <https://doi.org/https://doi.org/10.1016/j.jbusres.2016.08.001>
- Stylos, N., Zwiegelhaar, J., and Buhalis, D., 2021. Big data empowered agility for dynamic, volatile, and time-sensitive service industries: the case of tourism sector. *International Journal of Contemporary Hospitality Management*, 33 (3), Pp. 1015–1036.

- Suppiah, K., and Arumugam, D., 2023. Impact of data analytics on reporting quality of forensic audit: a study focus in Malaysian auditors. *E3S Web of Conferences*, 389, Pp. 9033.
- Szukits, Á., 2022. The illusion of data-driven decision making--The mediating effect of digital orientation and controllers' added value in explaining organizational implications of advanced analytics. *Journal of Management Control*, 33 (3), Pp. 403–446. <https://doi.org/https://doi.org/10.1007/s00187-022-00343-w>
- Thongpapanl, N., Ashraf, A.R., Lapa, L., and Venkatesh, V., 2018. Differential effects of customers' regulatory fit on trust, perceived value, and m-commerce use among developing and developed countries. *Journal of International Marketing*, 26 (3), Pp. 22–44.
- Zheng, Y., Vanderzalm, J., Hartog, N., Escalante, E.F., and Stefan, C., 2023. The 21st century water quality challenges for managed aquifer recharge: Towards a risk-based regulatory approach. *Hydrogeology Journal*, 31 (1), Pp. 31–34.

