

**AI-enabled strategic decision-making for advancing sustainability in digital marketing****Mohammad Zulfeequar Alam<sup>a\*</sup>, Sharifa Syed-Ahmad<sup>a</sup>, Nadeem Akhtar<sup>b</sup>, Hatem Hassan Farag Garamoun<sup>a</sup> and Bakhteyar Ahmad<sup>c</sup>**<sup>a</sup>Department of Marketing, University of Business and Technology (UBT), Jeddah, Saudi Arabia<sup>b</sup>Department of Computer Engineering and Technology, Aligarh Muslim University, Aligarh 202002 (UP), India<sup>c</sup>Department of Education and Training, College of Teacher Education, ASET, West Bengal, India**CHRONICLE**

Received August 22, 2025  
 Received in revised format  
 September 28, 2025  
 Accepted November 20 2025  
 Available online  
 November 20 2025

**Keywords:**

*Predictive analytics*  
*Marketing performance*  
*AI adoption*  
*Personalization*  
*Strategic decision-making*  
*Sustainable digital marketing*

**ABSTRACT**

The integration of AI in DM is reshaping strategies to promote sustainability-oriented outcomes. AI-powered capabilities, including PA and PS, offer opportunities for firms to improve the MP while addressing the environmental responsibilities. This research examines the straight impacts of AIA on advertising presentation and examines the part of PA, PS, and SDM as key mechanisms through which AI enhances sustainable DM outcomes. A structural method was developed and tested using SPSS 26.0 and SmartPLS-SEM 4.0 based on data gathered from 312 marketing professionals. AIA was treated as the primary construct, hypothesized to positively influence PA and PS, which subsequently enhanced the SDM. The structural method was assessed to test the significance of direct relations and assess the explanatory power of the constructs. The analysis indicates that the proposed hypotheses were well supported. AIA significantly improved PA ( $\beta = 0.78$ ), PS ( $\beta = 0.63$ ), and SDM, enhancing overall marketing outcomes. The results emphasize the central role of SDM in leveraging AI insights to enhance campaign effectiveness, customer engagement, and brand loyalty in sustainability-focused marketing. This research demonstrates that AIA is strategically leveraged to improve MP while advancing environmental responsibility. The proposed method offers practical guidance for managers and policymakers aiming to integrate AI in sustainable DM, balancing ecological imperatives with competitive growth.

© 2026 by the authors; licensee Growing Science, Canada.

**List of Abbreviations and Descriptions**

Abbreviation	Description
AI	Artificial Intelligence
IT	Information Technology
FF	Fermatean Fuzzy
SWARA	Step-Wise Weight Assessment Ratio Analysis
CoPRAS	Complex Proportional Assessment
SME	Small and Medium Enterprises
SDM	Strategic Decision-Making
MP	Marketing Performance
B2B	Business-to-Business
DM	Digital Marketing
SEM	Structural Equation Modeling
PLS	Partial Least Squares
SmartPLS-SEM	Smart Partial Least Squares Structural Equation Modeling
EFA	Exploratory Factor Analysis
CR	Composite Reliability
AVE	Average Variance Extracted
HTMT	Heterotrait-Monotrait Ratio
CSR	Corporate Social Responsibility

\* Corresponding author

E-mail address: [zulfeequar@ubt.edu.sa](mailto:zulfeequar@ubt.edu.sa) (M. Z. Alam)

ISSN 2561-8156 (Online) - ISSN 2561-8148 (Print)

© 2026 by the authors; licensee Growing Science, Canada.

doi: 10.5267/j.ijds.2025.11.010

## 1. Introduction

Marketing refers to the practice of analyzing, planning and delivering value to consumers in a profitable manner. It includes the growth of value to the businesses and consumers in products, services as well as communicative activities (Acatrinei et al., 2025). The predictable advertising impression has changed into DM, leveraging online platforms, data analytics, and interactive tools to engage consumers more effectively and efficiently on a global scale (Admass et al., 2024). Transaction administration is a strategic choice making procedure which is made based on the available information and business objective. The key processes in marketing decisions are the price setting, communications planning, product and customer relationship management positioning among others (Bag et al., 2021). Digital decision making is a practice, but it is conducted within a paradigm of adopting digital technologies and resting on the principles of online behavior, social media measurements, and predictive strategies that allow, in succession, real time making marketing decisions (Blomster and Koivumäki, 2022). Advance in AI transformed digital decision-making into AI-driven tactical decision-making. Intelligent AI systems analyze extensive datasets, anticipate client requirements, automate promotional activities, and deliver personalized experiences (Boddu et al., 2022; da Silva et al., 2023; Alam & Abunar, 2020). AI supports strategic planning, generates predictive insights, targets audience segments, enhances user experiences, and promotes sustainability-oriented strategies. Besides promoting sustainability, companies reduce resources and attract eco-conscious consumers by embedding sustainable approaches into advertising campaigns and CSR efforts (Forghani et al., 2022). The common AI uses in DM include the personalized advertising, optimization of content, customer services bots, predicting trends, and sustainable campaigns. It also contains chatbots, recommender systems, PA applications and sentiment analysis applications (Gao et al., 2023). The AIA has a couple of obstacles that are unique in marketing despite its potential to provide enormous promotions. The most commonly discussed topics concerning AI in marketing are ethical concerns, the fairness of the algorithm, the premise of data quality to automate the marketing tasks, and optimize the marketing tasks (Giannakopoulos et al., 2024).

Even though AI offers the necessary value, especially streamlining efficacies, automating marketing processes, the proportions between AI automation and human decision-making are significant in achieving sustainable, ethical, and efficient DM outcomes (Gunduzyeli, 2024). Although AI is possible, the adoption of AI in DM is limited, which restricts the effective use of PA, P, and SDM, and limits the long-term MP. The current study evaluates the increase of AIA in the PA, P, and SDM to make the sustainable MP better and the mechanism according to which these AI capabilities lead to the improvement of the engagement with customers, the effectiveness of the campaigns, and the adherence to the sustainability goals. This study provides the practical insights of the marketer and policymaker on the strategic adoption of AI in DM practices to balance both competitive expansion and environmental sustainability.

**Research Organization:** Section 2 provides the associated research regarding AI in DM. Section 3 illustrates the short explanation of the structural procedure. Section 4 represents the outcomes of testing the significance systems. Section 5 is the conclusion.

## 2. Related work

The literature identifies that AI and ML imply suggestive effectiveness in the domain of organizations, to better engage and decide correctly and present campaigns. Research indicates that there are significant improvements in the customer interaction, conversion, and strategic management. However, there are scalability, data integration, secrecy and organizational adaptation issues. On the whole, the implementation of AI leads to the tangible progress of marketing performance with the applied limitations of implementation.

### 2.1 AI adoption (AIA) in Digital Marketing (DM)

The incorporation of ML, robotics, and AI in was examined, with impact on operations and strategic decisions studied through analytical approaches, as discussed by Habbal et al. (2024). It was found that marketing efficiency was improved, the rate of engagement grew by 37% and the correctness of decisions by 42%, though it was not as scalable to diverse business processes. The research compared the data science systems and methodological strategies within the field of online marketing based on analysis of performance measures as discussed by Hussain et al. (2023). It was found that the effectiveness of the campaigns grew by 41% and the accuracy of customer engagement grew by 36%; and the interpretation of the methods was also an urgent concern. Krabokoukis et al. (2025) developed a combined AI system for information generation and B2B advertising management using structural modeling approaches. The results showed that the performance and accuracy of decision-making of firms were improved by 36% and 29%, but the adjustment to several organizational conditions remained challenging (Alam, M., 2023).

### 2.2 Predictive Analytics (PA) and Data-Driven Insights

A reinforcement learning approach was employed to optimize display advertising click-through rates through experimental modeling as demonstrated by Jin et al. (2024). It was found that the rates of clicking on the advertisements increased by 28% and the rate of accuracy in the targeting of the advertisements was improved by 22% since it was hard to control the behavior of the users on the fly. The research employed a combination of three ML approaches with an AI to simplify marketing tactics for food delivery services through PA tools, as illustrated by Kaponis et al. (2025). The results included a 39% increase in

customer interaction and 34% growth in conversion rate, and model complexity and cost of computation posed feasibility problems.

### 2.3 Personalization (PS) in Artificial Intelligent (AI)-Enabled Marketing

The research analyzed ML to enhance user experience in online marketing by using case-based and trend analysis, as demonstrated by Hicham et al. (2023). The results demonstrated a 45% improvement in P effectiveness and a 33% increase in customer retention, whereas data heterogeneity and privacy issues limited the general model optimization. The research examined how marketing tactics influence purchasing performance of troubled shoppers during online transactions through modeling based on rough set theory, as demonstrated by Lessmann et al. (2021). The results showed that purchase intention accuracy increased by 38% and behavioural prediction reliability increased by 35%, but uncertainty in data handling was also a methodological weakness. The research has optimized multichannel DM with respect to the tourism and hospitality sector through big data analytics and performance modeling techniques, as demonstrated by Pascucci et al. (2023). The findings demonstrated that customer engagement increased by 42%, conversion efficiency was enhanced by 38%, and data integration across numerous channels was one of the main operational issues. The qualitative assessment and capability examination methods were utilized to examine the necessary resources, skills, and capabilities for efficient deployment of ML in DM, as discussed by Kufile et al. (2022). The findings revealed a 40% increase in the success rates of the research and a 32% improvement in the adaptability of the organization, and the skill gaps and data management constraints reduced scalability.

### 2.4 Strategic Decision-Making (SDM) and Artificial Intelligent (AI) integration

A theoretical framework and corresponding evaluation method were designed to utilize AI in guiding marketing decisions, as proposed by Korucuk et al. (2022). The outcomes specified that the efficacy of organization increased by 31% and alignment of strategy increased by 27%, though there was insufficient application in diverse industries. Campaign effectiveness dashboards were created on Table to support decision-making at the Chief Marketing Officer (CMO) level using data visualization and performance analytics tools, as described by Martínez-Peláez et al. (2024). The results proved that the customer engagement was improved by 42 percent, the conversion efficiency was improved by 38 percent, and the data integration between many channels was among the primary areas of operation concern. The methods to be applied in the qualitative assessment and capabilities examination were used to analyze the needed resources, skills, and capabilities to deploy ML successfully in DM, as Kufile et al. (2022) argue. The results showed that there were 40 percentages of success rates increase of the research and a 32 percent increment of the organizations adaptability and the skills gap and limitations with data management lowered scalability.

### 2.5 Marketing Performance (MP) and Sustainable Outcomes

Krishen et al. (2021) utilized comparative and appraisal methods to assess how technology contributes to attaining a competitive advantage in DM. The findings showed that market reach had increased by 33 points and campaign efficiency had increased by 30 points, while integration with legacy systems remained a major limitation. Sakas et al. (2022) conducted a quantitative investigation of DM in travel organizations in Greece using survey data. The results showed that the customer acquisition rate improved by 35%, the brand visibility increased by 29% and the lack of extensive digital infrastructure limited widespread implementations (Alam et al., 20224).

### 2.6 Research gap

Existing research examined AI, ML, and big data in DM (Habbal et al., 2024; Hussain et al., 2023; Sakas et al., 2022), enhancing engagement (28-45%) and decision accuracy (22-42%). Nevertheless, the majority concentrated on single methods (Jin et al., 2024; Kaponis et al., 2025; Martínez-Peláez et al., 2024) and did not integrate AIA, PA, P, and SDM. The applicability in real practice in any industry, scalability, and integration with legacy systems were still limited effects of AIA, PA, P, and SDM in MP (Pascucci et al., 2023; Lessmann et al., 2021; Krabokoukis et al., 2025). This research transcends the above limitations by combining AIA, PA, P, and SDM into a SmartPLS-SEM method to achieve scalable, sustainable MP.

### 2.7 Conceptual Framework and Hypotheses Development

A model is developed to examine the relationships among AIA, PA, P, SDM, and MP. Figure 1 displays the AIA method for SDM and results. The main hypotheses are formulated as follows:

The adoption of AI improves the analytical capacity of an organization by facilitating automated data processing and modeling and strengthening PA, which are crucial in creating accurate and sustainability-focused marketing insights.

**H<sub>1</sub>:** *AI adoption (AIA) positively influences Predictive Analytics (PA).*

The application of AI within organizations increases the capacity to process data and provides the possibility to apply advanced data analysis approaches (e.g., reinforcement learning, ensemble methods) that directly enhance predictive-analytics solutions demanded to make precise marketing forecasts aimed at sustainability (Zaman, 2022).

**H<sub>2</sub>:** *AI adoption (AIA) significantly enhances Personalization (PS).*

Targeting AI-based recommender systems and machine-learning pipelines allow fine-grained consumer-level profiling and on-the-fly content modification, enhancing its accuracy in targeting and personalized experience (Ziółkowska., 2021).

**H3:** *AI adoption (AIA) has a positive and important influence on Strategic Decision-Making (SDM).*

AI applications (dashboards, automated analytics, multi-criteria models) are timely, evidence-based inputs that optimize the quality, agility, and alignment of the managerial decision to the sustainability goals. (Evangelista et al., 2023)

**H4:** *Predictive Analytics (PA) has a positive and important influence on Personalization (PS).*

Predictive models transform behavioural and transactional data into actionable one-on-one customer predictions to drive context-aware personalization and better customer response. (Lessmann et al., 2021)

**H5:** *Predictive Analytics (PA) has a positive and important effect on Strategic Decision-Making (SDM).*

Pattern-detection and forecasts based on PA provide managers with strategic information that is used to distribute resources, plot campaigns and implement sustainability-oriented strategies. (Haupt and Lessmann, 2022)

**H6:** *Predictive Analytics (PA) positively influences marketing outcomes.*

It is proven that PA-driven targeting and campaign optimization enhance engagement, conversion and campaign efficiency which are the vital elements of MP (Martínez-Peláez et al., 2023).

**H7:** *Personalization (PS) has a positive and important impact on Strategic Decision-Making (SDM).*

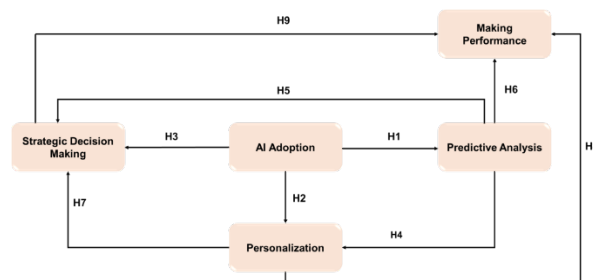
Personalization data at customer level assists in segmentation and strategic decision making and helps in more accurate and customer focused marketing plans (Saheb et al., 2021).

**H8:** *Personalization (PS) significantly enhances marketing outcomes.*

Individual experiences can improve satisfaction, retention and conversion, which are the direct marketing performance metrics (Frempong et al., 2022).

**H9:** *Strategic Decision-Making (SDM) has a positive and important impact on Marketing Performance (MP).*

Improved SDM-enabled by AI and analytics contributes to accelerated and more alignment-oriented campaigns and quantifiable MP benefits (Sakas et al., 2022).



**Fig. 1.** AI-Driven Decision-Making Method for Organizational Performance

**3. Materials and methods**

The research created the impact of AIA on sustainable MP in DM setting. Structured online survey has been used to collect data among DM professionals and five latent constructs including AIA, PA, PS, SDM, and MP were addressed. The constructs were measured with validated multi-item Likert scales, data were analyzed by SPSS 26.0 to do EFA and SmartPLS 4.0 to analyze the data by a PLS-SEM model, reliability, validity, and structural model measurements. The strategy has allowed a strict, dependable, and comprehensive evaluation of AI-based strategies to serve sustainability in DM.

*3.1 Data collection*

Data was collected via a questionnaire dispatched to the marketing experts operating in sectors that were embracing AI-based sustainability initiatives. The selected sampling strategy also guaranteed the selection of the participants with the relevant experience in the field of AI-based marketing systems. Following the screening of the responses in relation to completeness and consistency, 312 valid responses were maintained among the 400 responses received and used later in analysis.

*3.2 Selection criteria*

The respondents were selected based on their active work in the DM world and experience with AI-enabled products. The participants had to be employed in the marketing field at the time of questionnaire, knowledgeable in AI applications, and open to answer as an informed person. The exclusion criteria removed participants who do not have a direct involvement with DM or minimal exposure to AI-based strategies, which guarantees that the data obtained has been germane to the comprehension of expertise and other pertinent information to interpret AI utilization and sustainable MP.

**Table 1**  
Demographic Characteristics of Participants Included in the Research

Demographic Variable	Category	Frequency (n = 312)	Percentage (%)
Gender	Male	178	57.1
	Female	134	42.9
Age Group (Years)	21 – 30	96	30.8
	31 – 40	132	42.3
	41 – 50	58	18.6
	Above 50	26	8.3
Educational Qualification	Bachelor's Degree	118	37.8
	Master's Degree	142	45.5
	Doctorate	28	9.0
	Others (Diploma/Professional)	24	7.7
Work Experience (Years)	Less than 3	64	20.5
	3 – 6	104	33.3
	7 – 10	82	26.3
	Above 10	62	19.9
Industry Sector	Retail and E-commerce	76	24.4
	IT	68	21.8
	Banking and Finance	54	17.3
	Advertising and Media	48	15.4
	Other Services	66	21.1

Table 1 presents demographic data of 312 respondents where it was revealed that 57.1% of the respondents were males and 42.9% were females. The largest number of respondents were aged 31-40 (42.3%), 21-30 (30.8), 41-50 (18.6) and age over 50 years (8.3). With respect to education, 45.5% of them had master qualifications, 37.8 percent had bachelors' qualifications, 9.0 percent had doctorate, and 7.7 percent had other degrees. The industry was 33.3 years 3-6 years and experience was 24.4% retail and e-commerce, 21.8% IT, 17.3% banking and finance, 15.4% media and advertising, 21.1% other services.

### 3.3 Measurement Instrument

The measurement tool included five latent measured constructs, which were operationalized with an already proven scale and rated on a standard 5-level scale of agreement. The choice of this format was deemed an acceptable trade-off between sensitivity of measurements and understanding of the respondents, especially among the managerial and marketing practitioners who might not be conversant with AI phenomena. This scale alleviates the cognitive burden, minimizes error in random sampling and optimizes uniformity of one response.

- **AI adoption (AIA):** The AIA is measured with the help of the indicators of technological capability, algorithm integration, and the readiness of the organization.
- **Predictive Analytics (PA):** This is embodied in the variables, which refer to the data-driven prediction, trend analysis, and pattern identification.
- **Personalization (PS):** It is measured against the characteristics of individualized marketing content, customer targeting accuracy, and responsive targeting.
- **Strategic Decision-Making (SDM):** it was assessed based on the rationality, agility, and responsiveness in marketing activities.
- **Marketing Performance (MP):** It is assessed through indicators such as efficiency of the campaign, customer engagement, and sustainability of brand perception.

### 3.4 Statistical Analysis

The impact of adopting AI applications on sustainable MP for purposes of PA, PS, and SDM is evaluated. This research examined the data collected from the DM professionals through SPSS 26.0 and SmartPLS 4.0. The statistical tests are utilized to assess the reliability, validity, and theorized relationships among the constructs that include EFA, MME, and SEM.

## 4. Result and discussion

This analysis investigated how of AIA affects sustainable performance efficiency through PA, PS, and SDM, and examined the hypothesized relationships (H1–H9) among the constructs. The outcomes of measurement validation and the structural model of the testing conducted.

### 4.1 Measurement Model Evaluation (MME)

Construct consistency, convergent and discriminant properties established by the MME are ensured to confirm measurement accuracy prior to testing structural relationships in the SmartPLS-SEM. CR, AVE, and HTMT correlations assess discriminant properties, ensuring that each construct in the method is empirically distinct from the others.

**Table 2**

MME of Constructs Including Reliability, Convergent, Validity, and HTMT

Construct	Cronbach's $\alpha$	CR	AVE	HTMT (Max)
AI Adoption	0.88	0.91	0.67	0.62
Predictive Analytics	0.85	0.89	0.62	0.66
Personalization	0.83	0.87	0.61	0.63
SDM	0.89	0.92	0.65	0.68
MP	0.91	0.94	0.68	0.68

Table 2 presents the MME results, indicating that all constructs were found to be strongly internally-consistent with a *Cronbach's  $\alpha$*  value of 0.83 to 0.91 and *CR* values of 0.87 to 0.94. The convergent validity was established, where all the constructs had an AVE of over 0.60. The support of discriminant validity was also made because HTMT values are between 0.62 and 0.68 and not more than 0.85. Results of these specify that the measurement system is valid and dependable and can be analyzed using structural models.

#### 4.2 Exploratory Factor Analysis (EFA)

The EFA determines the underlying factor structure, item-grouping is verified, and construct validity is assured in the research method to have robust and reliable measurement. Table 3 shows the result of the EFA on all constructs and items. The factor loading of all items was between 0.756 and 0.873, showing that items had strong item-construct correlations. Factor Eigenvalues were 1.985 to 3.284, with personal variance explained of 7.92% to 24.21%. The total variance captured by the five factors was 73.40%, which validated the sufficiency and strength of the measurement model to be used in further analysis.

**Table 3**

EFA Analysis Results for Identified Research Constructs

Factor	Variable	Factor Loading	Eigenvalue	Variance Explained (%)	Cumulative Variance (%)
AIA	AI1	0.812	3.284	24.21	24.21
	AI2	0.845	3.284	24.21	24.21
	AI3	0.861	3.284	24.21	24.21
	AI4	0.794	3.284	24.21	24.21
PA	PA1	0.826	2.917	18.47	42.68
	PA2	0.857	2.917	18.47	42.68
	PA3	0.842	2.917	18.47	42.68
	PA4	0.801	2.917	18.47	42.68
PS	PS1	0.824	2.543	12.96	55.64
	PS2	0.837	2.543	12.96	55.64
	PS3	0.798	2.543	12.96	55.64
	PS4	0.756	2.543	12.96	55.64
SDM	SD1	0.873	2.268	9.84	65.48
	SD2	0.854	2.268	9.84	65.48
	SD3	0.821	2.268	9.84	65.48
	SD4	0.785	2.268	9.84	65.48
MP	MP1	0.848	1.985	7.92	73.40
	MP2	0.833	1.985	7.92	73.40
	MP3	0.815	1.985	7.92	73.40
	MP4	0.789	1.985	7.92	73.40

#### 4.3 SmartPLS-SEM

SmartPLS-SEM is employed to investigate intricate interactions among latent dimensions, test hypotheses, and assess reliability, validity, ability to forecast, and mediation impacts in the proposed marketing model. Structural model analysis tests constructs relationships, hypotheses, and the predictive value, the magnitude of effects, and mediation in the hypothesized model.

**Table 4**

Hypothesis Testing Results for the Method

Relationship	Hypothesis	t – value	p – value	$\beta$	Supported
AIA → PA	H1	15.42	0.000	0.78	Yes
AIA → PS	H2	11.83	0.000	0.63	Yes
AIA → SDM	H3	9.27	0.000	0.47	Yes
PA → PS	H4	10.19	0.000	0.56	Yes
PA → SDM	H5	12.33	0.000	0.59	Yes
PA → MP	H6	8.26	0.000	0.41	Yes
PS → SDM	H7	9.04	0.000	0.45	Yes
PS → MP	H8	7.11	0.000	0.38	Yes
SDM → MP	H9	13.74	0.000	0.66	Yes

(Note:  $\beta$ - Path Coefficient)

Table 4 and Fig. 2 show that the findings of the SmartPLS-SEM indicate that the path coefficient of H1 (AIA → PA) is 0.78 ( $p < 0.000$ ,  $t = 15.42$ ). H2 (AIA → PS) = 0.63 ( $p < 0.000$ ,  $t = 11.83$ ), and H3 (AIA → SDM) = 0.47 ( $p < 0.000$ ,  $t = 9.27$ ). H4 (PA → P) has 0.56 ( $p < 0.000$ ,  $t = 10.19$ ) and H5 (PA → SDM) has 0.59 ( $p < 0.000$ ,  $t = 12.33$ ). The H6 (PA → MP) 0.41 ( $p < 0.009$ ,  $t = 8.26$ ), H7 (PS → SDM) 0.45 ( $p < 0.009$ ,  $t = 9.04$ ), H8 (PS → MP) 0.38 ( $p < 0.000$ ,  $t = 7.11$ ), and H9 (SDM → MP) 0.66 ( $p < 0.000$ ,  $t = 13.74$ ).

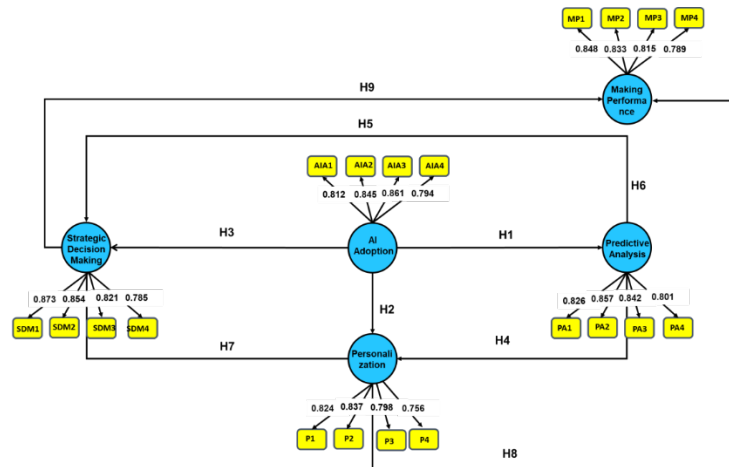


Fig. 2. Measurement Method of AI-Enabled SDM and MP

4.4 Discussion

The research investigated the effect of AI implementation on PA and P to promote sustainable marketing practices. The limitations of the previous studies were numerous. DM modeling based on AI and agro-economic indices did not provide any insights into practical implementation in terms of sustainability, as discussed by Saura (2021). The systematic marketing application of the random forest (RF) methodology employing big data had not considered the P or strategic considerations, as noted by Schmitt (2023). Fuzzy multi-criteria evaluation had utilized the methodology but did not evaluate the outcomes on MP, as reported by Singh et al., (2023). Trends were identified only through bibliometric observations without testing structural relations between constructs, as noted by Velentza and Metaxas (2023). The method to social media emphasized platform estimation but disregarded the mediating behavior of PA, as highlighted by Vollrath and Villegas, (2022). The fuzzy rough set application focused more on growth than on the structures relating to business decisions, as noted by Yaiprasert and Hidayanto, (2023) and Alam et al. (2025). Descriptive models of customer decision journeys may at the same time provide strategic insight but do not consider any outcome of AI implementation, as reported by Yi et al., (2024). To address these gaps, this research produced a SmartPLS-SEM method that incorporated AI uptake, PA, PS, and SDM into sustainable marketing. The analysis resulted from a SmartPLS-SEM analysis that confirmed that each of the proposed hypotheses was well supported, thereby confirming a significant positive influence of AIA on PA.

5. Conclusion

The present research confirmed that the adoption of AI led to prominent positive enhancements in the sustainable digital MP efficiency through enhanced PA, PS, along with SDM. The AI-powered methods of precision targeting, data-driven predictions, and instantaneous decision-making have enabled the organizations to improve the marketing campaign performance, consumer response, and brand loyalty. The analysis resulted from a SmartPLS-SEM analysis confirmed that each of the proposed hypotheses was well supported, thereby confirming the substantial positive impact of AIA on PA ( $\beta = 0.78, p < 0.000$ ), P ( $\beta = 0.63, p < 0.000$ ), and SDM ( $\beta = 0.47, p < 0.000$ ), thereby leading to significant positive influence on MP ( $\beta = 0.66, p < 0.000$ ). The PA and PS features of AI also had significant indirect effects on MP from SDM. The research provided evidence that SDM presented a key moderator between AI-sourced insights and MP. The research's limitations were related to self-report survey data and application on a small sample size, which may have added bias to the outcome. Future research will utilize larger samples across multiple industries and objective measures of performance to evidence and generalize the research.

References

Acatrinei, C. Apostol, I.G. Barbu, L.N. Chivu, R.G., & Orzan, M.C. (2025). Artificial Intelligence in Digital Marketing: Enhancing Consumer Engagement and Supporting Sustainable Behavior Through Social and Mobile Networks. *Sustainability*, 17(14), 6638. <https://doi.org/10.1016/j.csa.2023.100031>

Admass, W.S. Munaye, Y.Y., & Diro, A.A. (2024). Cyber security: State of the art, challenges and future directions. *Cyber Security and Applications*, 2, 100031. <https://doi.org/10.1016/j.indmarman.2020.12.001>

- Alam, M. (2023). An investigation on the use of digital marketing towards the customer satisfaction and brand loyalty of restaurants in Saudi Arabia. *International Journal of Data and Network Science*, 7(4), 1493–1504. <https://doi.org/10.5267/j.ijdns.2023.8.013>
- Alam, M. Z., & Abunar, S. (2023). Appraising the Buyers Approach Towards Sustainable Development with Special Reference to Buying Habits and Knowledge Source of Green Packaging: A Cross-Sectional Study. *WSEAS Transactions on Environment and Development*, 19, 400-411. <https://doi.org/10.37394/232015.2023.19.37>
- Alam, M. Z., Ahmad, T., Parveen. S. (2025) Assessing social media and influential marketing on brand perception and selection of higher educational institute in India, *International Journal of Data and Network Science*, 9(1), 27-36. <https://doi.org/10.5267/j.ijdns.2024.11.001>
- Alam, M., Naseem, M., Garamoun, H., Althagafi, A., & Silawi, A. (2024). Evaluating the Adoption of Sustainable Marketing Strategies Towards Electronics Industries Business Performance. *Journal of Sustainable Development of Energy, Water and Environment Systems*, 12(3), 1-17. <https://doi.org/10.13044/j.sdwes.d12.0523>
- Bag, S. Gupta, S. Kumar, A., & Sivarajah, U. (2021). An integrated artificial intelligence framework for knowledge creation and B2B marketing rational decision making for improving firm performance. *Industrial Marketing Management*, 92, 178-189. <https://doi.org/10.1007/s10257-021-00547-y>
- Blomster, M., & Koivumäki, T. (2022). Exploring the resources, competencies, and capabilities needed for successful machine learning projects in digital marketing. *Information Systems and e-Business Management*, 20(1), 123-169. <https://doi.org/10.1016/j.matpr.2021.11.637>
- Boddu, R.S.K. Santoki, A.A. Khurana, S. Koli, P.V. Rai, R., & Agrawal, A. (2022). An analysis to understand the role of machine learning, robotics, and artificial intelligence in digital marketing. *Materials Today: Proceedings*, 56, 2288-2292. <https://doi.org/10.1016/j.procs.2023.07.024>
- da Silva, D.J.C. da Silva Stertz, E. Portella, A.G. Gomes, C.F.S. Moreira, M.Â.L., & dos Santos, M. (2023). Social media platform for digital marketing: An analysis using the CRITIC-GRA-3N method. *Procedia Computer Science*, 221, 169-176. <https://doi.org/10.1007/s13198-021-01315-4>
- Evangelista, S.S. Aro, J.L. Selerio Jr, E. Maturan, F. Atibing, N.M. Ocampo, L., & Pamucar, D. (2023). An integrated Fermatean fuzzy multi-attribute evaluation of digital technologies for circular public sector supply chains. *International Journal of Computational Intelligence Systems*, 16(1), 122. <https://doi.org/10.1007/s44196-023-00294-7>
- Forghani, E. Sheik, R. Hosseini, S.M.H., & Sana, S.S. (2022). The impact of digital marketing strategies on customers buying behavior in online shopping using the rough set theory. *International Journal of System Assurance Engineering and Management*, 13(2), 625-640. <https://doi.org/10.1007/s44196-023-00298-3>
- Frempong, D. Akinboboye, O. Okoli, I. Afrihyia, E. Umar, M.O. Umana, A.U. Appoh, M., & Omolayo, O. (2022). Real-time analytics dashboards for decision-making using Tableau in public sector and business intelligence applications. *Journal of Frontiers in Multidisciplinary Research*, 3(2), 65-80. <https://doi.org/10.54660/IJFMR.2022.3.2.65->
- Gao, K. Liu, T. Yue, D. Simic, V. Rong, Y., & Garg, H. (2023). An integrated spherical fuzzy multi-criterion group decision-making approach and its application in digital marketing technology assessment. *International Journal of Computational Intelligence Systems*, 16(1), 125. <https://doi.org/10.3390/info15020067>
- Giannakopoulos, N.T. Terzi, M.C. Sakas, D.P. Kanellos, N. Toudas, K.S., & Migkos, S.P. (2024). Agro-economic indexes and big data: digital marketing analytics implications for enhanced decision making with artificial intelligence-based modelling. *Information*, 15(2), 67. <https://doi.org/10.3390/su162310511>
- Gündüzyeli, B. (2024). Artificial Intelligence in Digital Marketing Within the Framework of Sustainable Management. *Sustainability*, 16(23), 10511. <https://doi.org/10.1016/j.eswa.2023.122442>
- Habbal, A. Ali, M.K., & Abuzaraida, M.A. (2024). Artificial Intelligence Trust, risk and security management (AI trism): Frameworks, applications, challenges and future research directions. *Expert Systems with Applications*, 240, 122442. <https://doi.org/10.1016/j.eswa.2023.122442>
- Haupt, J., & Lessmann, S. (2022). Targeting customers under response-dependent costs. *European Journal of Operational Research*, 297(1), 369-379. <https://doi.org/10.1016/j.ejor.2021.05.045>
- Hicham, N. Nasser, H., & Karim, S. (2023). Strategic framework for leveraging artificial intelligence in future marketing decision-making. *Journal of Intelligent Management Decision*, 2(3), 139-150. <https://www.acadlore.com/journals/JIMD>
- Hussain, H.N. Alabdullah, T.T.Y. Ries, E., & Jamal, K.M. (2023). Implementing technology for competitive advantage in digital marketing. *International Journal of Scientific and Management Research*, 6(6), 95-114. <http://doi.org/10.37502/IJSMR.2023.6607>
- Jin, K. Zhong, Z.Z., & Zhao, E.Y. (2024). Sustainable digital marketing under big data: an AI random forest model approach. *IEEE Transactions on Engineering Management*, 71, 3566-3579. <https://doi.org/10.1109/TEM.2023.3348991>
- Kaponis, A., Maragoudakis, M., & Sofianos, K. C. (2025). Enhancing User Experiences in Digital Marketing Through Machine Learning: Cases, Trends, and Challenges. *Computers*, 14(6), 211. <https://doi.org/10.3390/computers14060211>
- Korucuk, S. Aytakin, A. Ecer, F. Karamaşa, Ç., & Zavadskas, E.K. (2022). Assessing green approaches and digital marketing strategies for twin transition via fermatean fuzzy SWARA-COPRAS. *Axioms*, 11(12), 709. <https://doi.org/10.3390/axioms11120709>
- Krabokoukis, T. (2025). Bridging neuromarketing and data analytics in tourism: An adaptive digital marketing framework for hotels and destinations. *Tourism and Hospitality*, 6(1), 12. <https://doi.org/10.3390/tourhosp6010012>
- Krishen, A.S. Dwivedi, Y.K. Bindu, N., & Kumar, K.S. (2021). A broad overview of interactive digital marketing: A bibliometric network analysis. *Journal of Business Research*, 131, 183-195. <https://doi.org/10.1016/j.jbusres.2021.03.061>

- Kufile, O.T. Otokiti, B.O. Onifade, A.Y. Ogunwale, B., & Harriet, C. (2022). Building campaign effectiveness dashboards using Tableau for CMO-level decision making. *Journal of Frontiers in Multidisciplinary Research*, 3(1), 414-424. <https://doi.org/10.54660/.JFMR.2022.3.1.414-424>
- Lessmann, S. Haupt, J. Coussement, K., & De Bock, K.W. (2021). Targeting customers for profit: An ensemble learning framework to support marketing decision-making. *Information Sciences*, 557, 286-301. <https://doi.org/10.1016/j.ins.2019.05.027>
- Martínez-Peláez, R. Escobar, M.A. Félix, V.G. Ostos, R. Parra-Michel, J. García, V. Ochoa-Brust, A. Velarde-Alvarado, P. Félix, R.A. Olivares-Bautista, S., & Flores, V. (2024). Sustainable digital transformation for SMEs: A comprehensive framework for informed decision-making. *Sustainability*, 16(11), 4447. <https://doi.org/10.3390/su16114447>
- Martínez-Peláez, R. Ochoa-Brust, A. Rivera, S. Félix, V.G. Ostos, R. Brito, H. Félix, R.A., & Mena, L.J. (2023). Role of digital transformation for achieving sustainability: mediated role of stakeholders, key capabilities, and technology. *Sustainability*, 15(14), 11221. <https://doi.org/10.3390/su151411221>
- Molina, R.I.R. Ruiz, M.J.S. Castro, L.C.M. Raby, N.D.L. Hinojoza-Montañez, S., & Samper, M.G. (2024). Bibliometric behavior of big data and digital marketing as real-time multimedia. *Procedia Computer Science*, 241, 526-532. <https://doi.org/10.1016/j.procs.2024.08.075>
- Pascucci, F. Savelli, E., & Gistri, G. (2023). How digital technologies reshape marketing: evidence from a qualitative investigation. *Italian Journal of Marketing*, 2023(1), 27-58. <https://doi.org/10.1007/s43039-023-00063-6>
- Saheb, T. Amini, B., & Alamdari, F.K. (2021). Quantitative analysis of the development of digital marketing field: Bibliometric analysis and network mapping. *International Journal of Information Management Data Insights*, 1(2), p.100018. <https://doi.org/10.1016/j.ijime.2021.100018>
- Sakas, D.P. Reklitis, D.P. Terzi, M.C., & Vassilakis, C. (2022). Multichannel digital marketing optimizations through big data analytics in the tourism and hospitality industry. *Journal of Theoretical and Applied Electronic Commerce Research*, 17(4), 1383-1408. <https://doi.org/10.3390/jtaer17040070>
- Sakas, D.P. Reklitis, D.P. Trivellas, P. Vassilakis, C., & Terzi, M.C. (2022). The effects of logistics websites' technical factors on the optimization of digital marketing strategies and corporate brand name. *Processes*, 10(5), 892. <https://doi.org/10.3390/pr10050892>
- Saura, J.R. (2021). Using data sciences in digital marketing: Framework, methods, and performance metrics. *Journal of Innovation & Knowledge*, 6(2), 92-102. <https://doi.org/10.1016/j.jik.2020.08.001>
- Schmitt, M. (2023). 'Automated machine learning: AI-driven decision making in business analytics', *Intelligent Systems with Applications*, 18, pp. 200188. <https://doi.org/10.1016/j.iswa.2023.200188>
- Singh, V. Nanavati, B. Kar, A.K., & Gupta, A. (2023). How to maximize clicks for display advertisements in digital marketing? A reinforcement learning approach. *Information Systems Frontiers*, 25(4), 1621-1638. <https://doi.org/10.1007/s10796-022-10314-0>
- Velentza, A., & Metaxas, T. (2023). The role of digital marketing in tourism businesses: An empirical investigation in Greece. *Businesses*, 3(2), 272-292. <https://doi.org/10.3390/businesses3020018>
- Vollrath, M.D., & Villegas, S.G. (2022). Avoiding digital marketing analytics myopia: revisiting the customer decision journey as a strategic marketing framework. *Journal of Marketing Analytics*, 10(2), 106-113. <https://doi.org/10.1057/s41270-020-00098-0>
- Yaiprasert, C., & Hidayanto, A.N. (2023). An AI-driven ensemble of three machine learning models to enhance digital marketing strategies in the food delivery business. *Intelligent Systems with Applications*, 18, 200235. <https://doi.org/10.1016/j.iswa.2023.200235>
- Yi, J. Ahmmad, J. Mahmood, T. Rehman, U.U., & Zeng, S. (2024). Complex fuzzy rough set: An application in digital marketing for business growth. *IEEE Access*, 12, 66453-66465. <https://doi.org/10.1109/ACCESS.2024.3397699>
- Zaman, K. (2022). Transformation of marketing decisions through artificial intelligence and digital marketing. *Journal of Marketing Strategies*, 4(2), 353-364. <https://doi.org/10.52633/jms.v4i2.210>
- Ziółkowska, M.J. (2021). Digital transformation and marketing activities in small and medium-sized enterprises. *Sustainability*, 13(5), p.2512. <https://doi.org/10.3390/su13052512>

## Appendix

### Questionnaire for AI-Enabled Sustainable Digital Marketing

Instruction:

Please indicate the extent to which you agree with each statement below based on your organization's experience with AI-enabled digital marketing systems.

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

- **AI Adoption (AIA)**

Measures technological capability, algorithmic integration, and organizational readiness.

Code	Item Statement
AI1	Our organization actively integrates AI tools into digital marketing operations.
AI2	AI algorithms are widely used to automate and optimize our marketing processes.
AI3	The management strongly supports investments in AI-driven marketing systems.
AI4	Our marketing teams are well-prepared and trained to work with AI applications.

### • Predictive Analytics (PA)

Measures use of data-driven prediction, trend analysis, and pattern identification.

Code	Item Statement
PA1	Our marketing decisions are guided by predictive models built on customer data.
PA2	AI systems help us forecast consumer behavior and future market trends.
PA3	Predictive analytics improve the accuracy of our marketing campaigns.
PA4	Data-driven insights are routinely used to adjust campaign strategies in real time.

### • Personalization (PS)

Measures individualized content delivery and responsive customer targeting.

Code	Item Statement
PS1	AI enables us to deliver personalized marketing messages to customers.
PS2	Our marketing content is customized to match each customer's preferences.
PS3	AI-based personalization increases the relevance of our promotional offers.
PS4	Personalized interactions have improved overall customer satisfaction.

### • Strategic Decision-Making (SDM)

Assesses rationality, agility, and responsiveness in marketing strategy revision.

Code	Item Statement
SD1	AI insights play a crucial role in revising our marketing strategies.
SD2	Strategic marketing decisions are supported by AI-driven analytical tools.
SD3	Our organization quickly adapts strategies based on AI-generated information.
SD4	Data visualization and AI dashboards enhance the quality of strategic decisions.

### • Marketing Performance (MP)

Evaluates campaign efficiency, customer engagement, and sustainability outcomes.

Code	Item Statement
MP1	AI adoption has increased the overall efficiency of our marketing campaigns.
MP2	Customer engagement levels have improved through AI-driven marketing.
MP3	AI applications have strengthened our brand visibility and loyalty.
MP4	Sustainable marketing outcomes have improved due to AI integration.



© 2026 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).