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## Optimizing Marketing Strategies with Big Data, AI, and Technology: Its Impact on Business Innovation and Economic Growth and in the Digital Market

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### Abstract

*Digitalization and technological advancements have brought about a major change in marketing strategies in the digital age. Big Data, Artificial Intelligence (AI), and other modern technologies are key elements in creating business innovation and driving economic growth. This research aims to analyze the optimization of marketing strategies using Big Data, AI, and technology, as well as their impact on business and economic innovation in the digital market. This study uses a descriptive-qualitative method with a literature study approach to analyze the role of Big Data, Artificial Intelligence (AI), and technology in optimizing marketing strategies, business innovation, and economic growth in the digital market. Meanwhile, the results of the analysis show that the application of Big Data allows companies to understand consumer behavior in depth, while AI supports service personalization and marketing process automation. The integration of this technology not only improves operational efficiency, but also creates a new business model that is adaptive to market needs. In addition, the application of this technology contributes to economic growth by increasing productivity and creating new added value in the digital sector. However, the implementation of Big Data and AI faces challenges, such as high implementation costs, data privacy concerns, and limited access to technology. Therefore, technology-based marketing strategies require a balanced approach between innovation and ethics. This research contributes to understanding the role of technology in building business competitiveness and maximizing the potential for economic growth in the digital era.*

*Keywords: Big Data, Artificial Intelligence, Marketing Strategy, Digital Technology, Business Innovation, Economic Growth.*

### 1. Introduction

In today's digital era, marketing has undergone a significant transformation thanks to technological advancements, especially in the use of Big Data and artificial intelligence (AI)[1]. Companies not only rely on intuition and experience in designing marketing strategies, but also leverage abundant data to understand consumer behavior, market trends, and evolving needs. Big Data allows for the collection and analysis of information from various sources, providing deeper insights into customer preferences and market dynamics.[2]

Along with the development of technology, the business world has undergone a significant transformation from a conventional model to a digital business era. This raises the question of what is meant by a digital business. Digitalization, which refers to the process of transforming a business into a digital form by utilizing technology, is now a necessity. The main goal is to increase profits and create opportunities to generate new added value. Currently, many companies are undergoing the digitalization process. Several large and well-known companies have taken this step to achieve success in economic, financial, and customer satisfaction aspects.[3]

Digitalization plays a crucial role for individuals and business actors who want to start or transform their business into a digital-based[4]. Therefore, keeping up with the development of digitalization is a necessity that cannot be ignored. Today, various popular digital technologies, such as Artificial Intelligence (AI), Machine Learning, Virtual Reality, Augmented Reality, Robotic Process Automation (RPA), Quantum Computing, Edge Computing, Blockchain, 5G, and the Internet of Things (IoT), are driving business transformation. This phenomenon is reflected in the more than

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2 billion websites that exist in the world. The internet itself is a very large entity, so it is difficult to measure its size with certainty. However, information technology giants such as Microsoft, Amazon, Google, and Facebook are known to store an incredible amount of data, which is around 1.5 million terabytes.[5]

The use of AI in marketing has also opened up new opportunities for innovation. Advanced algorithms can analyze data patterns and provide more precise recommendations, improving the efficiency of marketing campaigns. Additionally, this technology allows for better personalization, where the customer experience can be customized based on individual behavior and preferences.[6]

The impact of implementing marketing strategies powered by Big Data and AI is not only felt by companies, but also contributes to overall economic growth. By increasing competitiveness and operational efficiency,[7] Companies can create new jobs, encourage innovation, and stimulate investment. The growing digital market offers opportunities for businesses to reach a wider audience, making data-driven marketing the key to future success.[8]

Big Data allows companies to collect, analyze, and utilize large amounts of data to deeply understand consumer behavior. Based on the research of Chen et al. (2012), the use of Big Data-based analytics improves accuracy in predicting market needs and consumer trends, thereby allowing companies to develop more targeted and personalized marketing strategies. By understanding consumption patterns, companies can allocate marketing resources efficiently, reduce waste, and increase ROI (Return on Investment).[9]

AI supports companies in creating personalized customer experiences through predictive analytics and automation technologies. Davenport & Ronanki (2018) show that AI helps speed up decision-making, personalize customer interactions, and automate marketing tasks such as audience segmentation and email campaigns. AI technology is able to create new opportunities by providing relevant and timely services to customers, thereby increasing loyalty and retention.[10]

Despite the large impact, the implementation of this technology still faces challenges, such as limited data access, high implementation costs, and concerns related to consumer privacy. Gandomi & Haider (2015) mentioned that companies need to develop a balanced strategy between technological innovation and data use ethics. Overcoming these challenges is key to ensuring sustainability in the application of advanced technology in the field of marketing.

Optimizing marketing strategies through Big Data, AI, and technology has a significant impact on business innovation and economic growth. By harnessing the power of digital technology, companies can strengthen their position in the digital market, improve operational efficiency, and create added value for customers and society as a whole. However, this success requires careful planning, proper technology adoption, and good data ethical management to ensure a sustainable positive impact.[11]

Furthermore, the study will explore various case studies that demonstrate the practical implementation of Big Data and AI in marketing, as well as analyze the results and impacts generated. In addition, we will discuss the challenges that companies may face in the process of adopting this technology, as well as ways they can be overcome to gain a competitive advantage in an increasingly tight market. Thus, a deep understanding of data-driven marketing strategies will not only strengthen the company's market position, but also contribute to sustainable economic growth.

Through this explanation, this research will discuss more deeply about optimizing marketing strategies using Big Data and AI, as well as their impact on business innovation and economic growth in the digital market. By understanding how this technology can be integrated into marketing strategies, companies can identify new opportunities, reduce risk, and improve faster and more accurate decision-making. Deep data analysis also allows companies to respond to market changes in real-time, so they can adapt quickly to changing consumer needs and expectations.

## **2. Method**

This study uses a descriptive-qualitative method with a literature study approach to analyze the role of Big Data, Artificial Intelligence (AI), and technology in optimizing marketing strategies, business innovation, and economic growth in the digital market. The research process is carried out through the following stages:

### **2.1 Data Collection[12]**

Data is obtained from secondary sources in the form of scientific journals, conference articles, industry reports, books, and other trusted documents that discuss Big Data, AI, digital technology, and their impact on marketing strategies and the digital economy.

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## 2.2 Data Analysis

- a. Qualitative Analysis: The collected data is analyzed to identify patterns, trends, and relationships between Big Data, AI, and marketing strategies. A thematic approach is used to group information based on categories such as business innovation, marketing efficiency, and economic growth.
- b. Literature Synthesis: Previous research is compared to find similarities, differences, and gaps in research that can be used as a basis for the findings of this study.[13]

## 2.3 Analysis Framework

This study uses an analytical framework based on *the technology adoption model* (TAM) to understand the factors that drive technology adoption in the marketing sector. The aspects evaluated include:

- a. Perceived Usefulness: The benefits of technology to the effectiveness of marketing strategies.
- b. Ease of Use: Ease of technology implementation in business.
- c. Cost-Benefit Analysis: The economic impact of the use of technology.

## 2.4 Data Validation[14]

The validity of information is guaranteed through the selection of reliable sources, especially publications indexed on international databases such as Scopus, Web of Science, and Google Scholar.

## 2.5 Research Output

The results of the research are presented in a descriptive and analytical form, focusing on recommendations for technology-based marketing strategies to support business innovation and economic growth in the digital market.

This approach provides a comprehensive understanding of how companies can leverage Big Data, AI, and technology to face challenges and capitalize on opportunities in the digital market.

## 3. Results and Discussion

In today's digital era, optimizing marketing strategies using Big Data, artificial intelligence (AI), and technology has become the key to increasing business innovation and economic growth. By leveraging big data and advanced technology, companies can better understand consumer behavior, identify market trends, and respond to customer needs more effectively.

### 3.1 Utilization of Big Data in Marketing Strategy

In the increasingly evolving digital era, the utilization of Big Data has become a key element in modern marketing strategies. Big Data refers to very large and complex data sets that cannot be managed by traditional methods. With key characteristics such as volume, variety, and velocity, Big Data allows companies to gain deeper insights into consumer behavior and market trends.[15]

#### 1. Building a Strong Data Infrastructure

The first step in utilizing Big Data is to build an efficient data infrastructure. This involves investing in storage technology and data processing systems that can handle large volumes of data quickly and accurately. This infrastructure should be able to provide real-time access to data, so that marketing teams can make informed decisions. Choosing a scalable storage platform is essential to adapt to the growth of data volumes.[16]

#### 2. Data Security and Privacy

With the increasing attention to data privacy, companies must ensure that they implement strict security protocols to protect sensitive information. The implementation of encryption technology and strict access control will help maintain data security while still providing access to relevant parties within the organization. Compliance with regulations such as GDPR (General Data Protection Regulation) is also crucial to avoid fines and maintain brand reputation.

#### 3. Advanced Analytics for Valuable Insights

Analytics capabilities are a critical component of Big Data infrastructure. The use of advanced analytics technologies such as machine learning and artificial intelligence allows companies to analyze big data effectively. With these analytics tools, companies can find previously invisible patterns and trends, as well as conduct predictive analytics to forecast consumer behavior. This allows marketing teams to adjust their strategies before major changes occur.

#### 4. Personalize the Customer Experience

One of the biggest benefits of leveraging Big Data is the ability to personalize the customer experience. By gathering detailed data on consumer preferences and behaviors, companies can create marketing campaigns that

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are more relevant and engaging to their target audience. For example, a travel business uses booking data to recommend specific destinations or activities to travellers based on their browsing history.

#### 5. Identify Market Trends

Big Data also allows companies to identify new trends in the market more quickly. Through social media analytics and other sources, businesses can track conversations about a particular product or service, so they can develop marketing campaigns that align with those trends.[17]

### 3.2 The Impact of Change Towards a New Strategy

Changes towards new strategies in organizations, especially government agencies, have a significant impact both positively and negatively. To understand this impact, we need to look at some of the key aspects involved in the process of change.[18]

#### 1. Increased Organizational Effectiveness

One of the main impacts of the change towards the new strategy is the increase in organizational effectiveness. By adopting new strategies, institutions can be more responsive to the needs of society and the ever-changing demands of the market. For example, the application of new technology in public services can speed up the administrative process and increase community satisfaction. This shows that well-planned changes can lead to better outcomes for all stakeholders.

#### 2. Improve Employee Performance

Strategy changes often involve training and developing new skills for employees. This not only improves the abilities of individuals but also contributes to the improvement of the overall performance of the organization. When employees feel more skilled and ready to take on new challenges, they tend to be more motivated and productive. Therefore, investment in human resource development during the change process is essential.

#### 3. Better Competitiveness

By adopting new strategies, organizations can increase their competitiveness in the market. For example, if a government agency implements a more efficient information system for public data management, it will not only improve services but also provide a competitive advantage compared to other agencies that have not done the same. Increased competitiveness allows organizations to attract more resources and support from the public.

#### 4. Innovation and Creativity

Changes to new strategies often drive innovation in the way we work and service delivery. When an organizational culture supports innovation, employees feel empowered to think creatively and find new solutions to existing problems. It creates a dynamic work environment where fresh ideas can flourish, resulting in better products or services.[19]

#### 5. The Challenge of Resistance to Change

While there are many benefits to strategic change, the biggest challenge is often resistance from within the organization itself. Employees may feel uncomfortable with the change due to fear of losing their job or unsure about how the change will affect their current role. Therefore, it is important for management to communicate effectively regarding the reasons behind the change and its benefits for all parties.

#### 6. The Need for Strong Leadership

The successful implementation of the new strategy is highly dependent on strong and effective leadership. Leaders must be able to motivate their teams and provide clear direction during this transition process. Without solid leadership, even the best plans can fail due to a lack of support from employees.

#### 7. Continuous Evaluation

Once the implementation of the new strategy is carried out, continuous evaluation becomes important to ensure that the initial goals are achieved and that the impact is positive on the organization as a whole. The evaluation process helps in identifying areas of improvement and adjusting strategies if needed to remain relevant to the needs of the community.

Overall, the change towards the new strategy has a far-reaching impact on organizational effectiveness, employee performance, competitiveness, innovation as well as the challenge of resistance to change and the need for strong leadership.

### 3.3 Assets generate Return On Investment (ROI) by utilizing Big Data Technology, Internet of Things, Artificial Intelligence.

Return on Investment (ROI) is a metric used to measure the efficiency or profitability of an investment. In the context of technologies such as Big Data, the Internet of Things (IoT), and Artificial Intelligence (AI), ROI can be calculated by comparing the benefits generated from the implementation of these technologies to the costs incurred for their implementation.[20]

#### 1. The Application of Big Data in Increasing ROI

Big Data refers to very large and complex data sets that cannot be processed using traditional methods. By analyzing this data, companies can:[21]

- a. Gain Customer Insights: Analyzing customer data allows companies to understand their behaviors and preferences, thereby improving the customer experience and increasing sales.
- b. Operational Optimization: By monitoring business processes in real-time, companies can identify inefficiencies and reduce operational costs.
- c. Market Trend Prediction: Using predictive analytics, companies can forecast market trends and adjust their business strategies to capitalize on new opportunities.

A real example is a retail company that uses data analysis to determine which products should be stocked based on customer buying patterns.

#### 2. The Role of the Internet of Things (IoT) in Increasing ROI

IoT refers to a network of physical devices that are connected to the internet, allowing for the collection and exchange of data. IoT adoption can increase ROI through:[22]

- a. Real-Time Monitoring: IoT sensors allow for real-time monitoring of the condition of a machine or product, aiding in predictive maintenance and reducing downtime.
- b. Automated Data Collection: IoT allows for the automatic collection of data from various sources without human intervention, thereby reducing labor costs.
- c. Improved Energy Efficiency: IoT devices can help companies monitor energy usage and identify areas for cost savings.

For example, a factory that uses IoT sensors to monitor their machines can detect problems before they become major breakdowns, saving on repair costs.

#### 3. Implementation of Artificial Intelligence (AI) to Increase ROI

AI includes advanced algorithms that are capable of learning from data and making automated decisions. AI contributes to ROI through:

- a. Business Process Automation: AI can replace routine tasks performed by humans, thereby reducing labor costs.
- b. Big Data Analytics: AI is capable of analyzing large volumes of data faster than humans, providing valuable insights in a short period of time.
- c. Customer Service Personalization: Using machine learning, AI can provide personalized product recommendations to customers based on their previous behavior.

An example of the application of AI is chatbots that provide 24/7 customer service without the need for direct human intervention.

#### 4. Calculating the ROI of This Technology

Calculating Return on Investment (ROI) using Big Data, IoT, and AI technologies requires data on the profits obtained from investing in these technologies as well as the total cost of the investment. Here are the steps and application of the formula:

##### a. Basic Formula:

$$ROI = \frac{(Investment\ Cost - Benefits)}{Investment\ Costs} \times 100\%$$

##### b. Calculation Components:

###### 1) Benefits:

###### a) Advantages can be in the form of:

- 1) Reduced operational costs.
- 2) Increased revenue due to efficiency or use of technology.
- 3) Savings from reduced downtime or asset failure.

###### 2) Investment Cost:

###### a) Fee included:

- 1) Hardware and software implementation of technology.
- 2) Employee training.
- 3) The cost of maintaining the technology.

##### c. Example ROI Calculation:

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- 1) Data Assumptions:
  - a) Profit: IDR 500 million (operational savings and increased revenue).
  - b) Investment cost: IDR 200 million (including the purchase of IoT devices, AI development, and training).

- 2) ROI calculation:

$$ROI = \frac{(500.000.000 - 200.000.000)}{200.000.000} \times 100\%$$

$$ROI = \frac{300.000.000}{200.000.000} \times 100\%$$

$$ROI = 150\%$$

- 3) Interpretation of Results:
  - a) An ROI of 150% means that investments in Big Data, IoT, and AI generate a profit of 1.5 times the cost of investment.
  - b) This shows that the investment is very profitable for the company.
- 4) High ROI Supporting Factors:
  - a) Proper Implementation: Technology is used strategically for the areas with the greatest impact.
  - b) Optimal Maintenance: Reduces downtime and increases productivity.
  - c) Employee Skill Improvement: Trained employees maximize the potential of technology.

This calculation is useful as a basis for evaluating the effectiveness of technology investments and strategic decision-making going forward. This way, companies can get a clear picture of how effective the technology is in generating profits compared to the costs incurred.

By utilizing Big Data, IoT, and AI synergistically, companies can not only improve operational efficiency but also create added value for customers and increase profitability. The implementation of this technology must be done with careful planning so that the results are optimal in generating Return on Investment (ROI).

### 3.4 Building a Data-Based Marketing Strategy Framework

In the modern world of marketing, building a data-driven marketing strategy framework is essential to achieve success. This approach allows companies to better understand consumer behavior and market trends, as well as optimize their marketing campaigns. Here are the steps to build the framework.[23]

1. Define Marketing Objectives

The first step in building a data-driven marketing strategy is to define clear and measurable goals. These goals can be increased sales, increased brand awareness, or increased customer loyalty. With clear objectives, companies can determine the type of data that needs to be collected and analyzed.

2. Identify the Target Audience

After setting the goal, the next step is to identify the target audience. It involves segmenting the market based on consumer demographics, behavior, and preferences. Data from customer surveys, social media analytics, and digital monitoring tools can be used to understand who the audience is most relevant to the product or service offered.

3. Collect Relevant Data

Data collection is a crucial part of a data-driven marketing strategy. Companies must collect different types of data, including:

- a. Demographic Data: Information about age, gender, geographic location, and income.
- b. Behavioral Data: Information about how consumers interact with products or services through websites or apps.
- c. Transaction Data: A record of previous purchases that helps you understand your spending patterns.

Data collection can be done through various channels such as online registration forms, customer surveys, and behavioral analysis on websites.

4. Data Analysis

Once the data is collected, the next step is to analyze that information to find new patterns and insights. Statistical analysis techniques and analytics tools such as Google Analytics or CRM (Customer Relationship Management) software can be used to evaluate the data in depth.

This analysis can help in:

- a. Identify buying trends.
- b. Understand customer preferences.
- c. Determine the effectiveness of previous marketing campaigns.

5. Develop a Marketing Strategy Based on Data Insights

With the insights gained from data analysis, companies can develop more effective marketing strategies. This can include:[24]

- a. Content Personalization: Sending special messages or offers to specific audience segments based on their preferences.
  - b. Geo-targeting: Tailor ad campaigns based on the geographic location of consumers.
  - c. Behavior-Based Marketing: Using user behavior on a website to target ads more precisely.
6. Implement Marketing Campaigns

Once the strategy is developed, the next step is the implementation of the marketing campaign. This involves launching ads on various platforms (social media, email marketing, etc.) according to a plan that has been made.

7. Monitor and Evaluate Campaign Performance

Monitoring campaign performance is essential to know if a data-driven strategy is successfully achieving the set goals. The use of digital monitoring tools allows companies to track metrics such as sales conversions, user engagement rates, and ROI (Return on Investment). Periodic evaluations of campaign results will provide valuable feedback to improve future strategies.

8. Update the Strategy Regularly

Data-driven marketing is not a one-time process; It requires constant updates and adjustments based on the results of the latest analysis and changes in consumer behavior or market trends. By following these steps systematically, companies can build a data-driven marketing strategy framework that is effective and adaptive to market needs and consumer behavior.

### 3.5 Leveraging Real-Time Data to Craft Responsive Marketing Campaigns

The use of real-time data in marketing campaigns allows companies to respond quickly and appropriately to changes in consumer behavior and market dynamics, thereby creating more relevant and effective marketing strategies. With technologies such as streaming analytics and interactive dashboards, companies can monitor campaign performance in real-time, see emerging trends, and make quick adjustments to strategies based on the insights gained. This allows for more adaptive and actual data-driven campaign drafting, which in turn improves the company's ability to attract and retain customers.[25]

The advantage of applying real-time data is its ability to provide a deeper understanding of consumers' reactions to marketing messages conveyed, whether through digital advertising, social media, or other communication channels. Companies can easily identify the most effective elements, such as content type, publication timing, and distribution channels, so that they can optimize every aspect of the campaign with more precision. Additionally, real-time data also helps in anticipating potential problems and opportunities that may arise, allowing companies to take proactive action before the situation becomes more complex.[26]

Real-time data-driven marketing strategies also provide high flexibility in personalizing messages and offers to consumers, which can significantly increase engagement and conversions. By dynamically tailoring marketing content based on detected consumer interactions and preferences, companies can create a more personalized and relevant experience for each audience segment. This provides a huge competitive advantage in building consumer loyalty and ensuring the success of marketing campaigns in the midst of increasingly fierce competition.

Real-time data also allows companies to personalize content and offers to their customers. By understanding individual preferences based on their recent behavior, companies can send relevant product recommendations or special offers via email or digital advertising. Overall, the use of real-time data in crafting responsive marketing campaigns provides a competitive advantage for businesses in this digital era. With the ability to collect and analyze information in real time and quickly adjust strategies based on those insights, companies are not only able to meet customer needs but also adapt to changing market dynamics.

### 3.6 Development of Data-Based Monitoring and Decision Making System for Sustainable Marketing

The development of an effective and integrated monitoring system allows companies to monitor marketing performance in real-time and identify emerging opportunities and challenges quickly and precisely. By using advanced analytics platforms, such as interactive dashboards and data visualization tools, marketing teams can see key performance indicators (KPIs) in real time and gain deeper insights into the effectiveness of their campaigns and marketing strategies. This system not only makes monitoring easier, but also allows early detection of anomalies or trend changes, so companies can take corrective action before the negative impact becomes more widespread.[27]

The advantage of developing a data-driven monitoring system is its ability to support faster, fact-based decision-making, which is crucial in a dynamic and competitive business environment. With data that is always updated

and well-organized, companies can respond more proactively to changes in the market and consumer preferences, so that marketing strategies can be adjusted in a timely manner. In addition, a good monitoring system also helps in optimizing marketing budget allocation, by providing a clear picture of the performance of each marketing channel and its impact on the business goals to be achieved.[28]

Data-driven monitoring and decision-making systems not only improve operational efficiency, but also support the sustainability of marketing strategies in the long term. By collecting and analyzing data on an ongoing basis, companies can build a database rich in insights, which can be used to design more strategic and measurable marketing campaigns. This approach gives companies the ability to continue to evolve and adapt to changing markets, as well as maintain relevance and competitiveness in an ever-changing industry.

Data plays a crucial role in sustainable marketing as it helps companies understand consumer preferences and behaviors that are increasingly concerned about sustainability issues. Additionally, by using data, companies can measure the environmental impact of their products and adjust marketing strategies to highlight sustainable aspects. Data also allows companies to optimize the use of resources more efficiently, thereby reducing waste and increasing profitability.

Developing an effective monitoring system involves several key steps, namely: first, identifying the specific objectives of the monitoring system, such as increasing brand awareness or reducing carbon footprint. Second, the collection of data from a variety of sources, including customer surveys, web analytics, social media, and sustainability reports. Third, data analysis uses statistical analysis techniques or machine learning to evaluate the collected data, and finally, clear and informative reporting on the analysis findings so that they can be used by stakeholders in decision-making.

Once the monitoring system is developed, the next step is the implementation of data-driven decision-making. This involves integrating the results of the monitoring system with other business processes such as strategic planning and product development. Training the marketing team on how to use data in day-to-day decision-making is essential, followed by piloting new strategies based on insights from the data, as well as monitoring the results to make adjustments if necessary.

While there are many benefits of a data-driven monitoring system, there are several challenges that must be faced. The quality of accurate and relevant data is essential for generating useful insights. Additionally, managing consumer privacy when collecting data is a legal and ethical challenge that must be considered. Changing organizational culture is also a challenge, as implementing a data-driven approach may require a change in attitudes within the team so that all members accept the importance of using data.

#### 4. Conclusion

This research shows that Big Data, Artificial Intelligence (AI), and other digital technologies play an important role in optimizing marketing strategies, driving business innovation, and supporting economic growth in the digital market. The application of Big Data allows companies to analyze data in depth, thereby better understanding consumer needs and preferences. AI, with its automation and personalization capabilities, strengthens customer interactions and improves operational efficiency. In addition, the integration of digital technology supports the creation of new business models that are more adaptive and relevant to market dynamics. The positive impact of this technology includes increased productivity, cost efficiency, and significant contribution to the growth of the digital economy globally. However, the application of this technology cannot be separated from challenges such as high implementation costs, limited infrastructure, and data privacy issues. Therefore, companies need to adopt a balanced strategy, utilize technology innovatively, and ensure compliance with ethical and regulatory aspects. The optimization of Big Data, AI, and digital technology is not only a tool to improve the competitiveness of companies, but also a driver of sustainable economic transformation in the digital era.

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