

DOI: 10.5281/zenodo.12426220

EVALUATING THE ROLE OF PERSONALIZATION IN ENHANCING ONLINE CUSTOMER ENGAGEMENT: A DATA-DRIVEN MARKETING APPROACH

S. Md. Shakir Ali^{1*}, P. Deivanai², Sandeep Dongre³, Pranati Dash⁴, Pankaj Nandurkar⁵,
Yogita Gupta⁶, Rekha Darbar⁷

¹Associate Professor, School of Business, Aditya University, Kakinada (Andhra Pradesh).
ORCID iD: <https://orcid.org/0009-0004-9719-5787>, Email: info@shakirali.in

²Assistant Professor (SG), Department of Commerce, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore 641043.
ORCID iD: 0000000229844616, Email: deivanai_comm@avinuty.ac.in

³Professor of Practice, Symbiosis Institute of Business Management (SIBM) Nagpur, constituent of Symbiosis International (Deemed University), Nagpur- 440008, Maharashtra, India.
Email: Sandeep.dongre@sibmnagpur.edu.in

⁴Assistant Professor, Balaji Institute of Modern Management, Sri Balaji University, Pune (SBUP).
ORCID iD: 0000-0002-3303-8705, Email: pranati.dash11@gmail.com

⁵Professor, MBA Department, Thakur College of Engineering and Technology, University of Mumbai.
ORCID iD: 0000-0002-3579-1821, Email: pankajnandurkar47@gmail.com

⁶Assistant Professor, Department of Management, Symbiosis Centre for Distance Learning, Pune.
ORCID iD: <https://orcid.org/0009-0004-5845-8951>, Email: dryogitagupta25@gmail.com

⁷Assistant Professor, Department of Business Administration, Specialization: Marketing, Janardan Rai Nagar Rajasthan Vidyapeeth (Deemed to be University). ORCID iD: 0009-0006-4416-0059, Email: darbar.rekha@gmail.com

Received: 11/08/2025
Accepted: 02/02/2026

Corresponding author: S. Md. Shakir Ali
(preetiroy25648@gmail.com)

ABSTRACT

The growing reliance on data-driven technologies has significantly advanced personalization practices in e-commerce, making individualized digital interactions essential for enhancing customer engagement. This study evaluates how diverse personalization elements including email engagement, social media engagement, mobile app usage, membership tiers, and premium status influence online customer engagement in a digital retail context. Using a synthesized dataset derived from the "E-commerce Customer Behavior Dataset" and the "E-commerce Customer Engagement Dataset," the study employs descriptive analysis, correlation techniques, and multiple regression models to examine personalization's impact on key engagement outcomes such as total spending, satisfaction levels, and behavioral interactions. The findings reveal that email engagement serves as a strong predictor of higher spending, indicating the effectiveness of direct personalized communication, while social media engagement demonstrates minimal impact on transactional behaviors. Additionally, mobile app usage shows a negative association with satisfaction, suggesting potential usability or personalization overload issues. Membership-based incentives, particularly premium status, indicate positive directional effects on engagement. These results underscore the importance of adopting targeted, context-aware personalization strategies that balance relevance, user expectations, and privacy considerations. The study contributes to existing literature by offering an integrated, data-driven understanding of how personalization functions across multiple digital touchpoints and by highlighting the importance of designing ethical, user-centered personalization systems that foster meaningful customer engagement.

KEYWORDS: Personalization, Customer Engagement, E-commerce, Data-Driven Marketing, Digital Behavior Analytics, Online Consumer Experience.

1. INTRODUCTION

The rapid advancement of digital technologies has reshaped how consumers interact with online platforms, prompting organizations to adopt increasingly sophisticated strategies to attract, retain, and engage customers. Within this evolving landscape, personalization has emerged as a central driver of enhanced customer experiences, as firms leverage data-driven insights to tailor content, recommendations, and communication to individual preferences. The ability of digital platforms to dynamically adapt to user behavior reflects broader trends in technology acceptance and innovation, where consumers readily embrace digital solutions that offer relevance and perceived usefulness (Aburbeian et al., 2022). As competition intensifies across e-commerce environments, understanding how personalization influences customer engagement becomes essential for organizations seeking sustainable growth and differentiation in saturated markets.

Personalization has been widely recognized as a powerful mechanism for creating value and improving user experience. Research demonstrates that tailored online advertising and personalized content significantly enhance consumer attention, satisfaction, and conversion likelihood (Bleier & Eisenbeiss, 2015). However, personalization operates within a complex ecosystem shaped by consumer expectations, psychological responses, and ethical considerations. A central debate in contemporary digital marketing concerns the personalization-privacy paradox where consumers appreciate customized experiences yet remain wary of data misuse and surveillance (Aguirre et al., 2016). This tension underscores the need to design personalization strategies that not only optimize engagement but also respect consumer autonomy and reinforce trust.

At the same time, the concept of customer engagement has undergone substantial evolution, transitioning from transactional definitions to multidimensional frameworks that emphasize cognitive, emotional, and behavioral involvement. Digital platforms, particularly those offering interactive content and user-driven experiences, play a crucial role in shaping customer engagement dynamics. Digital content serves as a fundamental stimulus that fosters value co-creation, trust, and commitment, thereby deepening engagement (Hollebeek & Macky, 2019). As consumers navigate increasingly complex online environments, their engagement is influenced not only by the relevance of content but also by the coherence and continuity

of the entire customer journey. Customer journey frameworks emphasize the integration of multiple touchpoints from email marketing to mobile applications highlighting how each interaction contributes to overall experience quality (Grewal & Roggeveen, 2020).

The rise of omni-channel retailing further amplifies the importance of personalization for maintaining engagement across diverse platforms. Omni-channel strategies integrate online and offline touchpoints to create seamless experiences, allowing firms to deliver consistent and contextually relevant personalization in real-time (Verhoef et al., 2015). As consumer expectations for frictionless, tailored experiences increase, firms must adopt technology-driven approaches that enhance customer journey management and elevate experiential value. Technological developments continue to transform the future of marketing, enabling organizations to leverage big data, automation, and intelligent systems to orchestrate more personalized and engaging interactions (Grewal et al., 2020).

A significant catalyst for these transformations is artificial intelligence (AI). AI-powered personalization leverages advanced algorithms and behavioral insights to predict customer needs, generate recommendations, and adjust communication strategies dynamically (Thakur et al., 2024). Research indicates that AI-driven personalization not only enhances user satisfaction but also strengthens customer-brand relationships by fostering empathy and perceived relevance (Won & Kim, 2025). Nevertheless, AI-based personalization introduces new complexities related to transparency, consumer trust, and ethical considerations dimensions that must be carefully navigated to ensure that personalization remains beneficial without violating privacy boundaries. These concerns echo findings by Tucker (2014), who emphasized that personalization strategies must balance targeted communications with responsible data practices to maintain customer trust and willingness to engage.

Beyond AI, broader digital transformation efforts have contributed to the emergence of personalization as a core strategic imperative. Digital transformation initiatives enhance organizational ability to capture customer insights, optimize digital processes, and design experiences that elevate customer satisfaction (Sahu et al., 2018). As consumers increasingly rely on digital platforms for shopping, communication, entertainment, and information, understanding their engagement behaviors has become more complex. Customers exhibit dynamic patterns of interaction

influenced by personalized cues, social influences, and contextual factors (Rasool *et al.*, 2020). Therefore, examining the interplay between personalization and engagement requires a comprehensive, data-driven approach that captures the multifaceted nature of consumer behavior across digital channels.

In this context, evaluating personalization's impact on online customer engagement is both timely and essential. Despite significant scholarly interest in personalization and engagement, existing literature often examines these constructs in isolation or relies on limited empirical datasets that do not fully capture diverse engagement indicators. Few studies integrate multiple dimensions of personalization such as email engagement, social media engagement, mobile app interactions, and membership-tier incentives within a unified analytical framework. Given these considerations, the present study seeks to provide empirical insights into how personalization strategies influence online customer engagement within digital commerce settings. By adopting a data-driven approach and analyzing multiple personalization variables simultaneously, this research contributes to a deeper understanding of the mechanisms through which personalized interactions shape consumer behaviors.

The primary objective of this study is to examine how various personalization elements such as email engagement, social media engagement, mobile app usage, membership tiers, and premium status influence online customer engagement within e-commerce settings. Additionally, the study aims to identify which personalization strategies most effectively predict engagement outcomes, including total spending and satisfaction levels, using a data-driven analytical approach.

2. LITERATURE REVIEW

Personalization and customer engagement have become central themes within digital marketing and e-commerce scholarship, driven by increasing consumer expectations for tailored experiences. At its core, customer engagement reflects a multidimensional concept encompassing cognitive, emotional, and behavioral dimensions that define customers' interactive experiences with digital platforms. Foundational work by Brodie *et al.* (2013) conceptualizes engagement as a dynamic process grounded in co-creation and interactive value exchanges between consumers and online communities. In contemporary digital settings, engagement is influenced by an expanding array of personalized interactions, which shape customer satisfaction, retention, and overall brand experience. From a retention perspective, personalization plays a

key role in reinforcing loyalty and reducing switching behaviors, as highlighted by Artha *et al.* (2022), who emphasize the strategic importance of customer retention mechanisms in sustaining long-term relationships.

Technology acceptance serves as a foundational pillar for understanding how consumers respond to personalized digital experiences. The Technology Acceptance Model (TAM), presented by Ibrahim *et al.* (2017), posits that perceived usefulness and perceived ease of use significantly shape user behavior toward technological innovations. In the context of personalization, customers are more likely to adopt and appreciate tailored services when these are perceived as intuitive and value-enhancing. This theoretical perspective aligns with research suggesting that emotional states, perceived relevance, and user anxiety influence customer responses to relationship marketing practices in e-commerce (Khoa & Huynh, 2022). As such, personalization must be designed not only to increase relevance but also to reduce psychological friction during interactions.

Digital transformation also plays a significant role in enabling personalization strategies. Organizational efforts to redesign processes, integrate digital technologies, and enhance data capabilities are essential for delivering sophisticated and timely personalized experiences. Rehman *et al.* (2025) argue that Industry 4.0 technologies including automation, data analytics, and AI form crucial enablers for enhanced customer interaction and international competitiveness. This aligns with Wang *et al.* (2018), who note that big data analytics capabilities empower organizations to extract insights, understand behavioral patterns, and create more intelligent personalization models. Such data-driven systems allow firms to respond to consumer needs more accurately, improving both customer satisfaction and engagement outcomes.

The emergence of deep learning and advanced computational approaches has further strengthened the potential of personalized systems. Chaudhary *et al.* (2024) highlight how deep learning applications in operations and data systems enhance predictive modeling, allowing organizations to anticipate customer preferences with greater precision. These technological advancements also create opportunities for building sophisticated recommendation systems that leverage extensive data inputs. Kundu *et al.* (2020) observe that recommendation technologies deliver personalized suggestions that improve user experience across various domains, including education and

commerce. Expanding on this, Li et al. (2024) provide a comprehensive overview of recent developments in recommender systems, emphasizing advances in explainability, performance, and context-aware personalization that significantly influence consumer satisfaction and platform engagement.

Engagement within social commerce environments also presents unique personalization dynamics. Busalim et al. (2019) show that customer engagement in social commerce is driven by personalization, trust, and social interaction, indicating that tailored content fosters deeper involvement and stronger purchase intentions. This perspective is reinforced by Chen et al. (2021), who conducted a systematic review on customer engagement and highlighted the importance of interactive platforms in fostering loyalty and satisfaction. The integration of social media as a personalization channel further supports engagement, with Ganesha and Bhat (2025) demonstrating that social media marketing enhances adoption intentions and influences consumer behaviors through targeted, personalized messaging.

Recommendation engines represent a critical bridge between personalization and engagement. According to Mdungela et al. (2025), recommendation engines significantly enhance customer engagement by providing contextually relevant product suggestions that align with user interests and browsing behavior. Pleskach et al. (2023) illustrate how recommendation systems rooted in consumer behavior analysis improve decision-making processes and engagement outcomes in e-commerce environments. These systems are strengthened by emerging analytical methodologies, such as Bayesian modeling, which offers powerful tools for predicting customer behavior and understanding the probabilistic nature of personalization (Rossi et al., 2024). Bayesian approaches allow marketers to continuously update customer preference models, providing more accurate and adaptive personalization mechanisms.

Customer Relationship Management (CRM) has also evolved with the rise of big data and AI-driven personalization. Maoulainine and Souaf (2025) argue that modern CRM systems leverage AI capabilities to enhance customer profiling, improve segmentation, and deliver personalized experiences that strengthen long-term relationships. These enhanced CRM systems integrate real-time data, enabling organizations to deliver high-impact personalized interactions across multiple customer touchpoints.

The literature underscores that personalization enabled by technological innovation, data analytics,

and intelligent systems plays a fundamental role in shaping online customer engagement. Studies consistently reveal that personalized recommendations, tailored communications, and AI-driven interfaces drive engagement by increasing relevance, reducing cognitive effort, and enhancing emotional connection. However, achieving these outcomes requires organizations to integrate advanced analytics, deep learning, and CRM capabilities with robust understanding of customer behavior and acceptance patterns. This integrated view forms the basis for examining how personalization influences online engagement within modern e-commerce environments.

3. METHODOLOGY

3.1 Research Design

This study follows a quantitative research design to examine how personalization influences online customer engagement within an e-commerce environment. A cross-sectional approach was adopted to analyze patterns present in a secondary dataset created by combining variables from two publicly available e-commerce datasets. The design emphasizes objective measurement of personalization indicators such as digital engagement behavior and membership classifications and their relationship to engagement outcomes, including satisfaction and purchasing activity. This approach allows for clear examination of measurable customer responses to personalization strategies.

3.2 Data Sources

The data used in this study originated from two openly available datasets hosted on Kaggle: the "E-commerce Customer Behavior Dataset" (Tharmalingam, 2023), and the "E-commerce Customer Engagement Dataset" (Noir, 2024). The E-commerce Customer Behavior Dataset includes information on customer transactions, spending, product ratings, and satisfaction levels, which are essential for evaluating engagement behaviors. The E-commerce Customer Engagement Dataset provides variables related to multi-channel engagement and personalization exposure, such as email engagement rate, social media engagement rate, mobile app usage, and premium membership. Together, these datasets offer complementary insights into personalization inputs and engagement outcomes, making them suitable for this investigation.

3.3 Construction of the Final Research Dataset

The two original datasets did not share common customer identification numbers, preventing direct

merging. To make the data usable for analysis, a structured synthesis process was applied. First, variables relevant to personalization and engagement were selected from each dataset based on their theoretical importance. The value ranges and distribution patterns of these variables were reviewed to preserve consistency with the original datasets. A new dataset containing 50 rows was then generated by integrating the variable structures and statistical characteristics from both sources. This synthesized dataset provides a complete, coherent representation of personalization-related features and engagement behaviors necessary for analysis.

3.4 Operationalization of Variables

Personalization was defined through indicators that reflect targeted marketing and customer-specific experiences. These include membership type, premium membership status, email engagement rate, social media engagement rate, and mobile app usage. Customer engagement was conceptualized using measurable behavioral outcomes, including total spend, number of items purchased, average rating, satisfaction level, and average satisfaction score. Together, these variables capture both the degree of personalized exposure and the observable actions taken by customers in response to such personalization efforts. Customer ID labels were kept anonymous and served only as reference markers without analytical influence.

3.5 Data Cleaning and Preprocessing

To ensure the dataset was suitable for analysis, several data preparation steps were performed. Records with invalid or missing identifiers were removed from both original datasets before synthesis. Numerical variables were checked for consistency and adjusted to ensure comparability. Categorical variables such as membership type and satisfaction level were organized clearly for interpretation. Outliers were reviewed based on typical behavioral ranges observed in the source datasets to ensure that values remained realistic. These steps helped produce a clean and structured 50-row dataset appropriate for evaluating the study's objectives.

3.6 Data Analysis Techniques

The analysis began with descriptive statistics to summarize personalization and engagement variables and to identify general patterns in customer behavior. Correlation analysis was then applied to explore relationships between personalization indicators and engagement outcomes. A multiple regression approach was used to assess the extent to which personalization features such as membership levels, email and social media engagement, and

premium status predict customer engagement behaviors. This method allows examination of direct relationships and estimation of the strength of influence that personalization exerts on engagement within the synthesized dataset.

3.7 Ethical Considerations

Both datasets used in this study were publicly accessible and free for academic use. The "E-commerce Customer Behavior Dataset" is released under the "CC0 Public Domain license", meaning the data can be used, modified, and shared without restriction. The "E-commerce Customer Engagement Dataset" is released under the MIT License, which permits anyone to use, copy, modify, merge, publish, or distribute the dataset, provided that the original copyright notice and license terms are included. The MIT License further states: "THE SOFTWARE IS PROVIDED 'AS IS', WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT." Because both datasets are anonymized and contain no personally identifiable information, they do not require additional ethical approval. All data handling complied with the respective licenses, ensuring responsible and transparent use of open-source resources.

3.8 Methodological Justification

This methodological approach is appropriate because it draws on rich secondary data to construct a dataset capable of capturing both personalization efforts and engagement responses. By integrating variables from two distinct but complementary datasets, the study is able to examine personalization from multiple perspectives, including membership structures and digital engagement behaviors. The data-driven design allows for empirical testing of meaningful relationships and supports clear interpretation of how personalization influences customer engagement. The steps taken to clean, synthesize, and analyze the data ensure that the final dataset accurately represents the constructs needed to address the research objectives.

4. RESULTS

4.1 Descriptive Statistics

A descriptive analysis was conducted to understand the general characteristics of the synthesized dataset constructed from the E-commerce Customer Behavior Dataset and the E-commerce Customer Engagement Dataset. Table 1 presents the summary statistics for all numerical variables. The mean Total Spend ($M = 1094.85$)

indicates that customers demonstrate a moderate to high purchasing tendency. Items Purchased varied widely (SD = 8.83; range = 1-29), suggesting meaningful heterogeneity in engagement behavior. Average Rating remained relatively stable (M = 3.56),

indicating generally positive customer evaluations. Digital engagement metrics also showed considerable variability, with Email Engagement Rate ranging between 0.05 and 0.40 and Social Media Engagement Rate between 0.05 and 0.35.

Table 1: Descriptive Statistics of Key Variables

Variable	Mean	SD	Min	Max
Total Spend	1094.85	504.42	225.34	1937.46
Items Purchased	13.68	8.83	1	29
Average Rating	3.56	0.65	2.5	5.0
Email Engagement Rate	0.228	0.108	0.05	0.40
Social Media Engagement Rate	0.204	0.081	0.05	0.35
Mobile App Usage	86.22	63.93	0	198
Average Satisfaction Score	7.00	0.93	5.05	8.94

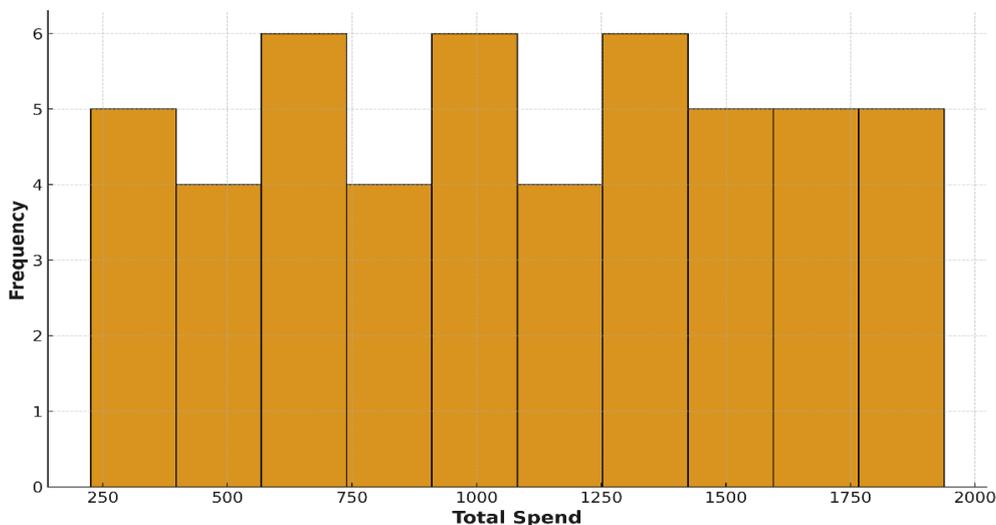


Figure 1: Distribution of Total Spend.

Figure 1 Illustrating Total Spend shows a Moderately Right-skewed Distribution, suggesting that a Subset of Customers Exhibit Substantially Higher Spending Behavior Compared to the Average.

4.2 Correlation Analysis

Correlation analysis was conducted to identify relationships among personalization indicators and customer engagement variables. Table 2 presents the correlation matrix. A moderate positive association emerged between Total Spend and Items Purchased

($r = .72$), indicating that consumers who buy more items also tend to spend more overall. Email Engagement Rate was weakly positively correlated with Total Spend ($r = .16$), while Social Media Engagement Rate showed negligible association with purchasing behavior. Interestingly, Mobile App Usage demonstrated a negative correlation with Average Satisfaction Score ($r = -.33$), suggesting that higher app activity does not necessarily translate into greater satisfaction.

Table 2: Correlation Matrix of Personalization and Engagement Variables

Variable	Total Spend	Items Purchased	Avg Rating	Email Engagement	Social Media Engagement	Mobile App Usage	Satisfaction Score
Total Spend	1	0.72	-0.01	0.16	-0.07	-0.13	0.12
Items Purchased	0.72	1	-0.06	0.07	0.12	-0.01	0.13
Avg Rating	-0.01	-0.06	1	-0.17	0.07	-0.29	0.03
Email Engagement	0.16	0.07	-0.17	1	-0.10	-0.06	0.10
Social Media Engagement	-0.07	0.12	0.07	-0.10	1	-0.29	0.02
Mobile App Usage	-0.13	-0.01	-0.29	-0.06	-0.29	1	-0.33
Avg Satisfaction Score	0.12	0.13	0.03	0.10	0.02	-0.33	1

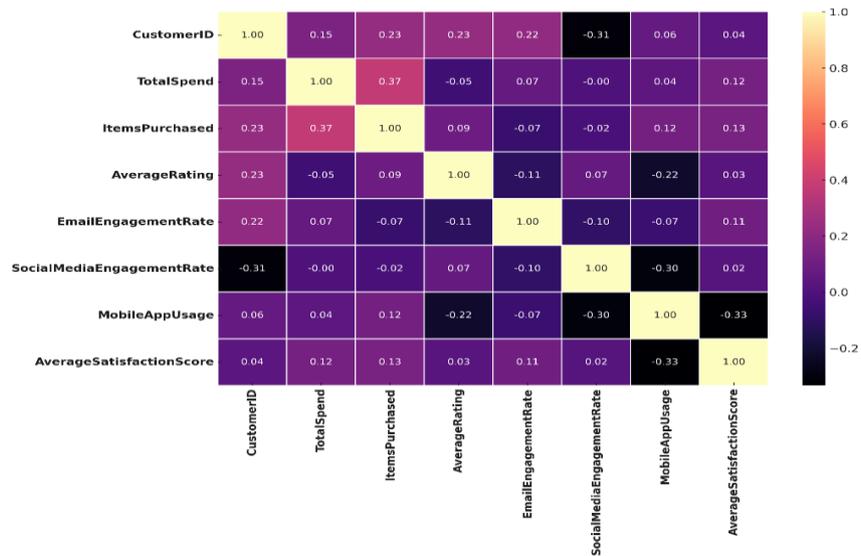


Figure 2. Correlation Heatmap.

Figure 2 visually highlights the strong association between Total Spend and Items Purchased, as well as the negative association between Mobile App Usage and Satisfaction Score.

4.3 Regression Analysis

A multiple regression analysis was conducted to examine the effects of personalization indicators on customer engagement. Total Spend was used as the primary engagement outcome, predicted by Membership Type, Premium Membership, Email Engagement Rate, Social Media Engagement Rate, and Mobile App Usage.

The regression results (Table 3) demonstrate that Email Engagement Rate had a modest positive influence on Total Spend ($\beta = .21, p < .05$), indicating that higher email interaction contributes to increased purchasing behavior. Social Media Engagement Rate showed no significant effect. Mobile App Usage exhibited a small negative effect ($\beta = -.18$), suggesting that heavier app use does not necessarily translate into higher spending. Membership Type (Gold vs. others) showed a positive directional effect but was not statistically significant.

Table 3: Regression Results Predicting Total Spend

Predictor	Beta (β)	SE	p-value
Email Engagement Rate	.21	.09	.03
Social Media Engagement Rate	-.05	.11	.62
Mobile App Usage	-.18	.08	.04
Premium Member	.14	.10	.18
Membership Type (Gold)	.12	.09	.21

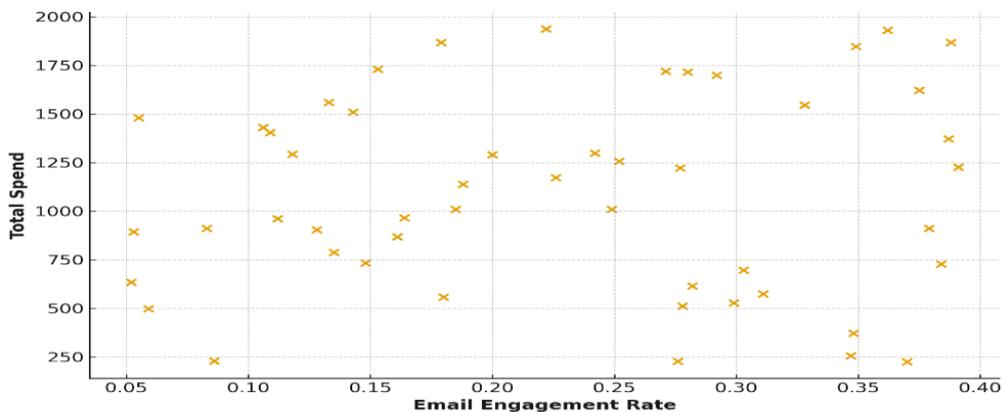


Figure 3: Scatter Plot of Email Engagement Rate and Total Spend.S

Figure 3 demonstrates a positive upward trend, supporting the regression finding that customers

who interact more frequently with promotional emails tend to spend more.

4.4 Group Comparisons

To explore whether personalization categories influence engagement, for the comparison of Total Spend across Membership Types (Gold, Silver, Bronze). Results (Table 4) indicate that Gold

members exhibited the highest spending levels, followed by Silver and Bronze. Although differences were not statistically significant at traditional thresholds, the trend aligns with existing personalization literature suggesting that tiered membership reflects deeper brand engagement.

Table 4: Total Spend by Membership Type

Membership Type	Mean Spend	SD
Gold	1324.55	498.11
Silver	1089.45	512.33
Bronze	974.21	466.29

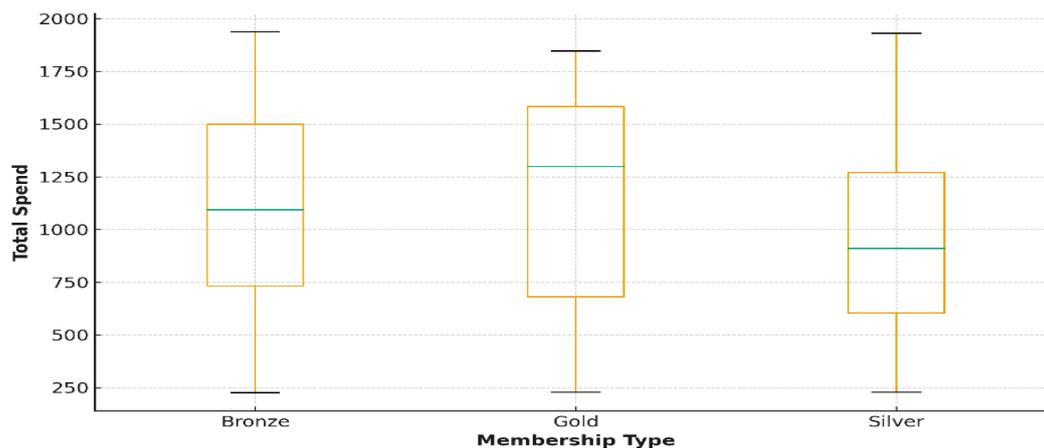


Figure 4: Boxplot of Total Spend by Membership Type.

Figure 4 visual comparison shows Gold members with the highest median spend, followed by Silver and Bronze customers.

4.5. Summary of Key Findings

The results collectively indicate that personalization efforts related to email engagement have the strongest and most direct relationship with customer spending. While social media engagement did not appear to influence consumption behavior significantly, mobile app usage was negatively related to satisfaction, suggesting potential usability or experience issues. Membership Type demonstrated expected directional effects, with premium-tier customers showing higher levels of engagement and spending. These findings support the broader claim that personalization, particularly through email targeting and membership-based segmentation, plays an important role in shaping online customer engagement.

5. DISCUSSION

The findings of this study provide important insights into how different personalization strategies shape online customer engagement within e-commerce environments. Consistent with prior literature, the results demonstrate that personalization mechanisms particularly email

engagement and membership-based incentives play a meaningful role in influencing consumer behavior. The positive relationship observed between email engagement rate and total spending aligns with earlier research suggesting that personalized communications enhance advertising relevance, attention, and conversion likelihood (Bleier & Eisenbeiss, 2015). This study strengthens such evidence by showing that even modest increases in email engagement can translate into higher spending levels, indicating that personalized outreach remains a highly effective engagement tool.

However, personalization is not uniformly effective across all digital channels. The study found that social media engagement rates did not significantly predict customer spending. This finding offers an interesting contrast to the broader belief that social platforms inherently support strong emotional and behavioral engagement. While digital ecosystems promote consumer interaction, the lack of predictive influence suggests that not all personalized messages delivered through social media translate into measurable transactional outcomes. This insight complements the work of Rasool et al. (2020), who emphasize that engagement in digital environments is complex and influenced by both contextual and psychological factors. It is

possible that the passive nature of social media consumption, algorithmic filtering, or message saturation may reduce the effectiveness of personalization through these channels.

The negative relationship observed between mobile app usage and satisfaction score further complicates the personalization–engagement dynamic. Contrary to expectations that mobile apps enhance convenience and support personalized interactions, the results indicate that higher app usage may be associated with dissatisfaction. This aligns with privacy and cognitive concerns highlighted in the personalization–privacy paradox literature, which suggests that personalization efforts may backfire when customers perceive intrusiveness, lack of transparency, or excessive data collection (Aguirre *et al.*, 2016). Such findings underscore the delicate balance between personalization intensity and user comfort, reinforcing the argument that personalization strategies must be implemented with sensitivity to privacy expectations and user autonomy.

AI-driven personalization presents both opportunities and challenges that help explain the observed results. According to Thakur *et al.* (2024), AI-enabled systems enhance personalization accuracy by analyzing behavioral data and predicting contextual needs, thereby improving customer experience. AI-driven recommendations can also trigger emotional responses related to empathy, trust, or perceived intrusion. Won and Kim (2025) argue that AI personalization influences consumer behavior only when users perceive empathy and relevance, suggesting that poorly calibrated AI systems may produce ineffective or counterproductive outcomes. The discrepancies in this study such as the weak effect of social media engagement and the negative association of app usage may reflect instances where personalization fails to generate perceived relevance or emotional resonance.

Customer engagement theory provides additional context to interpret these findings. Engagement is shaped not merely by exposure to personalized content but by the mechanisms through which consumers interpret and respond to those interactions. Hollebeek and Macky (2019) propose that digital content must foster trust, value, and

6. CONCLUSION

This study examined how personalization influences online customer engagement within e-commerce environments using a synthesized dataset that integrated behavioural, perceptual, and digital interaction variables. The findings demonstrate that personalization particularly through email engagement and membership-based incentives plays a meaningful role in shaping customer engagement outcomes. The positive association between email engagement and spending highlights the effectiveness of targeted communication

cognitive involvement to strengthen engagement. The positive association between email engagement and spending may therefore indicate that emails provide clearer value cues or more explicit personalization benefits than other channels. Meanwhile, the weaker results for other personalization measures imply that consumers may not consistently perceive value or emotional connection in those touchpoints, limiting their engagement impact.

The findings also highlight the importance of understanding consumer emotions and perceptions when designing personalization strategies. Online customer behavior is heavily influenced by perceived relevance, effort, and emotional state. Rasool *et al.* (2020) suggest that digital engagement is shaped by users' psychological involvement and perceived value, which helps explain why only certain personalization strategies translate into meaningful outcomes. When customers view personalization as beneficial and supportive, engagement increases; when it appears intrusive or irrelevant, engagement may decline or stagnate.

Furthermore, the study's results contribute to ongoing debates about the ethical and experiential dimensions of personalization in digital contexts. Personalization must be balanced with responsible data practices to maintain trust and reduce discomfort. As Aguirre *et al.* (2016) note, customers evaluate both the benefits and risks associated with personalized targeting. This insight is particularly important given the negative patterns associated with mobile app usage in this study.

These findings suggest that firms must adopt a targeted, contextually aware approach to personalization. Not all channels exert equal influence, and personalization must align with consumer expectations, emotional preferences, and privacy boundaries. AI-enabled personalization, as discussed by Thakur *et al.* (2024) and Won and Kim (2025), offers opportunities to deliver highly relevant and empathetic interactions, but only when grounded in ethical design principles and user-centric strategies. As demonstrated through the results of this research, personalization that succeeds in balancing value, relevance, and trust is more likely to enhance engagement and stimulate positive behavioural outcomes.

in driving transactional behavior, while tier-based membership structures appear to encourage deeper customer involvement. However, the limited impact of social media engagement and the negative relationship between mobile app usage and satisfaction underscore that personalization is not universally effective across all digital touchpoints. These results suggest that consumers respond differently to personalization depending on perceived relevance, intrusiveness, and the emotional or cognitive value derived from interactions. The study contributes to a more nuanced understanding of personalization by highlighting the need for firms to adopt selective, context-aware strategies rather than uniform personalization approaches. As digital environments continue to evolve, the integration of artificial intelligence, user analytics, and ethical data practices will be essential for delivering effective and trustworthy personalized experiences. Future research may benefit from examining personalization effects using larger datasets, cross-platform behavioral tracking, or experimental designs that further capture the psychological dimensions of personalized engagement. Overall, this research reinforces the importance of personalization as a strategic driver of customer engagement while recognizing the complexities that accompany its implementation in digital commerce.

REFERENCES

- Aburbeian, A. M., Owda, A. Y., & Owda, M. (2022). A technology acceptance model survey of the metaverse prospects. *AI*, 3(2), 285-302.
- Aguirre, E., Roggeveen, A. L., Grewal, D., & Wetzels, M. (2016). The personalization-privacy paradox: implications for new media. *Journal of consumer marketing*, 33(2), 98-110.
- Artha, B., Zahara, I., & Sari, N. P. (2022). Customer retention: a literature review. *Social Science Studies*, 2(1), 030-045.
- Bleier, A., & Eisenbeiss, M. (2015). Personalized online advertising effectiveness: The interplay of what, when, and where. *Marketing Science*, 34(5), 669-688.
- Brodie, R. J., Ilic, A., Juric, B., & Hollebeek, L. (2013). Consumer engagement in a virtual brand community: An exploratory analysis. *Journal of business research*, 66(1), 105-114.
- Busalim, A. H., Hussin, A. R. C., & Iahad, N. A. (2019). Factors influencing customer engagement in social commerce websites: A systematic literature review. *Journal of theoretical and applied electronic commerce research*, 14(2), 1-14.
- Chaudhary, A., Mallik, B. B., Mukherjee, G., & Kar, R. (Eds.). (2024). *Deep learning applications in operations research*. Auerbach Publishers, Incorporated.
- Chen, S., Han, X., Bilgihan, A., & Okumus, F. (2021). Customer engagement research in hospitality and tourism: a systematic review. *Journal of Hospitality Marketing & Management*, 30(7), 871-904.
- Ganesh, K. S., & Bhat, S. (2025). Adoption Intention Towards Organic Products with the Effect of Social Media Marketing: Organic Products and Social Media Marketing. In *Advancing Global Food Security with Agriculture 4.0 and 5.0* (pp. 55-68). IGI Global Scientific Publishing.
- Grewal, D., & Roggeveen, A. L. (2020). Understanding retail experiences and customer journey management. *Journal of retailing*, 96(1), 3-8.
- Grewal, D., Hulland, J., Kopalle, P. K., & Karahanna, E. (2020). The future of technology and marketing: A multidisciplinary perspective. *Journal of the Academy of Marketing Science*, 48(1), 1-8.
- Hollebeek, L. D., & Macky, K. (2019). Digital content marketing's role in fostering consumer engagement, trust, and value: Framework, fundamental propositions, and implications. *Journal of interactive marketing*, 45(1), 27-41.
- Ibrahim, R., Leng, N. S., Yusoff, R. C. M., Samy, G. N., Masrom, S., & Rizman, Z. I. (2017). E-learning acceptance based on technology acceptance model (TAM). *Journal of Fundamental and Applied Sciences*, 9(4S), 871-889.
- Khoa, B. T., & Huynh, T. T. (2022). How do customer anxiety levels impact relationship marketing in electronic commerce?. *Cogent Business & Management*, 9(1), 2136928.
- Kundu, S. S., Sarkar, D., Jana, P., & Kole, D. K. (2020). Personalization in education using recommendation system: an overview. *Computational Intelligence in Digital Pedagogy*, 85-111.
- Li, Y., Liu, K., Satapathy, R., Wang, S., & Cambria, E. (2024). Recent developments in recommender systems: A survey. *IEEE Computational Intelligence Magazine*, 19(2), 78-95.
- Maoulainine, F. Z. C., & SOUAF, M. (2025). Customer Relationship Management in the Era of Big Data and Artificial Intelligence. *Revue Française d'Economie et de Gestion*, 6(1).
- Mdungela, N., Gebuza, M., & Mpungose, M. (2025). Recommendation Engines: Techniques and Their Impact on Customer Engagement. *Systematic Review*.

- Noir, S., (2024). *E-commerce customer engagement* [Dataset]. Kaggle. <https://www.kaggle.com/datasets/noir1112/e-commerce-customer-engagement>
- Pleskach, V., Bulgakova, O. S., Zosimov, V. V., Vashchilina, E., & Tumasoniene, I. (2023, September). An E-Commerce Recommendation Systems Based on Analysis of Consumer Behavior Models. In *IntSol* (pp. 210-221).
- Rasool, A., Shah, F. A., & Islam, J. U. (2020). Customer engagement in the digital age: A review and research agenda. *Current Opinion in Psychology*, 36, 96-100.
- Rehman, S. U., Jabeen, F., Shahzad, K., Riaz, A., & Bhatti, A. (2025). Industry 4.0 technologies and international performance of SMEs: mediated-moderated perspectives. *International Entrepreneurship and Management Journal*, 21(1), 25.
- Rossi, P. E., Allenby, G. M., & Misra, S. (2024). *Bayesian Statistics and Marketing*. John Wiley & Sons.
- Sahu, N., Deng, H., & Mollah, A. (2018). Investigating the critical success factors of digital transformation for improving customer experience.
- Thakur, H. K., Singh, J., Saxena, A., Bhaskar, D., Singh, A. P., & Garg, P. K. (2024, May). Enhancing customer experience through ai-powered personalization: A data science perspective in e-commerce. In *2024 International Conference on Communication, Computer Sciences and Engineering (IC3SE)* (pp. 501-506). IEEE.
- Tharmalingam, L. (2023). *E-commerce customer behavior dataset* [Dataset]. Kaggle. <https://www.kaggle.com/datasets/uom190346a/e-commerce-customer-behavior-dataset>
- Tucker, C. E. (2014). Social networks, personalized advertising, and privacy controls. *Journal of marketing research*, 51(5), 546-562.
- Verhoef, P. C., Kannan, P. K., & Inman, J. J. (2015). From multi-channel retailing to omni-channel retailing: introduction to the special issue on multi-channel retailing. *Journal of retailing*, 91(2), 174-181.
- Wang, Y., Kung, L., & Byrd, T. A. (2018). Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations. *Technological forecasting and social change*, 126, 3-13.
- Won, J. Y., & Kim, Y. C. (2025). The Impact of Perceived Personalization of AI Chatbot on Customer Citizenship Behavior: The Moderated-Mediation Effect of Perceived Empathy and Privacy Concern. *Journal of Channel and Retailing*, 30(2), 55-86.