



Original Article

Big Data Analytics in Business Decision-Making

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Manuscript ID:

IBMIIIRJ -2025-020738

Submitted: 15 June 2025

Revised: 04 July 2025

Accepted: 20 July 2025

Published: 31 July 2025

ISSN: 3065-7857

Volume-2

Issue-7

Pp. 182-185

July 2025

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Quick Response Code:



Web: <https://ibrj.us>



DOI: 10.5281/zenodo.17066810

DOI Link:

<https://doi.org/10.5281/zenodo.17066810>



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Abstract

Big Data Analytics has emerged as a transformative tool for improving organizational decision-making by leveraging vast and diverse datasets. This paper explores the fundamental characteristics of big data, particularly the five Vs—Volume, Velocity, Variety, Veracity, and Value—along with the tools and techniques such as Hadoop, Spark, SQL, and cloud computing that support large-scale data processing. It examines the differences between traditional and big data analytics, outlining how advanced methods like machine learning, data mining, and predictive modeling enhance business intelligence. The study further discusses the decision-making process, including data collection, integration, analysis, and application, supported by four main data analysis approaches—descriptive, diagnostic, predictive, and prescriptive. Research methodologies in big data, including quantitative, qualitative, and mixed methods, are highlighted alongside popular techniques such as A/B testing, regression, NLP, clustering, and time-series analysis. The paper also evaluates the challenges of big data, including issues of volume, velocity, variety, veracity, and value, while emphasizing ethical considerations in its use. Finally, it underscores the benefits of big data in providing accurate insights, forecasting opportunities, improving customer understanding, and enhancing adaptability to market dynamics. The findings suggest that when effectively implemented, big data analytics empowers businesses to make more evidence-based, strategic, and competitive decisions.

Keywords: Associated with Big Data include the five Vs (Volume, Velocity, Variety, Veracity, and Value), along with specific tools and techniques like Hadoop, Spark, and SQL. Data mining, data warehousing, and cloud computing are also

Introduction

Big data can benefit any organization that is ready to use it. Since data must be collected, protected, and used carefully, it can be expensive for industries that are not experienced in handling information securely. This is why finance and health have been leaders in adopting newer data technologies. They have set the stage for tools that even smaller industries can use.

Finance

Credit card companies flag transactions that fall outside usual spending patterns to identify and decrease potentially fraudulent transactions. Financing companies use machine learning to find the right monthly loan payment amount for each borrower and make sure they can continue to pay on time.

Healthcare

The realm of big data analytics is reshaping organizational operations in a multitude of industries. Yet, the most substantial influence may be seen in the area of medicine, where cutting-edge health care analytics has the potential to fundamentally change patient care.

Differences between big data and traditional data

Traditional data consists of information that can be easily organized and stored in straightforward databases, such as spreadsheets or small computer systems. Examples include customer names, phone numbers, and sales records. In contrast, big data is significantly larger and more intricate. It encompasses vast quantities of information from a variety of sources, including social media, online videos, machine sensors, and website interactions. Big data analytics uses methods like machine learning and data mining to pull information from complex data sets.

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How to cite this article:

Yede, S. B., & Shinde, A. B. (2025). Big Data Analytics in Business Decision-Making. *Insight Bulletin: A Multidisciplinary Interlink International Research Journal*, 2(7), 182–185. <https://doi.org/10.5281/zenodo.17066810>

Decision-making process

Data collection.

Data is sourced from various places, including existing onsite databases, historical sales data, e-commerce tools and plugins, social media channels, and customer conversations with support reps.

Data integration.

Each source has its own data type and different formats, including structured and unstructured data. This data must be unified or changed to a common format to be used by different tools. With one body of data to access, better insights can be gained.

Data analysis.

This is the brain of the decision-making process. Technology, usually in AI-powered software as a service tools, sorts through the data to find useful trends and patterns.

Decision-making.

They can then choose what's best for their organization and what actions to take next. These decisions rely more on evidence than on instinct or immediate circumstances since the data is historical and can show years of trends to draw from.

Four main data analysis methods

Descriptive analytics

The phase of data analysis that addresses "what happened." This stage emphasizes the summarization and description of historical data to comprehend its fundamental characteristics.

Diagnostic analytics

This is the stage that seeks to answer "why it happened." Through an in-depth examination of the data, diagnostic analytics uncovers the underlying patterns and trends identified in descriptive analytics.

Predictive analytics

This stage focuses on "what will happen." It employs historical data, statistical modeling, and machine learning techniques to project future trends.

Prescriptive analytics

Prescriptive analytics represents the third and concluding phase of business analytics, which encompasses both descriptive and predictive analytics. Often described as the "final frontier of analytic capabilities", prescriptive analytics involves the utilization of mathematical and computational sciences, providing recommendations for decision-making on how to leverage the outcomes derived from the descriptive and predictive phases.

Research methodologies in big data analytics

Quantitative methods

This approach primarily focuses on numerical data and employs statistical methods and tools to analyze large datasets.

Qualitative methods

This approach focuses on non-numerical data like text, images, and audio to understand opinions, concepts, or experiences.

Mixed methods research

Combines elements of both quantitative and qualitative research to gain a more complete understanding of the research question.

Big Data Analysis Techniques?

A/B Testing

A/B testing involves comparing a control group with a test group to identify which variable modifications yield the most favorable results. For instance, this analytical approach is frequently employed in email marketing to evaluate various subject lines or images.

Data Mining

Data mining identifies patterns within extensive data sets by applying statistical techniques and machine learning. A significant application of data mining is to analyze customer behavior, enabling the provision of the most suitable products to specific segments of the overall customer database.

Regression Analysis

Regression analysis, as a statistical technique, seeks to ascertain the impact of an independent variable on a dependent variable. It assesses how variations in the independent variable influence changes in the dependent variable.

Natural Language Processing) NLP (

Natural Language Processing) NLP (is a discipline that integrates computer science, artificial intelligence, and linguistics. It enables computers to comprehend, process, and generate human language in a coherent and practical manner. As the volume of textual data from social media, websites, and various other sources continues to increase, NLP is emerging as an essential tool for deriving insights and automating tasks such as text analysis and language translation.

Cluster Analysis

Cluster analysis is employed to uncover patterns from large data sets. It operates by categorizing data elements that share similarities. Additionally, it can provide context to observed trends. Given a vast customer base, comprehending individual behaviors can be challenging.

Time Series Analysis

In this type of analysis, analysts systematically record data points at regular intervals throughout a defined period, as opposed to capturing them sporadically or randomly. Nevertheless, this form of analysis transcends the mere collection of data

over time. What distinguishes time series data from other types of data is its ability to illustrate how variables evolve over time. In essence, time serves as a vital variable, revealing how the data transforms throughout the duration of the data points and influencing the final outcomes. This approach offers an additional layer of insight and establishes a structured order of dependencies among the data.

Best Tools for Data Analysis

When searching for tools for big data analytics, there exists technology that can benefit you. Some of the leading tools are as follows:

Hadoop:

This is an open-source framework capable of handling both structured and unstructured data.

NoSQL Databases:

This acronym stands for "not only SQL" and pertains to non-relational data management systems that are suitable for unstructured data.

Python:

Python is an object-oriented programming language that can be utilized for data analysis.

No-code Automation Solutions:

Instead of needing to possess coding skills, you can opt for a ready-to-use solution featuring drag-and-drop capabilities to fulfill your data analysis requirements. Such tools provide insights in visual formats, making it accessible for everyone to comprehend.

Challenges and ethical considerations

While big data analytics tools offer numerous opportunities for organizations, they also introduce new challenges.

Data Volume

Big data is termed "big" for a reason; as more data sets are generated, collected, and stored, managing the vast quantity of this data can become quite challenging. There are typically financial and time implications associated with its storage and processing, which escalate with the increase in data volume.

Data Velocity

Data holds the greatest value when it is current, yet it is constantly evolving. To maximize the benefits of big data, organizations require tools that can capture data in its most up-to-date form, ranging from social media updates to online shopping behaviors.

Data Variety

Data can be categorized into two types: structured data (organized and defined data that is easily searchable, such as names or email addresses) and unstructured data.

Data Veracity

Asingle inaccurate data source can distort the reliability of an entire data set. This underscores the necessity of vetting data sources, conducting regular audits, and having strategies in place to address data "noise."

Data Value

In an ideal situation, data should be clean, accurate, timely, and user-friendly. Consequently, the value derived from data is often contingent upon the specific use case.

These represent the primary challenges

Advantages and Benefits

Big data presents opportunities for improved decision-making over time. The advantages of utilizing data for business insights encompass:

1. The capability to swiftly adjust to fluctuating market conditions
2. A deeper comprehension of customers, including their behaviors and habits
3. An enhanced accuracy in assessing sales, inventory, or other metrics over time, along with the capacity to generate highly detailed reports and delve into specific information
4. The potential for forecasting opportunities that were unattainable with conventional data methods
5. The capacity to collect data from numerous (or even thousands of) sources and integrate it for a cohesive perspective

Limitations and Challenges of Data Analysis

While automation tools simplify data analysis, your organization may encounter certain challenges, such as:

Lack of Direction

To effectively establish your data analysis methods, it is essential to first have a well-defined set of objectives and business inquiries that you aim to address. This clarity aids in determining the necessary data and establishing the guidelines to adhere to.

Data Visualisation

The insights derived from data analysis are crucial. However, if these insights are not comprehensible, they lose their significance.

Incomplete Communication

Every department and team generally possesses their own set of data, objectives, and strategies. It is essential for all parties to engage in communication and collaboration to achieve common business objectives. By utilizing automation software, all data is centralized and integrated.

Acknowledgment

The authors wish to express their sincere gratitude to Pharate Patil Management Institutes, Mandavgan Pharata, Pune, and Shri Vasantao Pharate Patil Arts, Commerce & Science College, Mandavgan Pharata, Pune, for providing academic support and encouragement during the preparation of this research work.

We also extend our thanks to colleagues and peers from the Departments of BBA/MBA and Commerce for their valuable discussions and constructive feedback. The guidance from mentors and support from institutional resources have been instrumental in shaping this study.

Finally, we acknowledge the encouragement of our families and well-wishers, whose constant support has been a source of motivation throughout this research journey.

Financial Support and Sponsorship

Nil

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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