

IMPLEMENTATION OF BIG DATA ANALYTICS FOR  
BUSINESS DECISION MAKING IN E-COMMERCE

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**Abstarct**

This paper seeks to investigate the role of Big Data Analytics in decision-making in the e-commerce field and the importance of their application, impacts and challenges faced in relation to the digital transformation era. Background of the study The background of the study refers to the rapid development of the e-commerce field in Indonesia where a vast volume of diverse and growing data is produced but not optimized in terms of its utilization in strategic decision-making. Methodology The study will be carried out using qualitative descriptive methodology which means the collection of secondary data through a literature study. Secondary data will be collected through a review of scientific journals, reference books, and scientific articles relating to the topic of investigation. Analysis The analysis will be performed to assess the application of Big Data Analytics and their importance in improving the performance of the business operation. In particular, this study seeks to explore the role of Big Data Analytics in consumer behavior analysis and data-based formulation of marketing strategies. Expected outcomes The study suggests that there exist many opportunities associated with the effective use of Big Data Analytics in decision-making and e-commerce operations in general. Particularly, the role of Big Data Analytics consists of faster decision making, increased efficiency, and deeper knowledge of consumer behavior and preferences. Efficient utilization of data also leads to product/service innovation, customer satisfaction, and enhanced competitiveness of e-commerce companies. Meanwhile, some challenges can be observed including massive volumes of data, difficulty of integration of data, data security and quality, and human resource availability with relevant analytic skills. Based on the results obtained, it is recommended to improve information technologies, implement data governance and data security policies and ensure efficient data management. Thus, the implementation of Big Data Analytics will become more effective and sustainable in the future.

**Keywords:** Big Data Analytics, E-commerce, Decision Making

## **Introduction**

Development of digital technology over the past decade has led to a tremendous change in shopping patterns and transactions (Amory & Mudo, 2025). Now, virtually all needs can be satisfied in the form of an online platform or electronic commerce. According to statistics, the development in Indonesia demonstrates tremendous growth figures. As reported in the Ministry of Communication and Information, approximately 3.82 million e-commerce business players operated at the end of 2023, while the total amount of transactions reached 512 trillion IDR in 2024. Moreover, the figure is expected to increase even more with the projected increase in the number of users to reach 99.1 million people in 2029. Similarly, according to the report of Optin Moster (2025), the global picture does not look different. The prediction for 2025 implies about 2.77 billion online shoppers, with China as a country with the highest number of online shoppers. The above facts suggest that today e-commerce has gained a huge significance for the modern economic system and continues developing together with the adoption of technologies. Very rapid development of e-commerce also implies increasing numbers of generated data. Every transaction, every click by users, every feedbacks on products or other activities generate huge amounts of data (Octiva et al., 2024). This information may prove useful to understand consumer behaviors, market dynamics, or even marketing strategies. However, not all businesses are ready to make use of the above. Many Indonesian companies still cannot analyze vast data into valuable information that would assist with decision-making (Sabban et al., 2024). The problem is that many e-commerce businesses in Indonesia do not see opportunities of making profit due to improper use of data. Therefore, the core problem of the current state of e-commerce concerns efficient transformation of "piles of data" into valuable insight. Such problems become increasingly actual since non-data-driven decision-making is usually associated with high risks in the rapidly changing world of digital business. For instance, an improper pricing policy might push consumers to seek alternative solutions or an untargeted marketing campaign may simply waste the company's resources. Hence, the necessity of using more innovative approaches to understanding the current state of the market and consumers becomes obvious. Big Data Analytics can prove helpful for this purpose (Zega & Sianturi, 2025). The use of this technology allows performing fast and accurate data processing and obtaining insights into consumer behaviors and future tendencies in the market. Thus, the decision-making is done on the basis of solid data rather than intuition. Numerous examples prove the application of Big Data Analytics for the advantage of many giant e-commerce companies. For instance, Tokopedia analyzes data for providing relevant product recommendations in order to improve the chances of making purchase decisions. Shopee performs behavioral data analysis to identify the right time periods for promotions while Lazada uses data to increase shipping effectiveness (Dzakiyyah

et al., 2023). The use of Big Data proves its effectiveness and ability to provide many benefits related to competitiveness, consumer understanding, and customer satisfaction. Nevertheless, implementation of this technology is not an easy task. It requires appropriate human resources capable of handling the data analysis as well as necessary technological equipment. Taking into account the importance and opportunities provided by this technology, studying the application of Big Data Analytics in business decision-making within the field of e-commerce is crucial. First of all, such research is vital since it is important to see the potential and opportunities provided by Big Data. However, on the other hand, it is also necessary to understand what threats and difficulties this technology poses and how they can be overcome. Seeing huge potential and significant challenges in applying Big Data to business decision-making in e-commerce industry, research is critical for further development of the area. First of all, it is important to understand the use of Big Data in Indonesia and the world for better understanding of the problem and its features. Secondly, studying the advantages of using Big Data in e-commerce companies is necessary. At last, it is also essential to learn about the challenges faced by Indonesian business owners when using this technology

#### Research Methods

This research uses a qualitative descriptive method with a literature study approach, which aims to comprehensively describe, understand, and analyze the application of Big Data Analytics in business decision making in the e-commerce sector. This approach was chosen because it is able to provide an in-depth understanding of the phenomenon being studied based on theoretical studies and empirical findings from various written sources, without collecting primary data directly in the field. The data used in this research are secondary data obtained from various trusted sources, including national and international scientific journals, e-commerce industry reports, digital technology and business articles, reference books, and official publications from e-commerce companies and related research institutions. The selection of data sources was carried out selectively by considering the relevance, credibility, and recency of the information so that the results of the analysis reflect the actual conditions of the application of Big Data Analytics in the e-commerce industry. The data collection process was carried out through library research, namely by reviewing, examining, and organizing various literature containing information about the concept of Big Data Analytics, data analysis techniques, implementation practices in the e-commerce sector, as well as the benefits and challenges faced by companies. The collected literature was then classified based on key themes, such as consumer data utilization, operational optimization, data-driven marketing strategies, and strategic decision-making. Furthermore, the collected data was analyzed using content analysis. This method is used to identify patterns, trends, and relationships between

concepts that appear in various literature sources. The analysis focused on Big Data Analytics implementation strategies, their impact on the effectiveness and accuracy of business decision-making, operational performance improvement, and their contribution to increasing the competitiveness of e-commerce companies in the digital era. The results of the analysis were then synthesized to produce conclusions and recommendations that can serve as a reference for e-commerce business actors in optimizing the use of Big Data Analytics in a sustainable manner.

### Results and Discussion

Big data is a term that refers to a set of large, complex, and continuously growing data that cannot be managed with existing database management systems. Big data comes from human activity related to social media applications, online e-commerce transactions, bank services, industries, and Internet of Things applications. As stated by IBM, about 2.5 quintillion bytes of data is produced every day, and this number is still rising due to the rapid advancement of information technology. DOMO reported that within one minute, internet users produce millions of actions, from 4.16 million messages in Facebook, 300 thousand tweets on Twitter, to 77 thousand hours viewing movies on Netflix (Santoso, 2020). The idea of Big Data is concentrated on the quantity of data and its utilization. Big Data Analytics is used to analyze and visualize data that leads to finding hidden relations, patterns, and information that may be helpful for future decisions. Such process requires several steps including data cleansing, storing, parallel processing, predictive analysis, and descriptive analysis by utilizing cloud computing and distributed systems. Big data is widely applied in different areas, starting from business, finance, healthcare to manufacturing. With the help of Big Data Analytics, organizations can analyze users' behaviors, make operations more efficient, and implement new innovations tailored to the needs of contemporary society.

There are five main aspects of big data known as the 5Vs, including (Santoso, 2020):

**Volume (Data Size):** The first aspect of big data is the huge amount of information that keeps growing each second. Such data can be obtained from different sources including social media, online shopping transactions, industry sensors, IoT devices. The high volume of data cannot be managed in regular database systems, and therefore distributed storage and computation methods such as Hadoop and Spark should be utilized. **Velocity (Data Speed):** Velocity refers to the speed at which data is created and processed in real-time. Examples include instantaneous data from online transactions and social media interactions that need to be analyzed for decision making purposes. Such processes include fraud detection, product recommendation, and others. **Variety (Data Variety):** Big data is varied, including structured data (relational databases), semi-structured data (XML or JSON files) and unstructured data (photos, videos, documents). Variety of data types requires flexibility of the system that will

manage data efficiently. Veracity (Data Accuracy): Veracity refers to data accuracy, as there are many sources of data that can result in inaccuracy. Data validation and cleansing become highly required. Value (Data Value): Value highlights the significance of data utilization and extracting valuable information out of it. The main purpose of Big Data Analytics is producing meaningful information that will improve decision-making within the organization.

**Table 1.** The 5Vs of Big Data Analytics

<b>Aspect</b>	<b>Meaning</b>	<b>Relevance to E-commerce</b>
Volume	Large amount of data	Transactions, clicks, reviews
Velocity	Speed of data generation	Real-time purchases and searches
Variety	Different data formats	Text, images, videos, transaction records
Veracity	Data accuracy	Reliable customer and sales data
Value	Useful insight from data	Better business decisions

### 3.1. Implementing Big Data Analytics in E-commerce Businesses

First of all, the application of Big Data Analytics in e-commerce plays an important role in allowing e-commerce companies to analyze their customers' behaviors and characteristics, increase business efficiency, and support business decision-making. Every activity by each user performed on any e-commerce site generates a massive amount of diverse data in real time. This includes activities like browsing history, clicks, searches, buying history, payment options, reviewing, and even interactions on social media.

It is clear that the proper utilization and management of the generated data turn it into a strategic asset for companies. Through the application of Big Data Analytics, e-commerce companies can make sense of this data to analyze consumers' behaviors, preferences, buying patterns, and even market trends. The insights gained through the analysis of this data help them better understand customer demands, anticipate product demand, and find new business opportunities. As a result, e-commerce companies do not merely react to the changes but proactively develop business strategies. As the number of online transactions continues to grow day-by-day, the problems related to data management and analysis become even more complicated. Hence, e-commerce companies have to make the most out of Big Data Analytics technology by collecting, processing, storing, and analyzing data efficiently. As a result, the effective utilization of data analytics technologies enables companies to get meaningful and actionable insights that help them make well-informed decisions and act effectively and swiftly.

Operationally, the application of Big Data Analytics may lead to increased

business efficiency, improved logistics and stock management, and improved system performance. Moreover, data analytics also stimulates the development of personal services and experiences, such as recommending products according to customers' preferences and delivering promotions that fit customers. All of these aspects positively contribute to increasing consumer satisfaction and loyalty. In total, several main areas of Big Data application can be defined. These include customer behavior analysis, marketing optimization, logistics and stock management, and strategic business decision-making. Some examples of Big Data Analytics implementation in the context of e-commerce companies include (Zega & Sianturi, 2025):

#### Customer Behavior Analysis

First, Big Data Analytics is useful in terms of analyzing customer behaviors and preferences. Using different indicators of customer activity, such as clicks, searches, and purchases, it is possible to find out what people buy and when they buy it. Moreover, platforms like Tokopedia and Shopee utilize data analytics to give users product recommendations corresponding to their interests. Such an approach makes consumers' purchasing experience more personalized and convenient.

#### Dynamic Pricing Strategies

The use of data analytics can be helpful for adjusting prices. In particular, by analyzing prices of competitors, market trends, and consumer demand, one can adjust product prices accordingly (Patria, et al., 2025). In particular, prices can be increased when the demand goes up, while decreasing when there is an excessive amount of products in stock. As a result, one can achieve maximum revenue and profitability without losing market competitiveness.

#### Inventory and Logistic Management

As already mentioned, inventory management and logistics are critical elements in terms of making sure that the consumers will get their products in time. Big Data Analytics makes it possible to forecast demand based on earlier consumer behaviors and seasonal trends (Sulistiyawati, 2024). In other words, knowing when sales would go up due to holidays and festivals, companies can plan their inventory and logistic management appropriately.

#### System and Applications Performance Monitoring

Since cloud applications in the field of e-commerce experience sharp fluctuations in workloads, especially during sales and events like Flash Sale and Harbolnas, it is important to control system performance to avoid any negative consequences. By conducting various types of testing (such as stress and load testing), companies are able to find possible bottlenecks, such as overloaded servers and low network capacities. After identifying these factors, one can make appropriate changes, such as increasing the number of servers.

**Fraud Detection**

Fraudulent activities are typical of e-commerce. They range from fraudulent purchases to the use of fake accounts and credit cards and writing fake reviews. However, with the help of data analytics, one can detect unusual patterns in transaction behavior. For example, many purchases conducted within an excessively short period of time or a large number of purchases made from an odd location can alert the system. It is possible to either postpone or check such transactions to avoid financial and reputational losses.

**Improved Customer Service**

Another important area of application of Big Data Analytics involves improvement in customer service. One can gather a lot of insights by analyzing chatbot records, consumers' opinions, and feedbacks. An artificial intelligence system powered by big data can analyze past data to deliver answers to consumers' questions immediately. Thus, customer services become efficient, personalized, and quick.

**Prediction of Future Trends and Creation of Innovations**

Finally, data can be used to forecast future developments in the industry. For example, growing interest towards environmental-friendly products might encourage companies to expand this product category. Moreover, Big Data Analytics helps in inventing innovative products that correspond to current customers' needs based on data about their preferences and reviews.

**Table 2.** Applications of Big Data Analytics in E-commerce

<b>Application Area</b>	<b>Function</b>	<b>Business Benefit</b>
Customer behavior analysis	Tracks clicks, searches, purchases	Personalized recommendations
Dynamic pricing	Adjusts prices based on demand	Higher revenue
Inventory management	Forecasts product demand	Reduces stock problems
Fraud detection	Detects unusual transactions	Improves security
Customer service	Uses chatbot and feedback data	Faster responses

**3.2. The Impact of Big Data Analytics Implementation on Decision Making in E-commerce Businesses**

Implementation of Big Data Analytics in e-commerce businesses has led to major changes in the way companies formulate business decisions. Before the implementation of this technology, decisions were usually subjective and highly

dependent on gut feeling, management experience, and analysis of minimal data. However, with Big Data, companies have been enabled to make decisions based on actual real-time data, and hence, the processes have become more objective and effective. As a result, through the continuous processing of massive amounts of data, businesses are enabled to comprehend customer behavior and preferences, follow up the performance and sales, and make future predictions regarding market trends and consumer demand. The obtained information serves as the basis for making various strategic business decisions and planning. Big Data plays an important role of providing a company with a comprehensive decision support system.

#### Quicker and Accurate Decisions

Through the implementation of big data, companies are able to analyze millions of transaction and customer data within a short period (Indarto & Santoso, 2024). Processes that would take several days to complete before are now done in a matter of minutes. Therefore, the company's management team is able to come up with quick decisions supported by factual evidence rather than assumptions. If, for instance, there was an upsurge in the demand of certain commodities, the company could easily recommend increasing prices or stocks. Time and speed are two of the most important competitive advantages in e-commerce industry.

#### Better Understanding of Customers

An important contribution of big data to a business operation is the better comprehension of its consumers. The data gathered from online activities of customers can provide the company with important insights regarding the behavior and preferences of customers (Halawa, 2025). With the help of this understanding, a company could be able to create tailored business plans, such as displaying recommendations according to the preferences of the customers or sending promotions in accordance to the purchases. Besides increasing the satisfaction level of customers, it will also encourage customer loyalty. For example, Tokopedia and Shopee utilize data algorithms to tailor the display of recommended products according to consumer preferences on their homepage.

#### Efficient Operations Management

Big Data also has an important impact on the operations of companies. By analyzing the data regarding sales and consumer preferences, a company would be able to identify inefficient areas of business, including late deliveries, excess of stock, or less popular products. As a result, more accurate business decisions can be made in regard to logistics, warehouse management, and human resources. For instance, analyzing data on delivery routes can allow identifying the most efficient delivery route, resulting in lower logistics cost. Furthermore, data on predicted market demands can be used to establish how much stock the company should have in order not to experience shortages or oversupply.

### Improved Business Strategy Planning

By obtaining vast quantities of data, companies get a chance to observe market dynamics from a wider perspective in regard to product development and other aspects of business activities. Analysis of market trends and consumer preferences gives the company a clear understanding of which directions it should focus in when developing new products and business models. For example, by looking at the current trends in the market, a company may determine whether there is demand for environmentally-friendly commodities. If yes, a business may consider expanding that particular product line or developing a new brand altogether.

### Increased Business Competitiveness and Innovation

Besides being an important source of valuable business insights, big data allows companies to be innovative and competitive in the global economy. Thanks to constantly updated information, businesses can keep track of competitor activities, market trends, and consumer behaviors, making necessary adjustments when needed. Additionally, analyzing customer reviews, a company can identify possible product improvements and come up with new product variations. Another possibility offered by Big Data is the use of predictive analytics, i.e., predicting future market trends according to the data obtained on the basis of historical trends.

### 3.3 Challenges of Implementing Big Data Analytics for Decision Making in E-commerce Businesses

Indeed, the application of Big Data Analytics brings various advantages for e-commerce companies; however, the following obstacles should still be taken into account:

Large amounts of data to manage. Every moment, e-commerce businesses collect hundreds of thousands of pieces of information about users through their transactions, search history, clicks, and even social media interactions. What is more important, data in the form of texts, photos, or videos come in enormous quantities. It needs a good technological infrastructure, which means money spent, to store and analyze it. Moreover, due to the great amount of data gathered by e-commerce, the data becomes unstructured and hard to manage through classical approaches. E-commerce companies with insufficient technologies will face problems with handling data because of inefficiency.

Quality and safety of the data itself. The data collected by e-commerce is considered one of the most important assets for the business, and that is why its correct management is necessary. However, with a huge variety of sources of information, there is always a chance that the data is incorrect or even inconsistent. Even small mistakes in data collection and processing may influence further business strategy. Besides, privacy issues cannot be neglected as a leakage of customer information may affect the company's reputation seriously. Therefore, companies working in e-

commerce should ensure themselves with proper data security measures, implement an effective encryption system, and meet the requirements of GDPR and other regulations related to privacy.

Personnel and organizational aspects. Although the development of technology makes possible the implementation of new data processing methods, many e-commerce companies still lack specialists in the field of data analysis. They are required to help managers to interpret results and use them strategically (Maharani, 2025). Furthermore, some business managers may not be interested in applying Big Data to decision-making due to their reliance on intuition. Lack of awareness of the value of data may complicate this process greatly. To cope with the problem, companies should invest in personnel development and establish a culture of working with data.

### Conclusion

From the outcomes of the research and discussion presented above, it could be summarized that the application of Big Data Analytics in e-commerce companies is extremely strategic for making decisions that would be more efficient and evidence-based. The large amount of data, which includes transactions, consumer behavior, and market trends, would help organizations understand the needs of consumers, so their decisions would not be spontaneous anymore but made on the basis of complex analysis. The application of Big Data has proven its effectiveness when applied to increasing efficiency in operations, especially regarding inventory management, dynamic pricing, optimization of business processes, and real-time monitoring of the system's performance. Moreover, the use of Big Data is also associated with the emergence of innovations in business processes, as well as personalized services, such as targeted recommendations and promotions to specific clients, which contribute to the improvement of customer satisfaction and loyalty. Nevertheless, despite the benefits of the implementation of Big Data Analytics in e-commerce, there are numerous difficulties and barriers that impede its optimal application. First, the problem relates to the management of large data amounts, the integration of complex data sets, and the problems related to data quality and security of client information. Furthermore, the limited number of skilled employees with sufficient knowledge in data analytics and big data technologies becomes another issue that hinders the optimal implementation of Big Data in business processes. As a result, e-commerce firms need to enhance their technological capacity and adopt appropriate governance and security measures for data handling. Therefore, the significance of Big Data Analytics is not only in providing support with technological tools but also in becoming an essential component of contemporary business strategies. Sustainable implementation would be crucial for success in e-commerce companies' operations in global competition, sustainability, and achieving competitive advantage in the digital era.

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