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Sensory Experience and Artificial Intelligence in Marketing: A Survey of Consumers Examining Mediating and Moderating Effects

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Abstract

The advent of Artificial Intelligence (AI) has revolutionized the way consumers and brands interact, especially in digital space with experience-driven, personalized, and immersive interactions. This study was designed to investigate how AI-enabled sensory marketing innovations affect the behavioral level of behavioral brand engagement with brand experience co-creation as the mediating variable and technology readiness as the moderating variable The quantitative cross-sectional survey design was used and data were gathered from 428 consumers through a structured questionnaire. Convenience sampling was employed, and gender, age, monthly income, and exposure to AI-enabled marketing systems were treated as control variables. The direct, mediating, and moderating relationships among AI-enabled sensory marketing innovations, brand experience co-creation, technology readiness, and behavioral brand engagement were tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results showed that most participants had a high awareness of AI-related marketing, with more than 70% stating that they had come across AI marketing in digital marketing tools. About half of the participants had experience with immersive technologies like AR/VR-based marketing, and over half were regular users of AI recommendation systems. The analysis of structures revealed that AI-enabled sensory marketing innovations have a strong impact on behavioral brand engagement and brand experience co-creation. Brand experience co-creation was found to significantly mediate the relationship between AI-enabled sensory marketing innovations and behavioral brand engagement, while technology readiness significantly strengthened the relationship between brand experience co-creation and behavioral brand engagement. All hypothesized relationship was supported. Behavioral brand engagement is greatly improved through experiential brand experience co-creation processes facilitated by AI-enabled sensory marketing innovations, and this impact is further amplified by technology readiness.

Keywords*:* Artificial Intelligence (AI); Sensory Marketing; Behavioral Brand Engagement; Brand Experience Co-Creation; Technology Readiness.

Introduction

The digital revolution has revolutionized today's marketing world by changing the paradigm of marketing to a more personalized and interactive approach, through data and new technologies (Kobets et al., 2024; Haudi, 2025). One such development is the integration of Artificial Intelligence (AI), which is revolutionizing the way that organizations process vast amounts of consumer data, forecast consumer behavior, automate decision making and provide real time individualised experiences (Nalini, 2024). AI-enabled sensory marketing innovations enable custom and context-sensitive outreach, which aids in delivering improved consumer experiences

and deepening brand connections, in contrast to conventional marketing strategies that adopt a one-size-fits-all method. AI-enabled sensory marketing innovations facilitate adaptive and context-sensitive outreach, delivering enhanced consumer experiences and strengthening brand interactions, as compared to traditional marketing strategies that take a one-size-fits-all approach (Vyas & Vishwakarma, 2026). Concurrently, sensory marketing has become more prevalent in recent years as businesses look to engage consumers' senses and emotions through multi-sensory experiences, such as visual, auditory, tactile, and immersive digital elements (Petit et al., 2019; Kaushik & Gokhale, 2022). In the present day, sensory marketing goes past the actual retail store and is extended to e-commerce websites, augmented reality (AR), and virtual reality (VR), as well as the AI-powered suggestion systems. Emotionally engaging and immersive brand experiences can be created by integrating, which can significantly increase trust, satisfaction and customer retention. (Mouammine, 2026). The synergy of AI-enabled sensory marketing innovations and sensory marketing is indicative of the trend of experiential marketing, which focuses on consumers' active role in shaping the brand experience rather than just receiving marketing messages (Helmefalk et al., 2025; Puntoni et al., 2021). Consumers interact with the brand and share their feedback and ideas continuously, and the brand provides them with personalized suggestions to help them have a deeper emotional connection with the brand and feel more valuable (Zha et al., 2022; Merrilees, 2016). This study is theoretically grounded in the Stimulus–Organism–Response (SOR) model and the Technology Acceptance Model (TAM). The conceptual framework proposes that AI-enabled sensory marketing innovations act as the stimulus, brand experience co-creation functions as the organism, and behavioral brand engagement represents the response. Technology readiness is incorporated as a moderating variable that strengthens or weakens the relationship between brand experience co-creation and behavioral brand engagement. Additionally, demographic variables including gender, age, monthly income, and exposure to AI-enabled marketing systems were incorporated as control variables.

Research Objective

To examine the impact of AI-enabled sensory marketing innovations on behavioral brand engagement through the mediating role of brand experience co-creation and the moderating role of technology readiness among consumers.

Research Questions

1. How do AI-enabled sensory marketing innovations influence behavioral brand engagement among consumers?
2. What is the effect of AI-enabled sensory marketing innovations on brand experience co-creation?
3. How does brand experience co-creation affect behavioral brand engagement?
4. Does brand experience co-creation mediate the relationship between AI-enabled sensory marketing innovations and behavioral brand engagement?
5. Does technology readiness moderate the relationship between brand experience co-creation and behavioral brand engagement?

Hypotheses

- H1: AI-enabled sensory marketing innovations have a positive impact on behavioral brand engagement.
- H2: AI-enabled sensory marketing innovations have a positive impact on brand experience co-creation.
- H3: Brand experience co-creation has a positive impact on behavioral brand engagement.
- H4: Brand experience co-creation mediates the relationship between AI-enabled sensory marketing innovations and behavioral brand engagement.

- H5: Technology readiness moderates the relationship between brand experience co-creation and behavioral brand engagement

Literature Review

AI is one of the most impactful technological advancements in modern marketing, revolutionizing the way businesses comprehend, anticipate, and shape consumer actions. Unlike traditional marketing methods that focus on broad communication techniques and looking back on past results, AI can sift through a ton of customer data, identify trends and behaviors, predict preferences and communicate with customers in a way that is very personalized on the fly (Sarin, 2025). Thanks to machine learning and other technologies like predictive analytics, recommendation engines, chatbots and intelligent automation, businesses can create predictive, adaptive marketing experiences tailored to each consumer's specific tastes and needs (Vdovichena et al., 2024). Some previous studies point out that AI provides numerous benefits for marketing, including higher marketing efficiency, high level of accuracy in customer targeting, personalization and the effectiveness of decision-making, to mention but a few, and that it also enhances the customer experience and satisfaction (Rane et al., 2024). While there has been a lot of research on the benefits of AI for operations and strategies, there is little academic work investigating the impact of AI-enabled sensory marketing innovations on consumers' sensory-experiential responses, particularly in digitally immersive marketing contexts, as highlighted by Nikzat (2025). Sensory marketing is also an important subject in both consumer behaviour and marketing literature because of its ability to impact perception, emotional connection, memory and buying decisions via sensory stimulation. Sensory marketing in its original meaning is the use of the senses to impact the cognitive and emotional responses of consumers to brands (Haase et al., 2018). The use of sensory cues has been demonstrated to have a significant impact on brand recall, satisfaction, emotional involvement, perceived product quality and purchase intention by improving consumers' experiential interactions with products and services, as evidenced by existing literature. For example, when it comes to attractiveness and trust, visual cues play a role, and when it comes to emotional mood, sounds have an impact; when it comes to feelings of ownership and emotional connection, touch does (Nazarov, 2026). This research has been conducted in physical stores and focuses on store atmospherics, packaging and face-to-face consumer experiences, making it difficult to apply the findings to digital and AI-driven environments. With the introduction of AI in the field of digital marketing, sensory marketing has expanded from physical spaces to a more immersive and personal consumer journey. Today, AI-enabled sensory marketing innovations are becoming more prevalent and increasingly involve the use of augmented reality (AR), virtual reality (VR), intelligent recommendation systems, voice-enabled assistants, interactive interfaces, and adaptive digital environments that mimic sensory experiences across online touchpoints (Bharathi et al., 2026). Unlike previous sensory systems, which are relatively static, AI-powered sensory systems constantly fine-tune content, recommendations, interface features, and interactions according to the preferences and feedback of individual consumers. This makes the consumers more unique, more immersive and more emotionally connected to the product, making them more engaged and thus more likely to change their behavior (Sharma et al., 2026). While sensory experiences and AI-enabled sensory marketing innovations are increasingly discussed, existing research primarily focuses on either sensory experiences or AI, providing only partial empirical evidence on the long-term impact of AI-enabled sensory marketing innovations on behavioral brand engagement in sensory experiences (Mouammine, 2026). In the marketplace today, behavioral brand engagement has become a key concept in marketing because it reflects the extent to which consumers interact, engage, and remain involved with brands. Digital environments include behaviors that go beyond transactional purchasing, including brand interaction, participation, content sharing, feedback generation, loyalty behaviors, and long-term relational involvement. Previous studies indicate that consumer

emotional attachment, advocacy behavior, trust, and repeated interaction with brands are more likely when consumers demonstrate high engagement (Blasco-Arcas et al., 2016). Furthermore, growing digital interaction has shifted consumers from passive receivers of marketing communication to active participants in brand experience co-creation processes. Despite extensive research on behavioral engagement in digital marketing, much of the prior work does not address the link between AI-driven sensory experiences and meaningful engagement outcomes, suggesting a key conceptual and empirical gap (Hollebeek et al., 2024). In this study, brand experience co-creation is defined as a mediating variable to understand the underlying mechanism through which AI-enabled sensory marketing innovations influence behavioral brand engagement. When consumers are actively involved in brand experiences over time through interactions, feedback sharing with brand organizations, and collaborative participation with other consumers, this process is referred to as brand experience co-creation (Merrilees, 2016). Consumers become more engaged in creating brand value through interactions with AI-powered recommendation systems, intelligent interfaces, and personalized digital experiences (Sharma et al., 2026). Previous research on brand experience co-creation demonstrates that it enhances perceived value, trust, satisfaction, emotional attachment, and relational commitment because consumers actively participate in shaping their experiences. Therefore, AI-enabled sensory marketing innovations may not directly lead to behavioral brand engagement unless they facilitate meaningful brand experience co-creation. From a theoretical perspective, brand experience co-creation is a key mechanism in sensory marketing; however, empirical studies examining its mediating role remain limited, thereby providing an important opportunity for further investigation.

In addition to experiential mechanisms, consumer differences in technology adoption can have a significant impact on consumer reactions to AI-based sensory marketing systems. The term technology readiness refers to an individual's propensity to embrace and use new technologies (Mahmood et al., 2023). The literature on technology adoption suggests that consumers who are more technologically ready have higher levels of usefulness, trust, convenience and ease of interaction with AI-based systems, which leads to engagement with personalized digital experiences (Becan & Çeber, 2026). On the other hand, there are some people who are not receptive to or comfortable with newer technological systems and might face resistance, discomfort, uncertainty, or skepticism, which can negatively impact engagement outcomes (Blut & Wang, 2020). Therefore, consumers who are more technology ready are more likely to convert into greater behavioral brand engagement as a result of co-created brand experiences with AI, while consumers who are less tech ready might feel uncertain or even have some resistance, which would consequently have a dampening effect on this relationship. Despite existing research on technology readiness in digital adoption and e-commerce contexts, limited evidence exists on its moderating role in AI-enabled sensory marketing environments (Mouammine, 2026).

This study is conducted based on the theoretical framework of SOR and TAM to grasp consumer responses toward AI in marketing systems. Within the SOR theory, the environmental stimuli affect consumers' internal cognitive and emotional state, which in turn affect behavior, where AI-enabled sensory marketing innovations is the "stimulus", brand experience co-creation is the "organism", and behavioral brand engagement is the "response". SOR is useful but not comprehensive enough to capture the technology acceptance factors; the technology readiness, ease of use, and perceived usefulness are aspects that are also significant, which is why TAM complements the model. Combining both provides a fuller picture of consumers' buying behaviour, encompassing emotional-experiential with the technologically-cognitive mechanisms. While the study of AI, sensory marketing, and digital engagement is growing, the results are still sporadic, and a few studies have integrated these areas into one model. Besides, empirical support for the mediating effect of brand experience co-creation, and the moderating effect of technology readiness, is still scarce, particularly in emerging markets. To fill this gap, this study develops an

integrated behavioral model to describe how the use of AI in sensory marketing contributes to the behavioral involvement of brands over time.

Conceptual Framework

This study proposes a conceptual framework integrating the Stimulus–Organism–Response (SOR) model and the Technology Acceptance Model (TAM). AI-enabled sensory marketing innovations are conceptualized as the independent variable (stimulus), brand experience co-creation as the mediating variable (organism), and behavioral brand engagement as the dependent variable (response). Technology readiness serves as a moderating variable influencing the relationship between brand experience co-creation and behavioral brand engagement. Furthermore, demographic characteristics including gender, age, monthly income, and exposure to AI-enabled marketing systems are treated as control variables to account for possible respondent differences. The framework explains how AI-driven sensory experiences influence behavioral brand engagement both directly and indirectly through co-created brand experiences (figure 1).

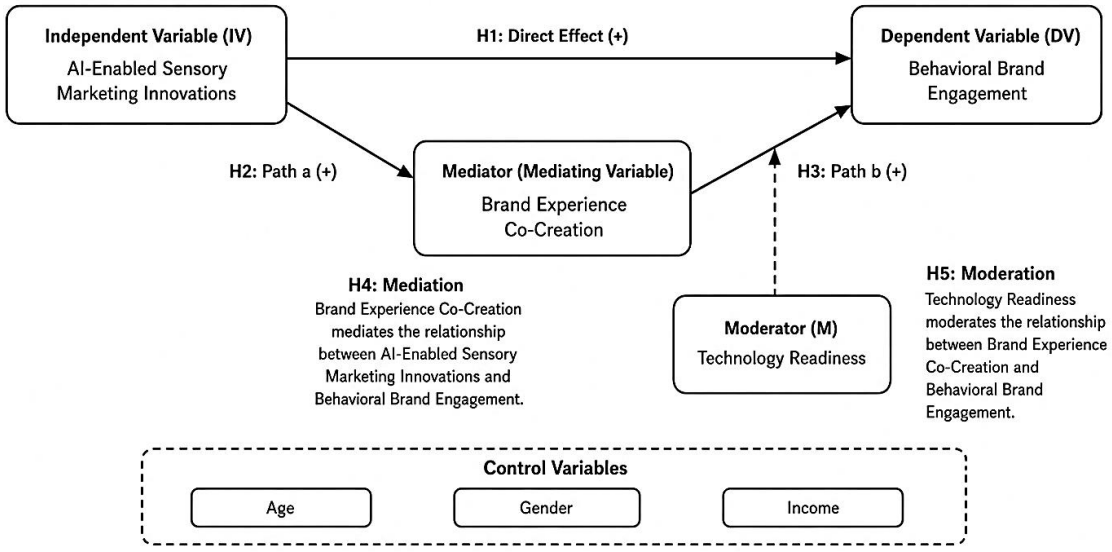

Figure 1: Conceptual Framework of AI-Enabled Sensory Marketing Innovations and Behavioral Brand Engagement

Research Methodology

Study Design and Setting

The research method used in this study was quantitative research, where AI-enabled sensory marketing innovations were treated as the independent variable, behavioral brand engagement as the dependent variable, brand experience co-creation as the mediating variable, and technology readiness as the moderating variable. In addition, demographic characteristics including gender, age, monthly income, and exposure to AI-enabled marketing systems were included as control variables to minimize confounding effects and respondent heterogeneity in the proposed relationships. Primary data were gathered from consumers through a structured questionnaire. The study design was cross-sectional and explanatory with a one-time data collection approach to examine the causal relationships among study variables.

Study Population

Our target population comprised digitally savvy consumers, primarily students of the University of International Islamic University, Islamabad, who frequently use digital platforms, social media apps and digital brand environments with AI. The students selected were those who were likely to have early exposure to the AI-driven marketing tools and technologies and who are likely to be

witness to personalised and immersive digital brand experiences, making them ideal for analyzing behavioral responses in an emerging digital economy scenario.

Sample Size

The final analysis was based on 428 valid responses. This sample size was deemed appropriate for further analyses such as correlation, regression, mediation, moderation and Structural Equation Modeling (SEM) analyses, and is in accordance with the suggested criteria for statistical power, stability of the estimates and model reliability.

Sampling Technique

The respondents were selected using a convenience sampling method because it was easy to access, time efficient and because the respondents were familiar with the environments of digital marketing and AI. The non-probability sampling technique may reduce the generalizability of the findings, but it is agreed upon in exploratory and theory testing research, especially in the context of new technologies.

Data Collection Method

Primary data were obtained by using a self-administered structured questionnaires which were distributed physically and electronically at International Islamic University Islamabad. The respondents were told about the study and they gave informed consent before they participated. The study was conducted on a voluntary basis and confidentiality and anonymity were ensured. Data collection included pilot testing and full-scale survey administration and centered on the perceptions of AI-powered sensory marketing, brand experience co-creation, technology readiness, and behavioral brand engagement from January 2024 to June 2024.

Measurement of Variables

This study adopted AI-enabled sensory marketing innovations as the independent variable, behavioral brand engagement as the dependent variable, brand experience co-creation as the mediating variable, and technology readiness as the moderating variable. Gender, age, monthly income, and exposure to AI-enabled marketing systems were included as control variables. Each construct was measured using a multi-item Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Minor wording modifications were made to adapt the scales to the AI-enabled marketing context while preserving the conceptual meaning of the original instruments.

Questionnaire Development

The questionnaire was developed following a comprehensive literature review on AI-enabled sensory marketing innovations, behavioral brand engagement, brand experience co-creation, and technology readiness. The instrument consisted of demographic information and construct-related items. Measurement scales were adapted from previously validated studies to ensure content validity and construct reliability. Items measuring AI-enabled sensory marketing innovations were adapted from Petit et al. (2019) and Hollebeek et al. (2024). Brand experience co-creation items were adapted from Merrilees (2016). Behavioral brand engagement items were adapted from Blasco-Arcas et al. (2016), while technology readiness items were adapted from Parasuraman (2000) and Venkatesh et al. (2003). Minor wording modifications were made to contextualize the instrument for AI-enabled marketing settings without changing the theoretical meaning of the constructs. A pilot study was conducted to improve clarity, contextual relevance, and reliability of the questionnaire.

Data Analysis Techniques

The data were analyzed by SPSS and by the application of Structural Equation Modeling (SEM). Data was summarized using descriptive statistics (frequency, percentage, mean and standard deviation) and tested hypotheses using inferential statistics (correlation, regression, mediation and moderation analysis). Partial Least Squares Structural Equation Modeling (PLS-SEM) was selected because it is a suitable method for dealing with non-normal data distributions and complex predictive models.

Reliability and Validity Analysis

The reliability of the instruments was assessed using Cronbach's alpha test, with a satisfactory value of 0.70 or above (Tavakol & Dennick, 2011). Convergent and discriminant validity were assessed using factor loadings, Composite Reliability (CR), Average Variance Extracted (AVE), and the Fornell–Larcker criterion to ensure measurement adequacy and construct validity.

Ethical Considerations

All ethical requirements were adhered to during the study. All of this was done on a voluntary basis and informed consent was obtained and respondents' confidentiality and anonymity were respected. No personal identifiers was collected and the data was used only for academic purposes and in accordance with the guidelines of research ethics.

Results

The demographic distribution shows a fairly balanced sample of 428 respondents, with 53.27% male and 46.73% female participants (table 1). Most respondents were young adults, with 44.16% aged 23–27 years and 41.12% aged 18–22 years, indicating a predominantly youth-based sample. In terms of income, the largest group (40.65%) earned PKR 30,000–60,000, followed by 37.85% earning below PKR 30,000. Regarding AI exposure, a strong majority (72.90%) reported awareness of AI-based marketing, while 46.26% had experience with AR/VR marketing. Additionally, 56.31% were frequent users of AI recommendation systems, showing moderate to high digital and AI engagement among respondents.

Table 1: Demographic Profile and Exposure to AI-Enabled Marketing Systems (Consumers, N = 428)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	228	53.27
	Female	200	46.73
Age	18–22 years	176	41.12
	23–27 years	189	44.16
	28–32 years	63	14.72
Monthly Income (PKR)	Below 30,000	162	37.85
	30,000–60,000	174	40.65
	Above 60,000	92	21.50
Awareness of AI-based marketing	Yes	312	72.90
	No	116	27.10
Experience with AR/VR marketing	Yes	198	46.26
	No	230	53.74
Use of AI recommendation systems	Frequent users	241	56.31
	Occasional users	127	29.67
	Rare users	60	14.02

The descriptive results indicate generally positive perceptions of all study constructs (table 2). AI-Enabled Sensory Marketing Innovations recorded the highest mean score (M = 3.89, SD = 0.74),

followed by behavioral brand engagement (M = 3.84, SD = 0.72) and brand experience co-creation (M = 3.76, SD = 0.69), while technology readiness showed a moderate level (M = 3.68, SD = 0.81). Reliability analysis confirmed strong internal consistency, with Cronbach's alpha values ranging from 0.87 to 0.91 and composite reliability values between 0.90 and 0.93. Convergent validity was also established, as AVE values ranged from 0.62 to 0.68, exceeding the acceptable threshold of 0.50, indicating that all constructs are reliable and valid for further analysis.

Table 2: Descriptive Statistics, Reliability and Validity of Study Variables (N = 428)

Variable	Mean	Std. Deviation	Interpretation	Cronbach's Alpha	Composite Reliability	AVE
AI-Enabled Sensory Marketing Innovations	3.89	0.74	High	0.91	0.93	0.68
Brand Experience Co-Creation	3.76	0.69	Moderate–High	0.89	0.92	0.65
Technology Readiness	3.68	0.81	Moderate	0.87	0.90	0.62
Behavioral Brand Engagement	3.84	0.72	High	0.90	0.93	0.67

The correlation results reveal significant positive relationships among all study variables (figure 2). Behavioral brand engagement showed the strongest association with brand experience co-creation (r = 0.70), followed by AI-enabled sensory marketing innovations (r = 0.66) and technology readiness (r = 0.58). Similarly, AI-enabled sensory marketing innovations were positively correlated with brand experience co-creation (r = 0.62) and technology readiness (r = 0.48). The correlation between brand experience co-creation and technology readiness was also moderate (r = 0.55), indicating that all variables are meaningfully interconnected and support the proposed conceptual framework.

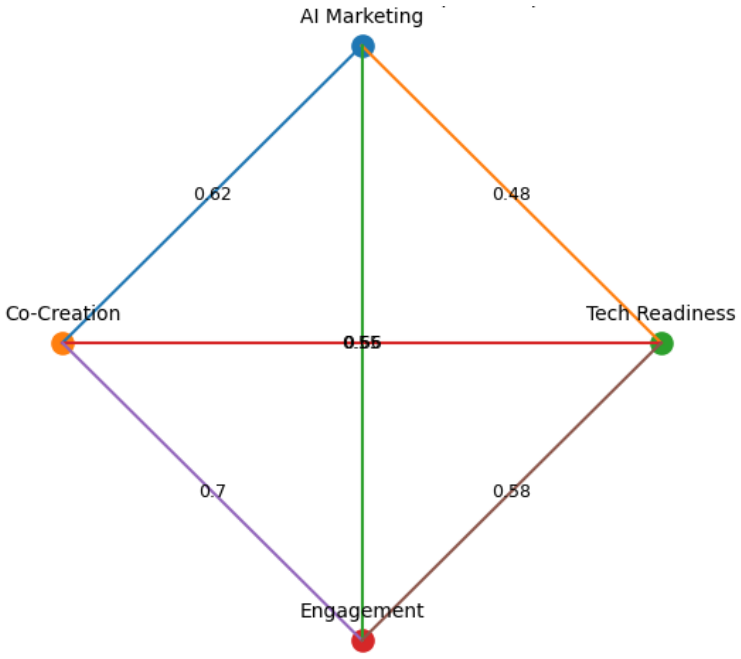

Figure 2: Correlation Matrix of Study Variables (Consumers, N = 428)

The regression analysis confirms that all direct relationships are statistically significant (table 3). AI-enabled sensory marketing innovations have a positive effect on behavioral brand engagement ($\beta = 0.34$, $t = 6.21$, $p < 0.001$) and a stronger effect on brand experience co-creation ($\beta = 0.52$, $t = 9.14$, $p < 0.001$). Additionally, brand experience co-creation significantly influences behavioral brand engagement ($\beta = 0.46$, $t = 8.02$, $p < 0.001$). These findings indicate that AI-enabled sensory marketing innovations not only directly enhance behavioral brand engagement but also strongly promotes consumer involvement in co-creating brand experiences.

Table 3: Regression Results (Direct Effects)

Path	Beta (β)	t-value	p-value	Result
AI-Enabled Sensory Marketing Innovations → Behavioral Brand Engagement	0.34	6.21	0.000	Supported
AI-Enabled Sensory Marketing Innovations → Brand Experience Co-Creation	0.52	9.14	0.000	Supported
Brand Experience Co-Creation → Behavioral Brand Engagement	0.46	8.02	0.000	Supported

The mediation results show that brand experience co-creation partially mediates the relationship between AI-enabled sensory marketing innovations and behavioral brand engagement (table 4). The direct effect remains significant ($\beta = 0.34$), while the indirect effect through co-creation is also significant ($\beta = 0.24$, $t = 5.89$, $p < 0.001$). The total effect ($\beta = 0.58$) indicates a strong overall relationship, suggesting that AI enhances engagement both directly and indirectly through consumer participation in co-creating brand experiences.

Table 4: Mediation Analysis (Brand Experience Co-Creation)

Effect Type	Beta (β)	t-value	p-value	Conclusion
Direct Effect (AI-Enabled Sensory Marketing Innovations → Behavioral Brand Engagement)	0.34	6.21	0.000	Significant
Indirect Effect (AI-Enabled Sensory Marketing Innovations → Brand Experience Co-Creation → Behavioral Brand Engagement)	0.24	5.89	0.000	Significant Mediation
Total Effect	0.58	—	0.000	Strong Effect

The moderation analysis confirms that technology readiness significantly moderates the relationship between brand experience co-creation and behavioral brand engagement ($\beta = 0.19$, $t = 4.76$, $p < 0.001$), shown in table 5. This indicates that consumers with higher technology readiness are more likely to translate co-created brand experiences into stronger engagement behaviors, while those with lower readiness show comparatively weaker engagement responses. The findings highlight the importance of individual technological adaptability in strengthening engagement outcomes.

Table 5: Moderation Analysis (Technology Readiness)

Path	Beta (β)	t-value	p-value	Interpretation
Brand Experience Co-Creation × Technology Readiness → Behavioral Brand Engagement	0.19	4.76	0.000	Significant Moderator Effect

Discussion

The present study revealed that AI-enabled sensory marketing innovations had a strong and significant impact on behavioral brand engagement ($\beta = 0.34$, $t = 6.21$, $p < 0.001$). This fits in with the SOR model, which is explaining how external stimuli affects the behavior through internal psychological states. Hollebeek et al., (2024) also provide evidence that emotional and cognitive stimulation are achievable in an immersive digital environment, which greatly aids consumers' engagement. The present study supports this evidence by demonstrating that AI-enabled sensory marketing innovations serve as more effective digital cues, especially in personalized marketing settings where real-time interactions are crucial. Similarly, the results showed that AI-enabled sensory marketing innovations had a strong positive impact on brand experience co-creation with a value of $\beta = 0.52$, $t = 9.14$, and $p < 0.001$. This aligns with the conclusion by Sharma et al., (2026), which highlighted the role AI personalization plays in improving user engagement and experience. In the same way, Merrilees, (2016) stated that co-creation arises when consumers become involved in the process of creating brand experiences. The findings of the present study show that the coefficient is more powerful with the use of AI systems than the traditional interactive marketing tools, which strengthens the consumer's involvement in the marketing process. Brand experience co-creation was also found to significantly influence behavioral brand engagement ($\beta = 0.46$, $t = 8.02$, $p < 0.001$). This result supports Blasco-Arcas et al., (2016), who found co-creation's benefits in terms of increased emotional attachment and loyalty behaviors. The current research builds on this literature by demonstrating that, in AI settings, co-creation processes are more dynamic and continuous, enhancing behavioral brand engagement behaviors such as participation, advocacy, and content sharing.

The mediation analysis results showed a partial mediation effect of AI-enabled sensory marketing innovations on behavioral brand engagement through brand experience co-creation, as the indirect effect was found significant ($\beta = 0.24$, $t = 5.89$, $p < 0.001$). This aligns with SOR model and the results of Puntoni et al. (2021) who suggested that consumers' engagement with digital ecosystems is mostly experiential transformation and not from stimulus. The findings suggest that AI-enabled sensory marketing innovations enhance behavioral brand engagement when they facilitate meaningful brand experience co-creation. In terms of the moderation effect, the relationship between brand experience co-creation and behavioral brand engagement was significantly strengthened by technology readiness ($\beta = 0.19$, $t = 4.76$, $p < 0.001$). This is in line with Davis (1989) and Venkatesh et al. (2003) Technology Acceptance Model. The focus of these studies is on the role of individual readiness and perceived ease of use in technology-driven behavior. The current study validates that the readier consumers are, the more positive the engagement responses are to co-created experiences. The overall goodness of fit of the integrated SOR–TAM framework was good, and all of the structural paths were significant ($0.19 < \beta < 0.52$, $p < 0.001$). The results confirm Vdovichena et al., (2024), who stated that the effectiveness of marketing with the use of AI is influenced by the interaction between the technological system and the process of experiential consumption. The current study builds on this by empirically establishing the impact of these mechanisms on explaining and predicting the sustained behavioral brand engagement in AI-enabled sensory marketing environments.

Conclusion

This current research reveals that AI-enabled sensory marketing innovations significantly enhance behavioral brand engagement by elevating the consumer experience to an immersive, individualized and interactive level. The results reveal that AI-enabled sensory marketing innovations have a direct impact on behavioral brand engagement and significantly enhance brand experience co-creation, suggesting that consumers are proactively involved in creating brand experiences in AI environments. The brand experience co-creation process, in turn, plays an important role in how AI-enabled sensory marketing innovations helps to maintain continuous

engagement, highlighting the significance of experiential value in digital marketing contexts. Also, the results show that the relationship between brand experience co-creation and behavioral brand engagement is significantly amplified by technology readiness, meaning that if the consumer is more comfortable and familiar with the use of technology, the possibility is greater that they will have a greater behavioral engagement after co-creating the brand experience. Overall, the integrated SOR–TAM framework can account for the impact of technological innovation and consumer psychological readiness on the outcomes of behavioral brand engagement in AI-enabled sensory marketing contexts, as technoliterate exposure is only part of the brand engagement, while the majority stems from significant experiential engagement and individual readiness for digital technologies.

Limitation and Future Research

This study, however, has some limitations that need to be considered. First, the cross-sectional research design limits the ability to draw causal inferences over time, as consumer perceptions toward AI-enabled sensory marketing innovations, behavioral brand engagement, and technology readiness may evolve. Second, the use of convenience sampling and data collection from a single institutional setting limits the generalizability of the findings to broader and more culturally diverse consumer populations. Third, the study relied primarily on self-reported responses, which may be subject to response bias and may not fully represent actual behavioral brand engagement in real digital environments. Furthermore, the proposed model included selected variables only, namely AI-enabled sensory marketing innovations, brand experience co-creation, technology readiness, and behavioral brand engagement, while excluding other potentially influential factors such as perceived privacy risk, trust, brand authenticity, or perceived usefulness that may shape consumer responses in AI-enabled sensory marketing environments. Future studies should address these limitations through longitudinal or experimental research designs to establish causal relationships more effectively. Greater external validity may also be achieved through broader and more representative sampling frames across different consumer groups and market settings. In addition, future research may examine additional psychological, technological, and contextual variables to better understand consumer responses in AI-enabled sensory marketing ecosystems. Survey-based findings may also be complemented with behavioral analytics, platform usage data, or observational methods to provide a more objective and comprehensive understanding of actual behavioral brand engagement.

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Questionnaire

AI-Enabled Sensory Marketing Innovations, Brand Experience Co-Creation, and Behavioral Brand Engagement: A Survey of Consumers Examining Mediating and Moderating Effects

Section A: Demographic Information

Please tick the appropriate option.

1. Gender
- ☐ Male
- ☐ Female

2. Age
- ☐ 18–22 years
- ☐ 23–27 years
- ☐ 28–32 years
- ☐ 33 years and above

3. Monthly Income
- ☐ Below PKR 30,000
- ☐ PKR 30,000 – 60,000
- ☐ Above PKR 60,000

4. Do you use digital platforms regularly (social media, online shopping, apps)?
- ☐ Yes
- ☐ No

Section B: Study Constructs

Instructions: Please indicate your level of agreement with each statement.

Scale:

1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

1. AI-Enabled Sensory Marketing Innovations (Independent Variable)

1. I often encounter personalized advertisements powered by artificial intelligence.
2. AI-based marketing content enhances my visual and interactive online experience.
3. AI-driven recommendations make online shopping more engaging for me.
4. I feel that AI-enabled sensory marketing innovations understand my preferences accurately.
5. AI-enabled digital platforms provide immersive and interactive brand experiences.
6. I experience a more engaging brand environment when AI is used in marketing.

2. Brand Experience Co-Creation (Mediating Variable)

7. I actively interact with brands through online platforms and social media.
8. I provide feedback that helps brands improve their services or products.
9. I participate in shaping my own brand experiences through digital engagement.
10. I feel that I contribute to how brands design their marketing content.
11. I engage with brands by sharing ideas, reviews, or suggestions online.
12. I collaborate with brands to enhance my overall experience with them.

3. Behavioral Brand Engagement (Dependent Variable)

13. I frequently interact with my favorite brands on digital platforms.
14. I regularly share brand-related content on social media.
15. I recommend brands that I like to others.
16. I actively participate in brand-related online communities.
17. I feel emotionally connected to brands I engage with online.
18. I show loyalty by repeatedly engaging with the same brands.

4. Technology Readiness (Moderating Variable – TAM-based)

19. I feel confident using new technologies in my daily life.
20. I enjoy trying new AI-based applications and digital tools.
21. I find new technologies easy to understand and use.
22. I prefer using advanced digital platforms over traditional ones.
23. I trust AI-based systems for online recommendations and services.
24. I quickly adapt to new technological changes in digital marketing.

Section C: Exposure to AI-enabled Marketing Systems (Optional Supporting Section)

25. Are you aware of AI-based marketing tools?
- ☐ Yes
- ☐ No

26. Have you experienced AR/VR-based marketing?
- ☐ Yes
- ☐ No

27. How often do you use AI recommendation systems?
- ☐ Frequently
- ☐ Occasionally
- ☐ Rarely