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Big Data Challenges And Opportunities In The Development Of Digital Technology

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ABSTRACT
At this time big data, with large data volumes that continue to grow and become complex, is a challenge and opportunity for governments and organizations. This is said to be a challenge considering that the increase in data volume will produce a lot and variety of information, thus requiring efficient ways of storing and managing data. Big data is said to be an opportunity considering that the magnitude of the study results and proper information management will open up new opportunities to recognize the potential for improving services in various government and organizational sectors. Big data can open up opportunities to increase knowledge about various aspects of people's lives so that it can encourage the creation of new trends and innovations in various fields, improve and optimize operations, and determine future conditions so that governments and organizations can produce appropriate basic products. In the future, big data will change the way governments and organizations run their operations, creating challenges and opportunities for decision-makers. Even so, in the future big data can be utilized more optimally for the benefit of the wider community. In the future, big data has great potential to be used in many sectors to improve people's welfare. By using the right methods, big data can be very valuable in improving the welfare and quality of life of the wider community. Therefore, to be able to implement big data to improve the welfare and quality of life of the wider community, it is necessary to understand the challenges and opportunities of big data in the development of digital technology.

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INTRODUCTION

The rapidly increasing growth in data volume has occurred recently, and the development of digital technology has had a lot of influence on this rapid data growth. This big data growth comes from a variety of varied and complex data. The abundance of data from various sources, such as social media, e-commerce, and IoT devices, has revolutionized the way we approach decision-making, problem-solving, and innovation across industries (Hassani & MacFeely, 2023). Several previous studies have attempted to understand the nature of big data which continues to grow, so that digital solutions are needed that are fairer, for everyone (Neves & Burgers, 2022). Several studies have shown that big data can play an important

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role in sectors such as industry. Big data in the financial sector is evaluated by building a financial risk indicator system (J. Liu & Fu, 2024). In research in the agricultural sector, big data can be used as a tool for monitoring soil quality (Obade & Gaya, 2021). From the description of the research that has been carried out previously, it can be said that research by Liu & Fu (2024) and other research described above illustrate that big data can contribute to overcoming challenges in many sectors such as business, finance, agriculture and so on if applied practically. Big Data can be applied practically to overcome the challenges faced by these sectors. With the right strategy and the use of advanced technology, Big Data can provide significant competitive advantages for organizations and society at large. Therefore, the ability to be able to implement big data is needed to improve the welfare and quality of life of the wider community. It is necessary to understand the challenges and opportunities of big data in the development of digital technology.

The ever-increasing volume of data generated from all parts of the world is known as big data (Tenali & Babu, 2023). The concept of big data is developing rapidly along with increasing internet use, resulting in a flood of data. Data sources Big data comes from many sources such as social media, web applications, scientific research, e-commerce platforms, smart devices, and so on (Dasari & Kaluri, 2023). Big data can be said to be a collection of data with a large and complex volume, where in managing, analyzing, and storing data it is difficult to apply traditional methods. What is meant by traditional methods is using descriptive and inferential statistics, relational databases, visualization techniques for example bar graphs, management information systems, and so on. The main aspects of big data are volume, velocity, and variety (Bianchini et al., 2024). Volume means that big data has a very large amount of data, velocity means that in big data the speed of the data produced is proportional to the speed of the data and the process and variety means that big data has different types of data (Wang, 2024). In public sector services, big data technology can be useful for organizations, private companies, and government companies. Even though the implementation of big data requires costs that are not cheap and the process is not easy, the use of big data can make it easier for users to manage data to achieve the right basis for decision-making so that organizations get even greater profits from existing investments. However, it is important to pay attention to how to comply with regulations and carry out smooth communication between stakeholders, as well as security and privacy issues related to trust in big data (Rahmadian et al., 2023). At this time, data has grown so rapidly with very complex and varied data types, structures, and dimensions (Huadong & Dong, 2024). The wave of information has presented challenges and opportunities in the development of digital technology. Big data becomes a challenge when the volume increases with large capacity and the complexity of big data which will ultimately create big challenges in the storage, processing, and analysis processes (Rawat & Yadav, 2021). Challenges in big data must also be able to recognize and overcome ethical issues (Tripathi et al., 2024).

Big data is now developing rapidly in all fields of science and engineering, apart from that we will get the latest trends in the development of Big Data and how this can change the way companies operate and compete in the global market (Cheng & Huang, 2021). Big data is facing challenges and opportunities in the development of digital technology, especially

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related to data management, security, and infrastructure requirements. The ever-changing complexity of digital technology (Zairis & Zairis, n.d.). Where the problem is a lack of integrated data sources, in addition to the large amount of unstructured data, this makes the data management process complicated and challenging. Apart from that, there is the issue of data security, which protects sensitive information from big data from unauthorized access (Al Nuaimi et al., 2015). Challenges also include infrastructure skills to be able to analyze big data and operate it effectively. Big Data's ability to perform predictive and prescriptive analysis also provides great added value. Big Data analytics offers a solution to these challenges by enabling organizations to effectively manage, process, and analyze large amounts of data (Maroufkhani et al., 2019). Opportunities in the application of big data, due to the continuous development of digital technology, are expected to further expand opportunities for the application of big data in various sectors, both in government, organizations, business, and so on. To solve big data problems, challenges, and opportunities in the development of digital technology, things that can be done are carrying out effective data management, maintaining data security and privacy, improving human resource competence, and infrastructure in technology, conducting analysis and data interpretation, and implementing policies.

METHODS

The research method for the topic Big Data Challenges and Opportunities in the Development of Digital Technology uses a comprehensive and diverse approach to collect, analyze, and interpret data and information from existing research or previous studies on research topics, through articles, journals on Google Scholar, libraries digital, websites and browsers. Library research is research that collects data including observation and literature study. collect scientific sources, journal articles, industry reports, and various sources that accurately discuss big data and digital technology. The data collection method uses secondary and primary data collection. Data analysis was carried out, both qualitative analysis and quantitative analysis related to the research topic.

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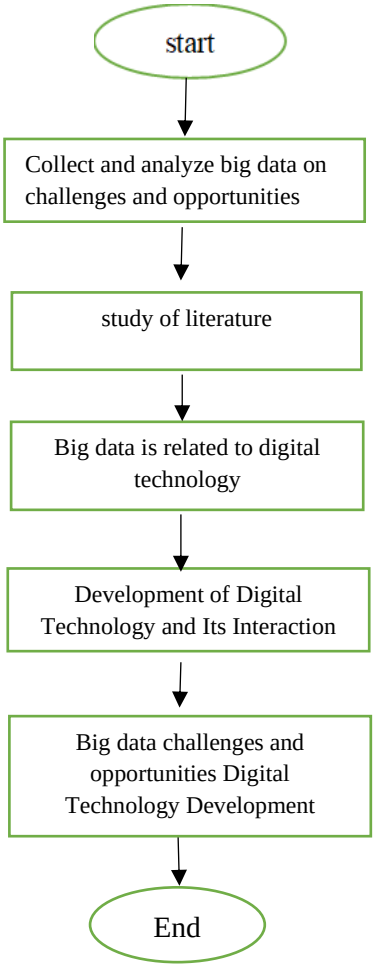

Figure 1. Research Methods

RESULTS AND DISCUSSION

Big Data and Digital Technology

Currently, big data and digital technology have changed the way information is collected, analyzed, and utilized. Big data collects and processes large amounts of data from various sources, including social media, sensors, and online transactions, all the data collected is useful in providing valuable information in various sectors such as the world of business, organizations and government, education, health, and others as a basis for accurate decision making to expand effective strategies in the future. The application of big data and digital technology has made rapid progress in many sectors, namely government, business, education, health, and others (Al-Kabi & Jirjees, 2019). In this era, businesses and organizations rely on big data and digital technology to gain a competitive advantage. Where this technology can filter important information from very large data sets, make more accurate future predictions, and specialized experience, to be able to achieve targeted strategies. Big data and digital technology can overcome social challenges to improve public services. By utilizing big data and the results of its analysis, the government can detect patterns and trends in many sectors such as education, health services, and transportation to make

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appropriate policy decisions based on data. It can be said that big data and digital technology have changed the way humans collect, analyze, and utilize information. With the development of the digital era, the amount of data generated from various sources such as social media, online transactions, and sensors has increased significantly (Haddad, 2024). Big data refers to large amounts of structured, semi-structured, and unstructured data obtained at high speed from various sources. Where the data is too complex and large to be processed using traditional data processing techniques. These technologies include distributed file systems such as Hadoop, which enable distributed storage and processing of data across multiple machines, as well as parallel processing frameworks such as Spark, for fast and efficient data processing(Sais et al., 2023).

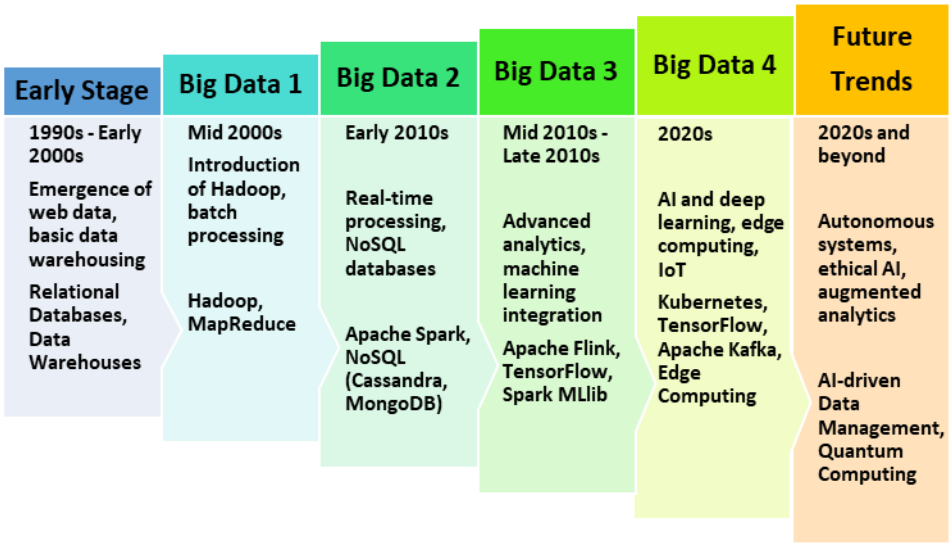

Figure 2. Big Data Technology Evolution Phases

Development Of Digital Technology and Its Interaction with Big Data

In the digital era, technology is very influential in shaping many aspects of life. The key technology today is digital technology, where this technology operates using digital signals and processes data in binary format. With digital technology, communication, storage, and processing of information can be made faster and more efficient. Big Data refers to large amounts of data generated every second where the source comes from social media, sensors, and online transactions. Collaboration between digital technology and big data is very important. Digital technology provides the facilities and tools needed to collect, store, process, and analyze big data. Digital technology collects data from various sources such as websites, mobile applications, social media, as well as IoT sensors. Then the data is processed and analyzed using digital tools, data analysis software, machine learning algorithms, and cloud computing platforms (Reshetnikova et al., 2021). The collaboration of digital technology and big data produces valuable patterns and trends from large amounts of data. This collaboration produces accurate decisions, improves business operations, optimizes resource allocation, and encourages innovation in various fields such as education services, government, finance, transportation, intelligent and automatic systems, and so on (Artemenko & Zenchenko, 2021).

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It can be said that digital technology and big data are closely related, where big data provides raw data to be processed by digital technology. The collaboration of digital technology and big data has changed the perspective on understanding and interacting with information in this era. The interaction between digital technology and big data can be seen in Table 1 below:

Table 1. Digital Technology And Its Interaction With Big Data

Digital Technology	Interaction with Big Data
Internet of Things (IoT)	Generates vast amounts of data for Big Data Analytics
Cloud Computing	Provides scalable storage and processing power for Big Data
Machine Learning	Analyzes Big Data to uncover patterns and make predictions
Blockchain	Ensures data integrity and security in Big Data environments
Artificial Intelligence (AI)	Utilizes Big Data to train and improve AI models
Data Analytics	Extracts valuable insights from Big Data
Big Data Frameworks	Examples include Hadoop and Spark, which facilitate Big Data operations
Edge Computing	Reduces latency by processing Big Data closer to its origin

Big Data Challenges in the Development of Digital Technology

The sharp increase in data volume in big data has the potential to provide challenges for many parties, including governments, organizations, businesses, and so on. Of course, to manage this big data, digital technology is needed (H. Liu et al., 2021). Some of the main challenges of big data in the development of digital technology are as follows:

Table 2. Big Data Challenges in the Development of Digital Technology

Big Data Challenges	The development of Digital Technology
Data Volume	Data Volume, digital technology has produced enormous amounts of big data. Where often managing big data using traditional methods is no longer able to handle it. So it is difficult to store and manage big data.
Real-Time Processing	With the development of digital technology, very high speeds require continuous real-time processing
Different Formats	Has a variety of sources with different formats, so each technique has a different way of managing it
Data That Changes Frequently	Data Verification, the quality and precision of the data vary greatly, and the data often changes
Data Security	Data security needs to be considered, especially access from unauthorized people.
Sofware Dan Hardware	Requires good infrastructure, both software and hardware

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Big Data Challenges	The development of Digital Technology
High Costs in Managing Big Data	The problem of quite high costs in managing big data is a challenge in itself.
Human Resources	Skills are required from existing human resources to manage big data

It can be said that the topic of big data challenges in the development of digital technology covers various aspects related to the challenges faced in the use of Big Data in the development of digital technology, such as the volume and speed of data, data comes from various sources and in various formats, data is always changing and incomplete results in misleading analysis and inappropriate decisions. Therefore, data security and good human resource capabilities are required to manage data. To overcome big data challenges in the development of digital technology, you can consider the following strategies:

Table 3: Big Data Challenges And Strategy

Big Data Challenges	Strategy
Distributed storage and massive storage systems	Implement distributed storage solutions and massive storage systems to handle high data volumes
Perform real-time processing	The process of processing data directly after the data is received, to provide results or responses in a very short time to increase operational efficiency.
Using Artificial Intelligence	Using Artificial Intelligence to address data security issues
Invest in Training and Recruiting	Allocate resources for developing the skills of current employees and attracting new talent to the organization. So that companies can increase productivity
Cloud Services	Perform cloud-based services, providing cost-effective infrastructure solutions

All the challenges that exist can be said, that even though big data has changed the way humans use and standardize information, there are still challenges as technical problems that must be overcome. In the future, innovation and collaboration from several fields will be able to overcome existing challenges and maximize the benefits of Big Data in the development of digital technology.

Big Data Opportunities in Digital Technology Development

The opportunity for big data in the development of digital technology is that the ability of big data to collect, process, and analyze data in real time often provides benefits for information as a basis for making decisions quickly and accurately. Information that is available in real-time makes optimizing the operations of organizations, governments, businesses, and so on

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able to increase high competitiveness (Hassani & MacFeely, 2023). Big data capabilities in infrastructure management, resource management, capabilities in predictive analytics (ability to predict the future) in the public sector as well as policy evaluation capabilities are big data opportunities in the application of digital technology as a trend in the future. There are several examples of utilizing big data in the current development of digital technology, namely in the health sector in the form of monitoring public health services, crime detection as an application of public security, traffic monitoring, handling natural disaster problems, and so on (de Santiago & Polanski, 2022). Of course, opportunities in utilizing big data require investment accompanied by safe usage policies. Big data has developed rapidly nowadays, the use of big data brings the development of innovative technology, increases operational efficiency, and encourages business growth where big data analysis can identify trends and patterns that may not have been visible until now. By harnessing the power of big data, organizations can uncover hidden opportunities, optimize processes, and create experiences that enhance their customers.

CONCLUSION

Big data, in its use in the development of digital technology, includes the ability to obtain value in the form of developing innovative technology, increasing operational efficiency, and encouraging business growth. By overcoming existing challenges and taking advantage of opportunities generated by big data, organizations, governments, businesses, and so on can increase efficiency, innovation, and more optimal service to customers. Effective use of big data will optimize well-planned strategies, invest in the use of appropriate technology, be able to manage data safely, and have the right human resource skills. Thus, Big Data can be a major driver in the development of digital technology and business transformation for both governments and other organizations.

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