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EXPLORING THE IMPACT OF BIG DATA ANALYTICS ON BUSINESS PERFORMANCE IN THE DIGITAL ERA

Abstract. *The corporate world is benefiting from the trends of BIG DATA (BD) and business modeling and analysis. Previous studies have demonstrated the enormous and exponential growth of data created in the modern world. These consist of the everyday inundation of unstructured and structured information in companies.*
Problem statement. *The main research gap addressed by previous literature studies is the lack of a comprehensive analysis of BD's application for digital transformation.*
Purpose of study. *This is filled by looking at the strategic benefits, opportunities, and challenges that BD presents to companies as they digitally transform their IT platforms. Therefore, the purpose of this study is to draw attention to the numerous uses and advantages of the technology of BD among researchers and companies. Methodology. Qualitative Research Methods, Utilizes qualitative research methods for a broad perspective. Emphasizes exploratory research to advance knowledge in the field. Uses an epistemological approach to find relevant literature sources from reputable databases like Google Scholar and Science Direct. Scientific novelty. Based on the research that is currently accessible, the article evaluates and discusses the latest trends, possibilities, and dangers of BD and how it has helped firms stay competitive by enabling them to develop successful business strategies. The assessment also covers the several uses for BD and analytics in business, as well as the data sources that are produced and their salient features.* ***Conclusion:*** *Lastly, the paper not only describes the difficulties in putting BD projects into practice successfully but also points up open research paths in BD analytics that need further attention. According to the BD topics under evaluation, effective administration and manipulation of massive data sets utilizing BD techniques and technologies may produce valuable business insights.*
Key words: *Big data, Digital transformation, Machine Learning, Artificial intelligence, Customer insight, Market trend, AI tools.*

Василь НЕСТЕРОВ. ДОСЛІДЖЕННЯ ВПЛИВУ АНАЛІТИКИ ВЕЛИКИХ ДАНИХ НА ЕФЕКТИВНІСТЬ БІЗНЕСУ В ЦИФРОВУ ЕПОХУ

Анотація. *Корпоративний світ отримує вигоду від тенденцій BIG DATA (BD) та бізнес-моделювання і аналізу. Попередні дослідження продемонстрували величезний і експоненціальний ріст даних, що створюються в сучасному світі. Вони складаються з щоденного потоку неструктурованої та структурованої інформації в компаніях. Постановка проблеми. Основною прогалиною в попередніх дослідженнях є відсутність комплексного аналізу застосування BD для цифрової трансформації.* ***Мета дослідження.*** *Заповнити цю прогалину шляхом аналізу стратегічних переваг, можливостей та викликів, які BD надає компаніям у процесі цифрової трансформації їхніх ІТ-платформ. Тому метою цього дослідження є привернення уваги дослідників та компаній до численних застосувань та переваг технологій BD.* ***Методологія.*** *Якісні методи дослідження, використовує якісні методи дослідження для широкої перспективи. Наголошує на пошукових дослідженнях для поглиблення знань у цій галузі. Використовується епістемологічний підхід для пошуку відповідних літературних джерел з авторитетних баз даних, таких як Google Scholar та Science Direct. Наукова новизна: На основі доступних на даний момент досліджень у статті оцінюються та обговорюються останні тенденції, можливості та небезпеки BD, а також те, як він допомагає фірмам залишатися конкурентоспроможними, дозволяючи їм розробляти успішні бізнес-стратегії. Оцінка також охоплює кілька сфер застосування бізнес-аналітики в бізнесі, а також джерела даних, які створюються, та їхні основні характеристики.* ***Висновок:*** *Насамкінець, стаття не лише описує труднощі в успішному впровадженні BD-проектів на практиці, але й вказує на відкриті дослідницькі шляхи в BD-аналітиці, які потребують подальшої уваги. Відповідно до розглянутих тем BD, ефективне адміністрування та маніпулювання великими масивами даних з використанням методів і технологій BD може дати цінні бізнес-інсайти.*
Ключові слова: *Великі дані, цифрова трансформація, машинне навчання, штучний інтелект, розуміння клієнтів, ринкові тенденції, інструменти штучного інтелекту.*

Introduction. Data processing, Artifical intelligent (AI) technologies are evolving quickly these days, and social media is becoming more and more significant. Data transmission security methods are becoming more and more important as technologies advance. Businesses are undergoing significant changes as a result of the extensive usage of information technology in many areas of life. It is important to note the increasing significance of information technology in corporate management. Businesses both create their solutions and apply outside ones. This is to guarantee the safety of data storage and transfer [19]. The growth of new fields of knowledge and the integration of technology for communication and information constitute the foundation of an enterprise's organizational process. The lines between the many industries and businesses nowadays are unclear. This is a result of the thinning of the lines separating the competencies of different organizations. New, very adaptable, and effective organizational solutions are built on the foundation of business networks, contemporary IT tools and databases, and, most importantly, creative individuals [18].

When large data sets are computationally examined to identify patterns, trends, and connections–particularly those pertaining to human behavior and interaction–they are referred to as "Big data (BD)". These massive information sets require state-of-the-art computational techniques for analysis. The phrase "BD analytics" has become more common in academic and professional contexts, including papers, journals, and conferences. In essence, it describes the enormous volume, variety, and speed with which data is produced and made accessible in the modern world. Large quantities, high-velocity, high-variety, and high-value information resources are referred to as BD, and to provide insights and support wise decision-making, new and economical information processing techniques must be used [21]. Despite the impressive achievements in BD analytics, many businesses find it difficult to implement these technologies due to high costs and other obstacles. Furthermore, there is scant experimental proof of the overall positive effects. Therefore, the study issue addressed in this article is if information-driven decision-making using BD Analytics leads to higher performance and a competitive edge in Pakistan's industrial industry. Effective business tales highlight how important it is to make deliberate decisions based on trustworthy information. High-quality data is required by the industrial sector to improve productivity and the effectiveness of business operations. Reliable data is essential to organizational decision-making processes because it converts inputs into knowledge that can be put into practice. This is how data-driven choices are made [19].

Problem statement. In an attempt to fully explore the potential of BD analytics, many companies have begun to invest large sums of money in the field. Nevertheless, the majority of research publications are general and do not provide industry-specific guidance on how businesses should change to take full advantage of these technological advancements.

BD is still a relatively new idea, and most of the studies that have been done on it have focused on its theoretical characteristics rather than its use in the age of digital transformation. The significant gaps hamper BD's strategic and commercial potential in our understanding of how it creates corporate value, despite the widespread excitement surrounding this technology.

The majority of research has advanced our knowledge of BD's supporting infrastructure, tools, and other resources, but it has seldom addressed BD's function in an organization's digital transformation.

Recent research and study. Managing bigger datasets becomes more challenging. The phrase "BD" describes databases that have grown to such an extent that they are difficult for traditional database management systems to handle (Almeida, Brás, Sargento, & Pinto, 2023). Moreover, the scope of BD surpasses the capacity of current data management, storage, and processing techniques. Three primary attributes of BD are volume, velocity, and diversity [2]

Three factors–volume, velocity, and variety–determine an organization's capacity for making well-informed judgments. Variety refers to the range of forms and types of data, volume represents the amount of the data, and velocity defines the pace at which it is changing. IBM presented Veracity, its fourth [19], Furthermore, according to some scholars, data significance is a fifth in the process of decision-making [27].

BDA uses sophisticated techniques to analyze BD sets. Larger datasets, however, also come with greater obstacles and problems. Improved decision-making, risk mitigation, and the finding of insightful information may all be facilitated by advanced analytics. Many academics have studied management decision-making extensively throughout the years, and it is very important. Simon's four stages of decision-making–intelligence, design, choice, and execution–are widely applied by decision-makers in many situations. Furthermore, there are several stages involved in the BD analysis pipeline, each with unique decision-making needs and obstacles [22, p.15].

These options include how to collect data, which data to gather, how to portray data once it has been extracted for analysis, and how to make decisions using the data that has been acquired. The report further highlights that adopting a data-driven method of decision-making necessitates modifying the organizational environment, management, HRM, and other methods of management. By putting these changes into practice, a business may improve its competitive position by fostering stronger customer interactions, reducing management risks, and increasing operational efficiency [13].

In strategic management, BD has come to be seen as an essential corporate asset for the success of organizations. To establish a framework that facilitates decision-making, boosts organizational effectiveness, and provides a sustained competitive advantage, BD must be combined with other assets and skills. An examination of the literature yielded the conclusion that, although some studies use comparable methodologies, other research investigations use a variety of both theoretical and practical methods for data collecting and refining. All organizations nowadays rely on information-driven decision-making. BD analytics provides helpful resources and insights to enhance traditional data mining techniques and decision-making algorithms [21].

The basic goal of every firm is to improve performance. Company strategic management is regarded to have one ultimate goal: to improve organizational performance. As a result, organizations have shifted their attention to this area. The variety of definitions, views, and measuring indicators provided suggests that experts are divided on what an organization's performance entails and how it will be judged. As a result, it can be challenging for

businesses to define, analyze, and assess performance [3]. This study presents a model for investigating the effects of business process adoption (BPA) and the role of mediator that business process performance (BPER) plays in the relationship between business process adoption and firm performance. It accomplishes this by building on principles from the resource-based viewpoint (RBV). The empirical study's findings, which are based on statistics collected from 204 moderately to high-level company executives throughout a variety of industries, show that the use of BA has a favorable influence on BPER. Furthermore, firm performance (FP) and BPER get together well. Furthermore, the results show that BPER mediates the connection between FP and BA adoption [6].

Purpose of the study. This study's primary goal is to investigate BD's importance in the age of digital transformation. While a number of academics have examined the BD idea from a technological standpoint, there hasn't been much research done on the topic from a management one. Furthermore, the use of BD in an organization's digital transformation to meet changing business needs has received little attention from scholars and practitioners.

This study aims to explore BD as a concept in general, with a focus on its strategic benefits, possibilities, and problems as well as the impact of Machine Learning (ML) and market trends as companies digitally modernize their infrastructures. Additionally, because BD is still a relatively new field, this research aims to close the current gap by identifying BD as a facilitator of organizational digital transformation. Encouraging managers who are either new to BD or looking to extend their horizons to have a deeper comprehension of it is another crucial goal of this research.

Research design. Given the novelty of BD, this study will use qualitative research methods to provide a broad perspective of the subject. Additionally, emphasizing exploratory research methods, this project will advance knowledge in the field. Most significantly, based on the abstract and introduction parts provided in each journal article, this research will consider secondary resources and understand crucial words and theoretical frameworks. Among these sources are news periodicals, corporate reports, and press releases. In addition, depending on the validity and dependability of the chosen papers, this study will assess the present status of the field's research.

The search parameters have been created using an epistemological approach, given the multidisciplinary nature of the study issue. Therefore, to find relevant literature sources from reputable databases like Google Scholar and Science Direct, a variety of keywords like "Big Data", "digital transformation", "importance of Big Data", "impact of Big Data". Therefore, to find relevant literature sources from reputable databases like Google Scholar and Science Direct, a variety of keywords like "BD" "ML business strategy", "digital transformation", "organizational efficiency", "impact of Big Data", "customer insights" and "Big Data and digital transformation" have been used.

Main analysis of study. BD's effect on business operations BD's great potential has prompted major organizational reforms, particularly in the field of operations optimization. The following is a discussion of some of these [16]:

1. Improving production and operational efficiency:

Consider an efficient system that manufactures goods or services with pinpoint accuracy. BD assists businesses with this. Businesses get invaluable insights into their operations by leveraging massive amounts of structured and unstructured data. Regular monitoring and analysis immediately identify and address obstacles and inefficiencies.

As a result, it's reasonable to say that it empowers businesses to make based on evidence selections, allowing them to optimize operations and manage assets more accurately. Businesses can now focus on what matters: innovation and development, thanks to optimized manufacturing lines and automating boring labor.

2. Improving Data-Driven Management of Supply Chains

Every business's logistics network is its basis; it is a fragile system that can experience serious effects from even minor disruptions. BD analytics is a phenomenon responsible for such comprehensive perception of the whole supply chain, beginning from the purchase of raw materials till delivering finished products. Companies will be able to project disruptions and build flexible plans by observing supplier information, stock levels, transportation, and consumer trend on a regular basis. This enables retailers to balance the market and ensure a continuous flow of items; hence, the consumer is satisfied thus increasing their loyalty.

3. Better Cost Management should include listing of resources and their allocation in management.

For business people, managing funds is a problematic tightrope. BD relies on high-precision analysis as well as constant data input to avoid uncertainty. This thus gives organizations an insight into their habit of spending and allows them to detect where they have merely wasted their money.

Implementing resource allocation optimization enables an organization to reduce expenses and result in higher returns on investments at the same time. Firms with those new capabilities can choose to direct their money to areas that stimulate creativity, technology, and customers' joy as opposed to less functional areas.

The fundamentals of management in an age of emerging technologies. For production companies, for instance, implementing BD Analytics projects entails several steps, including defining the business problem, determining the extent of the data, assembling a cross-functional team, creating a schedule for each task, gathering and choosing data, analyzing and modeling it, visualizing it, producing a report, integrating it into information systems, and providing specialized training [4].

BD management, or BDA, offers a chance to change workforce and business methods. By analogy, it is feasible to analyze the method of automation and its impact on the manufacturing workforce thanks to the insights obtained from BD Analytics, way it was before the production operations were mechanized, many years ago. Using predictive analytics, machine learning, or methods similar to MapReduce [1], BD analytics provides fast and reliable insights to help improve production decisions. Public databases facilitate the creation of new uses for data resources by linking businesses or specific systems inside an organization. Similar to how the Internet of Things is creating data, employees are also becoming "data generators" as they may generate data both internally and outside through the use of IP addresses and different kinds of sensors. Machine interpretation of data is made possible by more complex software, which allows for a more thorough integration of applications based on BD with conventional value-creation processes and largely autonomous decision-making. Many sectors are facing challenges to their business models due to digitalization and BD Analytics [6].

Some businesses, even those with a dominant market position, may struggle to modify their operations in response to the changing circumstances and fail to fully capitalize on the potential presented by the process of digitization and BD Analytics. The continuous digitization trend lowers transaction costs related to control, communication, and information collection by a large margin. Companies can analyze the interrelated nature of purchasing behavior to better suit advertising material, for example, thanks to easier access to an updated pool of data and powerful BD Analytics. This might reflect in greater total customer demand [5].

As a result, over time, less effective business models may be replaced by gradually improving current company models through greater digitization and data analytics. Deployed and standardized BD solutions could not be sufficient to provide a long-term competitive edge, nevertheless, as standards rise. Organizations may obtain valuable insights not just from publicly accessible online datasets but also from privately acquired data by utilizing analytical tools that examine both structured and unstructured data. Connecting data from websites, product rating sites, and social network data with consumer choices and product features gives businesses a wealth of opportunities to comprehend customer needs, anticipate their requirements, and, most importantly, maximize resource utilization [6].

BD ML Applications' Challenges. The following are general ML challenges [12, 13]: (i) creating flexible and scalable computational architectures; (ii) comprehending data properties before utilizing ML tools and algorithms; and (iii) being able to build, learn, and predict as you increase sample size, dimension, and label categories. Many significant specialized subfields of large-scale machine learning, including large-scale recommendation systems, natural language processing, rule-based association learning, and ensemble learning, continue to struggle with scaling issues despite the availability of numerous large-scale ML algorithms [4].

A crucial component of ML is absent from the fundamental MapReduce architecture that is frequently offered by first-generation "BD analytics" platforms like Hadoop. Iteration, recursion, and other essential properties needed to effectively iterate "around" a MapReduce program are not supported by MapReduce. On these platforms, programmers creating MLmodels must implement looping in non-standard ways that are not part of the standard MapReduce architecture. The recent creation of several specific techniques or libraries to enable iterative programming on big clusters has been spurred by this lack of support. In the meantime, an iteration failure in MapReduce is the direct target of newer MapReduce extensions like HaLoop, Twister, and PrItr [14].

The following are the main reasons ML approaches are not appropriate for handling BD classification problems [20]: (i) An ML method trained on a specifically labeled dataset may not be appropriate for another dataset; (ii) an ML method is typically trained using a certain number of class types, which means a large variety of class kinds discovered in a dynamically growing dataset will lead to insufficient classification results; and (iii) an ML method develops based on a single learning task, making them unsuitable for the multiple training tasks and knowledge transfer requirements of BD analysis that are present today.

Technological Development of BD ML Applications. The majority of scalable ML advancements (such Madlib, Apache Mahout, etc.) take place in the field of massively parallel database processing. ML algorithms with scalable predictive functions may be designed and implemented to enable better work in the BD age. The following techniques have been investigated and assessed [9].

(i) Progressive enhancement neural networks in associative memory architectures that can easily adapt to new datasets and sources;

(ii) facets developing that can learn a hierarchical arrangement in the data;

(iv) multi-task learning that can learn multiple predictive functions in parallel;

(iii) deep learning techniques that automate the method of feature engineering by learning to generate and sift through data-driven features. BD's vast and expanding data domain necessitates the employment of the multi-domain representation-learning (MDRL) approach for categorization.

The distance-metric learning, feature extraction, and feature variable learning components of the MDRL approach are all included. Many representation-learning techniques have been put forth in machine learning.

In addition to the recommended network model, the cross-domain, representation-learning (CDRL) approach may be appropriate for BD categorization [15]. Deep learning is a particularly helpful tool for BD analytics because it can analyze and learn from vast volumes of unstructured data, which is one of its main advantages. It was investigated how deep learning may be used to BD analytics, specifically in relation to simplifying discriminative tasks, quick information retrieval, semantic indexing, data tagging, and the extraction of complicated patterns from large amounts of data. Additional research was conducted on deep learning in BD, encompassing data streaming, high-dimensional data, distributed computing, and the scalability of Deep Learning models [27].

The Bayesian Network (BN) is a prominent ML approach commonly used to describe probabilistic correlations between variables. A novel weight-based ensemble technique was presented to train a BN architecture from an ensemble of local outcomes; an intelligent BD initial processing technique and a data quality score have been suggested to test and assure the data quality and data fidelity. The whole learning process was built using the Kepler scientific workflow, which made it simple to integrate the algorithm with data-parallelism distributed (DDP) engines like Hadoop. It was also shown how Kepler may help with the development and operation of the BD BN learning application [28].

Machine learning, cloud computing, and workflow methodologies were combined to create a Scalable Bayesian Network Learning (SBNL) workflow. The technique makes use of distributed computing models and ensemble learning to enable efficient BN learning from BD, as well as intelligent pre-processing of BD [26].

Through HBase and the Hadoop Distributed File System (HDFS), the architecture offers dependable permanent data storage. The modules for batch and stream processing make up the architecture's core. It offers MLtools and algorithms that developers may use with ease to do tasks like classification, recommendation, clustering, and prediction, among others [15].

Scalable Advanced Massive Online Analysis (SAMOA), an open-source platform for large data stream mining, has the technique accessible. Adaptive Model Rules (AMRules) are distributed throughout a cluster using a combination of vertical and horizontal parallelism. AMRules creates understandable representations of decision rules. Developing novel distributed ML algorithms and implementing them on top of cutting-edge distributed stream processing engines (DSPEs) is made easier by SAMOA. Additionally, it provides a library of distributed ML algorithms that anyone may use or alter [2]

This study [19] paper looks at how Russian aggression has affected Ukraine's cyberspace and suggests ways to uninstall infected malware from digital equipment. Taking into account the hostile acts of the aggressor state, the research attempts to identify sensitive sectors and specify the vector of development of digital technologies that may be utilized securely in Ukraine. The study makes use of information research, statistical research, and analytic definition to pinpoint areas of Ukraine's cyberspace that urgently need assistance to liberate digital tools from corrupted software belonging to the aggressor state.

The Risks and Concerns of Russian Influence. The report emphasizes how vital it is to rid Ukraine's cyberspace of the parasitic effects of digital tools created by Russian businesses. It highlights issues that pose a danger to state security and offers workable suggestions for guaranteeing state digital security as well as the future growth of Ukraine's digital sector. The urgent necessity to replace Russian software in the organizational and managerial domains of Ukraine's cyber-digital infrastructure is also emphasized in the study. The growth of the Ukrainian IT cluster and Ukraine's potential as a digital state with high levels of digital means integration are also covered.

Recommendations for Protecting Cyberspace in Ukraine. According to the study the Ukrainian authorities still depend on Russian soft-ware so it will be necessary to support national organic development of the digital tools if the country will be able to clear the reliance on the third party. The document issues its staging specifications based on the declared study goals, such as the immediate isolation and elimination of Russian software and services, and taking decisive efforts for fueling domestic IT industry growth. Also, it advises to form Government assisting programs and to let domestic computer engineering researches to take place for the purpose to provide financial support and to increase adequacy of the cyber-digital area in Ukraine.

However, the main idea of the final study is how we can derive profit from AI in the digital age. Companies must be ready to question the common approach and take an adventure into non-explored zones to position itself ahead of the trend and adjust to the dynamic environment as AI provides new opportunities. Consequently, businesses are capable to get a notable competitive advantage which can hardly be copied and offer a wide array of opportunities to create value [7].

Conclusion. AI has been promoted as the game-changing tech issue that could transform the functions and management of the organization. This research will examine the ways in which AI is especially adapted into the IT & business strategies of an organization that makes the company's objectives and plan to thrive in the digital world. The research indicated that creative and routine AI integrations collude with each other to surpass the amount of efficaciousness of solo operations. The study also pointed out that strategic business/IT integrations are crucial in bridging the digital transformation gaps.

The key finding of the study is that AI functions as an engine that can enforce serious transformations within organizations regardless of whether it should be seen as a tool or not. The organizational realm has to be ready for challenges of AI and understand the ways in which it could be implemented to overcome hurdles and develop entirely new value. The ability to apply knowledge and explore – meaning more than theoretical thinking – is thus also required.

This is the reason, that employing AI by companies into their business strategy is exactly like changing lead into gold, since in this case companies turn technology and data into new forms of competitive advantage and value. The process of AI adoption requires a firm grasp of its principles but also the ability to experiment zealously and in an agile manner.

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