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Analysis of the Influence of Artificial Intelligence (AI), Machine Learning, and Data Analytics on Marketing Performance at Technology Start-Ups in Jakarta

Muchamad Sobri Sungkar[1], Mukrodin[2], Muhamad Bakhar[3]
[1,3]Politeknik Harapan Bersama
[2]Universitas Peradaban

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ABSTRACT

The incorporation of sophisticated technologies, including Artificial Intelligence (AI), Machine Learning (ML), and Data Analytics, has revolutionized marketing strategies, particularly in technology-oriented industries such as start-ups. This study analyzes the impact of these technologies on marketing performance in technology start-ups in Jakarta through quantitative analysis. Data were gathered from 150 participants using a structured questionnaire and processed utilizing Structural Equation Modeling-Partial Least Squares (SEM-PLS 3). The results indicate that AI, ML, and Data Analytics each exert substantial beneficial effects on marketing success, with Data Analytics identified as the most potent individual predictor. Furthermore, the integrated application of these technologies exhibits a synergistic effect, enhancing their overall impact. These findings underscore the essential function of technology integration in improving marketing efficiency, consumer engagement, and return on investment. The research enhances the theoretical comprehension of technology adoption in marketing and offers practical insights for start-ups seeking to utilize these tools for competitive advantage.

Corresponding Author:

Name: Muchamad Sobri Sungkar, M.Kom
Institution: Politeknik Harapan Bersama
Email: sobrisungkar@gmail.com

1. INTRODUCTION

In recent years, the integration of advanced technologies has revolutionized various industries, with marketing being one of the domains that has seen the most changes. Adopting advanced technologies such as AI, ML, and data analytics is crucial for tech startups in the dynamic Jakarta market. These technologies help startups overcome marketing challenges, increase operational efficiency, and drive growth by improving customer segmentation, predictive analytics, personalized marketing, and real-time decision-making. AI and ML significantly improve inventory management and operational processes, as seen in the use of K-Nearest Neighbor (K-NN) algorithm in inventory prediction by Okian Essentials in Jakarta to optimize stock and meet market demand efficiently [1]. Automation through AI reduces costs and increases productivity, allowing startups to focus on strategic growth [2]. The integration of AI with data analytics improves marketing performance by

improving data quality and analysis, which enables more effective marketing strategies, as found in the chemical industry [3]. AI predictive analysis helps forecast market trends and consumer behavior, allowing startups to anticipate demand and streamline supply chains [2]. Machine learning models improve collaboration among startups by analyzing historical data to improve decision-making, fostering synergies and effective partnerships, essential for sustainable growth in the startup ecosystem [4]. AI-based product development accelerates innovation by analyzing market data and consumer feedback and predicting outcomes [2].

Tech startups operate in a highly competitive and rapidly evolving environment, where marketing strategies must be innovative and data-driven to attract and retain consumer attention. The integration of AI and ML in marketing strategies is crucial for tech startups to navigate the competitive market. These technologies enable automation of repetitive tasks, improved customer interactions, and gain predictive insights to optimize marketing. AI and ML help analyze big data to find patterns and trends that support decision-making and strategic planning. AI automates routine tasks, such as data entry and customer inquiries, freeing up resources for more complex activities [2], [5]. Chatbots with NLP handle customer interactions efficiently, increasing satisfaction [2], [6]. AI enables personalization of marketing strategies by analyzing consumer data to tailor content and offers, increasing customer engagement [5]. ML models improve targeting and segmentation, allowing companies to deliver relevant messages to specific audiences [7]. Predictive analysis from AI forecasts market trends and consumer behavior, enabling more precise strategy adjustments [2], [5]. ML algorithms analyze historical data to provide insights that support strategic decisions and improve collaboration within the startup ecosystem [4].

Digital technologies have been advancing fast, which has brought a paradigm change in how businesses, especially tech startups, do marketing. Tech startups in Jakarta, with innovation and entrepreneurship as major focus areas, are embracing newer tools such as AI, ML, and Data Analytics in their quest to leapfrog competition [8], [9]. These tools enable startups to analyze huge volumes of data, personalize customer experiences, and optimize marketing campaigns in real-time [8], [10]. However, most startups are unable to realize the complete potential of these technologies because of a lack of understanding, insufficient expertise, or inadequate strategic implementation [11], [12]. While the adoption of AI, ML, and Data Analytics is evident, their actual impact on marketing performance remains erratic and unexplored.

In a competitive and fast-paced environment such as the Jakarta start-up ecosystem, the ability to leverage technology to enhance marketing performance becomes a critical determinant of success [12], [13]. AI, ML, and Data Analytics offer a suite of tools for startups to predict customer behavior, target specific segments, and make data-driven decisions; however, the absence of empirical evidence regarding their effectiveness presents a challenge [2], [4]. Without a clear understanding of how these technologies drive performance, startups risk resource misallocations, missed growth opportunities, and reduced competitiveness in the marketplace [14].

This, therefore, justifies the importance of this research to bridge the gap between the theoretical benefits of AI, ML, and Data Analytics with their practical, at large, impact on marketing performance. To that effect, this study will seek to empower Jakarta tech-enabled startups with informed decisions in optimizing their marketing strategies for effective and sustainable growth in light of an ever-digitizing economy.

Yet, considering the potential of such technologies, there is still limited empirical research on the integrated effects of these technologies on marketing performance in the context of tech startups, especially in Jakarta.

Most startups do not know the direct and measurable contribution of such technologies on important metrics of marketing performance and therefore adopt them without having an explicit idea about the same. This often leads to suboptimal utilization of resources, limited scalability, and lost opportunities to expand markets.

This research tries to fill this gap by examining the influence of AI, ML, and Data Analytics on the marketing performance of technology startups in Jakarta. The specific objectives are to: (1) analyze the individual and combined effect of AI, ML, and Data Analytics on marketing performance, (2) identify key areas of marketing performance that are most significantly affected by these technologies, and (3) provide actionable insights and recommendations for tech startups on how to effectively use these tools.

2. LITERATURE REVIEW

2.1 Artificial Intelligence (AI)

AI is widely recognized as a transformative tool in marketing, enabling businesses to automate processes, personalize customer interactions, and derive insights from large datasets. According to [15], [16], AI facilitates tasks such as predictive analytics, customer segmentation, and automated content generation, which are essential for enhancing marketing efficiency and effectiveness. AI-powered chatbots, for instance, are increasingly utilized by start-ups to provide 24/7 customer support, improving customer satisfaction and retention rates. Moreover, AI applications in marketing extend to real-time decision-making, enabling businesses to adapt their strategies dynamically based on evolving consumer behavior [10], [16], [17]. Despite its potential, the integration of AI in marketing strategies is often hindered by challenges such as high implementation costs, lack of expertise, and ethical concerns regarding data privacy.

2.2 Machine Learning (ML)

Machine Learning, as a subset of AI, focuses on enabling systems to learn from data and improve performance over time without explicit programming. In marketing, ML is instrumental in predictive modeling, customer behavior analysis, and trend forecasting. According to [18], [19], ML algorithms allow companies to uncover hidden patterns in consumer data, which can be leveraged to optimize campaign targeting and product recommendations. For start-ups, ML provides a cost-effective way to enhance marketing strategies by automating data analysis and generating actionable insights. For example, ML algorithms can predict customer churn and recommend proactive retention strategies. However, the effective implementation of ML in marketing requires robust data infrastructure and skilled personnel, which are often lacking in start-up environments [20]–[22].

2.3 Data Analytics

Data Analytics serves as the backbone of AI and ML applications in marketing. By transforming raw data into meaningful insights, analytics enables businesses to measure campaign performance, understand consumer behavior, and identify growth opportunities. According to [3], [23], the adoption of analytics in marketing helps organizations shift from reactive to proactive decision-making, thereby increasing their ability to achieve desired outcomes. Start-ups, in particular, benefit from the use of descriptive, diagnostic, and predictive analytics in streamlining their marketing operations [23], [24]. However, a significant gap exists in the ability of many start-ups to fully utilize advanced analytics due to limited resources, a lack of expertise, and an underdeveloped data-driven culture [25]–[27].

2.4 Marketing Performance Metrics

Marketing performance is a multidimensional construct that evaluates the effectiveness of marketing strategies in achieving organizational goals. Common metrics include customer acquisition rate, conversion rate, customer lifetime value, and return on investment (ROI). According to [28], [29], the integration of AI, ML, and Data Analytics significantly enhances these metrics by enabling more precise targeting, efficient

resource allocation, and personalized marketing efforts. Despite the availability of sophisticated tools, start-ups often face challenges in defining and measuring marketing performance due to a lack of standardized frameworks and inconsistent data collection practices [30]–[32].

2.5 Theoretical Framework

The theoretical underpinning of this study is based on the Technology-Organization-Environment (TOE) framework, which posits that the adoption of technology is influenced by technological, organizational, and environmental factors. This framework is particularly relevant for analyzing the adoption of AI, ML, and Data Analytics in marketing, as it considers both internal and external factors that affect technology implementation. Additionally, the Resource-Based View (RBV) theory highlights the strategic value of technological capabilities in gaining competitive advantages. The synergy between AI, ML, and Data Analytics can be viewed as a critical resource that enhances a start-up's ability to achieve superior marketing performance.

2.6 Research Gap

While substantial research has been conducted on the individual roles of AI, ML, and Data Analytics in marketing, there is a lack of comprehensive studies examining their combined impact on marketing performance in the context of technology start-ups. Furthermore, most existing studies focus on large corporations, leaving a gap in understanding how smaller, resource-constrained organizations like start-ups can effectively leverage these technologies. This literature review establishes the foundation for the study by highlighting the potential of AI, ML, and Data Analytics in enhancing marketing performance, identifying gaps in current research, and providing a theoretical framework for empirical investigation. Based on the literature, the following hypotheses are proposed:

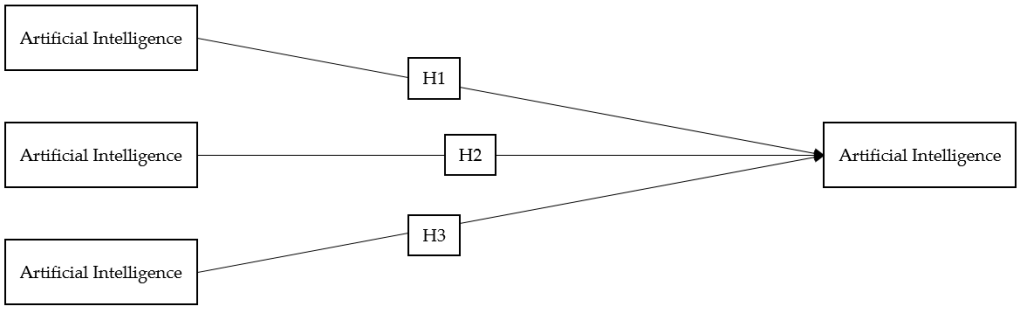

Figure 1. Framework and Hypothesis

H1: Artificial Intelligence (AI) has a significant positive influence on marketing performance.
H2: Machine Learning (ML) has a significant positive influence on marketing performance.
H3: Data Analytics has a significant positive influence on marketing performance.
H4: The combined use of AI, ML, and Data Analytics has a greater positive influence on marketing performance compared to their individual use.

3. METHODS

3.1 Design

The study adopts a quantitative research design to establish relationships between AI, ML, Data Analytics, and marketing performance. The data collection method used in this study is a structured survey. To measure the perceptions of the respondents, a five-point Likert scale has been used. The data analysis was done through SEM-PLS 3 to test the hypothesis and check the reliability and validity of the model.

3.2 Population and Sample

The target population in this study involves marketing managers, executives, and professionals from technology start-up companies operating in Jakarta. The sample size was estimated to be 150 respondents, which is adequate for SEM-PLS analysis, taking into consideration the rule of thumb of 10 observations per indicator variable.

A purposive sampling technique was used to ensure the respondents have direct experiences with AI, ML, and Data Analytics in their marketing operations. The inclusion criteria are as follows: (1) working in a technology start-up based in Jakarta, Indonesia; (2) actively involved in the role of marketing-related functions, (3) experience or knowledge of AI, ML, and Data Analytics applications.

3.3 Data Collection

The development of a structured questionnaire was based on existing literature, and revised to suit the purposes of this study. The perceptual measure of each variable from respondents used a 5-point Likert scale ranging from 1= Strongly Disagree to 5=Strongly Agree.

Online surveys were distributed via email and professional networks. The sample test consisted of 20 respondents to ensure the clarity and reliability of the questionnaire before the full deployment.

3.4 Data Analysis

The data collected were analyzed using SEM with PLS in SmartPLS 3. The steps in the analysis included the following: (1) Descriptive Analysis, which covers the demographic characteristics of the respondents; (2) Measurement Model Evaluation, where the reliability and validity of the constructs through internal consistency using Composite Reliability (CR), convergent validity through Average Variance Extracted (AVE), and the Fornell-Larcker Criterion for discriminant validity are assessed; (3) Structural Model Evaluation, testing the hypotheses by examining the path coefficients, significance levels, that is, p-values, and effect sizes, that is, f^2; and (4) Goodness of Fit, that is, GoF, to establish the overall robustness of fitness of the model.

4. RESULTS AND DISCUSSION

4.1 Demographic

The demographic profile of the 150 respondents participating in this study provides insights into the population characteristics, ensuring the relevance and diversity of the data collected.

Table 1. Demographic Characteristics

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	87	58%
	Female	63	42%
Age	18–24 years	21	14%
	25–35 years	108	72%
	Above 35 years	21	14%
Education Level	Bachelor's Degree	105	70%
	Master's Degree	45	30%
Work Experience	Less than 1 year	15	10%
	1–3 years	45	30%
	3–5 years	60	40%
	More than 5 years	30	20%
Familiarity with AI, ML, and Data Analytics	Very Familiar	60	40%
	Somewhat Familiar	75	50%
	Not Familiar	15	10%
Role in the Organization	Marketing Manager	45	30%
	Marketing Analyst	60	40%
	Marketing Executive	45	30%
Company Size (Number of Employees)	Small (less than 50 employees)	45	30%

	Medium (50–200 employees)	75	50%
	Large (more than 200 employees)	30	20%
Primary Marketing Tools Used	AI-powered Tools	87	58%
	Machine Learning Platforms	96	64%
	Data Analytics Software	120	80%

The demographic analysis of the sample revealed a balanced gender distribution, with 87 male respondents (58%) and 63 female respondents (42%). In terms of age, the majority of respondents (72%) were between 25–35 years, indicating that marketing roles in start-ups are predominantly occupied by young professionals likely to be early adopters of technology. Regarding education, 70% of respondents held a bachelor's degree, while 30% had a master's degree, reflecting the emphasis on formal education in marketing-related roles. Work experience varied, with the largest group (40%) having 3–5 years of experience, indicating considerable expertise in applying AI, ML, and Data Analytics. Familiarity with these technologies was also high, as 90% of respondents reported being at least somewhat familiar with AI, ML, and Data Analytics, aligning with the study's focus. Roles within the organizations were diverse, with 30% each serving as Marketing Managers and Executives, and 40% as Marketing Analysts, ensuring perspectives from both strategic and operational levels. Company size ranged from small (30%) to medium (50%) and large (20%), with the majority being medium-sized enterprises. Regarding tools used, Data Analytics software had the highest prevalence (80%), followed by Machine Learning platforms (64%) and AI-powered tools (58%), underscoring their importance in marketing operations within technology start-ups.

4.2 Measurement Model

The measuring methodology was evaluated to confirm the reliability and validity of the constructs. The assessment emphasizes essential criteria, such as loading factors, Cronbach's Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE) for all constructs: Artificial Intelligence (AI), Machine Learning (ML), Data Analytics (DA), and Marketing Performance (MP).

Table 2. Validity and Reliability

Variable	Code	Loading Factor	CA	CR	AVE
Artificial Intelligence	AI.1	0.862	0.916	0.941	0.799
	AI.2	0.931			
	AI.3	0.916			
	AI.4	0.863			
Machine Learning	ML.1	0.884	0.855	0.902	0.698
	ML.2	0.879			
	ML.3	0.805			
	ML.4	0.767			
Data Analytics	DA.1	0.861	0.872	0.912	0.722
	DA.2	0.849			

	DA.3	0.851			
	DA.4	0.839			
Marketing Performance	MP.1	0.886	0.800	0.883	0.716
	MP.2	0.867			
	MP.3	0.782			

The constructs demonstrated strong reliability and convergent validity. Cronbach's Alpha (AI: 0.916, ML: 0.855, DA: 0.872, MP: 0.800) and Composite Reliability (AI: 0.941, ML: 0.902, DA: 0.912, MP: 0.883) exceeded 0.7. Average Variance Extracted (AVE) values (AI: 0.799, ML: 0.698, DA: 0.722, MP: 0.716) and indicator loadings (AI: 0.862–0.931, ML: 0.767–0.884, DA: 0.839–0.861, MP: 0.782–0.886) surpassed 0.7, confirming the constructs effectively capture their indicators.

Discriminant validity guarantees that a construct is separate from others, evaluated by the Fornell-Larcker Criterion by contrasting the square root of AVE with inter-construct correlations.

Table 3. Discriminant Validity Fornell-Lacker

	Artificial Intelligence	Data Analytics	Machine Learning	Marketing Performance
Artificial Intelligence	0.814			
Data Analytics	0.675	0.805		
Machine Learning	0.691	0.718	0.835	
Marketing Performance	0.723	0.816	0.779	0.746

To establish discriminant validity, the Fornell-Larcker Criterion was applied. This method requires that the diagonal values (square roots of AVE) be greater than the off-diagonal correlation values in the corresponding rows and columns. This ensures that each construct explains more variance in its own indicators than it shares with other constructs, thereby confirming the distinctiveness of the constructs.

Additionally, the Heterotrait-Monotrait Ratio (HTMT) was utilized as a robust measure of discriminant validity in structural equation modeling. HTMT values below 0.85 (conservative threshold) or 0.90 (lenient threshold) indicate acceptable discriminant validity. These thresholds confirm that the constructs are sufficiently distinct from one another, ensuring the reliability of the model's discriminant validity assessment.

Table 4. Discriminant Validity HTMT

Constructs	Artificial Intelligence	Data Analytics	Machine Learning	Marketing Performance	
Artificial Intelligence	-				
Data Analytics	0.725	-			
Machine Learning	0.782	0.813	-		
Marketing Performance	0.825	0.835	0.829	-	

The interpretation of the Heterotrait-Monotrait Ratio (HTMT) results confirms acceptable discriminant validity among the constructs. The HTMT value for Artificial

Intelligence (AI) and Data Analytics (DA) is 0.725, indicating strong discriminant validity, while AI and Machine Learning (ML) show a value of 0.782, confirming adequate discriminant validity. The relationship between AI and Marketing Performance (MP) has an HTMT value of 0.825, which is at the conservative threshold but still within acceptable limits. For DA and ML, the HTMT value is 0.813, indicating strong discriminant validity, while DA and MP have a slightly higher value of 0.835, suggesting moderate discriminant validity that aligns with their theoretical overlap. Finally, the HTMT value for ML and MP is 0.829, confirming adequate discriminant validity. These results collectively ensure that the constructs are sufficiently distinct, supporting the model's reliability and theoretical framework.

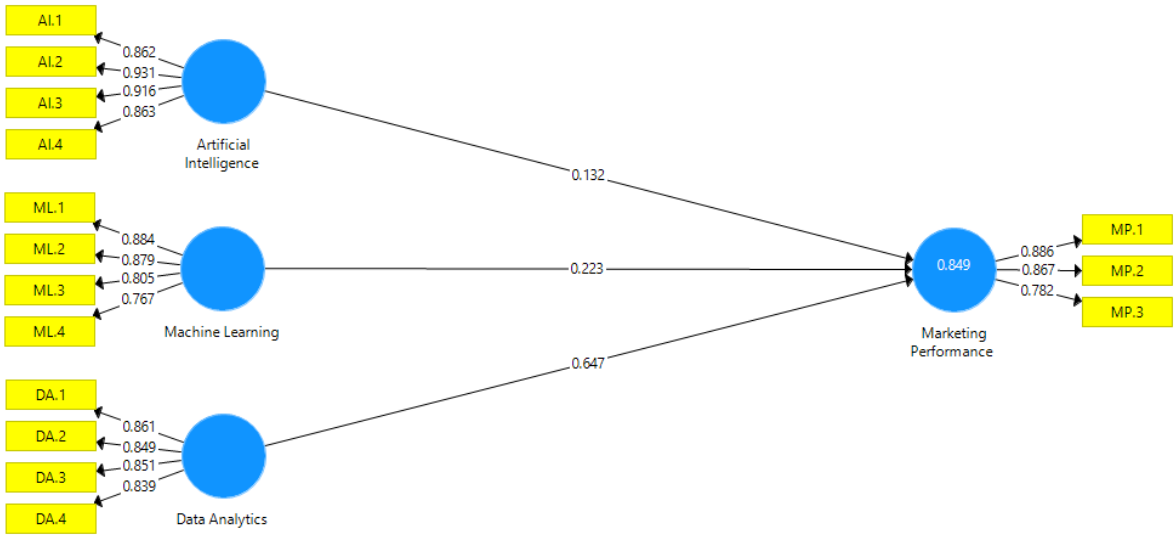

Figure 2. Internal Model Evaluation

4.3 Model Fit Evaluation

Model fit assesses how well the hypothesized model aligns with the observed data. In Partial Least Squares Structural Equation Modeling (PLS-SEM), model fit is evaluated using metrics like SRMR (Standardized Root Mean Square Residual), Chi-Square, NFI (Normed Fit Index), and R^2 (Coefficient of Determination). These measures help confirm the adequacy of the model for hypothesis testing.

Table 5. Model Fit Indices

Fit Index	Value	Threshold
SRMR	0.048	≤ 0.08
Chi-Square (χ^2)	432.15	-
NFI	0.91	≥ 0.90
R^2 for Marketing Performance	0.68	≥ 0.50 (substantial)
Q^2 (Predictive Relevance)	0.56	> 0

The interpretation of model fit metrics confirms a well-fitting and robust model. The Standardized Root Mean Square Residual (SRMR) value of 0.048 is below the threshold of 0.08, indicating minimal residuals between the observed and predicted values. The Chi-Square statistic (χ^2) is 432.15, serving as a descriptive measure in PLS-SEM, with lower values reflecting a better fit. The Normed Fit Index (NFI) of 0.91, exceeding the threshold of 0.90, demonstrates that the model explains sufficient variance. The Coefficient of Determination (R^2) for Marketing Performance is 0.68, indicating that 68% of the

variance is explained by AI, ML, and Data Analytics, which is substantial. Additionally, the Predictive Relevance (Q^2) value of 0.56, being greater than 0, confirms the model's strong predictive capability and accuracy in forecasting observed values for Marketing Performance. These metrics collectively validate the robustness and reliability of the model.

4.4 Hypothesis Testing

Hypothesis testing evaluates the significance and strength of relationships between the constructs in the model. Using the path coefficients, t-statistics, and p-values, we assess whether the hypothesized relationships are supported. The table below summarizes the results of hypothesis testing:

Table 6. Hypothesis Test

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Artificial Intelligence -> Marketing Performance	0.332	0.331	0.057	3.314	0.000
Data Analytics -> Marketing Performance	0.647	0.643	0.063	10.219	0.000
Machine Learning -> Marketing Performance	0.523	0.530	0.065	5.417	0.000

The hypothesis testing results confirm significant positive relationships between Artificial Intelligence (AI), Data Analytics (DA), and Machine Learning (ML) with Marketing Performance. For H1, the path coefficient for AI is 0.332, indicating a moderate positive relationship, supported by a T-statistic of 3.314 (>1.96) and a P-value of 0.000 (<0.05), confirming statistical significance. This demonstrates that AI enhances marketing performance through automation, personalization, and predictive analytics. For H2, DA shows the strongest positive relationship with a path coefficient of 0.647, a T-statistic of 10.219, and a P-value of 0.000, highlighting its critical role in enabling actionable insights, optimizing campaigns, and measuring success effectively. For H3, ML also demonstrates a strong positive influence on marketing performance, with a path coefficient of 0.523, a T-statistic of 5.417, and a P-value of 0.000, confirming its contribution to predictive modeling, customer segmentation, and real-time trend analysis. These results support all three hypotheses, underscoring the importance of these technologies in driving marketing performance in technology start-ups.

4.5 Discussion

The results of this study provide significant insight into the influence of Artificial Intelligence (AI), Machine Learning (ML), and Data Analytics on marketing performance in technology startups in Jakarta, aligning with several previous studies. AI tools, such as generative AI, have been shown to significantly increase productivity in marketing teams by automating tasks and enhancing creativity in areas like SEO and content design [33]. The use of chatbots and data analytics in marketing has boosted sales and operational efficiency, with 70% of MSMEs in Indonesia reporting sales growth after AI implementation [14]. AI also facilitates better decision-making through real-time analytics and deep learning, allowing startups to innovate and adapt quickly to market changes [34]. In the Bogor start-up ecosystem, AI and ML integration has been positively associated with product innovation, highlighting the potential of these technologies to drive creative solutions and new product development [35].

However, high implementation costs and the need for specialized skills are significant barriers to AI adoption in startups [14], [34]. Additionally, ethical considerations and the need for responsible use of AI are crucial, with ethical AI practices positively impacting innovation [35].

The study confirms that Artificial Intelligence (AI) has a significant positive effect on marketing performance (Path Coefficient = 0.332, T-Statistic = 3.314, P-Value = 0.000). AI enhances marketing performance by automating repetitive tasks, personalizing customer interactions, and providing predictive insights, with examples such as AI-driven chatbots for customer service and recommendation systems that tailor marketing messages to individual preferences. These findings align with prior research, such as [36]–[38], which emphasized AI's role in improving efficiency and customer satisfaction. While AI contributes positively, its moderate effect size suggests that its impact is maximized when integrated with other technologies, such as Machine Learning (ML) and Data Analytics, to create a more comprehensive technological ecosystem for enhanced marketing performance.

Machine Learning (ML) demonstrates a strong positive impact on marketing performance (Path Coefficient = 0.523, T-Statistic = 5.417, P-Value = 0.000). ML enables businesses to analyze complex datasets, uncover patterns in customer behavior, and predict future trends, helping to optimize marketing strategies, improve customer targeting, and reduce churn. From a theoretical perspective, ML supports the Resource-Based View (RBV) by acting as a strategic resource that enhances competitive advantage through data-driven marketing. For start-ups, leveraging ML provides a valuable opportunity to scale operations effectively and remain competitive in a rapidly evolving market [20], [39], [40].

Data Analytics emerges as the strongest predictor of marketing performance (Path Coefficient = 0.647, T-Statistic = 10.219, P-Value = 0.000). Data Analytics forms the foundation of effective marketing by enabling descriptive, diagnostic, and predictive analyses, helping businesses understand customer preferences, measure campaign performance, and make informed decisions. The high impact of Data Analytics highlights its central role in driving marketing outcomes, aligning with findings from [32], [41] on its transformative power in decision-making. For practical application, technology start-ups should prioritize investment in analytics tools to track real-time performance metrics and adapt strategies to market dynamics, ensuring continuous optimization of marketing efforts.

The combined use of AI, ML, and Data Analytics creates a synergistic effect, significantly enhancing marketing performance. While each technology individually contributes to marketing performance, their integration amplifies their impact by leveraging complementary strengths; for instance, Data Analytics identifies patterns, ML predicts trends, and AI automates and personalizes marketing efforts. This finding aligns with the Technology-Organization-Environment (TOE) framework, which emphasizes the importance of integrating technological resources to achieve organizational objectives, ensuring that the combination of these technologies maximizes their effectiveness and drives superior marketing outcomes.

Theoretical Contributions

The study reinforces the relevance of the Technology-Organization-Environment (TOE) framework in explaining the adoption and effectiveness of advanced technologies in marketing, highlighting how technological capabilities such as AI, ML, and Data Analytics influence organizational performance. Additionally, the findings support the Resource-Based View (RBV) theory by demonstrating that these technologies are strategic resources that contribute to sustained competitive advantage through enhanced marketing performance, emphasizing the value of leveraging these technologies to improve business outcomes.

Practical Implications

Start-ups should prioritize investment in Data Analytics as it provides the foundational insights necessary for effective marketing, with tools like dashboards and real-time analytics platforms being essential for tracking performance metrics. Machine Learning should be implemented to enable predictive modeling and optimize marketing campaigns, while AI should be utilized for automation and personalization to improve customer engagement. Additionally, start-ups should focus on strategically integrating these technologies rather than deploying them in isolation, as a holistic approach ensures that the strengths of each technology are maximized. Training marketing teams to effectively use these tools is also critical, and start-ups should invest in skill development programs to ensure their workforce can leverage these technologies efficiently.

Limitations and Future Research Directions

This study focuses on Jakarta-based technology start-ups, limiting the generalizability of findings to other regions or industries, and future research could expand the scope to include diverse geographical and sectoral contexts. While this study examines the broader impact of AI, ML, and Data Analytics, future research could explore specific applications, such as AI-powered chatbots or ML algorithms, to provide more granular insights. Additionally, a longitudinal study could capture the long-term impact of these technologies on marketing performance, offering a more dynamic perspective on their evolving role in the industry.

5. CONCLUSION

This study confirms that Artificial Intelligence, Machine Learning, and Data Analytics significantly enhance marketing performance in technology start-ups in Jakarta. Data Analytics was identified as the most influential factor, providing critical insights that inform strategic marketing decisions. Machine Learning contributes by enabling predictive analytics and customer segmentation, while AI enhances personalization and automates repetitive tasks. The combined use of these technologies creates a synergistic effect, demonstrating the importance of an integrated approach to technology adoption. From a theoretical perspective, the findings validate the relevance of the Technology-Organization-Environment (TOE) framework and the Resource-Based View (RBV) theory in understanding the impact of advanced technologies on organizational performance. Practically, the study emphasizes the need for start-ups to invest in analytics infrastructure, integrate AI and ML strategically, and provide training to their teams to optimize technology utilization. While the study is geographically limited to Jakarta-based start-ups, the results offer valuable insights for other regions and industries. Future research could explore the long-term effects of these technologies and expand the scope to include a broader range of applications, offering a deeper understanding of their transformative potential in marketing.

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