



Big Data Without Mathematical Thinking: A Dangerous Illusion in the Digital Economy

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ABSTRACT

This study explores the widespread misconception that big data alone is sufficient to support effective decision-making in the digital economy without the need for mathematical thinking. Using a qualitative library research approach, this study examines a wide range of primary and secondary sources from the fields of data science, economics, and decision theory. The analysis aims to understand the relationship between data availability and the role of mathematical reasoning in transforming data into meaningful insights. The findings reveal that although big data provides vast and diverse information, it does not automatically generate accurate or useful conclusions without proper mathematical interpretation. Mathematical thinking plays a critical role in organizing data, identifying patterns, and developing reliable predictive models. Without such analytical frameworks, data can easily be misinterpreted, leading to flawed conclusions and ineffective or even harmful strategic decisions. Furthermore, the absence of mathematical reasoning increases the likelihood of cognitive bias, overfitting, and erroneous analysis, particularly in complex and dynamic environments. These risks highlight the limitations of relying solely on data volume without adequate analytical rigor. Therefore, this study argues that treating big data as a standalone solution is a dangerous illusion. Integrating mathematical frameworks is essential to ensure valid, reliable, and evidence-based decision-making in the digital economy.

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1. INTRODUCTION

The development of digital technology in recent decades has brought fundamental changes to various aspects of life, including economics, business, and decision-making. One of the most prominent phenomena of this development is the emergence of the concept of *big data*, namely the collection of enormous amounts of data continuously generated from various digital activities. This data comes from various sources, such as online transactions, social media usage, Internet of Things (IoT) devices, and user interactions with various digital platforms. The existence of big data has changed the way organizations and companies view information. While previously data only served as a supplement to the decision-making process, it is now positioned as a strategic asset with high economic value. Many companies utilize data to understand consumer behavior, optimize operations, and develop more effective business strategies¹. Thus, data is no longer just a byproduct but has become a key resource in creating competitive advantage.

As data becomes more important, popular narratives have emerged that position big data as the primary solution for decision-making. It's believed that the greater the volume of data, the higher the quality of decisions². This perspective encourages organizations to collect as much data as possible in the hope that it will automatically generate valuable insights³. However, this view tends to oversimplify the complexity of data processing. Data in its raw form is essentially meaningless and unusable. Without proper analysis, data becomes little more than a collection of numbers or unstructured information. In some cases, excessive data can actually lead to confusion and increase the risk of error in decision-making. Furthermore, the phenomenon of *information overload* is a major challenge in the big data era. When individuals or organizations are faced with vast amounts of data, the ability to sort and prioritize information becomes increasingly crucial. Without this ability, data that should be helpful can actually hinder the decision-making process due to the overwhelming amount of information that must be processed⁴.

¹ Prima Yulianti et al., "Analisis Knowledge Management Menggunakan Model Big Data Di Media Sosial UMKM," *Jurnal Manajemen Informatika (JAMIKA)* 13, no. 1 (2023): 24–39, <https://doi.org/https://doi.org/10.34010/jamika.v13i1.8682>; Luluk Setyowati and Deni Nasir Ahmad, "Pemanfaatan Big Data Dalam Era Teknologi 5.0," *ABDINE: Jurnal Pengabdian Masyarakat* 1, no. 2 (2021): 117–22, <https://doi.org/https://doi.org/10.52072/abdine.v1i2.205>; Bunga Amira and Muhammad Irwan Padli Nasution, "Peluang Pemanfaatan Teknologi Big Data Pada UMKM Di Indonesia Untuk Meningkatkan Kinerja Perdagangan Di Era Industri 4.0," *Jurnal Ilmiah Nusantara* 1, no. 4 (2024): 695–704, <https://doi.org/https://doi.org/10.61722/jinu.v1i4.1888>.

² Ahmad Baihaqi and Muhammad Irwan Padli Nasution, "Analisis Kualitas Data Dalam Keputusan Pembelian Konsumen," *Socius: Jurnal Penelitian Ilmu-Ilmu Sosial* 2, no. 11 (2025): 126–28, <https://doi.org/https://doi.org/10.5281/zenodo.15538399>; Nurul Aini and Muhammad Irwan Padli Nasution, "Akurasi Kualitas Data Informasi Pada Sistem Manajemen," *Jurnal Rumpun Manajemen Dan Ekonomi* 2, no. 1 (2025): 40–50, <https://doi.org/https://doi.org/10.61722/jrme.v2i1.3259>.

³ Adelia Maharani, "Penerapan Big Data Dalam Perencanaan Strategis Dan Pengambilan Keputusan Bisnis," *JMEB Jurnal Manajemen Ekonomi & Bisnis* 3, no. 1 (2025): 15–23, <https://journal.sabajayapublisher.com/index.php/jmeh/article/view/554>; Sri Yani Kusumastuti et al., *Big Data: Teori Dan Penerapan Teknologi Big Data Dalam Berbagai Bidang* (PT. Sonpedia Publishing Indonesia, 2025).

⁴ S E Febrianty et al., *Manajemen Pengambilan Keputusan* (Perkumpulan Rumah Cemerlang Indonesia, 2023); Asty Raisha Agma, "Pengaruh Big Data Terhadap Manajemen Risiko Dan Keputusan Akuntansi," *Jurnal Akuntansi Dan Sistem Informasi* 1, no. 1 (2025): 28–37, <https://pustakajurnal.web.id/index.php/jasi/article/view/20>.

In this context, mathematics plays a crucial role as a tool for processing and interpreting data. Through a mathematical approach, complex data can be simplified into more easily understood patterns. Mathematics enables the identification of relationships between variables, the measurement of trends, and the testing of hypotheses relevant to the analysis's objectives⁵. Furthermore, mathematics is the foundation for various modern data analysis techniques, such as statistics, machine learning, and data mining. These techniques enable the extraction of valuable information from large amounts of data. Without an understanding of the underlying mathematical principles, the use of advanced analytical technologies is suboptimal and can potentially lead to erroneous interpretations. In practice, the data analysis process requires not only technological tools but also strong mathematical thinking skills. Mathematical thinking encompasses the ability to understand data structures, recognize patterns, and draw logical and systematic conclusions. These skills are crucial in ensuring that analysis results truly reflect the existing reality⁶.

On the other hand, a behavioral economics perspective provides an understanding that humans are not always rational in processing information. Daniel Kahneman explains that individuals tend to use heuristics, or cognitive shortcuts, in decision-making⁷. While heuristics can speed up the thinking process, they can also introduce biases that influence data interpretation. In the context of big data, cognitive biases can become even more complex when individuals are confronted with large amounts of data. Without adequate mathematical analysis, data can be subjectively selected or interpreted according to prior beliefs. This has the potential to reinforce existing biases and result in suboptimal decisions.

This phenomenon raises fundamental questions about the effectiveness of using big data without the support of mathematical thinking skills. Can large amounts of data truly improve decision quality if not processed with the right approach? This question becomes increasingly relevant amidst the increasing dependence of organizations on data in various operational aspects. Based on this background, this study aims to critically examine the role of mathematical thinking in the utilization of big data and identify the various risks that arise when data is used without adequate analysis. This study is expected to provide theoretical contributions to understanding the relationship between data, mathematics, and decision-making, while also providing a foundation for more effective practices in the modern digital economy.

2. METHODS

This study uses a qualitative approach aimed at deeply understanding the relationship between big data and mathematical thinking skills in decision-making⁸. This approach was chosen because the

⁵ Ibnu Imam Al Ayyubi et al., "Application Of Model-Eliciting Activities (MEAs) For Learning Mathematics Based On Students'initial Mathematical Abilities," *El Midad* 16, no. 1 (2024): 72–90, <https://doi.org/https://doi.org/10.20414/elmidad.v16i1.9654>; Ibnu Imam Al Ayyubi et al., "Maths In The Qur'an: Should The MI Curriculum Adopt An Islamisation Of Science Approach?," *International Journal of Interdisciplinary Research* 2, no. 1 (2026): 1–12, <https://doi.org/https://doi.org/10.71305/ijir.v2i1.235>.

⁶ Syahriani Syam et al., *Data Mining: Teori Dan Penerapannya Dalam Berbagai Bidang* (PT. Sonpedia Publishing Indonesia, 2024); Fitri Nurjanah et al., *Matematika Dan Statistika: Dasar Teori Dan Aplikasi Multidisipliner* (Tren Digital Publishing, 2026).

⁷ Loso Judijanto, "Analisis Bibliometrik Terhadap Bias Kognitif Dalam Pengambilan Keputusan Ekonomi," *Sanskara Ekonomi Dan Kewirausahaan* 3, no. 3 (2025): 136–46, <https://doi.org/https://doi.org/10.58812/sek.v3i03.578>.

⁸ Nurhayati Nurhayati et al., *Metodologi Penelitian Kualitatif: Teori Dan Praktik* (PT. Sonpedia Publishing Indonesia, 2024); M Fathun Niam et al., "Metode Penelitian Kualitatif," 2024.

focus of the research is not on numbers or statistical measurements, but rather on understanding concepts, roles, and relationships between variables in a logical and systematic manner. This approach allows for a more detailed and focused discussion. The type of research used is library research⁹. This research was conducted by reviewing various relevant written sources without directly collecting data in the field. This approach allows researchers to collect and compare various existing theories and research results, thus obtaining a broader and more structured understanding.

The selection of literature research was based on the conceptual nature of the topic. Studies on big data and mathematics require more theoretical explanation than direct observation. Therefore, analyzing relevant literature is the appropriate way to answer the research problem formulation in this study. The data sources in this study consist of primary and secondary sources. Primary sources are major scientific works that directly discuss big data, data science, mathematics, and the digital economy. These sources serve as the primary basis for developing the discussion framework. Meanwhile, secondary sources include scientific journal articles, textbooks, and other academic publications that support the discussion. Secondary sources are used to strengthen explanations, provide examples, and add perspectives to the topic under study. By combining these two types of sources, the discussion becomes more comprehensive and does not rely on a single reference.

Data collection techniques were conducted through documentation studies. Researchers collected various literature from academic databases, digital libraries, and other reliable sources. After that, the literature was selected based on its suitability to the topic, content quality, and relevance to the research objectives. After the data was collected, analysis was conducted using the content analysis method. This method is used to systematically examine the content from various sources. Researchers read, understand, and compare the literature to find patterns, similarities, and differences in the existing discussions. The analysis stages include data reduction, data presentation, and drawing conclusions. Data reduction is carried out by selecting the most relevant information, presenting the data in a coherent form, and drawing conclusions based on the results of the analysis. Through these steps, the research is expected to provide a clear understanding of the importance of mathematical skills in utilizing big data.

3. FINDINGS AND DISCUSSION

FINDINGS

In today's digital era, data is often considered a "new asset" capable of transforming the way organizations make decisions. Many assume that the more data they have, the greater the chance of making the right decisions. However, this study shows that this assumption is not entirely true. Abundant data does not automatically produce valuable information if it is not processed with the right approach. In this context, mathematical thinking skills are a key factor in determining whether data can be optimally utilized or whether it leads to errors in decision-making.

Big data without mathematical analysis does not produce meaningful information.

Big data is often viewed as a new source of power in modern decision-making¹⁰. Many organizations are racing to collect massive amounts of data in the hope of gaining more accurate

⁹ Hasan Syahrizal and M Syahrani Jailani, "Jenis-Jenis Penelitian Dalam Penelitian Kuantitatif Dan Kualitatif," *QOSIM: Jurnal Pendidikan Sosial & Humaniora* 1, no. 1 (2023): 13–23, <https://doi.org/https://doi.org/10.61104/jq.v1i1.49>; Mike Nurmalia Sari, Nelvia Susmita, and Al Ikhlas, *Melakukan Penelitian Kepustakaan* (Pradina Pustaka, 2025).

¹⁰ Dela Arum Lestari and Muhammad Irwan Padli Nasution, "Pengelolaan Big Data: Inovasi Solusi Dan Tantangan Dalam Era Informasi Modern," *Journal Sains Student Research* 3, no. 3 (2025): 502–11, <https://doi.org/https://doi.org/10.61722/jssr.v3i3.4818>.

insights. However, this study confirms that the presence of large amounts of data does not automatically produce meaningful information. Without proper analysis, data is simply a collection of numbers that provide no clear direction for decision-making. Essentially, data is raw material that has no meaning until it is processed. Data merely reflects specific events or activities without explaining the meaning behind them. For example, sales figures, number of users, or transaction frequency cannot provide any conclusions without further analysis. Therefore, data requires processing to transform it into understandable information¹¹.

Without mathematical analysis, data cannot reveal patterns or relationships within it. Yet, the primary value of big data lies in its ability to uncover patterns that are not readily apparent. Without a systematic approach, these patterns remain hidden and provide no benefit to data users. This demonstrates that data without analysis has only potential, but has not yet become knowledge. Furthermore, poorly analyzed data can lead to confusion in decision-making. Large amounts of data can actually make it difficult for individuals to determine which information is relevant. This condition is known as information overload, where too much data actually hinders the thinking process. Without the ability to filter and process data, individuals can lose focus and understand the true situation¹².

Furthermore, using data without mathematical analysis also increases the risk of misunderstanding a phenomenon. Data viewed directly often leads to erroneous interpretations. For example, an increase in a certain number does not necessarily indicate success, as it could be influenced by other, unseen factors. Without proper analysis, conclusions drawn can be inaccurate¹³. Another problem that arises is the tendency to draw hasty conclusions. When data is not analyzed systematically, individuals tend to rely on initial perceptions when interpreting information. This can lead to decisions not based on in-depth understanding. In the long term, such errors can negatively impact organizational performance.

Mathematical analysis plays a crucial role in transforming data into meaningful information. Through calculations, grouping, and modeling, data can be processed to produce clear patterns. This process allows individuals to understand the relationships between variables and draw more accurate conclusions. Without this process, data lacks practical value. Furthermore, mathematical analysis also helps simplify complex data. Big data often consists of various types and sources, making it difficult to understand directly. By using a mathematical approach, data can be summarized into a simpler, more understandable form. This is crucial for effective use of information in decision-making.

In an organizational context, failure to process data can lead to significant losses. Decisions made without a strong analytical foundation are potentially misguided and inconsistent with real-world conditions. This demonstrates that investment in data collection must be balanced with adequate analytical capabilities. Without them, data will become a burden, not an asset. Therefore, it can be concluded that big data has no significant value without mathematical analysis. Data must be processed through a systematic approach to produce accurate and useful information. Therefore, the ability to process data is crucial to optimally harnessing the potential of big data.

¹¹ Mona Nofita Sari et al., *Formulasi, Implementasi Dan Evaluasi Strategi Dalam Organisasi Modern* (Fahmi Karya, 2026).

¹² David Bawden and Lyn Robinson, "Information Overload: An Overview," 2020; David D Woods, Emily S Patterson, and Emilie M Roth, "Can We Ever Escape From Data Overload? A Cognitive Systems Diagnosis," *Cognition, Technology & Work* 4, no. 1 (2002): 22–36, <https://doi.org/https://doi.org/10.1007/s101110200002>.

¹³ Artika Andriyanti and Andika Setyo Budi Lestari, "Systematic Literature Review: Eksplorasi Variasi Terminologi Dalam Penelitian Kesalahan Matematika," *Jurnal Media Akademik (JMA)* 3, no. 5 (2025), <https://doi.org/https://doi.org/10.62281/jma>.

Mathematical thinking is important in identifying data patterns and relationships.

Mathematical thinking is a crucial skill in data analysis, especially in the context of complex and dynamic big data. This ability extends beyond numerical calculations to logical, systematic, and structured thinking in understanding information. This study emphasized that mathematical thinking is key to identifying hidden patterns and relationships within data. One of the primary functions of mathematical thinking is to help individuals see the relationships between variables. Available data often consists of multiple interconnected factors, but these relationships are not always immediately apparent. With a mathematical approach, individuals can analyze how one variable influences another, thus gaining a deeper understanding of a phenomenon.

Furthermore, mathematical thinking enables the identification of recurring patterns in data. These patterns can be upward or downward trends, or specific cycles that occur over a specific period of time. Without this ability, data would simply appear as a random collection of information. However, behind the data lies a pattern that can be used to understand current conditions and predict the future. In the context of big data, the ability to recognize patterns becomes increasingly important due to the sheer volume of data. Data generated from various sources has a complex and diverse structure. Mathematical thinking helps simplify this complexity so that the data can be processed into information that is easier to understand and use¹⁴.

Furthermore, mathematical thinking also plays a role in understanding the overall structure of data. Individuals not only view data in parts but are able to understand how it is structured and interrelated. This is crucial in ensuring that the analysis conducted is not superficial but rather reflects the actual situation. This ability also helps avoid errors in data interpretation. Without a mathematical approach, individuals tend to draw conclusions based on simple observations that are not necessarily accurate. With mathematical thinking, every conclusion is based on a clear and accountable analysis process¹⁵.

Furthermore, mathematical thinking enables the use of more precise analytical methods. In data analysis, various techniques can be used, such as descriptive statistics, correlation, and regression. Selecting the appropriate method depends heavily on an individual's ability to understand the characteristics of the data being analyzed. Without this ability, the analysis can be irrelevant. In decision-making, the ability to identify data patterns and relationships provides a significant advantage. Decisions are no longer based solely on intuition but are supported by clear evidence. This increases confidence in the analysis results and reduces the risk of errors in decision-making.

Furthermore, mathematical thinking also plays a role in predicting future possibilities. By understanding existing patterns, individuals can anticipate future trends and develop appropriate strategies. This predictive ability is one of the key values of data analysis in the modern world. Therefore, mathematical thinking is not merely a technical skill, but a fundamental capability that determines success in utilizing data. Without this ability, the enormous potential of big data cannot be

¹⁴ Lia Irawati and Muhamad Sofian Hadi, "Computational Thinking Dalam Pengembangan Berpikir Matematis Di Sekolah Dasar," *JIIIP-Jurnal Ilmiah Ilmu Pendidikan* 8, no. 2 (2025): 2358–64, <https://doi.org/https://doi.org/10.54371/jiip.v8i2.7106>.

¹⁵ Chongde Lin, "The Complete Structure Of Mathematical Thinking," in *Intellectual Development and Mathematics Learning* (Springer, 2023), 79–111, https://link.springer.com/chapter/10.1007/978-981-19-8757-1_4; Chris Kooloos et al., "Making Sense of Student Mathematical Thinking: The Role of Teacher Mathematical Thinking," *Educational Studies in Mathematics* 110, no. 3 (2022): 503–24, <https://link.springer.com/article/10.1007/s10649-021-10124-2>; S P Semenets et al., "Structural-Mathematical Thinking and Its Development in Teaching Mathematics," in *Journal of Physics: Conference Series*, vol. 2871 (IOP Publishing, 2024), 12003, <https://doi.org/10.1088/1742-6596/2871/1/012003>.

optimally utilized. Therefore, strengthening mathematical thinking skills is crucial in supporting more effective and accurate data-driven decision-making.

Without mathematics, the risk of bias and misinterpretation increases.

The absence of a mathematical approach in data analysis significantly increases the risk of bias and misinterpretation. When data is not systematically processed, individuals tend to rely on subjective judgment to understand the information. As a result, the conclusions drawn often do not reflect the true situation, but are instead influenced by personal perceptions or initial assumptions that may not be correct. Bias in data interpretation often arises because humans have a natural tendency to simplify complex information. Without clear analytical tools, individuals will choose the quickest way to understand the data, even if that method is not always accurate. In these situations, mathematics serves as a tool to maintain objectivity, so its absence makes the interpretation process vulnerable to error¹⁶.

One of the most common forms of bias is the tendency to interpret data according to pre-existing beliefs¹⁷. Individuals tend to look for patterns that support their views, while ignoring contradictory data. Without objective mathematical analysis, data is no longer a tool for discovering truth, but instead is used to justify existing opinions. Furthermore, misunderstanding the relationships between data poses a significant risk. Many individuals assume that if two variables are related, one must be the cause of the other. However, the relationship may be influenced by other, unseen factors. Without a mathematical approach, it is highly likely that the distinction between relationship and causation will be mistaken.

Misinterpretations can also arise from an inability to accurately read data patterns. Data that appears simple can be highly complex upon closer examination. Without adequate analytical tools, individuals may only see a fraction of the available information, leading to incomplete or even misleading conclusions. In the context of big data, this risk is magnified due to the sheer size and diversity of data. The more data available, the greater the potential for misinterpretation if not balanced with adequate analytical skills. Without mathematics, individuals can easily become trapped by irrelevant information or misunderstand the data.

Furthermore, without a mathematical approach, the decision-making process becomes less transparent and difficult to account for¹⁸. Decisions based solely on intuition or perception lack a solid foundation, making them difficult to verify. This differs from decisions based on mathematical analysis,

¹⁶ Ananta Rahma Alifya et al., "Pengaruh Cognitive Bias Dalam Pengambilan Keputusan Terhadap Dunia Bisnis," *Jurnal Humaniora Dan Sosial Sains* 1, no. 3 (2024): 329–35, <https://humaniorasains.id/jhss/article/view/43>; Mutia Kardina and Ofianto Ofianto, "Kontribusi Epistemologi Filsafat Ilmu Dalam Meminimalkan Bias Dalam Pengambilan Keputusan Administrasi Negara," *Innovative: Journal Of Social Science Research* 3, no. 6 (2023): 3296–3305, <https://j-innovative.org/index.php/Innovative/article/view/6492>; I Made Narsa and Niluh Putu Dian Rosalina Handayani Narsa, *Heuristik Dan Bias Judgment Dalam Riset Akuntansi* (Airlangga University Press, 2023).

¹⁷ Lorenzo Gagliardi, "The Role Of Cognitive Biases In Conspiracy Beliefs: A Literature Review," *Journal of Economic Surveys* 39, no. 1 (2025): 32–65, <https://doi.org/https://doi.org/10.1111/joes.12604>; Jakub Šrol, "Individual Differences In Epistemically Suspect Beliefs: The Role Of Analytic Thinking and Susceptibility To Cognitive Biases," *Thinking & Reasoning* 28, no. 1 (2022): 125–62, <https://doi.org/https://doi.org/10.1080/13546783.2021.1938220>.

¹⁸ Agustina Rahmi and Nor Fitriatun, "Pendekatan Sistematis Dalam Kepemimpinan Dan Pengambilan Keputusan Pendidikan: Kajian Literatur," *AT-TAKLIM: Jurnal Pendidikan Multidisiplin* 2, no. 5 (2025): 119–38, <https://doi.org/https://doi.org/10.71282/at-taklim.v2i5.280>; Indah Basma Sari and Devi Sintya Sari, "Peran Sistem Pendukung Keputusan Dalam Meningkatkan Efektivitas Pengambilan Keputusan," *Al-Bahts: Jurnal Ilmu Sosial, Politik, Dan Hukum* 2, no. 3 (2025): 20–27, <https://doi.org/https://doi.org/10.32520/albahts.v2i3.5010>.

which can be explained and tested logically. Another risk is overgeneralization from limited data. Without proper analysis, individuals may draw overly broad conclusions from small or unrepresentative samples. This error can have serious consequences, especially when used as the basis for strategic decision-making.

Furthermore, misinterpretation of data can also impact organizational planning and policymaking¹⁹. Decisions based on erroneous understanding can lead to ineffective strategies. In the long run, this can be detrimental to the organization both financially and in terms of reputation. Therefore, it can be concluded that mathematics plays a crucial role in maintaining objectivity and accuracy in data analysis. Without mathematics, data becomes highly susceptible to bias and misinterpretation. Therefore, the use of mathematical approaches is essential to ensuring that data truly provides valid information and can be used as a basis for sound decision-making.

Mathematical integration improves the quality of data-driven decision making.

The integration of mathematics and big data is a key factor in improving the quality of data-driven decision-making. When available data is processed using a mathematical approach, the resulting information becomes more structured, clear, and accountable. This eliminates speculative decisions from being based on systematic and logical analysis. A mathematical approach enables complex data to be transformed into simpler, more understandable information. In the context of big data, the sheer volume and diversity of data often pose challenges. With the help of mathematics, data can be summarized through various methods such as clustering, statistical calculations, and modeling, making it easier for decision-makers to understand the situation at hand²⁰.

Furthermore, the integration of mathematics improves accuracy in the data analysis process. Each step in data processing is carried out measurably, thus reducing the possibility of errors²¹. The analytical results obtained are more reliable because they are based on clear and tested methods. Thus, decisions taken have a higher level of reliability. The use of mathematics also helps reduce subjectivity in decision-making. Without a mathematical approach, decisions are often influenced by opinion, personal experience, or situational pressures. However, with data-driven analysis, decisions can be made more objectively because they are supported by concrete evidence. Furthermore, the integration of mathematics allows organizations to rationally compare various decision alternatives. Each option can be analyzed based on available data, clearly identifying the advantages and disadvantages of each option. This helps in selecting the most optimal decision in accordance with the desired goals.

Predictive capabilities are one of the key advantages of integrating mathematics into data analysis. By leveraging patterns found in data, organizations can estimate possible future events²². These predictions are crucial for strategic planning, as they enable organizations to prepare for various

¹⁹ Irma Suryani and Wardatul Jannah, "Pembuat Keputusan Dalam Organisasi," *Jurnal Ilmu Manajemen Dan Pendidikan* E-ISSN: 3062-7788 1, no. 4 (2025): 168–74, <https://jurnal.kopusingdo.com/index.php/jimp/article/view/612>.

²⁰ Sisilia Thyas Safitri et al., *Sistem Pendukung Keputusan (wawasan Ilmu, 2024)*; Samuel Manurung et al., *Big Data: Konsep, Teknologi, Dan Penerapan Era Modern* (Star Digital Publishing, 2026).

²¹ Chunming Xu, "Improving Mathematical Skills of Mathematics Education Students Through Integrated Use of Graphing Software and Programming Techniques," *International Journal of Education and Humanities* 5, no. 1 (2025): 13–24, [https://doi.org/https://doi.org/10.58557/\(ijeh\).v5i1.277](https://doi.org/https://doi.org/10.58557/(ijeh).v5i1.277); Jiabo Tan, "Information Analysis of Advanced Mathematics Education-Adaptive Algorithm Based on Big Data," *Mathematical Problems in Engineering* 2022, no. 1 (2022): 7796681, <https://doi.org/https://doi.org/10.1155/2022/7796681>.

²² Zhijuan Zong and Yu Guan, "AI-Driven Intelligent Data Analytics and Predictive Analysis In Industry 4.0: Transforming Knowledge, Innovation, And Efficiency," *Journal of the Knowledge Economy* 16, no. 1 (2025): 864–903, <https://link.springer.com/article/10.1007/s13132-024-02001-z>.

potential scenarios. Beyond predictions, mathematics also supports a more sophisticated planning process. Organizations can develop plans based on historical data and projections generated from analysis. Thus, planning is no longer simply guesswork, but based on more realistic and measurable calculations. In the face of uncertainty, mathematical integration provides advantages in risk management. By using a quantitative approach, risks can be better identified, measured, and controlled. This enables organizations to make decisions that are not only profit-oriented but also consider potential risks.

This integration also contributes to increased efficiency in decision-making. A systematic analysis process helps accelerate problem identification and appropriate solutions. This allows organizations to respond to change more quickly without compromising the quality of their decisions. Therefore, it can be concluded that the integration of mathematics and big data has a significant impact on the quality of decision-making. The resulting decisions become more accurate, objective, and long-term oriented. Therefore, the ability to combine mathematical analysis with data utilization is a crucial competency for organizations to face the challenges of the digital era.

DISCUSSION

The findings of this study confirm that the mere presence of big data is not enough to produce quality decisions. Many organizations assume that having large amounts of data automatically gives them an advantage in decision-making. However, the reality is that data without proper processing does not provide significant added value. Data remains merely a collection of raw information that cannot yet address the problems faced. In this context, it is crucial to understand that the primary value of data lies in how it is analyzed. Without a systematic analysis process, data cannot be transformed into meaningful information. Therefore, mathematical thinking is a key element in bridging the gap between raw data and quality decisions. This ability enables individuals to process data logically and in a structured manner²³.

Mathematics provides a clear framework for data analysis. With a mathematical approach, data can be systematically organized, measured, and compared. This allows for the identification of patterns and relationships between variables that are not readily apparent. Without this approach, the available data would not provide a complete picture of a phenomenon. Furthermore, the use of mathematics helps simplify data complexity. Big data often consists of various types of interrelated information that are difficult to understand directly. By using mathematical methods, data can be summarized and presented in a simpler form without losing its significance. This process is crucial for supporting effective decision-making²⁴.

However, without a mathematical understanding, the use of big data can potentially lead to misinterpretation. Large amounts of data often give the impression that analysis results are accurate, when in fact this is not necessarily true. Without proper analysis, data can lead to erroneous and misleading conclusions. This demonstrates that the amount of data does not always directly correlate with the quality of information. This phenomenon is often referred to as the illusion of accuracy, where the amount of data is perceived as a guarantee of truth. However, without proper analysis methods, large amounts of data can actually magnify errors. Small errors in interpretation can lead to conclusions that are far from reality. Therefore, it is crucial to ensure that data is analyzed with the correct approach.

²³ Kusumastuti et al., *Big Data: Teori Dan Penerapan Teknologi Big Data Dalam Berbagai Bidang*; Setyowati and Ahmad, "Pemanfaatan Big Data Dalam Era Teknologi 5.0."

²⁴ Fereshteh Zeynivandnezhad, Ipek Saralar-Aras, and Anjum Halai, "A Refined Framework For Qualitative Content Analysis Of Mathematics Textbooks," *EURASIA Journal of Mathematics, Science and Technology Education* 20, no. 3 (2024): em2412, <https://doi.org/https://doi.org/10.29333/ejmste/14284>.

The risk of error is even greater when individuals or organizations lack adequate mathematical thinking skills. Under these conditions, data tends to be interpreted subjectively according to individual perspectives. This results in analytical results that are less objective and difficult to validate. Furthermore, bias in data selection is also a common problem. Individuals tend to select data that supports pre-existing assumptions or hypotheses. Without mathematical analysis, there is no robust mechanism to test the validity of such data. As a result, decisions can be based on incomplete or unrepresentative information.

Behavioral economics offers an additional explanation for this phenomenon. Daniel Kahneman explains that humans have a tendency to seek patterns, even when none actually exist²⁵. This tendency can lead individuals to perceive seemingly insignificant relationships as meaningful. In the context of big data, this tendency becomes even more dangerous. Large amounts of data increase the likelihood of the emergence of seemingly meaningless patterns. Without mathematical tools to test these relationships, individuals can easily draw erroneous conclusions. This can seriously impact the quality of decisions made.

Furthermore, without a mathematical approach, it is difficult to distinguish between correlation and causation. Many decisions are made incorrectly because they assume a relationship between two variables implies a direct effect. However, the relationship may be influenced by other factors not considered. Mathematics helps to test these relationships more accurately. In organizational practice, errors in data interpretation can impact the strategy adopted. Decisions based on erroneous analysis can lead to losses, both financially and operationally. This demonstrates that the quality of data analysis is crucial to an organization's success.

Therefore, the integration of big data and mathematical thinking skills is crucial. Data provides the basic information, while mathematics serves as a tool to process and validate that information. Without this integration, the enormous potential of big data cannot be optimally utilized. Therefore, it can be concluded that big data without mathematical thinking is a dangerous illusion. Success in decision-making is determined not by the quantity of data, but by the ability to process and understand it. The integration of data and mathematics is key to producing accurate, objective, and reliable decisions.

4. CONCLUSION

This research confirms that using big data without the support of mathematical thinking skills is a high-risk approach to decision-making. The presence of large amounts of data often leads to the assumption that decisions will be more accurate, but without proper analysis, the data lacks clear meaning. In such situations, the data can be misleading and lead to erroneous conclusions. Therefore, the quality of decisions is determined not by the quantity of data, but by the ability to systematically process and interpret it. Mathematics, in this case, serves as the primary foundation in the data analysis process. Through a mathematical approach, data can be processed in a structured manner, producing more accurate, objective, and reliable information. Mathematics enables the identification of patterns, the measurement of relationships between variables, and the in-depth testing of data validity. Thus, decisions are no longer speculative, but are based on strong evidence and clear logic.

The integration of big data and mathematical thinking is an indispensable necessity in the context of the digital economy. Both play complementary roles, with data providing the basic information, while mathematics serves as a tool for processing and validating that information. Without this integration, the enormous potential of big data will not be optimally utilized. Therefore, strengthening mathematical thinking skills is crucial for individuals and organizations seeking to utilize data

²⁵ Eko Wiraspanggi et al., *Seni Mengambil Keputusan Saat Masa Depan Tidak Pasti* (Fahmi Karya, 2026).

effectively. As a recommendation, further research is expected to empirically examine the application of mathematical analysis in the use of big data in various sectors, such as education, business, and government, to obtain a more concrete picture of its impact on the quality of decision-making. Furthermore, an interdisciplinary approach combining mathematics, information technology, and psychology is also needed to more comprehensively understand how humans interact with data. Further research can also explore effective learning or training models for improving mathematical thinking skills in the context of data analysis, so that research results are not only theoretical but also have broad practical implications.

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