Bulletin of Innovation in Management (BIM)
Vol. 3, No. 1, July 2025, pp. 17-22
ISSN: 2988-5736, DOI: 10.59247/bim.v3i1.331

Big Data Technology to Improve Marketing Strategy

Efa Wakhidatus Solikhah[1], Mai Ulfa Atika[2], Joni Prayogi[3]
[1]Universitas Ahmad Dahlan, Indonesia
[2]Universitas Gadjah Mada, Indonesia
[3]Universitas Jenderal Soedirman, Indonesia

ARTICLE INFO

Article history:

Received July 08, 2025
Revised August 08, 2025
Published August 29, 2025

Keywords:

Big Data;
Marketing Strategy;
SmartPLS;
Decision Making;
Consumer Analytics;
Digital Technology

ABSTRACT

This study aims to analyze the effect of Big Data technology implementation on the effectiveness of a company's marketing strategy, by considering intermediary variables such as consumer understanding and data-based decision making. A quantitative approach was used in this study by collecting data through a survey of 110 respondents who are marketing managers in various industrial sectors in Indonesia. The data were analyzed using the Structural Equation Modeling (SEM) method based on Partial Least Squares (PLS) through SmartPLS 4.0 software. The results of the study indicate that the implementation of Big Data has a significant positive effect on marketing strategies, both directly and through increasing understanding of consumer behavior. This finding indicates that the integration of Big Data in the marketing process can improve the accuracy of market segmentation, campaign effectiveness, and service personalization. The practical implications of this study encourage companies to adopt data analytics as the main foundation in strategic marketing decision making in the digital era.

Corresponding Author:

Efa Wakhidatus Solikhah, Ahmad Dahlan University, Yogyakarta, Indonesia.
Email: efa.solikhah@mgm.uad.ac.id

1. INTRODUCTION

The rapid development of digital technology has revolutionized various aspects of life, including in the world of business and marketing [1]. One of the most influential innovations in this era of digital transformation is the presence of Big Data technology. Big Data refers to a very large, diverse, and growing collection of data, which if processed properly can produce high-value information [2]. In the context of marketing, Big Data provides a great opportunity for companies to understand consumer behavior more deeply, design more personalized marketing strategies, and measure the effectiveness of marketing campaigns more [3]. With the help of this technology, companies are not only able to adjust marketing messages and content in real-time, but can also predict market trends and make decisions based on strong empirical evidence [4]. This shows that Big Data is not just a technical tool, but has become an important part of the company's strategic foundation in facing increasingly complex business competition.

The application of Big Data in marketing allows companies to segment the market more sharply and accurately, because every consumer interaction with digital media leaves a trace of data that can be analyzed [5]. For example, information from social media, search history, online transactions, and customer reviews can be used to build a more complete and real-time consumer profile. That way, companies can provide a more personalized experience, increase consumer engagement, and build brand loyalty in a sustainable manner. According to a report [6] companies that integrate Big Data analytics into their marketing strategies can increase profits by 15–20% compared to companies that still rely on traditional approaches. This is reinforced by a survey from [7] which shows that the majority of marketing executives believe that data-based decisions are more

effective in achieving marketing targets.

However, behind the great potential offered, the use of Big Data in marketing practices also faces various challenges. Some companies do not yet have adequate technological infrastructure to manage large volumes of data, not to mention the limited human resources who have competence in the field of data analytics [8]. In addition, the complexity of combining data from various sources, as well as ethical issues and customer privacy protection are also concerns that cannot be ignored. Therefore, it is important for companies to have a clear and planned strategy in implementing Big Data technology holistically in order to provide real added value in marketing activities. Understanding the strategic value of Big Data, not only as a technological tool but as part of insight-based decision making, is the key to success in today's digital marketing [9].

Academically, the results of this study are expected to enrich the literature on the role of Big Data in the world of marketing, especially in the increasingly dynamic digital era. Meanwhile, in practice, the findings of this study are expected to provide guidance for business practitioners and marketing managers in developing strategies that are more effective, efficient, and based on accurate information. Thus, this research is not only relevant in an academic context, but also has high utility value for the business world. With increasingly tight competition and evolving consumer expectations, the integration of technology and marketing strategy is an inevitability that cannot be avoided [10]. Big Data technology will continue to evolve and present new opportunities, and companies that are able to leverage it well will have a sustainable competitive advantage in a fast-paced and uncertain market.

2. LITERATURE REVIEW

In today's digital era, big data technology has become a strategic element in modern marketing transformation. Big data refers to a large, diverse, and complex set of data that cannot be processed using conventional methods. The characteristics of big data are known through the concept of 5V: volume (very large amount of data), velocity (speed of data entry and processing), variety (diversity of data types such as text, video, or logs), veracity (level of data accuracy), and value (value that can be generated from processing the data) [11]. This technology allows companies to utilize information on a large scale in real-time, so that decision making can be done quickly and based on evidence [12]. In the context of marketing, data from various sources such as social media, customer transactions, sensors, to consumer browsing activities, can be combined to form a comprehensive understanding of consumer behavior [7]. As the volume of digital data increases, the ability to process and analyze big data becomes a vital competitive advantage in a company's marketing strategy.

Traditional marketing strategies that are general and one-way are now starting to be replaced by data-based approaches that are personal, dynamic, and interactive [1]. Big data technology allows companies to identify consumer behavior patterns, map preferences, and customize messages or offers according to individual customer needs [13]. This makes the marketing approach more targeted and efficient. [14] explains that data-based marketing helps companies understand the customer journey as a whole, from the awareness phase to loyalty. Thus, the use of big data plays an important role in developing adaptive, consumer-oriented marketing strategies based on real insights from data [15]. For example, through sentiment analysis from social media, companies can find out how the public perceives their brand in real time and responds immediately if a reputation crisis occurs. In addition, the use of big data in marketing not only has an impact on increasing campaign effectiveness, but also operational efficiency. [16] shows that big data allows companies to allocate marketing budgets more precisely, identify the most potential customer segments, and minimize waste in ineffective advertising. Through cross-channel data integration such as CRM, e-commerce platforms, and social media, companies can build detailed and accurate customer profiles [17]. This profile is then used to determine strategies such as product launch times, promotional designs, and the selection of appropriate communication media. This approach has been shown to increase conversion rates and customer retention. In fact, several large companies such as Amazon, Netflix, and Alibaba have made big data the main foundation in their recommendation systems, which directly affects increased sales and customer satisfaction.

Personalization is an important dimension in big data-based marketing strategies. With high analytical capabilities, companies can create content, offers, and experiences that are tailored to individual customer preferences. According to [6] data-based personalization can increase customer loyalty because they feel cared for and appreciated. Research by [3] noted that companies that adopt an intelligent personalization approach can increase revenue by up to 30% compared to their competitors. Big data technology supports more specific market segmentation based on customer behavior, location, purchase history, and even emotions, so that the marketing strategy built is truly in accordance with the needs of each segment [11]. This shows that personalization is not only a powerful marketing tool, but also a necessity in maintaining business competitiveness in the digital era.

Several empirical studies strengthen the evidence regarding the benefits of big data in improving marketing

strategies. [17] found that big data analytics capabilities have a significant relationship with marketing performance, especially in the context of data-based decision making and customer relationship management. Research conducted by [7] emphasizes that big data is not just about collecting data, but how companies are able to transform data into actionable insights. This requires a strong analytical system, as well as an organizational culture that is open to technology-based innovation. In Indonesia, research by [18] shows that e-commerce companies that utilize big data for personalization and demand prediction tend to have higher levels of customer satisfaction. Mechanism of the relationship between big data on marketing strategy shown in Fig. 1.

H_1: The use of Big Data technology has a positive effect on the effectiveness of marketing strategies.

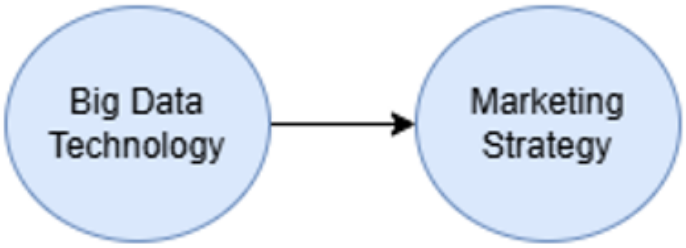

Fig. 1. Mechanism of the Relationship between Big Data on Marketing Strategy

Considering the development of technology and the dynamics of consumer behavior, the adoption of big data technology in marketing strategies is no longer just an option, but an urgent need. Big data provides a strong foundation for companies to be more responsive, relevant, and competitive. However, to maximize these benefits, companies need to invest in technological infrastructure, increase HR capacity, and formulate ethical and responsible data policies [1]. In the context of this research, it is important to systematically explore how big data technology has been used in marketing strategies, what impacts it has on marketing effectiveness, and what factors support or hinder the implementation of big data in companies. Thus, the results of this study are expected to provide theoretical and practical contributions to the development of digital marketing science and more data-based managerial decision-making.

3. METHODS

This study uses a quantitative explanatory approach to analyze the effect of Big Data technology adoption on increasing the effectiveness of marketing strategies. Data were collected by distributing questionnaires using a Likert scale (1–5) to respondents working in marketing, especially from companies that have implemented Big Data technology in business decision making [19]. The population in this study were marketing staff of digital, e-commerce, and modern retail companies in Indonesia. Sampling was carried out using purposive sampling, with the criteria that respondents have an understanding and experience in using big data for marketing strategy purposes [20]. The minimum sample size targeted was 110 respondents, in order to meet the requirements for model analysis using SmartPLS. Operational definition of variables shown in Table 1.

Table 1. Operational Definition of Variables

Variable	Variable Definition	Indicator
Big Data Technology	Technology used to collect, manage, and analyze large, complex, and diverse amounts of data to support decision making.	1. Volume of data processed 2. Speed of data processing 3. Variation of data 4. Analytical sophistication
Marketing strategy	A series of plans and actions that a company uses to promote a product or service to achieve market goals effectively.	1. Market segmentation 2. Target market determination 3. Product positioning 4. Promotion personalization

The research instruments included independent variables (Big Data Adoption), dependent variables (Marketing Strategy Effectiveness), and optional mediating variables (Data-Based Marketing Decisions), each of which was measured through several quantitative indicators. The data analysis technique used Partial Least Square-Structural Equation Modeling (PLS-SEM) through SmartPLS software. The analysis was conducted through the stages of validity and reliability testing, as well as hypothesis testing using the bootstrapping method [21]. This study also pays attention to research ethics by maintaining the confidentiality of respondent data and ensuring that all information obtained is only used for scientific purposes.

4. RESULT AND DISCUSSION

Before conducting the analysis, the questionnaire data underwent validity and reliability testing. SmartPLS 4.0 was utilized to evaluate the factor loading of each indicator, serving as a basis for assessing data validity within the study. As noted by [21], indicators with loading values below 0.4 can be eliminated, while values above 0.7 are considered highly valid. The validity test results revealed that all indicators achieved loading values greater than 0.5, confirming their validity and allowing all items to be retained for further analysis (Table 2).

Table 2. Final Validity Test Results

Variable	Item	Loading Factor	Information
Big Data Technology	BD1	0.888	Valid
	BD2	0.841	Valid
	BD3	0.827	Valid
	BD4	0.780	Valid
Marketing strategy	SP1	0.870	Valid
	SP2	0.907	Valid
	SP3	0.886	Valid
	SP4	0.846	Valid
Acceptable Limits		**> 0.5**	**Accepted**

The validation test results confirm the data's validity, as every variable demonstrates loading factor values above 0.5, enabling all items to proceed to further analysis. Reliability was evaluated by reviewing the composite reliability scores provided in the SmartPLS 4.0 output. As stated by [22] a variable is deemed to have strong reliability when its composite reliability score is greater than 0.7 and its Cronbach's alpha exceeds 0.6 (Table 3).

Table 3. Reliability Test Results

Variable	Item	Construct Reliability	AVE
Big Data Technology	BD1	0.902	0.697
	BD2		
	BD3		
	BD4		
Marketing strategy	SP1	0.931	0.770
	SP2		
	SP3		
	SP4		

The reliability test results for the research questionnaire indicate that all items have construct reliability values of 0.70 or higher. In addition, each item shows an Average Variance Extracted (AVE) value of at least 0.50 [23]. These findings confirm that the questionnaire demonstrates strong reliability, allowing the collected data to be used in the next stage of model analysis.

4.1. Testing Research Model Path Analysis

In PLS analysis, latent variable scores are generated through two key components: the inner model, which represents the connections between latent constructs, and the outer model, which links observed indicators to their respective constructs. To determine the strength and significance of these relationships, a structural model assessment is conducted. The results of this evaluation in the present research are outlined as Fig. 2.

Furthermore, determining whether a hypothesis is accepted or rejected is based on the significance probability derived from the analysis, using a significance level of $\alpha = 5\%$ or 0.05 as the [23]. The results of this analysis are presented in the following Table 4.

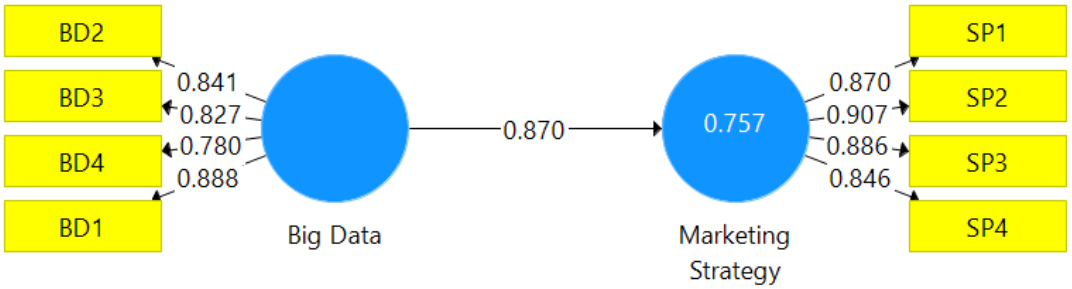

Fig. 2. SmartPLS 4.0 Structural Model

Table 4. Path Model Significance Test Results

Variable	Original Sample (O)	Sample average (M)	Standard Deviation (STDEV)	T-Statistic (|O/STDEV)	P	Information
BD → SP	0.870	0.875	0.025	34.748	0.000	Accepted

The structural model analysis indicates that Big Data (BD) has a strong and statistically significant positive effect on Marketing Strategy (SP). The path coefficient value is 0.870, with a t-statistic of 34.748 and a p-value of 0.000. Since the t-value is far above the critical value of 1.96 and the p-value is well below the 0.05 threshold, the hypothesis is accepted. This suggests that the implementation of Big Data significantly enhances the effectiveness of marketing strategies.

4.2. Discussion

The results of this study indicate that the use of Big Data technology has a significant positive effect on the effectiveness of marketing strategies. This indicates that companies that are able to utilize Big Data to manage and analyze consumer information in real time can develop more targeted marketing strategies [8]. Through Big Data analysis, companies can understand consumer preferences, behaviors, and needs in depth and personally, so that the marketing approach taken becomes more relevant, faster, and has a big impact on consumer decision-making [12]. Furthermore, Big Data allows companies to segment markets in more detail and accurately, and design campaigns that focus on audiences with high conversion potential [6]. The use of data from various sources such as social media, online transactions, to IoT sensor data helps companies develop marketing strategies based on predictions and content personalization [15]. This not only increases the effectiveness of marketing communications but is also able to reduce wasted marketing costs due to targeting errors. Thus, Big Data technology is not only a supporting tool, but also a guide in making strategic policies in the marketing field.

This finding is in line with research [17] which states that the use of Big Data improves a company's ability to design digital marketing strategies based on data and actual consumer behavior. In addition, research by [7] also supports these results, stating that companies that use Big Data analytics in marketing decision making have a significant competitive advantage over companies that still rely on conventional methods. With more accurate and measurable insights, companies can respond to market changes more quickly and efficiently.

However, it should be noted that the effectiveness of Big Data utilization is greatly influenced by the company's internal capacity, especially in terms of information technology infrastructure, the quality of the data collected, and the analytical capabilities of the marketing team [15]. Without the support of competent human resources in data processing and interpretation, the use of Big Data will only produce suboptimal information [10]. In addition, issues of ethics and data privacy are also challenges that need to be considered, especially when companies access and utilize customer data massively. Therefore, a Big Data-based marketing strategy must be accompanied by good data governance and compliance with consumer protection regulations.

5. CONCLUSION

Based on the research results, it can be concluded that the use of Big Data technology has a positive effect on the effectiveness of marketing strategies. Big Data provides companies with the ability to understand consumer behavior and preferences more accurately, enabling more precise market segmentation and designing personalized and relevant campaigns. With the use of comprehensive and real-time data, marketing strategies become more efficient, responsive, and have a direct impact on increasing business competitiveness. Therefore,

the integration of Big Data into the marketing process is a strategic step in facing increasingly competitive and digital-based market dynamics.

REFERENCES

[1] E. W. Solikhah, I. Fatmawati, R. Widowati, and M. Suyanto, "Factors Influencing Purchase Decisions on Online Sales in Indonesia," *Stud. Syst. Decis. Control*, vol. 487, pp. 329–339, 2024, https://doi.org/10.1007/978-3-031-35828-9_28.

[2] M. A. Amanullah *et al.*, "Deep learning and big data technologies for IoT security," *Comput. Commun.*, vol. 151, pp. 495–517, 2020, https://doi.org/10.1016/j.comcom.2020.01.016.

[3] Y. Duan, J. S. Edwards, and Y. K. Dwivedi, "Artificial intelligence for decision making in the era of Big Data – evolution, challenges and research agenda," *Int. J. Inf. Manage.*, vol. 48, pp. 63–71, 2019, https://doi.org/10.1016/j.ijinfomgt.2019.01.021.

[4] H. Zhang, S. Lee, Y. Lu, X. Yu, and H. Lu, "A Survey on Big Data Technologies and Their Applications to the Metaverse: Past, Current and Future," *Mathematics*, vol. 11, no. 1, 2023, https://doi.org/10.3390/math11010096.

[5] A. Mohamed, M. K. Najafabadi, Y. B. Wah, E. A. K. Zaman, and R. Maskat, "The state of the art and taxonomy of big data analytics: view from new big data framework," *Artif. Intell. Rev.*, vol. 53, no. 2, pp. 989–1037, 2020, https://doi.org/10.1007/s10462-019-09685-9.

[6] L. I. U. Xiao-Yuan, "Agricultural products intelligent marketing technology innovation in big data era," *Procedia Comput. Sci.*, vol. 183, pp. 648–654, 2021, https://doi.org/10.1016/j.procs.2021.02.110.

[7] A. Sestino, M. I. Prete, L. Piper, and G. Guido, "Internet of Things and Big Data as enablers for business digitalization strategies," *Technovation*, vol. 98, 2020, https://doi.org/10.1016/j.technovation.2020.102173.

[8] C. chong Qi, "Big data management in the mining industry," *Int. J. Miner. Metall. Mater.*, vol. 27, no. 2, pp. 131–139, 2020, https://doi.org/10.1007/s12613-019-1937-z.

[9] D. Samara, I. Magnisalis, and V. Peristeras, "Artificial intelligence and big data in tourism: a systematic literature review," *J. Hosp. Tour. Technol.*, vol. 11, no. 2, pp. 343–367, 2020, https://doi.org/10.1108/JHTT-12-2018-0118.

[10] A. K. Sandhu, "Big Data with Cloud Computing: Discussions and Challenges," *Big Data Min. Anal.*, vol. 5, no. 1, 2022, https://doi.org/10.26599/BDMA.2021.9020016.

[11] M. N. I. Sarker, Y. Peng, C. Yiran, and R. C. Shouse, "Disaster resilience through big data: Way to environmental sustainability," *Int. J. Disaster Risk Reduct.*, vol. 51, 2020, https://doi.org/10.1016/j.ijdrr.2020.101769.

[12] Z. Lv and L. Qiao, "Analysis of healthcare big data," *Futur. Gener. Comput. Syst.*, vol. 109, pp. 103–110, 2020, https://doi.org/10.1016/j.future.2020.03.039.

[13] A. Hamdan, "Artificial intelligence and transforming digital marketing," p. 1188, 2024, https://doi.org/10.1007/978-3-031-35828-9.

[14] S. Teja and B. Sr, "Big Data Meets Machine Learning: Strategies for Efficient Data Processing and Analysis in Large Datasets," *Int. J. Creat. Res. Comput. Technol. Des.*, vol. 2, no. 2, 2020, [Online]. Available: https://jrctd.in/index.php/IJRCTD/article/view/68.

[15] M. M. Hasan, J. Popp, and J. Oláh, "Current landscape and influence of big data on finance," *J. Big Data*, vol. 7, no. 1, 2020, https://doi.org/10.1186/s40537-020-00291-z.

[16] S. J. Miah, M. Miah, and J. Shen, "Editorial note: Learning management systems and big data technologies for higher education," *Educ. Inf. Technol.*, vol. 25, no. 2, pp. 725–730, 2020, https://doi.org/10.1007/s10639-020-10129-z.

[17] C. Odedina, "Impact of Big Data on Marketing Strategy and Consumer Behavior Analysis in the Us," *SSRN Electron. J.*, 2023, https://doi.org/10.2139/ssrn.4520361.

[18] L. T. Khrais, "Role of artificial intelligence in shaping consumer demand in e-commerce," *Futur. Internet*, vol. 12, no. 12, pp. 1–14, 2020, https://doi.org/10.3390/fi12120226.

[19] PP Kuantitatif, "Metode penelitian kunatitatif kualitatif dan R&D," *Alfabeta*, 2016, [Online]. Available: https://www.researchgate.net/publication/377469385_METODE_PENELITIAN_KUANTITATIF_KUALITATIF_DAN_RD.

[20] A. Muri Yusuf, *Metode Penelitian Kuantitatif, Kualitatif & Penelitian Gabungan*. Prenada Media, 2016. [Online]. Available: https://books.google.co.id/books?id=RnA-DwAAQBAJ&dq=Metodologi+Penelitian+Kualitatif,+Kuantitatif+dan+Penelitian+Gabungan.&lr=&hl=id&source=gbs_navlinks_s.

[21] Siswoyo Haryono, "Metode SEM Untuk Penelitian Manajemen dengan AMOS LISREL Smart PLS," *J. Phys. A Math. Theor.*, p. 450, 2016, [Online]. Available: https://text-id.123dok.com/document/ozl4x92y-metode-sem-untuk-penelitian-manajemen-dengan-amos-lisrel-pls.html.

[22] I. Ghozali, *Model persamaan struktural: Konsep dan aplikasi dengan program AMOS 16.0*. Badan Penerbit Universitas Diponegoro, 2008.

[23] I. Ghozali, *Structural Equation Modeling Metode Alternatif Dengan Partial Least Squares (PLS). Universitas Diponegoro Semarang*. 2014. [Online]. Available: https://repository.telkomuniversity.ac.id/pustaka/107442/structural-equation-modeling-metode-alternatif-dengan-partial-least-squares-pls-.html.