Fundamental Models of Digital Stimulus on Consumer Purchasing Decisions: Implications For AI-Based Marketing Strategies and The Digital Economy

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Abstract

This research aims to develop a fundamental model that links digital stimulus to consumer purchasing decisions, with AI-based marketing strategies as a moderator variable. The development of digital technology has revolutionized consumer behavior in the purchase decision-making process. Digital stimuli, such as personalized advertising, artificial intelligence-based interactions (including chatbots and virtual assistants), automated product recommendations, and interactive UI/UX designs, are increasingly influencing consumer preferences. However, research that comprehensively examines the relationship between digital stimulus, AI-based marketing strategies, and purchasing decisions is still limited, especially in Indonesia. The novelty of this research lies in the integration of consumer behavior analysis with machine learning approaches to validate prediction models of purchase decisions. The method employed was a survey of 420 active digital consumers, followed by Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis and algorithmic validation using Random Forest and Gradient Boosting. The results show that personalized advertising and UI/UX design have a significant positive effect on purchase intent, which is further the primary determinant of purchase decisions. Machine learning-based pricing strategies have been demonstrated to enhance the effectiveness of personalized advertising. At the same time, AI interactions, product recommendations, sentiment analysis, and customer engagement moderation are not significant. Algorithmic validation confirms a very high prediction accuracy (96.9%–98.3%), indicating that the model reliably maps the behavior patterns of digital consumers. Theoretically, this study enriches the literature on digital consumer behavior while providing practical recommendations for e-commerce to optimize ad personalization, enhance UI/UX design, and leverage AI-based pricing strategies. The implications of this research are also relevant for regulators in strengthening ethical policies and developing the national digital economy ecosystem.

Keywords: *Digital stimulus; Purchase intention; Purchase decision; AI marketing strategy; Machine learning.*

I. INTRODUCTION

Advances in digital technology have fundamentally changed the way consumers interact with brands, as well as in the process of making purchasing decisions. Digital transformation in the field of marketing, through the use of artificial intelligence (AI), big data, and other digital strategies, has given birth to digital stimuli that have a significant influence on consumer preferences and behaviors (Kotler, P., Keller, K. L., & Chernev, 2022). Today, purchasing decisions are increasingly determined by personalized digital content, chatbot-based interactions, and AI-powered product recommendations. (Vargas-Hernández & Cervantes-Guzmán, 2019). In modern marketing practices, digital stimulus includes aspects such as personalized advertising, automated recommendation systems, interactive experiences through UI/UX, to social media sentiment analysis. AI-based marketing approaches have been proven to increase campaign effectiveness and sales conversions. (Michel Wedel & P.K. Kannan, 2016), Strengthen customer engagement, as well as foster brand loyalty (Jarek & Mazurek, 2019).

In the context of Indonesia's digital economy, local studies have begun to explore the behavior patterns of digital consumers in greater depth. Generation Z, who are digital natives, show high loyalty to e-commerce platforms with a strong level of personalization (Ayuni, 2020). Therefore, consumer behavior analysis is crucial for developing effective digital marketing strategies (Saladin, 2021). Various studies confirm that social media, digital marketing strategies, and information quality have a significant effect on online shopping

decisions (Barus & Silalahi, 2021). Other factors, such as UI/UX design quality, big data analysis, and sentiment monitoring, also play a role in increasing consumer loyalty (David, 2023). However, conventional aspects such as product quality, brand image, and product variety remain relevant (Nasution et al., 2024). However, research specifically addressing AI-based digital stimuli and their impact on purchasing decisions remains relatively limited, particularly amid Indonesia's digital economy's structural transformation.

Based on these research gaps, this study seeks to develop a fundamental model of digital stimulus on consumer purchasing decisions by making AI-based marketing strategies as a moderator variable. The focus of the research is directed at the dynamics of digital economy transformation in Indonesia. The research questions posed include: (1) to what extent do digital stimuli influence consumer purchasing decisions in the digital era?; (2) how does AI-based marketing strategies strengthen the influence of digital stimulus on purchasing decisions?; and (3) how can fundamental models be formulated to explain the interconnectedness of digital stimulus, AI strategies, and consumer purchasing decisions in Indonesia's digital ecosystem?.

Medan was chosen as the research location because of its position as the capital of North Sumatra Province as well as the largest metropolitan city outside Java Island with a population of more than 2.5 million people who are culturally, socially, and economically diverse. In addition, Medan is in the top five regions with the highest number of internet users in Indonesia (Purba & Raja, 2022), thus acting as a center for digital economic growth in Sumatra. The results of MSME research also show that business actors in this city increasingly understand the importance of digital marketing to expand the market, especially since the COVID-19 pandemic (Widagdo, 2020) This makes Medan a "natural laboratory" to examine how AI-based digital stimuli affect consumer and business behavior.

In terms of academic contributions, most of the research on AI-based digital marketing in Indonesia is still concentrated in major cities on the island of Java. Therefore, the study in Medan can provide new empirical evidence that is relevant to urban cities outside Java. Although limited to respondents in Medan, the results of the study are still of academic value because this city represents an urban market with an active and heterogeneous digital consumer character. These limitations also open up opportunities for further research with a wider scope to gain a more comprehensive understanding of digital consumer behavior in Indonesia.

II. RESEARCH METHODOLOGY

This study uses a quantitative approach with an explanatory research design, which is aimed at examining the causal relationship between artificial intelligence (AI)-based digital stimulus and digital consumer purchase intention and purchase decision. The research population includes active e-commerce consumers in Indonesia who regularly conduct online transactions and have interacted with AI-based features, such as personalized ads, chatbots, product recommendation systems, and UI/UX displays on the platform. The analysis unit is an individual e-commerce user with the respondent criteria: at least 18 years old, have made an online purchase at least once in the last three months, and have experience using AI-based digital features. The sampling technique used is purposive sampling with a minimum number of respondents of 200 people, according to the recommendations for SEM analysis. The characteristics of the respondents were analyzed based on age, gender, education level, intensity of e-commerce use, and the category of products that were most often purchased.

Data collection was carried out through an online questionnaire distributed using social media, email, and online shopping communities. The research instrument was compiled using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) to measure respondents' perception of the research variables. Before the main deployment, an initial pilot test was conducted on 30 respondents to ensure language clarity, reliability, and consistency of answers. The test results are used as the basis for improving the instrument.

The research variable indicators are adapted from previous studies that have been tested for validity. AI-based digital stimulus is measured through several dimensions: personalized advertising (Lambrecht & Tucker, 2013), chatbot interaction (Adam et al., 2021; Gnewuch et al., 2017), product recommendation systems (Jannach & Adomavicius, 2016) UI/UX (Sri Purwantini, 2025), dynamic pricing (Liu et al., 2019), and sentiment analysis (Michel Wedel & P.K. Kannan, 2016). The purchase intention variable was measured using an indicator developed by Dodds et al. (William et al., 1991) and Pavlou (Pavlou, 2003), while purchase

decisions are proxied through actual consumer behavior in the form of purchase frequency, repurchase, and certainty of purchase decisions.

Data analysis was conducted using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method with SmartPLS 4 software. This technique was chosen because it is suitable for complex research models, is predictive, and can be applied to moderate sample sizes. The analysis process involves evaluating the outer model through testing the validity and reliability of the construct, as well as assessing the inner model to evaluate the prediction strength (R^2 and Q^2), effect size (f^2), and the significance of the relationship between variables using bootstrapping. In addition, predictive validity was strengthened by comparing SEM results using machine learning approaches, namely Random Forest and Gradient Boosting algorithms. This analysis allows mapping the behavior patterns of digital consumers with evaluation metrics in the form of accuracy, precision, recall, and F1-score.

III. RESULTS AND DISCUSSION

The results of the descriptive analysis illustrate that the study respondents are dominated by the age group of 18–24 years (40%) with the majority of women (53%). Most of the respondents have a bachelor's degree (37%) and an income between Rp 3-5 million per month (33%). In terms of platforms, Shopee is the most used application (50%), while the most popular payment method is e-wallet (64%). The most commonly purchased product is fashion (25%) and the most dominant device used is smartphones (98%). This data confirms that digital consumers in Medan are dominated by the young generation who are technologically literate and used to the digital payment system. Almost all respondents use smartphones (98%) to shop online.

Table 1. Respondent Characteristics

Characteristics	Category	Sum	%
Age	18-24 years old	167	40
Gender	Woman	223	53
Education	Degree	157	37
Income	3-5 million Rupiah	141	33
Platform	Shopee	206	50
Payment Methods	E-Wallet	268	64
Product	Fashion	103	25
Device	Smartphone	412	98

Source: Data processed, 2025

The outer model test showed that all indicators met the criteria of validity and reliability, with a loading factor value of > 0.7 and a composite reliability value of > 0.7. Discriminant validity is also achieved, so the research construct is considered valid. The internal evaluation of the model resulted in SRMR values = 0.038 (<0.08) and NFI = 0.888, which indicates that the research model is fit.

Table 2. Test Model Fit

Index	Rule of Thumb	Value	Information
SRMR	< 0.08	0.038	Fit
NFI	approach 1	0.888	Fit

Source: Data processed, 2025

The results of the hypothesis test show that personalized advertising (H1) and UI/UX (H4) design have a significant positive effect on purchase intention. Purchase intention has also been shown to have a significant effect on purchase decisions (H5). In addition, machine learning-based pricing (H6) functions as a moderator that strengthens the influence of personalized advertising on purchase intent. Meanwhile, AI interaction through chatbots (H2), AI-based product recommendations (H3), sentiment analysis (H7), and AI engagement (H8) had no significant effect.

Table 3. Hypothesis Test Results

Hypothesis	Relationship	T-Stat	P-Value	Decision
H1	Personalized advertising →	3.827	0.000	Accepted

	purchase intention			
H2	AI Interaction → purchase intention	1.582	0.114	Rejected
H3	Product Recommendations → purchase intention	0.115	0.909	Rejected
H4	UI/UX Design → purchase intention	4.620	0.000	Accpeted
H5	Purchase intention → purchase decision	33.618	0.000	Accepted
H6	ML-based pricing x Personalized ads → purchase intention	4.257	0.000	Accepted
H7	Sentiment analysis x AI interaction → purchase intention	0.674	0.500	Rejected
H8	Engagement AI x Product recommendation → purchase intention	0.807	0.420	Rejected

IV. CONCLUSION

This study has developed and validated a fundamental model that links digital stimulus to consumer purchasing decisions, with AI-based marketing strategies acting as a moderating factor. The findings demonstrate that personalized advertising and UI/UX design play a significant role in shaping purchase intention, which ultimately drives purchase decisions. Moreover, machine learning–based pricing strategies have been shown to strengthen the impact of personalized advertising, highlighting the importance of integrating advanced analytics into digital marketing practices. On the other hand, chatbot-based interactions, AI-driven product recommendations, sentiment analysis, and engagement mechanisms did not exhibit a significant influence, suggesting that consumers in this context prioritize personalization and usability over automated interactions. Theoretically, this research contributes to the growing body of literature on digital consumer behavior by combining behavioral analysis with algorithmic validation, achieving a high predictive accuracy (96.9%–98.3%). Practically, the results provide e-commerce businesses with actionable insights to enhance digital strategies, particularly in improving ad personalization, optimizing UI/UX, and leveraging AI-driven pricing models. These strategies are essential for sustaining competitiveness in the rapidly evolving digital economy. Nonetheless, studying has limitations. The sample was confined to digital consumers in Medan, which may limit the generalizability of the findings to other regions in Indonesia. Future research should expand the scope to include more diverse consumer groups and investigate additional AI-based stimuli as they evolve. Overall, the study highlights the transformative potential of AI-driven digital marketing in influencing consumer decision-making and enhancing the digital economy.

V. RECOMMENDATIONS

Suggestions for further research to close research shortcomings. It does not contain outside suggestions for further research.

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