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The Role of Big Data Analytics in Reinforcing the Business Sustainability of Enterprises

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Abstract: Nowadays Big Data is becoming a vital instrument for many different disciplines, especially for the environmental and ecosystems aspects. It considers a new way of thinking, whereas big data analytics are organizing and analyzing large sets of data to generate and discover new patterns and themes that can solve issues and challenges that arise in society. The main purpose of this article is to clarify the evidential role of big data analytics in business sustainability achievement and to support the decision-making process. Research objectives were achieved through developing a big data analytics framework to support a large scale of business organization to achieve business sustainability and operational excellence to ensure market survival. Also, this research demonstrates the results of applying big data analytics for three big business enterprises as case studies (Amazon, Netflix, and Walmart). In fact, the analytics of big data brought great benefits for business enterprises on different scales.

Keywords: Data analytics, Business sustainability, Predictive analytics, Data models, AI Algorithms.

Introduction

The main concern of business organizations now is looking for how to achieve business sustainability, big data are very strategic components of success for all types of business organizations, and it's considered the main crucial factor to keep their survival and operational excellence on the market. One of the main challenges of business is the need to get the right information as fast as possible to the right user at the right time and in the easiest possible way through a huge amount of information is produced every day in big variety of ways. Organization survival in a highly competitive environment depends upon possessing the right information at the right time. Companies must have information concerning their customers, products, environment and themselves also (Kubina et al., 2015).

Recently big data analytics was considered as a game changer enabling improved business efficiency and effectiveness because of its high operational and strategic potential. The emerging literature on BDA has identified a positive relationship between the deployment of customer analytics and firm performance. For example, BDA allows firms to analyze and manage strategy through a data lens. Indeed, BDA is increasingly becoming a crucial component of decision-making processes in businesses. BDA is now considered as "a major differentiator between high performing and low-performing organizations," as it allows firms become proactive and forward-looking, decreases customer acquisition costs by about 47% and enhances firm revenue by about 8% (Wamba et al., 2017).

Big Data Analytics also is increasingly becoming a trending practice that many organizations are adopting with the purpose of constructing valuable information from BD. The analytics process, including the deployment and use of BDA tools, is seen by organizations as a tool to improve operational efficiency though it has strategic potential, drives new revenue streams and gain competitive advantages over business rivals. Extant research

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

studies have demonstrated that substantial value and competitive advantage can be attained by businesses from taking effective decisions based on Data But, BDA is more perplexing than merely tracing, classifying, comprehending, and quoting data (Sivarajah et al., 2017).

The main purpose of this paper is to introduce a big data analytics framework to support a large scale of business organization to achieve its business sustainability and market survival. This paper is organized as follows; the next section is clarifying how big data now is becoming an important asset in business organization, that is our initial and introduction goal with describing the research methods. Next, the big data analytics importance and platforms are demonstrated with a brief review of relevant literature concerning. The paper then discusses the main aspects and characteristics of business sustainability. Developing the big data analytics framework is the main section of this paper, then the research ends with a conclusion section.

Literature Review

Big Data as an Asset

Big data is a potential knowledge asset, contingent upon the proper use of that knowledge. BDA represents technologies drivers of a strategic knowledge asset (big data). BDA applications have the potential to add value by providing more transparent and accurate results to support decision-making in several business areas (Côrte-Real et al., 2017).

The emerging technological development of big data is recognized as one of the most important areas of future information technology and is evolv- ing at a rapid speed, driven in part by social media and the Internet of Things (IoT) phenomenon. The technological developments in big data infrastruc- ture, analytics, and services allow firms to trans- form themselves into data-driven organizations (Lee, 2017). Big data provides great potential for firms in creat- ing new businesses, developing new products and services, and improving business operations, the use of big data analytics can create benefits, such as cost savings, better decision making, and higher product and service quality.

The opportunities arising from big data analytics for organizations are considered pivotal: big data has been described as, ‘‘the mother lode of disruptive change in a networked business environment”. By adopting big data technologies, organizations expect to gain benefits across many domains, such as e-commerce, e-government, science, health, and security. What benefits organizations perceive as ‘‘value” depends on their strategic goals for adopting and using big data (Günther et al., 2017).

Economic value can be measured by an organization’s increase in profit, business growth, and competitive advantage resulting from big data adoption (Davenport, 2006; Davis, 2014; Tyagi, 2003). Economic value often comprises monetary benefits that are appropriated by organizations. For example, organizations that rely on big data to guide organizational strategies and day-to-day operations are expected to perform better financially than organizations that do not, in other word we can say that big data has strategic potential drive new revenue streams and maximize the competitive advantages for business enterprises.

In general, big data is perceived as a source of innovative products, services, and business opportunities. Moreover, big data is believed to result in more efficient and effective operations by, for example, optimizing supply chain flows; setting the most profitable price for products and services; selecting the right people for certain tasks and jobs; minimizing errors and quality problems, and improving customer relationships. Additionally, further economic and social value can be gained from big data through enhanced decision making and more informed strategizing (Günther et al., 2017).

Conventionally, big data are presented in terms of 3 Vs namely, (1) volume, (2) velocity, and (3) value (Rehman et al., 2016; Xie et al., 2016; Ziora, 2015). *Volume* represents the size of the data, now every day the world produces around 4 quintillion bytes of data (i.e. 1 Exabyte equals 1 quintillion bytes or 1 Exabyte equals 1 billion gigabytes) as shown in table (1). whereas *Velocity* represents the increasing speed of data that can be generated and entered into big data systems. The *Value* property of big data determines its usefulness to take actionable decisions after data analysis. However, big data is currently redefined with the addition of three new Vs: (1) variety, (2) variability, and (3) Veracity, whereas *Variety* means multiple types of data sets, data can be existed in many types and forms, these data include textual content (i.e. structured, semi structured as well as unstructured), to multimedia content (e.g. videos, images, audio) on a multiplicity of platforms (e.g. machine-to-machine communications, social media sites, sensors networks, cyber-physical systems, and Internet of Things

(IoT)) ***Variability*** indicates to data whose meaning is constantly changing with inconsistencies data types and sources, and ***Veracity*** refers to uncertainty thinking about the big data accuracy, although the high potential value of Big Data, the data is virtually worthless if it's not accurate (Rehman et al., 2016). In our research we can expand big data characteristics into 10Vs to become as the following chart in Figure (1).

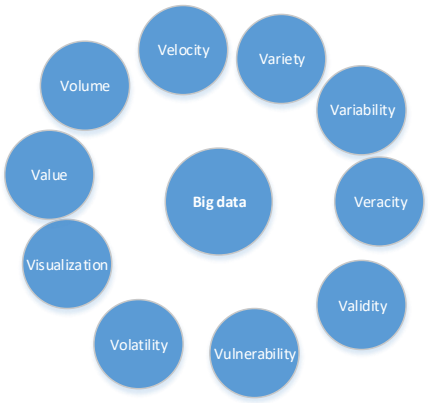

Figure 1. Big data 10Vs

The new 4Vs are Validity, Vulnerability, Volatility, and Visualization. *Validity* means adopting good data governance practices to ensure the consistency and the quality of data for analytics. *Vulnerability* refers to the new security concerns escorted with big data, now the probability of data breach with big data transaction can occur in a high percentage. *Volatility* indecates to the time aspects for big data management such as the procedures to ensure rapid retrieval of data when it's required, the costs and complexity of a big data storage and data process for business needs. Eventually, Big Data *Visualization* involves the presentation of data of almost any type in a graphical format that makes it easy to understand and interpret. But it goes far beyond typical corporate graphs, histograms and pie charts to more complex representations like heat maps and fever charts, enabling decision makers to explore data sets to identify correlations or unexpected patterns.

Table 1. Datasets volume size

Value	**Name**	**Abbreviation**
1000^1	Kilobytes	KB
1000^2	Megabytes	MB
1000^3	Gigabytes	GB
1000^4	Terabytes	TB
1000^5	Petabytes	PB
1000^6	Exabytes	EB
1000^7	Zettabytes	ZB
1000^8	Yottabytes	YB
1000^9	Brontobytes	BB
1000^{10}	Geopbytes	GEB

One of most recent Research in big data refers that nearly 90% of enterprises fail, and one of the key failure reasons is invaluable products and services that do not meet customer expectations. A market research on 135 failed startups reveals that 42% of failures occurred because the products and services did not meet the market needs, 17% failed because of the lack of business models, and 14% of the enter- prises failed because they ignored their customers (Rehman et al., 2016).

Likewise, organizations constantly look for opportunities to increase their competitive advantage in an increasingly competitive market place by using better analytical models as an aspect to attain business sustainability. so, it is necessary to introduce results in a more clear and concise form. These challenges push the organizations to depend on business intelligence applications and data analytics models that allow better reporting and visualization of the big data as an important asset for running the enterprise operations.

Tekiner and Keane made in-depth literature review to identify the added value of big data as an asset in the enterprises, also focused on investigating the main platforms of big data analytics and clarifying the main factors which construct the purposed framework to guide the business firms to achieve business sustainability. Developing the purposed framework in this research based on the balance between the information technology

factors and business factors which maximize the value of big data to achieve the business sustainability (Tekiner & Keane, 2013).

Big Data Analytics Importance and Platforms

Big data has become a vital resource for many sectors of society. Beyond its importance to businesses and industries, it also plays a role in everyday life and has implications for national security. Data today is generated through countless activities—such as point-of-sale (POS), sensor readings, online purchases, emails, videos, and interactions on social media. Major technology companies, including Google, Amazon, Facebook, Twitter, and Baidu, have already built extensive systems to capture and analyze this information. Governments in countries like the United States, China, India, and Japan have likewise invested heavily in advancing research and developing strategies to make use of big data (Chawda & Thakur, 2016). Big data analytics has become an essential driver of value for contemporary businesses. Organizations increasingly depend on analytical tools not only to manage internal operations but also to gather and interpret customer feedback. By doing so, they gain insights into consumer preferences and can adapt their products or services to meet evolving needs while maintaining a competitive edge. In this way, delivering value to the customer (V2C) is as important for long-term survival as achieving profitability and sustaining revenue growth (Rehman et al., 2016).

Another important aspect of big data analytics is the difficulty of managing business and manufacturing data with traditional platforms. Systems such as computer-aided design (CAD), supply chain management (SCM), manufacturing execution systems (MES), and enterprise resource planning (ERP) were not originally designed to process the sheer volume and complexity of modern data, which makes their use increasingly limited in this context.(Fahmideh & Beydoun, 2018). As illustrated in Figure (2), the process of big data analytics typically involves six key stages: (1) collecting data from various direct and indirect sources, (2) carrying out preprocessing and integration to enhance data quality, (3) developing learning models through statistical approaches and machine learning–based data mining techniques, (4) assessing these models with test data, (5) implementing the models in practical applications, and (6) monitoring their performance, particularly with respect to prediction accuracy (Rehman et al., 2016).

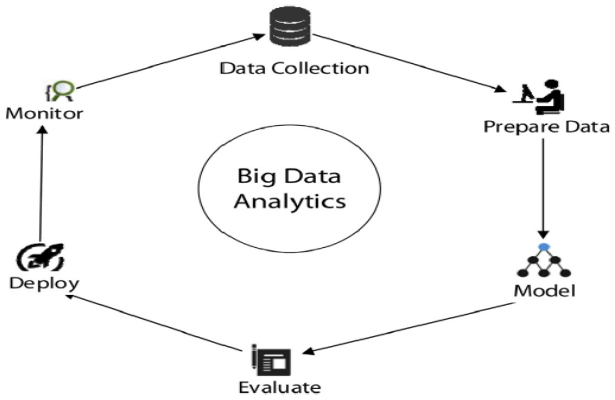

Figure 2. Big data analytics process, (Rehman et al., 2016)

With advanced big data (BD) analytics tools such as NoSQL databases, BigQuery, MapReduce, Hadoop, WibiData, and Skytree, organizations can now improve strategies and decision-making in areas like healthcare, economic growth, energy forecasting, and disaster prediction. Despite these advances, challenges remain: process-related issues include capturing, integrating, cleaning, and transforming data, as well as selecting suitable models and presenting results, while management challenges concern privacy, security, governance, cost, and ethical considerations (Sivarajah et al., 2017).

Types of Big Data Analytics

Big data analytics has become a core component of modern business, transforming large and complex datasets into actionable insights that support better decision-making. Its importance is reflected in the fact that nearly 80% of CEOs and executive teams view big data initiatives as essential for driving revenue growth, reducing costs, and improving efficiency. Consistently, more than 80% of organizations report that they are already engaged in projects in this area. (Park et al., 2017). In general, there are three types of BDA as following;

Descriptive Analytics

Descriptive analytics is the most basic form of big data analytics (BDA), aimed at summarizing and explaining patterns using statistical measures such as mean, median, mode, standard deviation, variance, and event frequency in data streams. A common application is dashboards, where organizations track key metrics to monitor processes over time (Banerjee, et al., 2013).

Predictive Analytics

Predictive analytics focuses on forecasting outcomes by applying statistical modeling and machine learning methods, including supervised, unsupervised, and semi-supervised approaches. By detecting patterns and relationships in historical data, it generates estimates about future events, allowing organizations to anticipate opportunities and risks (Gandomi et al., 2015).

Prescriptive Analytics

Prescriptive analytics focuses on determining the most effective next steps for a business. It takes the outcomes of other analyses and translates them into clear recommendations for improving processes. In other words, it uses predictions to guide organizations on how to optimize their operations. Although implementing prescriptive analytics can be challenging, it is highly valuable in helping companies adapt to changing information and ensuring that their business models continue to evolve (Sivarajah et al., 2017).

Big Data Analytics and Business Sustainability

Ertz et al. (2024), they explored how Big Data Analytics (BDA) influences a company's sustainability performance through the lens of a triple bottom line (TBL) framework. By examining 522 firms from the S&P 500 and TSX 60, the researchers discovered that BDA can significantly boost economic outcomes like achieving a 300% return on investment for data-driven content as well as social benefits, such as increased corporate social responsibility (CSR) engagement, and environmental improvements, including a 30% reduction in waste. They found that prescriptive analytics, which includes tools like AI and deep learning, tends to slightly outperform predictive analytics when it comes to enhancing sustainability. The researchers pointed out that the key to BDA success lies in human capital, stressing the importance of training the workforce rather than just investing in technology. Additionally, their research filled gaps left by previous self-reported studies by utilizing third-party data sources like MSCI ESG and Compustat, while integrating Resource-Based Theory with the Knowledge-Based View (Ertz et al., 2024).

Waqas and Tan (2022), they explored how Big Data Analytics (BDA) and green technology innovation capabilities (GTIC) can boost sustainable performance in the manufacturing sector of Pakistan. By analyzing survey data and employing structural equation modeling, the researchers discovered that both BDA and GTIC play a significant role in enhancing green production. This improvement not only leads to a competitive edge but also contributes to the overall sustainable performance of firms. The research also pointed out the important roles of corporate reputation and supply chain innovativeness, indicating that these elements can amplify the positive impacts of BDA. Interestingly, companies that utilized BDA saw better environmental results, such as reduced waste, along with economic benefits from more efficient green practices. This research highlights the strategic importance of combining BDA with an environmental focus, especially in emerging markets (Waqas & Tan, 2022).

Mehmood et al. (2023), investigated how Big Data Analytics (BDA) can create a green competitive advantage (GCA) through green innovation (GI) in 397 manufacturing companies. By analyzing time-lagged data, the research showed that BDA significantly boosts GI, which in turn positively influences GCA. Additionally, it was found that having a green organizational identity (GOI) strengthens the connection between GI and GCA, acting as an important moderator. These insights emphasize the role of BDA in achieving both environmental and economic benefits when it aligns with corporate sustainability values. This study fills a crucial gap by illustrating how data-driven innovation can lead to a unique position in the market (Mehmood et al.,2023).
Zameer et al., 2024, in this research they explored how big data capabilities can boost a company's green competitive advantage by enhancing organizational learning and green marketing skills. Additionally, big data capabilities played a moderating role, strengthening the connection between organizational learning and green

marketing, which in turn amplified the indirect effects. The study highlighted the game-changing impact of big data on sustainable business practices, providing valuable insights for companies looking to use data-driven strategies to meet their environmental and competitive objectives (Zameer et al., 2024).

Olajiga et al. (2024), they put forward an innovative framework aimed at harnessing data analytics within energy companies to drive strategic business success. They pointed out that by incorporating machine learning, predictive modeling, and real-time analytics, organizations can streamline their operations—think asset management, supply chains, and demand forecasting while also reducing risks in the ever-changing energy landscape. A key takeaway from the study is the importance of aligning analytics efforts with the company's culture and leadership to promote data-driven decision-making. Ultimately, their framework positions data analytics as a game-changing resource for boosting operational efficiency, enabling predictive maintenance, and enhancing competitive agility in the energy market (Olajiga et al., 2024).

Research Methodology

This study takes a mixed-methods approach, blending both qualitative and quantitative techniques to delve into how big data analytics can bolster business sustainability. On the qualitative side, we look at case studies from industry giants like Amazon, Netflix, and Walmart, alongside a thorough literature review to pinpoint trends, challenges, and best practices in adopting big data for sustainability. The quantitative aspect involves analyzing the performance of the developed framework. We asked the professionals executive managers in big data analytics about the framework's effectiveness; we employ thematic analysis for the qualitative insights and use statistical tools for the quantitative data. The research spans thirteen months and is organized into several phases: literature review, case study analysis, data collection, sustainability impact assessment, and write-up reporting. The developed framework evaluated accorindg to selected criteria like framework accuracy, scalability, easy of use, technical components, Data Quality and Integrity, and Performance and Speed.

Research Model and Framework Design

Designing a framework structure for Big Data Analytics in business organizations entails identifying the critical layers, components, and procedures that convert big data into usable business insights. Figure (3) illustrates the main components of the design structure for the developed framework of big data analytics.

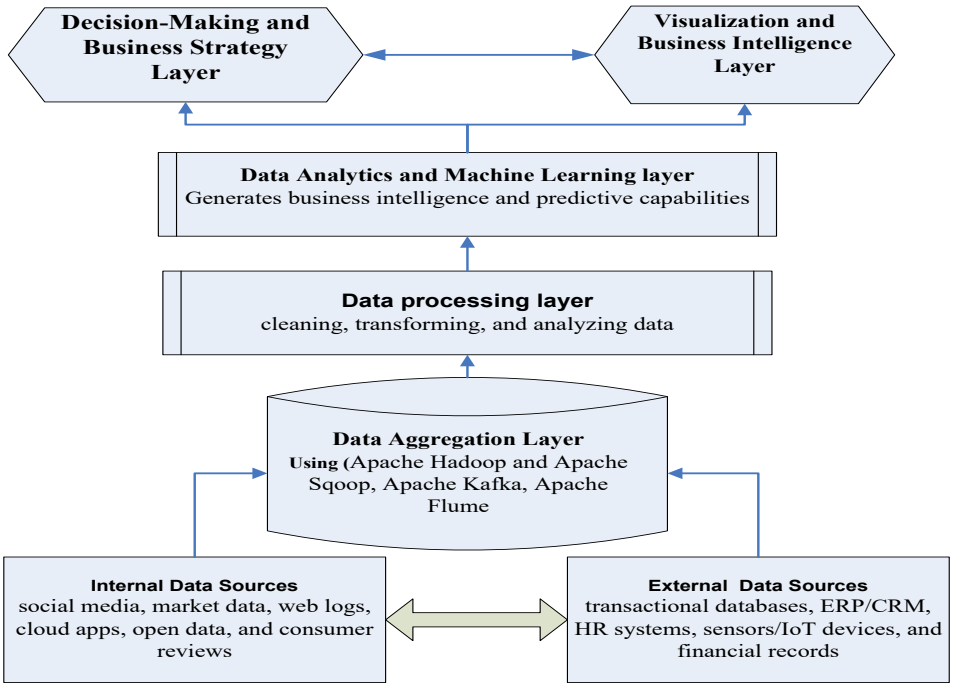

Figure 3. the developed framework structure of big data analytics

The process starts with the data sources layer, which collects structured, semi-structured, and unstructured data from both internal systems like ERP, CRM, and IoT devices and external settings like social media platforms,

market feeds, and open data repositories. These different datasets enter the system via the data ingestion layer, which controls both real-time and batch data flows with tools like Apache Kafka, Flume, and Hadoop. Then, data is structured and preserved at the data storage layer, which often uses scalable distributed storage systems like Hadoop Distributed File System (HDFS), NoSQL databases, or cloud-based data lakes. To ensure usability, the data processing layer cleans, transforms, and integrates data with batch and stream processing tools such as Apache Spark, Flink, and Storm.

The analytics and machine learning layer is the main focal point of the architecture, utilizing descriptive, predictive, and prescriptive analytics to extract business intelligence. Machine learning models, artificial intelligence algorithms, and statistical techniques improve the ability to identify patterns, forecast trends, and make data-driven decisions, subsequently, the insights gained are sent to the decision-making and strategy layer, where managers and executives use them to optimize operations, tailor consumer experiences, detect dangers, strengthen supply chains, and ensure long-term business viability. These framework design procedures can be summarized in the following steps:

(1) Data Sources Layer

Diverse data from internal and external sources flow into the analytics system, which serves as the framework's core. Internal sources include transactional databases, ERP/CRM, HR systems, sensors/IoT devices, and financial records. And the External sources include social media, market data, web logs, cloud apps, open data, and consumer reviews.

(2) Data Aggregation Layer

This layer is responsible for gathering, importing, and streaming data from various sources.

- Tools for batch processing include Apache Hadoop and Apache Sqoop.
- Real-time streaming tools include Apache Kafka, Apache Flume, and AWS Kinesis.

(3) Data Storage Layer

A scalable, distributed platform for storing enormous amounts of data. Example, Hadoop Distributed File System (HDFS). Also, Databases include NoSQL (MongoDB, Cassandra, HBase) and Relational (PostgreSQL, MySQL) and Data warehouses include Snowflake, Redshift, and BigQuery.

(4) Data Processing Layer

The core of analytics is in charge of cleaning, transforming, and analyzing data, At this phase more actions are done like the following procedures :

- Data preparation includes cleansing, normalization, and feature engineering.
- Extract, Transform, and Load (ETL) tools include Talend, Informatica, and Apache NiFi.
- Batch processing with Apache Hadoop and Spark

(5) The Analytics and Machine Learning layer

In this phase, it generates business intelligence and predictive capabilities through the following analysis.

- Descriptive Analytics includes historical reporting and dashboards.
- Diagnostic analytics for root cause analysis.
- Predictive analytics using TensorFlow, PyTorch, and Spark MLlib.

(6) Visualization and Business Intelligence Layer
It converts results into insights for decision-makers to be more useful for strategic decisions.

- Tools include Tableau, Power Bi and Looker.
- Functions include dashboards, scorecards, trend analysis, and forecasting charts.
- Create user-friendly reports for managers, executives, and stakeholders.

(7) Decision-Making and Business Strategy Layer

This is the final phase to translating data analytics insights into business value to achieve business objectives and sustainability, it also include:

- Applications include customer segmentation and customization.
- Optimize the supply chain.
- Fraud detection and risk management.
- Strategic planning and sustainability efforts.

Research Results

In this section, the results of measuring the effectiveness of the developed research BDA framework will be illustrated, also the results of applying big data analytics of the selected case studies are displayed. Regarding the effectiveness of the developed BDA framework, the executive managers of selected companies and institutions was asked to evaluate the framework from their practical experience, the evaluation of the framework effectiveness based on these criteria:

- The existence of Comprehensive technical components of the framework,
- Framework flexibility of use,
- Achieving Data Quality and Integrity,
- Scalability which the framework's ability to handle increasing data volumes and growing,
- Framework Performance and Speed,
- Framework Accuracy to make processing correctness and precision of the analytics results)

The responses collected from the executive managers showed very good effectiveness for the developed BDA framework as illustrated in Figure (4).

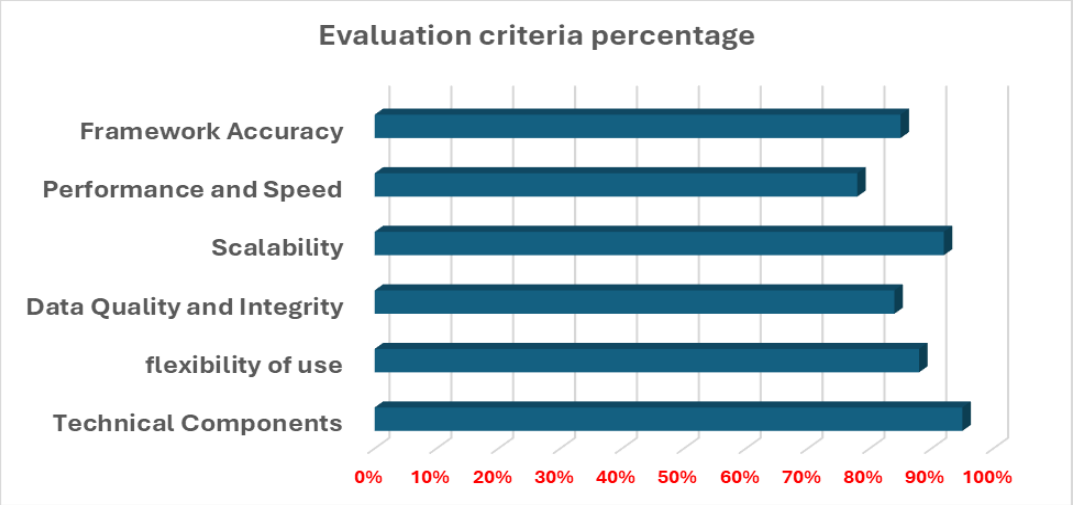

Figure 4. The evaluation criteria for the research framework

Secondly, the analysis of the research case studies shows high benefits and advantages of depending on big data analytics in business companies to achieve business sustainability and keeping the company market share according the following results for the big companies (Amazon, Netflix and Walmart).

Amazon - Leveraging Big Data for Enhanced Customer Experience and Operational Efficiency

Amazon leverages big data analytics to enhance customer experience and operational efficiency, directly contributing to its long-term business sustainability. By analyzing customer behavior, supply chain data, and market trends, Amazon achieves:

Revenue Growth

- Personalized recommendations drive 35% of total sales
- Dynamic pricing optimizes profit margins

Operational Efficiency

- Supply chain analytics reduce delivery times from 3 days to same/next-day
- Inventory management systems cut costs by 20%

Sustainable Competitive Advantage

- Customer sentiment analysis improves product quality & reduces returns
- Data-driven logistics minimize energy waste in fulfillment centers

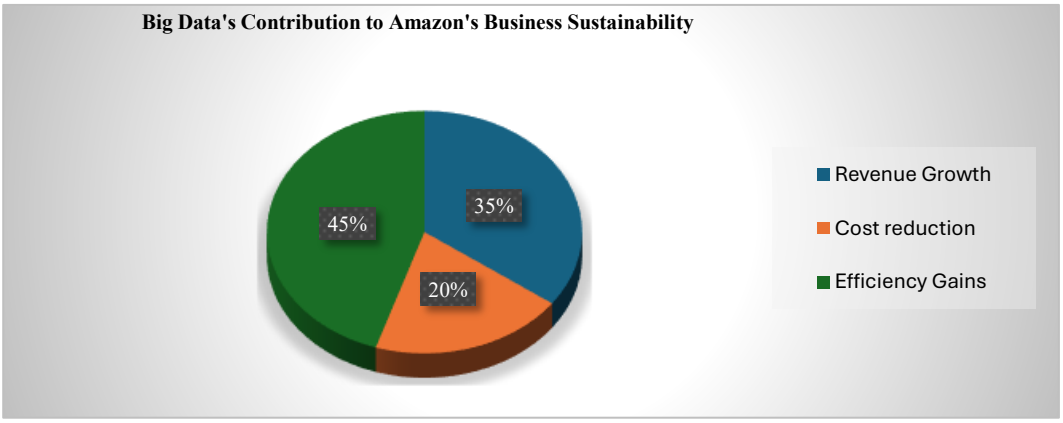

Figure 5. Big data's contribution to Amazon's business sustainability

Segments as illustrated in Figure (5):
Revenue Growth (35%) – Blue – Personalized recommendations driving sales
Cost Reduction (20%) – Orange – Supply chain optimization savings
Efficiency Gains (45%) – Grey – Faster deliveries + reduced waste
35% of Amazon's sustainability comes directly from data-driven revenue streams

Netflix - Using Big Data to Revolutionize Content Creation and Personalization

Netflix is shaking things up in the entertainment world by harnessing the power of big data. They use analytics not just to deliver content, but also to create it and keep their viewers coming back for more. Their recommendation system, which relies on cutting-edge machine learning, influences a whopping 80% of what people choose to watch. This data-driven approach has led to the creation of popular originals like House of Cards. By closely examining how users interact with their platform like when they pause or rewind shows Netflix has managed to cut subscriber churn by 25% with smart engagement strategies. On the operational side, they've optimized bandwidth by 20% through forecasting peak usage, and their investments in original content have paid off big time, yielding a 300% return on investment. Thanks to these innovative strategies, Netflix has skyrocketed to over 230 million subscribers and continues to lead the market.

This case demonstrates how big data enables sustainable competitive advantage in the digital entertainment industry as shown in Figure (6).

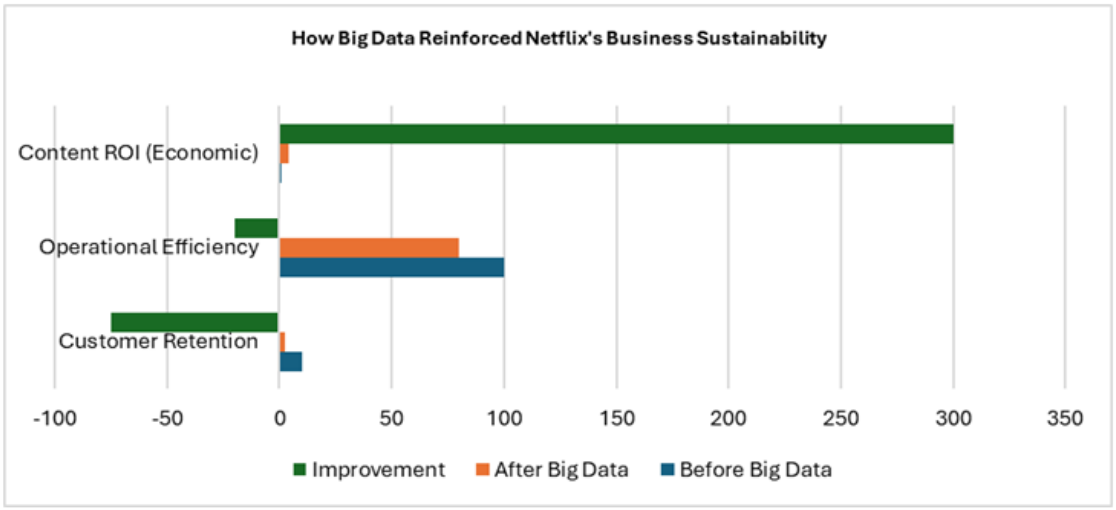

Figure 6. Netflix big data usages to improve three key business areas

Customer Retention

- Before: 10% of subscribers left monthly
- After: Only 2.5% leave now
- Improvement: 75% better

Operational Efficiency

- Before: Full bandwidth usage
- After: 20% less bandwidth needed
- Improvement: Smoother streaming

Economic Growth

- Before: $1 million profit per show
- After: $4 million profit per show
- Improvement: 300% more profitable

Case Study: Walmart - Optimizing Retail Operations and Enhancing Customer Experience

Walmart is really shaking things up in the retail world by using big data analytics to enhance everything from operations to supply chain management and customer interactions. Their unique Retail Link system processes millions of transactions every day, allowing for real-time inventory tweaks that help cut down stockouts by 30% and reduce overstock costs by 25%. Plus, their dynamic pricing algorithms, which are powered by competitor insights and demand data, not only drive sales but also help them stay ahead in pricing. By diving into customer buying habits, Walmart has managed to achieve a 20% boost in campaign conversion rates. Working closely with suppliers and sharing data has led to a 15% drop in logistics costs and faster delivery times. All these innovations have played a key role in keeping Walmart at the top as the world's largest retailer, raking in an impressive $611 billion in revenue for 2023.

As analysis in Figure 7, which illustrates the impact of Big Data Analytics on Walmart's approach to business sustainability. This clustered column chart highlights three important sustainability metrics, comparing the numbers before and after Walmart embraced big data solutions:

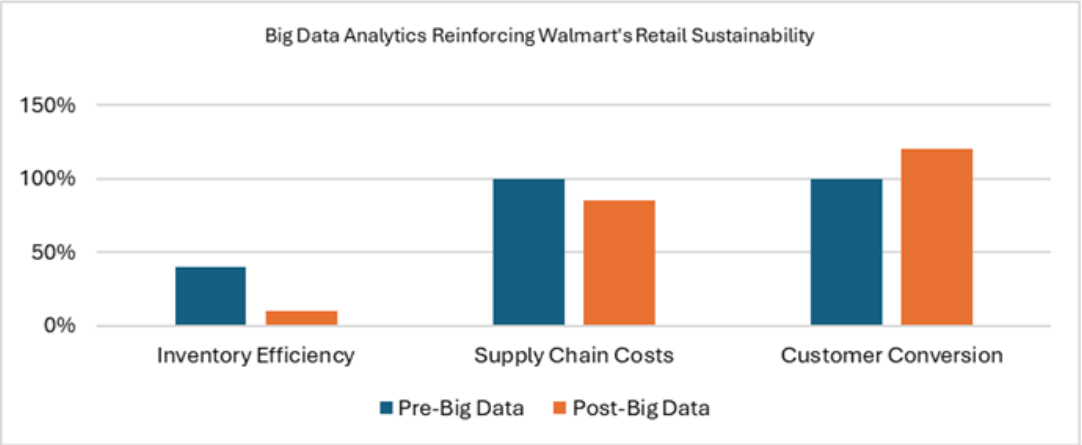

Figure 7. The impact of big data analytics on Walmart's

Inventory Efficiency (Red)

- Stockout rates dropped from 40% to 10%, a 30% reduction
- Achieved through predictive demand forecasting

Supply Chain Costs (Blue)

- Operational costs decreased from 100% baseline to 85%
- Represents 15% savings via logistics optimization

Customer Conversion (Green)

- Marketing effectiveness increased by 20% (100% → 120%)
- Driven by personalized promotions using purchase history

This visual clearly shows how big data enhances all three pillars of Walmart's business sustainability operational (inventory), economic (costs), and customer-facing (conversions). The most notable improvement was in inventory management, with a remarkable 30% reduction in stockouts. This underscores the crucial role big data plays in minimizing lost sales and cutting down on waste.

Results Discussions and Analysis

This study examines how major companies use big data analytics to strengthen their long-term business sustainability. Our deep dive into Amazon, Netflix, and Walmart highlights how big data analytics fuels sustainable business growth. These industry giants demonstrate that leveraging data-driven strategies can enhance financial performance, streamline operations, and positively impact the environment all at once. Take Amazon, for instance. They harness customer data to fuel recommendations that account for a whopping 35% of their total sales. Their systems are so advanced that they adjust prices in real-time to keep up with the competition. By analyzing supply chain data, Amazon has managed to slash delivery times from three days down to same-day for many orders, all while cutting costs by 20%. Their route optimization efforts have also saved 15% in fuel costs, proving that data can benefit both profits and the planet. Then there's Netflix, which keeps its audience hooked through data insights.

A staggering 80% of the content viewers watch comes from its recommendations. This strategy has led to a remarkable 75% drop in customer cancellations, going from 10% to just 2.5% monthly. Their data-driven decisions on content have paid off handsomely, with hits like House of Cards yielding returns of 300%. Plus, by predicting viewing patterns, Netflix uses 20% less bandwidth. Walmart's Retail Link system is another great example, tracking millions of transactions daily to enhance operations. This system has cut out-of-stock items by 30% and reduced excess inventory costs by 25%. Improvements in the supply chain have lowered expenses by 15% while speeding up delivery times. By utilizing customer data, Walmart has also made its marketing campaigns 20% more effective. Despite their successes, all three companies face common challenges. Building

these sophisticated data systems requires significant investment, and safeguarding customer privacy is paramount.

Employees must also be trained to effectively use these tools, and upgrading outdated computer systems can be quite a hurdle. Each industry applies data in its own unique way: - Retail (Walmart) hones in on inventory and pricing- Streaming (Netflix) focuses on enhancing content and customer retention. E-commerce (Amazon) optimizes delivery and personalized recommendations Looking to the future, companies that successfully blend big data with emerging technologies and invest in employee training are likely to keep their competitive edge. The evidence is clear: smart data utilization strengthens every facet of business sustainability financial, operational, and environmental.

Research Conclusion

- This research demonstrates the significant role of Big Data Analytics (BDA) in strengthening the business sustainability of enterprises. By enabling organizations to collect, process, and analyze massive volumes of structured and unstructured data, BDA empowers decision-makers to identify patterns, optimize operations, and anticipate market shifts.
- The research has developed a suitable framework for working with big data analytics to achieve business sustainability.
- The research deep dive into Amazon, Netflix, and Walmart highlights how big data analytics fuels sustainable business growth. These industry giants demonstrate that leveraging data-driven strategies can enhance financial performance, streamline operations

Scientific Ethics Declaration

*The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the authors.

Conflict of Interest

*The authors declare that they have no conflicts of interest

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References

Ahmed, E., Yaqoob, I., Hashem, I. A. T., Khan, I., Ahmed, A. I. A., Imran, M., & Vasilakos, A. V. (2017). The role of big data analytics in Internet of Things. *Computer Networks, 129*, 459-471

Banerjee, A., Bandyopadhyay, T., & Acharya, P. (2013). Data analytics: Hyped up aspirations or true potential?. *Vikalpa, 38*(4), 1-12

Brunswicker, S., Bertino, E., & Matei, S. (2015). Big data for open digital innovation–a research roadmap. *Big Data Research, 2*(2), 53-58

Chawda, R. K., & Thakur, G. (2016, March). Big data and advanced analytics tools. *2016 symposium on colossal data analysis and networking (CDAN)* (pp. 1-8). IEEE

Côrte-Real, N., Oliveira, T., & Ruivo, P. (2017). Assessing business value of big data analytics in European firms. *Journal of Business Research, 70*, 379-390.

Erevelles, S., Fukawa, N., & Swayne, L. (2016). Big Data consumer analytics and the transformation of marketing. *Journal of Business Research*, *69*(2), 897-904.

Ertz, M., Latrous, I., Dakhlaoui, A., & Sun, S. (2025). The impact of big data analytics on firm sustainable performance. *Corporate Social Responsibility and Environmental Management, 32*(1), 1261-1278Ertz,

M., Latrous, I., Dakhlaoui, A., & Sun, S. (2025). The impact of big data analytics on firm sustainable performance. *Corporate Social Responsibility and Environmental Management, 32*(1), 1261-1278

Fahmideh, M., & Beydoun, G. (2019). Big data analytics architecture design:An application in manufacturing systems. *Computers & Industrial Engineering, 128*, 948-963

Gandomi, A., & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. *International Journal of İnformation Management, 35*(2), 137-144

Gupta, M., & George, J. F. (2016). Toward the development of a big data analytics capability. *Information & Management, 53*(8), 1049-1064

Günther, W. A., Mehrizi, M. H. R., Huysman, M., & Feldberg, F. (2017). Debating big data: A literature review on realizing value from big data. *The Journal of Strategic Information Systems, 26*(3), 191-209

Kubina, M., Varmus, M., & Kubinova, I. (2015). Use of big data for competitive advantage of company. *Procedia Economics and Finance, 26*, 561-565

Lee, I. (2017). Big data: Dimensions, evolution, impacts, and challenges. *Business Horizons, 60*(3), 293-303

Mehmood, K., Kiani, A., & Rashid, M. D. (2025). Is data the key to sustainability? The roles of big data analytics, green innovation, and organizational identity in gaining green competitive advantage. *Technology Analysis & Strategic Management, 37*(5), 494-508

Olajiga, O. K., Olu-lawal, K. A., Usman, F. O., & Ninduwezuor-Ehiobu, N. (2024). Data analytics in energy corporations: Conceptual framework for strategic business outcomes. *World Journal of Advanced Research and Reviews, 21*(3), 952-963

Oussous, A., Benjelloun, F. Z., Ait Lahcen, A., & Belfkih, S. (2018). Big Data technologies: A survey. *Journal of King Saud University-Computer and Information Sciences, 30*(4), 431-448

Park, G., Park, S., Khan, L., & Chung, L. (2017, February). IRIS: A goal-oriented big data analytics framework on Spark for better business decisions. *2017 IEEE International Conference on Big Data and Smart Computing (BigComp)* (pp. 76-83). IEEE

Rehman, M. H., Chang, V., Batool, A., & Wah, T. Y. (2016). Big data reduction framework for value creation in sustainable enterprises. *International Journal of Information Management, 36*(6), 917-928

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

Tekiner, F., & Keane, J. A. (2013). Big data framework. *2013 IEEE İnternational Conference on Systems, Man, and Cybernetics* (pp. 1494-1499). IEEE

Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J. F., Dubey, R., & Childe, S. J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research, 70*, 356-365

Waqas, M., & Tan, L. (2023). Big data analytics capabilities for reinforcing green production and sustainable firm performance: The moderating role of corporate reputation and supply chain innovativeness. *Environmental Science and Pollution Research, 30*(6), 14318-14336

Xie, K., Wu, Y., Xiao, J., & Hu, Q. (2016). Value co-creation between firms and customers: The role of big data-based cooperative assets. *Information & Management, 53*(8), 1034-1048

Zameer, H., Wang, Y., & Yasmeen, H. (2024). Strengthening green competitive advantage through organizational learning and green marketing capabilities in a big data environment: a moderated-mediation model. *Business Process Management Journal, 30*(6), 2047-2072

Ziora, A. C. L. (2015). The role of big data solutions in the management of organizations. Review of selected practical examples. *Procedia Computer Science, 65*, 1006-1012

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