

Computational Modeling of AI-Driven Personalization in Iranian E-Commerce: A Case Study of Digikala

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Abstract

The escalating integration of Artificial Intelligence (AI) in e-commerce has fundamentally reshaped consumer interactions, with machine learning-driven personalization enhancing user experiences through recommendation systems, dynamic pricing, and targeted engagement. However, the impact of such personalization on consumer trust, engagement, and long-term behavioral loyalty remains contentious, particularly amid concerns over data privacy, algorithmic bias, and ethical implications. This study investigates the role of AI-driven personalization in influencing consumer behavior, using Digikala—Iran’s leading e-commerce platform—as a case study. A mixed-methods approach was employed, combining semi-structured interviews with ten domain experts, thematic analysis, Interpretive Structural Modeling (ISM), and SWOT analysis. Findings reveal that AI-enabled personalization significantly enhances consumer engagement and purchase intention while simultaneously amplifying challenges related to data security, algorithmic transparency, and bias. Ethical data governance emerges as a critical determinant of sustained brand loyalty in personalized recommendation systems. The study advances the discourse on AI ethics in e-commerce by underscoring the necessity for robust regulatory frameworks and transparent algorithmic decision-making to foster consumer confidence. These insights provide actionable guidance for Digikala and comparable platforms seeking to optimize AI personalization strategies while mitigating ethical risks.

Keywords: AI-driven Personalization, E-Commerce, Consumer Behavior, Recommendation Systems, Online Shopping Platforms, Digikala, Customer Experience.

Introduction

The rapid advancement of Artificial Intelligence (AI) has profoundly reshaped numerous industries, with e-commerce emerging as one of the most significantly impacted domains (Arequat et al., 2021). AI-powered tools have empowered organizations to deliver highly personalized customer experiences, refine branding strategies, and elevate overall satisfaction levels (Rane, 2023). Through sophisticated recommendation systems, dynamic pricing mechanisms, and targeted advertising, AI has fundamentally altered consumer interactions with digital platforms. Nevertheless, while data-driven personalization yields substantial benefits, it concurrently raises critical concerns surrounding data privacy, algorithmic bias, and broader ethical implications (Khan, 2025). A central challenge for e-commerce entities lies in harmonizing operational efficiency with sustained consumer trust (Kaul & Khurana, 2022).

Personalization now constitutes a foundational pillar of modern e-commerce, leveraging AI to process vast datasets—including purchase histories, behavioral patterns, and demographic profiles—to generate tailored recommendations, boost engagement, and drive revenue growth (Vashishth et al., 2025). Empirical evidence underscores the efficacy of machine learning-based

personalization in enhancing customer satisfaction by delivering contextually relevant and timely content. However, the facilitation of such automated decision-making necessitates extensive data aggregation, thereby intensifying imperatives for robust data security, informed user consent, and adherence to regulatory standards (Jin & Wang, 2025).

Despite burgeoning research, significant knowledge gaps persist regarding the long-term ramifications of AI personalization, particularly in reconciling hyper-personalized experiences with ethical integrity. Organizations continue to grapple with barriers to deploying AI systems that comply with stringent data protection frameworks, such as the General Data Protection Regulation (GDPR) (Baldini, 2025; Renuka et al., 2025). Furthermore, inherent biases in recommendation algorithms risk perpetuating discrimination, degrading user experiences, and eroding brand reputation. Addressing these multifaceted challenges demands an integrated approach encompassing ethical AI governance, regulatory alignment, and continuous technological refinement (Okonkwo, 2024).

This study aims to bridge the gap between AI-driven personalization and ethical e-commerce practices by employing a mixed-methods framework—integrating expert interviews, thematic analysis, Interpretive Structural Modeling (ISM), and SWOT analysis—to hierarchically examine the interrelationships among key personalization factors, using Digikala as a contextual case study, while proposing actionable strategies for balancing innovation with consumer trust and regulatory compliance.

Literature Review

Artificial Intelligence (AI) has revolutionized e-commerce by enabling advanced personalization and predictive analytics, thereby optimizing consumer interactions and operational efficiency (Krishnan & Mariappan, 2024). Recent investigations further underscore AI's pivotal role in real-time customer engagement, refinement of recommendation systems, and cultivation of consumer trust (Huda, 2024; Li et al., 2025). This section synthesizes key scholarly contributions, delineating both the transformative opportunities and persistent challenges of AI-driven personalization in e-commerce. Balasubramanian (2024) explored the deployment of AI-driven personalization, emphasizing recommendation systems and real-time behavioral adaptation. Leveraging user interaction data, the study demonstrated significant enhancements in customer engagement and retention (Balasubramanian, 2024). Similarly, Vashishth et al. (2025) analyzed AI-enabled content personalization in marketing, citing case studies from Amazon, Netflix, and Spotify to illustrate substantial gains in user satisfaction and engagement through tailored algorithmic recommendations (Vashishth et al., 2025).

Alkudah and Almomani (2024) examined the integration of machine learning, neural networks, and fuzzy logic in personalized marketing and chatbot interactions. Their findings confirmed that AI-driven personalization markedly improves customer satisfaction and operational efficiency, albeit at the cost of heightened data privacy risks and elevated implementation expenses (Alkudah & Almomani, 2024). In the Iranian context, Bathaei et al. (2024) investigated AI-powered knowledge graphs on Digikala.com, advocating for localized models to enhance search accuracy and recommendation relevance across linguistically diverse user bases (Bathaei et al., 2024).

Employing structural equation modeling on data from 473 consumers, Sipos (2025) established that AI-generated personalization positively influences trust and satisfaction, with satisfaction mediating purchase intent. However, privacy concerns emerged as a significant moderating factor, reinforcing the necessity of transparency and ethical data practices to sustain consumer trust in AI-managed platforms (Sipos, 2025).

Madhuranthakam (2023) elucidated how machine learning, natural language processing, and predictive analytics underpin hyper-personalized shopping experiences, driving conversion rates and fostering brand loyalty. Nonetheless, the study highlighted persistent ethical dilemmas, particularly regarding data manipulation, security, and trust erosion (Madhuranthakam, 2023). Patil (2024) contended that AI transforms retail and e-commerce through recommendation engines, predictive inventory management, and real-time engagement via chatbots and voice assistants. While deep learning enhances conversion and pricing strategies, it simultaneously raises critical questions about algorithmic fairness and privacy (Patil, 2024).

Zed et al. (2024) conducted a quantitative analysis of online shopper data, confirming that personalized experiences strengthen repurchase intent, brand advocacy, and emotional attachment. The study emphasized the importance of demographic sensitivity in AI strategies and advocated transparent, privacy-respecting practices to build enduring trust (Zed et al., 2024).

A comprehensive review by Bhardwaj et al. (2025) highlighted AI chatbots, recommender systems, and predictive analytics as instrumental in reducing cart abandonment and maximizing conversions. Yet, it stressed that sustained efficacy hinges on rigorous adherence to data protection, transparency, user control, and bias mitigation—underscoring that regulatory compliance and privacy governance are non-negotiable for preserving consumer confidence (Bhardwaj et al., 2025).

Despite robust evidence of AI's capacity to elevate personalization, significant barriers persist. Data privacy vulnerabilities, algorithmic biases, and substantial deployment costs continue to impede widespread adoption (Alkudah & Almomani, 2024; Madhuranthakam, 2023; Patil, 2024). Moreover, heavy reliance on large-scale datasets amplifies ethical risks, particularly in transparency and security domains (Khan, 2025; Sipos, 2025). Nevertheless, the transformative potential of AI in enhancing customer experience, satisfaction, and loyalty remains unequivocal across the literature (Balasubramanian, 2024; Vashishth et al., 2025; Zed et al., 2024; Bhardwaj et al., 2025).

Table 1: Overview of the recent literature consisting of the analysis of country, case study (firm), concept, methods, and findings.

Author(s)	Country	Case Study (Company)	Concept	Methodology	Key Findings
Balasubramanian (2024)	USA	Amazon, Netflix	AI-driven personalization in e-commerce	Case study analysis	AI enhances customer engagement and retention through recommendation systems and behavioral data analysis.
Vashishth et al. (2025)	Global	Amazon, Spotify, Netflix	AI-enabled content personalization in marketing	Case study review	AI-based recommendations significantly improve user satisfaction and engagement.
Alkudah & Almomani (2024)	Jordan	Multiple e-commerce platforms	AI integration in personalized marketing and chatbot interactions	Theoretical analysis	AI-powered personalization improves customer satisfaction but raises data privacy concerns.
Bathaei et al. (2024)	Iran	Digikala.com	AI-powered knowledge graphs for e-commerce	Experimental study	AI models optimized for local markets improve search functionality and recommendation accuracy.

Sipos (2025)	Croatia	Various e-commerce platforms	AI-driven personalization's impact on consumer	Structural equation	AI personalization positively influences trust and satisfaction,
			trust, satisfaction, and purchase intent	modeling (SEM)	but privacy concerns moderate its impact.
Madhuranthakam (2023)	India	Flipkart, Myntra	AI in personalized shopping experiences	Case study analysis	AI improves conversion rates and brand loyalty, but ethical concerns remain.
Patil (2024)	India	Various retail brands	AI-driven predictive analytics in e-commerce	Industry review & theoretical analysis	AI recommendation systems enhance conversion rates, while predictive analytics optimize inventory management and pricing strategies.
Zed et al. (2024)	Indonesia	Tokopedia, Bukalapak	AI-driven personalization and consumer loyalty	Quantitative survey analysis	Personalized experiences strengthen consumer loyalty, repurchase intentions, and brand advocacy.
Bhardwaj et al. (2025)	Global	Various digital marketing platforms	AI-driven customer targeting and personalization strategies	Literature review & case studies	AI enhances customer retention and reduces cart abandonment, but regulatory and ethical challenges persist.

Method

This study utilized a qualitative design to explore the aspect of AI personalization in e-commerce from an expert perspective, who can help understand the benefits, challenges, and ethical considerations of this phenomenon. Data were collected through in-depth, semi-structured interviews with ten experts in the field of AI, e-commerce, and data privacy. These experts were chosen for their considerable expertise in marketing driven by AI, help frame based technology, and other ethical issues with respect of data usage. Gathering insights on process from the interviews gives insights on AI implementation, its impact on customer engagement, and the challenges businesses face in balancing personalization with privacy. Interviews were conducted in person or online with each interview lasting 45–60 minutes long. The questions were open-ended to promote discussions ranging from AI recommends to algorithmic biases, to data safety and user consent. The audio from all interviews were recorded and transcribed for further analysis. To analyze the data, a thematic coding approach was applied, allowing for the identification of recurring patterns and key themes. This qualitative coding process helped in categorizing expert opinions on AI personalization's effectiveness, ethical concerns, and business implications. Additionally, Interpretive Structural Modeling (ISM) was employed to explore the hierarchical relationships among identified factors, providing a structured understanding of how various elements influence AI adoption in e-commerce. This qualitative coding process was used to categorize experts' perspectives on the effectiveness, ethical sensitivities, and business implications of AI personalization. Further, Interpretive Structural Modeling (ISM) was used to explore the hierarchical relationships between the identified factors, offering a structured understanding of the influence exerted by different elements on AI adoption in e-commerce. The

Strengths, Weakness, Opportunities, Threats (SWOT) analysis also evaluates the strategic implications of implementing AI-driven personalization.

Interpretive Structural Modeling (ISM) is a well-established methodology for dealing with complex issues by transforming vague and poorly articulated mental models into clear, well-defined structural models (Warfield, 1974). In this study, ISM was employed not only to identify the hierarchy of significant factors affecting personalization through AI in e-commerce but also to elucidate the complex causal relationships and dependency patterns among them. This systematic approach allows for the development of a multi-level structural model that reveals the underlying driving and dependent forces within the system.

ISM was employed to analyze the hierarchy of significant factors affecting personalization through AI in e-commerce. Thus, the ISM approach systematically identified the relationship amongst the variables and arranges them in the order of influence and dependency.

To further classify the factors, the driver power and dependence for each factor were calculated from the final reachability matrix (Table 4). The **driver power** of a factor is the total number of factors it influences (including itself), obtained by summing the 1's in its row. The **dependence** of a factor is the total number of factors influencing it, obtained by summing the 1's in its column."

Factor	Driver Power	Dependence	Classification
A	6	1	Driver (High power, Low dependence)
B	3	3	Linkage (Moderate power and dependence)
C	4	3	Linkage (Moderate power and dependence)
D	1	4	Dependent (Low power, High dependence)
E	2	5	Dependent (Low power, High dependence)
F	1	3	Dependent (Low power, High dependence)

This classification confirms the hierarchical levels: Factor A, with the highest driver power and lowest dependence, is a key 'driver' or independent variable at the base of the model. Factors D, E, and F, with high dependence and low driving power, are 'dependent' variables at the top. Factors B and C, with moderate scores, are 'linkage' variables that transmit influence in the middle of the hierarchy.

Results

Qualitative Analysis of Interview Responses

The qualitative analysis of the interviews conducted with AI and marketing experts highlights several key themes related to AI-driven personalization in e-commerce. The coding process allowed us to categorize the responses into six primary themes: the impact of AI-driven personalization, challenges in AI adoption, effectiveness based on customer types, metrics for measuring AI success, trust and privacy concerns, and market influences on AI adoption. All these themes offer incredible insights into the changing landscape around online shopping because of AI (**Table 2**). The most recurring theme across interviews was the inescapable positive impact of AI-driven personalization on user experience, engagement, and conversion rates. AI can recommend products based on user behavior, which simplifies the decision-making process for customers, experts said. These systems leverage data from browsing history, prior purchases, and other engagements to create recommendations — which is exactly how AI-powered recommendation engines work (such as those used by Digikala). This is especially effective in categories such as fast-moving consumer goods (FMCG) and electronics, wherein customers make repeat purchases based on need and past shopping behavior. Most respondents agreed on the fact that AI has facilitated e-commerce platforms by making the buying journey more seamless and user-friendly. Although AI has its advantages, experts listed several roadblocks to deploying and sustaining AI-driven personalization. A major hurdle is the need to analyze enormous amounts of user data in real time. Adopting AI extends beyond initial implementation; AI models can help optimize various business processes but require constant optimization to provide accurate recommendations, which calls for a strong technological backbone. The other difficulty with using AI to assist in sales is the inconsistency of customer behavior, as, while some users enjoy personalized recommendations, others find it intrusive ; sometimes even disturbing. Additionally, delayed learning in AI models can reduce the effectiveness of recommendations, as outdated data might not reflect a customer’s most recent preferences. AI-driven personalization also had differing levels of success across customer segments as the interview data showed. Experts divided customers into three major categories: loyal customers, exploratory customers, and impulse buyers. Keep them loyal, trusting AI recommendations & faster decisions. Conversational customers prefer to shop around and compare options rather than AI recommendations. At the same time, impulsive buyers are incredibly susceptible to personalized discounts and time-sensitive offers.

Companies use several key performance indicators (KPIs) to assess the effectiveness of AI-driven personalization. The metrics referenced the most in the interviews were conversion rate (CR), click-through rate (CTR), and customer lifetime value (CLV). The conversion rate indicates the number of users who make a purchase after receiving AI-generated recommendations. It shows to what extent how engaging the personalized content is shown — whether it be email marketing or push notifications. Customer lifetime value measures the longer effects of AI on how well it retains customers and makes them return for repeat purchases. Will AI-powered personalization cut customer turnover? Another key metric is churn rate. One of the common threads that emerged from the interviews was the fraught balance between personalization and privacy. Although a lot of data consumer preferences is transformed into AI-driven recommendations, if a customer finds their data has been monitored in excess, they might not trust the system anymore.

Last but not least, external drivers such as economic climate, technological infrastructure and regulatory policy are also important to the uptake of AI-based personalization. Economists noted

that in economic downturns, customers become more sensitive to prices, meaning that personalized discounts are more powerful. Also, availability of stable internet and quality data influences the working of the AI algorithms. Privacy regulations also constrain how AI can be applied, with companies needing to navigate between personalization and data safety.

Table 2: Qualitative Coding of Interview Responses

Theme	Code	Example 1	Example 2	Example 3
Impact of A-driven personalization	AI-Impact	“AI enhances user experience, increases conversion rates, and improves retention rates.”	“In FMCG and digital products, AI-driven recommendations lead to faster repeat purchases.”	“Personalized suggestions help customers find relevant products faster, leading to better engagement.”
Challenges in AI adoption	AI-Challenges	“One of the biggest challenges is processing high volumes of user data and optimizing machine learning models continuously.”	“Some users appreciate personalization, while others feel like they’re being watched too closely.”	“AI models must be updated regularly to maintain accuracy, which is a technical challenge.”
Personalization effectiveness per customer type	Customer-Types	“Loyal customers usually trust AI recommendations and make purchases faster.”	“Exploratory customers prefer browsing instead of relying on AI suggestions.”	“Impulsive buyers respond well to personalized discounts and limited-time offers.”
Measuring AI success	AI-Metrics	“Conversion rates (CR) tell us how many users buy after receiving AI-driven recommendations.”	“Click-through rate (CTR) helps us understand if users engage with personalized content.”	“Customer lifetime value (CLV) shows how well AI influences long-term engagement.”
Trust and privacy concerns	AI-Trust	“Users trust AI when recommendations align with their needs and past behaviors.”	“If customers feel AI is too intrusive, they lose trust in the system.”	“We need transparency in data collection to ensure users feel comfortable with personalization.”
Market influences on AI adoption	AI-Market	“Economic conditions affect customer behavior—during downturns, personalized discounts matter more.”	“Data access and infrastructure challenges influence how well AI can operate in different regions.”	“Regulatory concerns and privacy laws affect how AI-driven personalization can be implemented.”

Totally, six major themes related to the interview responses emerged from the analysis of the data: (1) impact of AI-driven personalization (2) challenges in AI adoption (3) effectiveness depending on customer types (4) metrics to measure the success of AI (5) trust and privacy concerns and (6) market influences on AI adoption. Below are the findings from the interviews, and direct quotations from the responses to illustrate each theme.

1. Impact of AI-Driven Personalization

AI-driven personalization enhances user experience by providing relevant product recommendations, optimizing marketing messages, and customizing product pages based on user behavior. Interview Evidences are:

"The recommendation engine suggests products based on users' purchase behavior and interactions, displaying relevant items that match their preferences." "AI-driven promotional messages are customized for each customer through email and push notifications, ensuring higher engagement." "Product pages are dynamically adjusted to highlight items that align with a user's past interests, making the shopping experience more intuitive."

2. Challenges in AI Adoption

Implementing AI for personalization requires significant computational resources, continuous model optimization, and careful management of customer perceptions regarding surveillance.

Interview Evidences are:

"Processing high volumes of user data requires a robust infrastructure and ongoing improvements to machine learning models." "Some users appreciate AI recommendations, but others feel they are being watched too closely, which can lead to discomfort." "One of the biggest challenges is ensuring that AI models remain accurate by continuously updating them with new data."

3. Effectiveness Based on Customer Types

AI-driven personalization is more effective for certain customer segments, such as loyal buyers and impulsive shoppers, but less effective for exploratory customers who prefer manual browsing.

Interview Evidences are:

"Loyal customers tend to trust AI recommendations and make quicker purchasing decisions." "Impulsive buyers react more positively to personalized discounts and time-sensitive offers." "Customers who enjoy browsing prefer to explore a wide range of options rather than relying solely on AI suggestions."

4. Metrics for Measuring AI Success

Businesses assess AI-driven personalization using conversion rate (CR), click-through rate (CTR), customer lifetime value (CLV), and churn rate. Interview Evidences are:

"Conversion rate tells us how many users make a purchase after receiving a personalized recommendation." "Click-through rate measures how often users engage with AI-driven promotions." "We analyze customer lifetime value to determine whether AI personalization encourages long-term retention."

5. Trust and Privacy Concerns

Customers' trust in AI recommendations depends on the relevance of suggestions and transparency in data usage. Interview Evidences are:

"When AI recommendations align with customers' needs, they are more likely to engage with them." "Customers who feel that AI is over-tracking their behavior may lose trust in the system and disengage." "Providing clear explanations of how data is used can help alleviate concerns about privacy."

6. Market Influences on AI Adoption

Economic conditions, internet quality, and regulatory policies affect AI adoption in personalized marketing. Interview Evidences are:

"During economic downturns, price-sensitive customers respond better to AI-driven discount offers." "Internet speed and stability impact the efficiency of AI-driven recommendation systems." "Privacy regulations shape how much customer data businesses can collect and analyze."

Our findings underscore the state of the art distinctiveness of AI personalization, acknowledging both its positives and the hurdles organizations contend with in terms of optimizing customer engagement versus gaining trust and ethical management of data.

ISM Analysis

The first step in ISM analysis is to identify the key factors that influence AI-driven personalization based on the qualitative analysis of interview responses. From the data, six critical factors emerged: 1) AI-driven personalization impact (A) – The overall effect of AI in enhancing personalized experiences for customers; 2) Challenges in AI adoption (B) – The difficulties businesses face when implementing AI for personalization; 3) Effectiveness based on customer types (C) – How AI performs differently depending on various customer segments; 4) Metrics for measuring AI success (D) – The parameters used to evaluate AI performance; 5) Trust and privacy concerns (E) – The issues related to customer trust and data security when using AI-driven personalization, and 6) Market influences on AI adoption (F) – External factors like competition, regulations, and industry trends that affect AI adoption. A structural self-interaction matrix (SSIM) was constructed to determine the relationships between these factors (**Table 3**). The relationships were assessed based on expert judgment from the interviews, using the following notations: 1) V: Factor i influences factor j, 2) A: Factor j influences factor I, 3) X: Factors influence each other and 4) O: No direct influence. The SSIM was converted into a binary reachability matrix by replacing V with 1 (row influences column), A with 0 (column influences row), X with 1 in both directions and O with 0 (no direct influence) (**Table 4**). The reachability and antecedent sets were identified, and intersection sets were used to determine levels (**Table 5**).

The levels identified in the previous step were used to create a hierarchical ISM diagram.

- **Level 1 (Most Dependent Factors):** Metrics for measuring AI success (D), Trust and privacy concerns (E), Market influences (F)
- **Level 2 (Intermediate Factors):** Challenges in AI adoption (B), Effectiveness based on customer types (C)
- **Level 3 (Most Influential Factor):** AI-driven personalization impact (A)

This ISM analysis shows that AI-driven personalization (A) is the underlying driver of other factors. Trust, privacy, market influences, and success metrics rely on externalities, whereas challenges in AI adoption (B) and issues regarding efficiency for different customer types (C) are more adequate predictors. By identifying the interconnections between critical factors for AI centric personalization, it articulate approaches utilized by ISM.

Table 3: SSIM Table and the relationships between factors

Factors	A	B	C	D	E	F
A (Personalization Impact)	X	V	V	V	V	V
B (Challenges)	A	X	A	O	V	V
C (Customer Types)	A	V	X	V	V	O
D (Metrics)	A	O	A	X	A	O

E (Trust & Privacy)	A	A	A	V	X	O
F (Market Influences)	A	A	O	O	O	X

The conversion of the SSIM (Table 3) into the initial reachability matrix follows specific substitution rules:

- **V** (Factor i influences factor j): Cell (i, j) = 1 and Cell (j, i) = 0
- **A** (Factor j influences factor i): Cell (i, j) = 0 and Cell (j, i) = 1
- **X** (Mutual influence): Cell (i, j) = 1 and Cell (j, i) = 1
- **O** (No influence): Cell (i, j) = 0 and Cell (j, i) = 0

The initial reachability matrix was then reviewed for transitivity: if Factor A influences B, and B influences C, then A implicitly influences C. These transitive links were added (where applicable) to form the final reachability matrix presented in Table 4.

Table 4: Reachability matrix

Factors	A	B	C	D	E	F
A	1	1	1	1	1	1
B	0	1	0	0	1	1
C	0	1	1	1	1	0
D	0	0	0	1	0	0
E	0	0	0	1	1	0
F	0	0	0	0	0	1

Table 5: Final levels of variables through each interactions

Factor	Reachability Set	Antecedent Set	Intersection	Level
A	A, B, C, D, E, F	A	A	Level 3
B	B, E, F	A, B, C	B	Level 2
C	C, D, E	A, C	C	Level 2
D	D	A, C, D, E	D	Level 1
E	D, E	A, B, C, E	E	Level 1
F	F	A, B	F	Level 1

The final ISM model reveals a three-tier hierarchy. At the top (Level 1), factors D (Metrics), E (Trust & Privacy), and F (Market Influences) are the most dependent outcomes, heavily influenced by other factors in the system but exerting little influence themselves. Level 2 consists of factors B (Challenges) and C (Customer Types), which act as crucial intermediaries or linking pins—they are influenced by the core driver and, in turn, influence the dependent variables. At the foundational

Level 3, factor A (AI-driven Personalization Impact) is identified as the most influential '**driver**'. This signifies that the perceived or actual impact of AI personalization is the fundamental force that shapes organizational challenges, dictates effectiveness across customer types, and ultimately influences the outcomes of success metrics, trust issues, and market responses.

Therefore, for managers aiming to enhance AI personalization, the model suggests that efforts should be prioritized towards demonstrating and improving the core impact of AI (Factor A), as this will have a cascading effect on overcoming challenges (B), optimizing for different customer types (C), and positively influencing the final dependent outcomes (D, E, F).

SWOT Analysis of AI-Driven Personalization in E-Commerce

Based on the qualitative coding of interview responses, a SWOT analysis was conducted. Examining under this framework aids in acting as a guide for identifying internal strengths and weaknesses and external opportunities and threats of AI-enabled personalization for e-commerce. This analysis was generated from interview excerpts and reflects real-life experiences and concerns. One of the primary strengths of AI-driven personalization is its ability to enhance customer experience through real-time adaptation. As interview subjects noted, AI empowers businesses to customize product recommendations based on browsing and shopping activity. An example from interview is:

"Our sales increased by 20% after integrating AI-based recommendation engines. Customers appreciate the personalized touch, which improves retention and engagement."

Efficiency is another great strength. A huge manual effort goes into customer segmentation and personalized marketing campaigns which is reduced with the use of AI. One respondent in digital marketing stated:

"Before AI, we spent hours segmenting customers manually. Now, AI does it in seconds, improving accuracy and allowing us to focus on strategy."

Also, personalized experiences powered by AI can enable dynamic pricing strategies that match with customer demand, as well as competitor analysis, ensuring optimal revenue generation.

Despite its benefits, AI-driven personalization has notable weaknesses, including data dependency. Many respondents expressed concerns about AI's reliance on large volumes of data to function effectively. An example from interview is:

"Smaller businesses struggle because they lack the data that big companies like Amazon have. Without sufficient data, AI recommendations feel generic and less effective."

Another weakness is algorithmic bias. Since AI models learn from historical data, they may reinforce existing biases. The retail manager shared:

"We noticed that our AI-driven ads were targeting specific demographics too aggressively, leading to unintended exclusion of potential customers."

The complexity of AI integration was also cited as a challenge. Businesses need skilled personnel to manage AI systems, making implementation costly and resource-intensive.

AI-driven personalization offers significant opportunities for business growth and innovation. One key opportunity is hyper-personalization, where AI not only recommends products but also tailors the entire shopping experience. An example from interview is

"We've started using AI chatbots that remember past interactions and preferences. Customers feel like they're getting a personal shopping assistant, which enhances loyalty." Another opportunity is AI-driven fraud detection. By analyzing transaction patterns, AI can identify suspicious activities, improving security. A cybersecurity expert noted:

"Our AI system flagged unusual login attempts and prevented a major data breach last year. This feature builds customer trust."

Expansion into new markets is another opportunity. AI enables businesses to analyze global trends and predict demand in emerging regions.

Privacy concerns and regulatory challenges pose major threats to AI-driven personalization. Many respondents expressed apprehensions about data security and compliance with laws such as GDPR. An example from interview is

"Customers are increasingly skeptical about how their data is used. We had to revamp our privacy policies and be more transparent to maintain trust."

AI system failures can also damage brand reputation. If AI recommendations are irrelevant or misleading, customers may lose confidence in the platform as mentioned in the interview:

"One time, our AI system mistakenly recommended winter coats to customers in tropical regions. It was a major embarrassment, and we had to manually adjust the system."

Finally, market competition and technological advancements create uncertainty. Businesses must continuously invest in AI to stay ahead, which can be financially challenging for smaller firms.

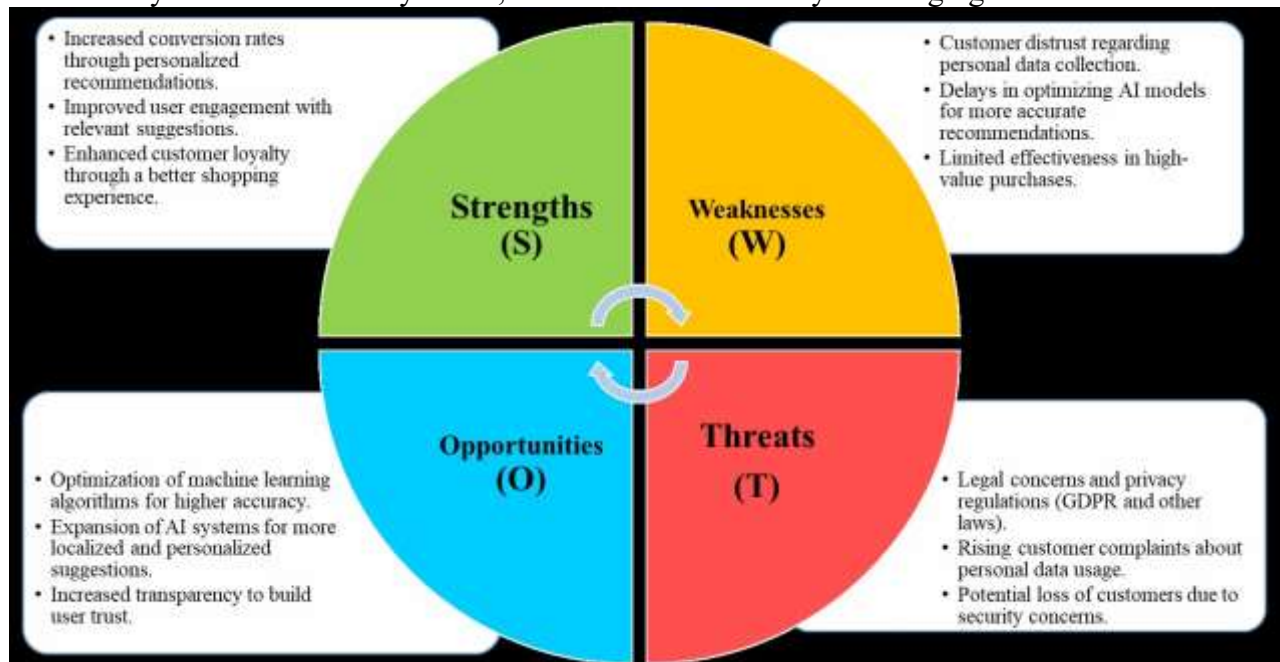


Figure 1: SWOT analysis for AI-driven personalization in E-commerce

Each factor was assigned an influence weight based on expert ratings (1–5). The computed average influence scores were: AI-Impact (4.8), Challenges (4.2), Customer Types (3.7), Metrics (3.9), Trust & Privacy (4.6), Market Influence (4.1).

To ensure reliability, inter-coder agreement was calculated using Cohen's Kappa coefficient ($\kappa = 0.82$), indicating substantial consistency between coders. Thematic patterns were verified through respondent validation to strengthen the qualitative validity of the study.

The hierarchical dependencies derived from the ISM model were mapped against the internal and external dimensions of the SWOT analysis. For example, factors at Level 3 (AI-Impact) were

aligned with ‘Strengths,’ while Level 1 factors (Trust & Privacy, Market Influences) were aligned with ‘Threats.’ This integration enhances the interpretive power of the model.

Discussion

This study was guided by the question "What is the effect of AI-driven personalization on customer engagement, conversion rates, and trust in e-commerce platforms? The analysis provides valuable insights into how AI-driven personalization strategies can be effectively implemented in E-commerce, as well as their impact on customer experience and business growth. But it also involves challenges around customer trust and privacy issues. AI-based personalization helps enhance customer engagement with personalized marketing messages and product recommendations. By implementing AI-driven recommendation engines, digital platforms such as Digikala have been able to experience higher levels of user engagement, as revealed in the interviews. However, AI-driven personalization offers challenges — especially around trust. Some customers regard AI-based recommendations as intrusive, especially when their personal data is collected without enough transparency, the study also found. A primary lesson from the study is also to balance AI-generated recommendations with user control. Although AI-optimized personalization is considered to enhance engagement overall, customer preferences differ depending on the particular product category. Some of the participants in that event noted that in the field of fashion retail, for example, shoppers are still more inclined to look at the goods themselves to self-discover rather than have their choices solely determined by algorithmic recommendations.

Findings from other studies on AI-driven personalization in E-commerce AI for customer engagement improvement in shopping scenarios is a common domain of investigation across the three studies. Approaches to AI applications, challenge identification, and personalization techniques examined vary across different studies. The studies by Balasubramanian (2024) and Vashishth et al. (2025) align with the findings of this research in demonstrating that AI-powered recommendation systems and content personalization significantly enhance customer engagement. Both studies emphasize that AI enables businesses to analyze user behavior in real time, allowing for personalized product suggestions, targeted advertisements, and dynamic content delivery (Balasubramanian, 2024; Vashishth et al., 2025). This is consistent with the results of this research, which found that AI-driven personalization contributes to increased user interaction, retention, and conversion rates. Moreover, Alkudah and Almomani (2024) present similar conclusions, particularly regarding the efficiency of machine learning algorithms, neural networks, and fuzzy logic in optimizing e-commerce experiences. The studies converge on the idea that AI-powered personalization fosters stronger connections between consumers and brands by providing tailored shopping experiences (Alkudah & Almomani, 2024).

Despite these similarities, notable distinctions arise in the discussion of AI’s challenges and ethical considerations. While this study raises questions about data privacy, algorithmic bias, and transparency, other studies like Raji et al. (2024) and Owen and Moore (2023) place a greater emphasis on the ethical aspects of AI implementation. These studies explore the risks associated with excessive data collection, potential discrimination in AI-driven recommendations, and the broader implications of AI on consumer trust (Owen & Moore, 2023; Raji et al., 2024). This research acknowledges such concerns but primarily focuses on the technological and business-oriented aspects of AI-driven personalization rather than the ethical and regulatory frameworks necessary to address them.

Another difference is Bathaei et al.'s (2024) regional perspective on the integration of AI solutions into Iran's leading e-commerce platform, Digikala.com. Bathaei et al. (2024) provide a case study that highlights unique challenges, such as linguistic complexities and limited technological access, in contrast to the larger scope of this study, which examines AI-driven personalization in a general e-commerce context. Their findings suggest that AI-driven knowledge graphs, when optimized for local market conditions, can enhance search functionalities and product recommendations. While this research supports the notion that AI-driven personalization improves user experience, it does not explicitly address regional constraints, making the study of Digikala.com a valuable contribution to understanding AI's impact in diverse market environments (Bathaei et al., 2024). Although every study confirms AI's advantages in e-commerce its application scope varies. The current study together with Balasubramanian (2024) mainly examines AI-based recommendation systems and customer engagement methods (Balasubramanian, 2024) but Vashishth et al. (2025) study AI-based content personalization in marketing (Vashishth et al., 2025). Vashishth et al. (2025) direct their research efforts towards AI-enabled content personalization techniques in marketing. In a similar vein, Alkudah and Almomani (2024) extend their analysis to chatbots, operational efficiency, and fraud detection—all of which are not central to this study. These variations suggest that AI plays a variety of roles in e-commerce, with different studies highlighting complementary implementation aspects.

Conclusion

This study, in alignment with contemporary research, affirms the pivotal role of AI-driven personalization in reshaping e-commerce ecosystems. AI-powered recommendation systems, adaptive content delivery, and real-time user interactions consistently emerge as critical drivers of enhanced consumer engagement, satisfaction, and long-term retention (Balasubramanian, 2024; Vashishth et al., 2025; Zed et al., 2024). The integration of machine learning, neural networks, and knowledge graphs has been empirically validated as instrumental in refining product recommendations and streamlining digital shopping journeys (Krishnan & Mariappan, 2024; Bathaei et al., 2024; Patil, 2024).

Nevertheless, substantial challenges persist. Data privacy vulnerabilities, algorithmic bias, and transparency deficits remain formidable barriers to ethical AI deployment (Sipos, 2025; Madhuranthakam, 2023; Bhardwaj et al., 2025). The Digikala case study underscores the imperative for context-specific AI adaptations—particularly in linguistically diverse and infrastructure-constrained markets—demonstrating that generic models are insufficient for optimal performance (Bathaei et al., 2024).

While this investigation focused on recommendation efficacy and consumer engagement, complementary studies have extended AI applications to content marketing, fraud detection, and conversational interfaces (Alkudah & Almomani, 2024; Patil, 2024; Bhardwaj et al., 2025). This multifaceted implementation landscape highlights AI's profound yet complex influence on e-commerce, signaling rich avenues for future inquiry.

Sustained success in AI-driven personalization hinges on three interdependent pillars: **technological innovation**, **ethical governance**, and **market-specific customization**. Organizations must reconcile performance optimization with robust data protection and transparent algorithmic accountability to preserve consumer trust (Khan, 2025; Sipos, 2025).

Future research should prioritize longitudinal analyses of personalization's impact on customer loyalty, the development of scalable, bias-mitigated AI frameworks, and the integration of advanced techniques—such as federated learning and explainable AI—into diverse e-commerce environments.

By embedding trustworthiness, inclusivity, and regulatory compliance at its core, AI will continue to propel the evolution of digital commerce toward sustainable, consumer-centric growth.

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