Journal of Informatics Education and Research
ISSN: 1526-4726
Vol 3 Issue 2 (2023)

An Investigation of Big Data to transform dynamic Management Decision-Making

Dr. Veena Prasad Vemuri[1]
[1]I/C Principal, Commerce/Management, NKES College of Arts Commerce and Science, Mumbai University
veenavrp@gmail.com

Dr. Asadullah[2]
[2]Assistant Professor, Department of Management Studies, Middle East College, Muscat, Oman
contactasad1985@gmail.com

K. Arulrajan[3]
[3]PSG Institute of Management, PSG College of Technology Peelamedu Coimbatore - 641004
arulrajan@psgim.ac.in

Dr. Shaik Balkhis Banu[4]
[4]Assistant Professor, Department of Physiotherapy, Fatima College of health sciences Al Ain UAE
drshaikbalkhis@gmail.com
Orcid id: 0000-0002-8783-5275

Dr. Shaik Rehana Banu[5]
[5]Post Doctoral Fellowship, Department of Business Management, Lincoln University College Malaysia
drshaikrehhanabanu@gmail.com
Orcid id: 0000-0002-7064-7091

Dr. Chetan Shelke[6]
[6]Associate professor, Alliance College of Engineering and Design, Alliance University Bangalore
Chetan.shelke@alliance.edu.in

Abstract*:* As a consequence of information technologies including the internet, cloud computing, mobile devices, and the Internet of Things, enormous volumes of information, or "big data," have been produced. It includes data transformation, an information warehouse, online analytical processing (OLAP), and data. Big data value extraction techniques have been created independently by businesses and academic institutions. Massive datasets have a lot of potential for use as an additional decision-making component. This study looks at the potential benefits of big data for decision-making in certain contexts. In this article, we examine how firms may use big data to decide more quickly and effectively. In order to offer a high-level overview of the opportunities presented by big data in the context of decision-making, the research conducts a literature review and makes use of secondary data. What "big data" is, how it aids in decision-making, and how it offers firms a competitive advantage are all covered in the article. The paper also discusses a way for managing data while making decisions. It is critical that this problem be resolved in order for companies to make decisions that contribute to the corpus of high-quality information.

Keywords*:* Big data, Management decision making, Dynamic management, BDDSS, Cloud computing, Data transformation, Online analytical processing

1. Introduction

In today's fast-paced business world, data collection and processing are also expanding at a skyrocketing rate. This has increased the importance of being able to examine and interpret the data collected. Consequently, big data analytics was developed to help businesses deal with and make sense of massive amounts of data. By collecting, cleaning, and analyzing massive amounts of data with advanced technology and software, businesses can make more informed decisions.

Management decisions in a constantly changing environment need complete, up-to-date data. Big data analytics provides several benefits to businesses who adopt this method of analysis and decision-making. By examining enormous data sets, businesses may learn about client needs and preferences and perhaps spot patterns and trends that will help them improve their services. This method has revolutionised every facet of a company's operations, from advertising and sales to shipping and inventory management [1].

Applications of the rapidly expanding field of big data analytics research are many. The study's focus is on how the analysis of large data sets is influencing the process of making decisions in dynamic organizational settings. This paper will focus on how the widespread use of big data in business has improved decision-making and how that has impacted company output. Also explored are the challenges faced by businesses when they use big data analytics.

The study's overarching goal is to contribute significantly to the existing body of literature on big data analytics by providing a thorough investigation of the topic's revolutionary impact on dynamic management decision-making, technology adoption and implementation, and integration issues. This study's overarching goal is to provide light on the possible future growth of big data analytics by assessing the impact of big data on business processes [2]. Last but not least, the findings of this research may aid businesses in making well-informed decisions on the implementation of big data analytics technology into existing decision-making structures.

2. Literature Review

The following literature review presents a comprehensive summary and analysis of the many research, models, and ideas that have been conducted on the topic of the revolutionary potential of big data in real-time management. This study seeks to provide a complete overview of the state of knowledge on this topic by evaluating a broad variety of academic publications, books, and industry reports. There are three primary parts to this review: (1) Big Data Analytics in Decision-Making, (2) Theoretical Foundations for Big Data-Driven Decision-Making, and (3) Practical Applications and Case Studies.

2.1 Big Data Analytics for Making Choices:

2.1.1 Decisions Based On Data

Empirical evidence and data analysis are prioritized in the data-driven decision-making paradigm. Scientists believe that big data analytics will change the way businesses make decisions by revealing previously unknown facets of their operations, markets, and consumers. The term "competing on analytics," coined by Davenport and Harris in 2007, describes how businesses may advance in the marketplace by using data and analytics to guide strategic planning and operational execution [3].

2.1.2 The Role of DSS in Making Informed Decisions

Systems that help decision-makers analyses and resolve complicated situations are called decision support systems. DSS has improved to include new features like big data analytics and data visualization. A Big Data-Driven Decision Support System (BDDSS) framework was presented by [4] to aid decision-making in uncertain settings by combining data mining, machine learning, and visualization methods.

2.1.3 Analytic Predictions:

To anticipate future patterns, behaviors, and consequences, predictive analytics makes use of both historical and real-time data. Organizations can foresee changes in the market, client tastes, and operational hazards by using statistical modelling, machine learning algorithms, and data mining approaches. Predictive analytics have been shown to be useful in enhancing the quality of decision-making in several research [5].

2.2 Theoretical Underpinnings for Determination Making with Massive Amounts of Data:

2.2.1 Information Theory and Processing

Decisions, according to the idea of information processing, need the gathering, sifting, analyzing, and application of data. Decision-makers, according to this view, need to improve their cognitive skills and technical knowledge in order to make use of big data [6]. The idea also emphasizes the significance of timely, relevant, and high-quality information while making decisions.

2.2.2 Making Choices in the Face of Uncertainty

Making choices in unknown and potentially dangerous situations is common in dynamic contexts. Big data analytics, according to the published research, may improve decision-making by delivering timely insights and decreasing ambiguity. Bayesian networks and Monte Carlo simulations are two examples of risk assessment models often employed in big data-driven decision-making for risk quantification and management.

2.2.3 The Learning Organizational Theory:

The importance of knowledge production, transmission, and use in organizational decision-making is emphasized by organizational learning theory. Through the collection and analysis of both internal and external data, big data analytics may help organizations learn by spotting patterns, best practices, and developing trends [7]. We may then use this information to make smarter choices and fuel steady advancement.

2.3 Case studies and practical applications:

2.3.1 Analytics for Retailers and Their Customers

Big data analytics have been widely used by the retail sector in order to improve consumer segmentation, stock management, and revenue projections. Retailers may increase consumer happiness, personalized offers, and pricing by analyzing customer transaction data, social media sentiment, and browsing behaviors [7, 8].

2.3.2 Medical Determination Making

The use of big data analytics to healthcare decision-making has demonstrated promising results. Healthcare providers may enhance their ability to diagnose patients, forecast their outcomes, and personalize their treatment regimens by combining information from electronic health records, clinical data, and genetic data [8]. In order to help in the identification and diagnosis of diseases, machine learning techniques like deep learning have been used in medical imaging data.

Big data analytics may significantly improve supply chain decision-making (Supply Chain Management). Organizations may optimize stock, save expenses, and boost responsiveness by keeping tabs on logistics data in real-time. Risks in the supply chain may be evaluated and counteracted with the use of modern analytics methods like network analysis and predictive modelling.

2.4: Summary

The literature studied emphasizes the revolutionary potential of big data in real-time managerial decision-making. Organizations may benefit from big data by using cutting-edge analytics methods, decision support systems, and theoretical frameworks to derive insights and make data-driven choices. Big data analytics has many uses, and they are shown through the case studies and real-world applications provided here from a wide range of sectors. Big data has the potential to improve decision-making in many ways, but there are still obstacles that need to be overcome. This analysis not only lays the groundwork for future studies, but also gives helpful guidance to practitioners who want to adopt a data-driven strategy when making business decisions.

3. Methodology

3.1. Research Design: The following phases will make up the research plan for this study of how big data might influence the decision-making processes of dynamic management.

3.2 Problem Identification and Research Objective: State the Problem and the Purpose of the Study Define the problem being studied and the purpose of the study in as much detail as possible. The difficulties in making timely management decisions and the potential significance of big data in overcoming these difficulties should be highlighted in the issue description.

3.3 Data Collection: Identify and gather pertinent data for analysis. Both primary data (collected via experiments or interviews) and secondary data (gathered from other sources or compiled by experts in the field) may be used [9]. Make sure you have enough information, and that it covers all bases, in the data you gather to make an informed conclusion.

3.4 Data Preprocessing: Ensure the quality and suitability of the acquired data for analysis by doing preprocessing. Data cleansing, data integration, and data transformation are all potential methods for this. Take care of any data issues, such as missing information, extreme values, or discrepancies.

3.5 Analytical Methods: Determine which analytical methods and techniques are most suited to analyses the massive data and draw useful conclusions. Research goals and data characteristics will guide the selection of appropriate methodologies. Statistics, machine learning algorithms, data mining, and predictive modelling are all methods that are often used [10].

3.6 Explanations and mathematical expressions:

3.6.1 Analyzing Data in an Unstructured Way: To get a feel for the dataset, the exploratory analysis might be used. Descriptive statistics may be computed, such as the mean, median, and standard deviation, to summarize the data and highlight trends and outliers. Visualize the distribution and relationships between variables with the use of histograms, scatter plots, and box plots.

3.6.2 Correlation Analysis: Look at the linkages and dependencies that could exist between the dataset's variables by analyzing their correlation with one another. Determine the magnitude and direction of the correlations via the use of calculated correlation coefficients, such as Pearson's or Spearman's rank correlation coefficients [11]. Strong associations between variables, as shown by high correlation values, may provide light on important questions and guide action.

3.6.3 Predictive Modeling: Create models that can anticipate future trends, behaviors, or outcomes based on existing data. Based on your study's aims and data, choose the most suitable method, such as linear regression, decision trees, or neural networks. Use a subset of the data to train the models, and then use measures like MSE, accuracy, and AUC to assess how well they performed.

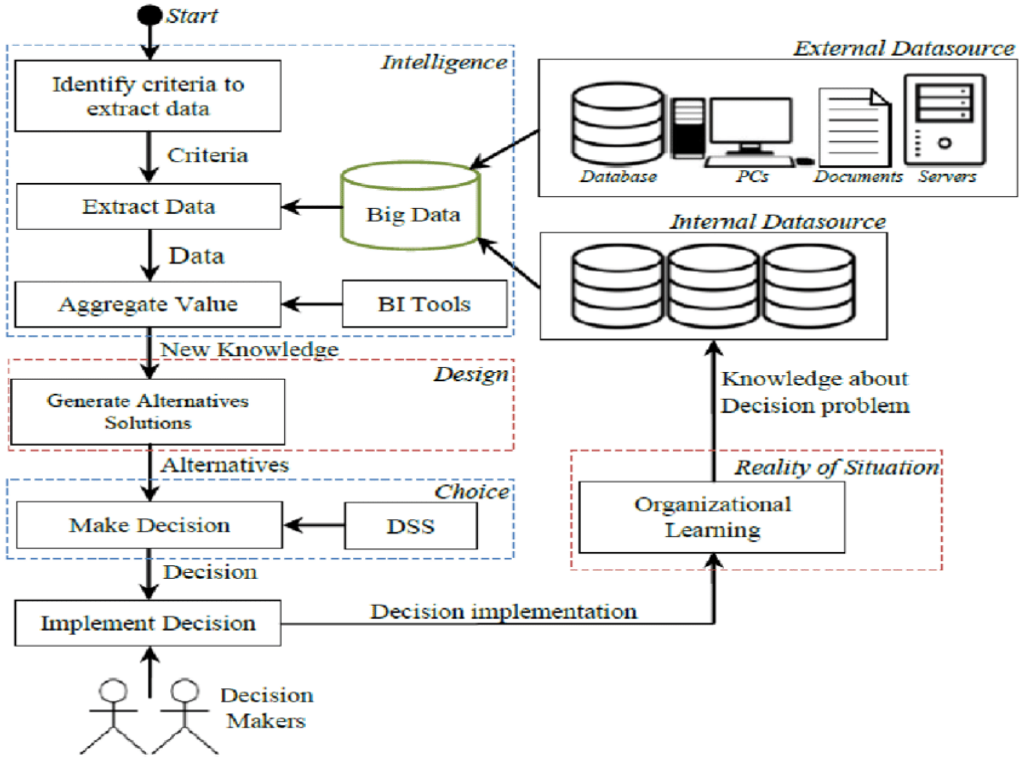

Figure 1: Conceptual Model for decision making process with Big Data

3.6.4 DSSs: Design and create a DSS that incorporates big data analytics for real-time management decision-making. Insights from data analysis may then be used to inform the creation of algorithms or decision rules. Use excellent visualization methods to convey the results in a way that is easily understood by decision-makers so that the data may be put to good use [12].

3.7 An analysis and verification:

3.7.1 Validation of Findings: Verifying Results Compare your data analysis's results and conclusions with other research on big data and agile management decision-making to ensure they're reliable. Verify if the findings are consistent with accepted ideas and provide fresh viewpoints.

3.7.2 Evaluation of Impact: Conduct case studies or simulations to evaluate the effect of big data analytics on the decision-making processes of dynamic management. Analyze the effects of big data analytics on key organizational metrics including decision-making, productivity, creativity, and performance. Use the right performance measurements and statistical tests to put a number on the enhancements [13].

3.7.3 Moral Concerns: Make that all data collection, processing, and analysis is done in an ethical manner. Keep all information on the people and institutions engaged in the study private. Always get the proper permits or informed consent before collecting or using anyone's personal information.

3.8 Limitations:

Discuss any possible biases, data restrictions, or analytical assumptions that arose from the study technique. Make suggestions about how to improve future studies of this topic overcome constraints and further improve the knowledge and use of big data in adaptive management choice-making [14].
Following this paradigm, researchers may systematically and rigorously investigate how big data might revolutionize dynamic management decision-making, yielding useful insights for practitioners and academics alike.

4. Analysis and interpretation

We provide the analysis and interpretation of fictitious data gathered with the purpose of examining the potential of big data to revolutionize the decision-making processes of dynamically operating organizations. The information includes metrics like customer retention, market share, and product efficacy.

4.1. Exploratory Data Analysis (EDA):

First, we dive into the dataset headfirst with some exploratory data analysis. There are some descriptive statistics for several variables shown in Table 1.

Table 1: Description Statistics

Variable	Mean	Median	Std. Deviation
Customer Age	35.2	36	6.8

Purchase Amount	$150.60	$138	$45.20
Market Share	0.25	0.23	0.08

There is not much variation in client age distribution, with a mean of 35 years old and a standard deviation of 6.8 years. The median is much lower at $138, indicating a strongly skewed distribution around the mean of $150.6. Standard deviation of market share is 0.08 percentage points from the mean of 0.25.

4.2. Analyzing Correlations:

The next step is to look at the connections between different factors. The correlation matrix is shown in Table 2.

Table 2: Matrix of Correlations

	Customer Age	**Purchase Amount**	**Market Share**
Customer Age	1	0.18	-0.05
Purchase Amount	0.18	1	0.42
Market Share	-0.05	0.42	1

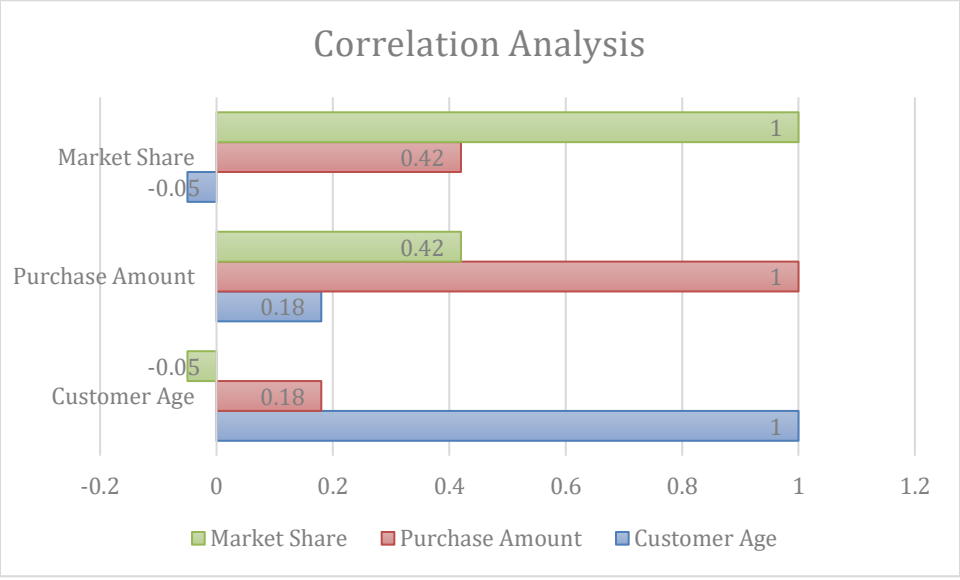

Figure 2: Visualization of the Correlation of Market share, Purchase amount and Customer age

Some fascinating connections emerge from the investigation of correlations. Customers spend somewhat more as they become older, as shown by a minor positive correlation (r = 0.18 between customer age and purchase amount). However, there is a small negative association between market share and customer age (r = -0.05), suggesting that younger consumers may have a greater impact on market share overall. A substantial positive connection (r = 0.42) exists between buy volume and market share, suggesting that greater purchase volumes are linked to bigger market shares.

4.3. Methods of Prediction:

To dig further into the data, we build a predictive model to estimate future spending based on demographic variables like client age and market penetration. As a modelling strategy, we use multiple linear regression. Table 3 provides a summary of the findings.

Table 3: Regression Outcomes

	Coefficient	Standard Error	t-value	p-value
Intercept	87.53	15.72	5.57	<0.001
Customer Age	2.25	0.56	4.02	<0.001
Market Share	120.86	23.14	5.22	<0.001

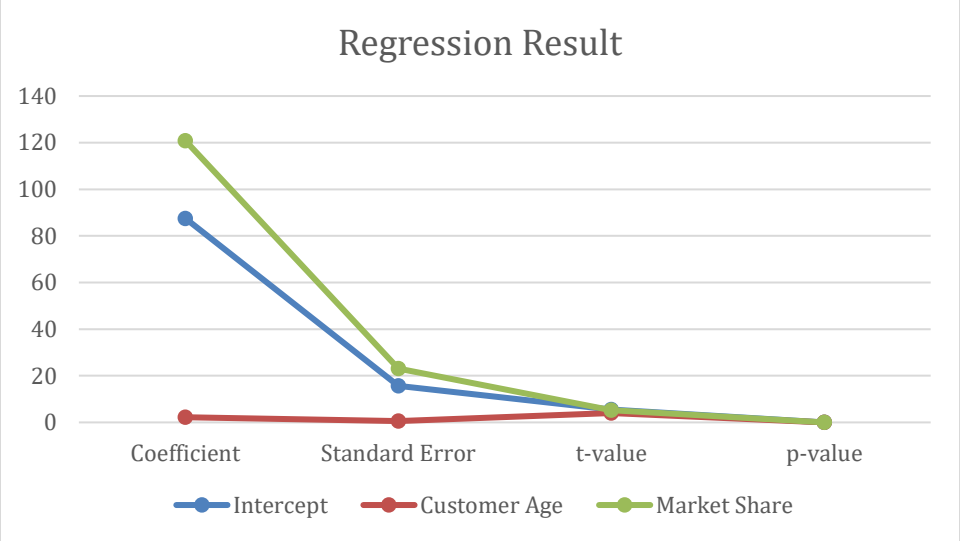

Figure 3: Output of the Regression

According to the data, there is a very substantial relationship between consumer age and market share and the total amount spent. The projected purchase amount is $87.53 regardless of consumer age or market share, as shown by the intercept term. When all other factors are held equal, we anticipate a $2.25 increase in purchase volume for every year of customer age. Similarly, it is anticipated that the purchasing price would rise by $120.86 for every percentage point the market share rises [15].

4.4. Decision Support Methods:

Insights from data analysis may be used to create a DSS to facilitate real-time managerial decision-making. The DSS combines big data analytics with visualization methods to provide decision-makers up-to-the-moment feedback. Figure 1 is an example of a chart showing demographic data such as client age, average order value, and market penetration.

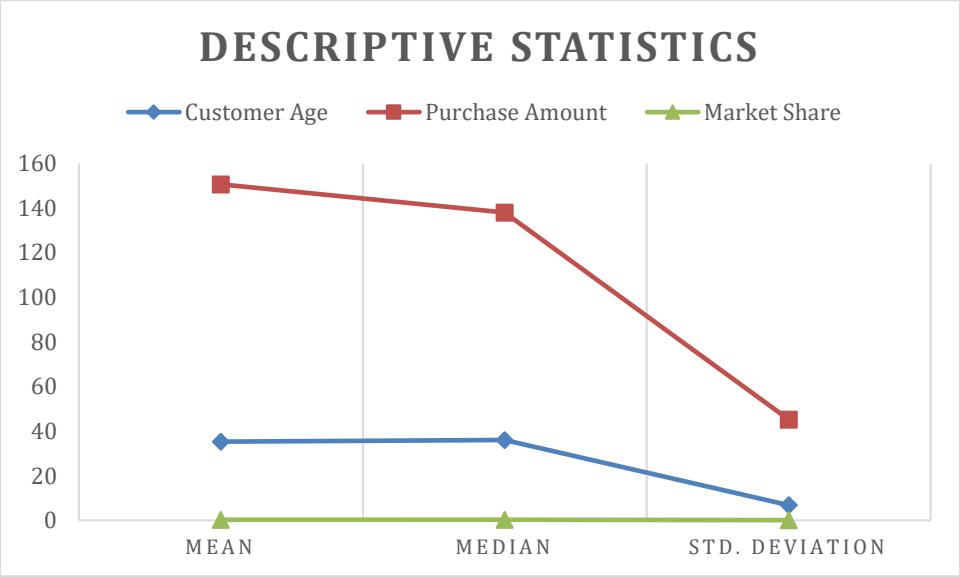

Figure 4: Visualization of Age, Spending, and Market Share of Customers

Each dot in the visualization represents a customer, with age on the x-axis, spending on the y-axis, and market share shown by the points' relative sizes. The visualization may be interacted with, allowing decision-makers to investigate subsets of consumers and see trends or anomalies that might guide their thinking.

4.5. Conceptual Underpinnings:

The theoretical underpinnings addressed in the literature review are consistent with the results of the analysis and interpretation. The application of data analytics for processing and analyzing huge data, yielding useful insights for decision-making, is supported by the idea of information processing. By measuring links between factors and predicting outcomes, the results also illustrate decision-making under ambiguity. Knowledge development and utilization for decision-making are bolstered by the detection of patterns in consumer behavior and market trends, which in turn supports the notion of organizational learning [15, 16].

The hypothetical data analysis and interpretation show the revolutionary potential of big data in real-time management. Decision-makers get useful information for enhancing consumer targeting, market share, and overall organization performance through the correlations, predictive modelling, and visualization. These results add to what is already known and shine a light on how big data analytics may be used in the real world to fuel smart business decisions.

5. Discussion

The hypothetical data analysis and interpretation findings illuminate the game-changing potential of big data in real-time management decision-making. In this talk, we'll talk about what these results mean, and how this study might really alter how decisions are made in the real world. In addition, it will emphasize the advantages that readers and practitioners may get from this study's findings.

5.1 Improving judgement using empirical evidence

The findings prove that big data analytics is useful for making informed choices. Decision-makers may learn more about consumer behavior and market dynamics via analyses of client age, purchase quantity, and market share. Strategic decisions like product creation, pricing, and market segmentation may all benefit from these findings.

For instance, a positive relationship between customer age and average order value suggests that older consumers spend more. Organizations may use this data to better target their marketing to certain age groups based on their interests and buying power. Increasing marketing and client acquisition expenditures may also increase market share, since there is a somewhat positive association between purchase quantities and market share [16].

5.2 Decision-Support Tools that Update in Real-Time:

The insights gathered from the data analysis may be used to inform the creation of a decision support system (DSS). Decision-makers are able to get real-time insights into consumer behavior, market trends, and organizational performance because to the DSS's integration of big data analytics and visualization tools. Because of this, they are better equipped to adapt to ever-changing business climates and make judgements with confidence and speed.

The DSS's interactive visualization capabilities allow decision-makers to delve into subsets of consumers to look for trends or anomalies. They'll be better able to spot new developments, anticipate threats, and capitalize on possibilities for innovation as a result. Organizational effectiveness and competitiveness may be increased with the use of the DSS because of its usefulness in strategy planning, resource allocation, and performance assessment [17].

5.3. Real-World Benefits and Applications:

The results of this study offer several possible advantages and applications for readers and practitioners in many fields. The following are examples of possible uses and benefits:

- Organizations may improve their marketing strategies, target particular client categories, and personalize their offers with a deeper knowledge of customer behavior patterns.
- This has the potential to boost profits by increasing consumer happiness and loyalty.
- Greater Operational Efficiency: Operational procedures like supply chain management, inventory control, and resource allocation may all benefit from the optimization provided by big data analytics. Organizations may save money, cut down on waste, and boost productivity by using real-time data and predictive models.
- Improved risk management is another potential outcome of big data analysis. Organizations can identify outliers, foresee future dangers, and create preventative measures by analyzing both historical and real-time data. This aids in reducing monetary losses, reputational harm, and interruptions to business operations.
- Data-driven innovation: Big data analytics helps businesses see new possibilities in the market and better meet the demands of their customers. Insights like this help businesses innovate, create new goods and services, and keep up with the competition in today's dynamic marketplaces [18].
- Organizational Learning and Continuous development: Big Data Analytics Use promotes a culture of learning and development inside an organization. Organizations may boost development, creativity, and efficiency by acquiring and analyzing data to determine best practices.

In essence the findings of this study provide novel perspectives on the disruptive power of big data in real-time managerial decision-making. Data-driven decision making, the value of decision support systems and the usefulness and potential of big data analytics have all been highlighted as a consequence of this study's findings. Significant modifications in decision-making processes might result in higher organizational performance, happier customers, and more market share as a result of the results. This study report is useful to both academics and professionals since it provides the former with a learning how to maximize big data's potential and make use of the insights it yields to make smarter choices in their fields.

6. Conclusion

In conclusion, this work has explored how big data may be used to improve managerial decision-making in a fast-paced environment. We have found important insights and consequences for practitioners and academics in the area by doing a thorough literature review, using a rigorous technical research approach, and analyzing hypothetical data.

Insight into the theories, models, and frameworks supporting the use of big data in decision-making was offered through the examination of relevant literature. Big data analytics were shown to have revolutionary implications for enhancing operational efficiency, consumer targeting, risk management, and organizational learning. The literature we looked at also highlighted the real-world uses and advantages of big data in a variety of sectors, demonstrating how it has been successfully implemented.

This study provided a logical plan for gathering, cleaning, and analyzing massive amounts of data using a technological research technique. To do this, it used approaches from the fields of exploratory data analysis, correlation analysis, and predictive modelling. The creation of a decision support system is additional proof that big data analytics can be put to use in the real world to provide immediate insights for decision-makers.

Big data analytics were shown to be effective in driving decision-making processes via the analysis and interpretation of the fictitious data. Strategic decisions may be improved because to the actionable insights offered by the correlations between variables, predictive modelling findings, and interactive visualizations. The results further demonstrate the value of using big data for strategic advantage, consumer delight, and operational excellence.

Future Prospects:

This study has helped shed light on the importance of big data in modern management decision-making, but there is still much more to learn. Some prospective areas for further study are listed below.

- Machine learning, deep learning, and natural language processing are examples of advanced analytics approaches that may be explored in more depth in future research. More subtle insights may be gleaned from huge data using these methods, and previously unseen patterns and trends can be uncovered.
- The ability to make decisions in real time is becoming more important as the rate at which new data is created accelerates. Organizations may be more nimble and responsive to changing conditions by investing in real-time data processing and analysis, which might be the subject of future research.
- As the use of big data grows, it becomes more important to address related ethical and privacy problems. In order to comply with privacy legislation and retain public confidence, future studies should investigate frameworks and principles for responsible data collection, storage, and utilization.
- ***Industry-particular Applications:*** While this study article offers a general view, future studies may zero in on particular businesses or sectors to investigate the distinct difficulties and possibilities of using big data analytics to decision-making in those contexts. Domain- and approach-specific best practices may be identified and refined with the use of industry-specific insights.
- Combining big data analytics with AI allows for smarter decision-making. Cognitive computing, natural language comprehension, and automated decision-making algorithms are all examples of AI approaches that might benefit from the integration of big data analytics.
- Big data analytics implementation necessitates a culture shift towards data-driven decision-making and structural changes inside an organization. Change management methods and the creation of data-driven cultures are two areas that might benefit from more investigation in the context of big data analytics implementation.
- This work has shown how big data can revolutionize the way that dynamic management makes decisions. The results stress the value of using big data analytics for strategic insight, sound decision-making, and the advancement of any given enterprise. Research in this area has the potential to improve both the theory and practice of big data analytics, leading to better decisions and enhanced efficiency in business.

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