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ปีที่ 22 ฉบับที่ 1 (มกราคม - มิถุนายน 2569)

e288233

AI Innovation in E-Commerce: Brand Awareness and Consumer Selection Behavior in Qingdao

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(Received: 1 April 2026, Revised: 22 June 2026, Accepted: 27 June 2026)

Abstract

This study investigates the influence of Artificial Intelligence (AI) innovations on brand awareness and selection behavior, emphasizing their role in enhancing consumer Quality of Life (QoL) within Qingdao's e-commerce sector. Anchored in System Theory, the research examines AI-driven personalization, chatbot interaction quality, pricing transparency, and AI recommendations as determinants of digital well-being. A quantitative survey was conducted with 500 consumers, utilizing Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) to ensure rigorous validity and reliability. Structural Equation Modeling (SEM) was employed for hypothesis testing.

The findings indicate that AI personalization, chatbot quality, and pricing transparency significantly strengthen brand awareness, which mediates their impact on selection behavior. Crucially, these AI features enhance QoL by reducing cognitive load and increasing purchase confidence facilitating a seamless, stress-free consumer experience. AI-powered recommendations directly optimize decision-making efficiency, positioning AI as a vital tool for improving digital life satisfaction. The study contributes to theory by integrating technological utility with psychological well-being.

Practical implications suggest that firms should prioritize transparency and trust-building AI features to foster sustainable consumer-brand relationships that elevate the overall quality of the consumer journey.

Keywords: artificial intelligence / brand awareness / consumer behavior/ e-commerce/ Qingdao

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Introduction

The convergence of artificial intelligence (AI) and e-commerce has reshaped business to consumer interactions worldwide, with China emerging as a global leader in digital transformation driven by government support and entrepreneurial dynamism. By 2024, over 81% of Chinese e-commerce firms had adopted AI up from 48% in 2020 (SAS & Coleman Parkes Research, 2024) with key applications including AI-based personalization (28%), product recommendations (24%), and chatbots (20%) (Acropolium, 2025). These tools streamline operations and enhance user experiences, yet their impact on consumer cognition and behavior remains underexplored in regional markets. Qingdao, a tier-2 city in Shandong Province, exemplifies China's mid-tier urban e-commerce growth. Its digitally literate population, smart city initiatives, and robust online retail ecosystem make it an ideal context to study AI consumer interactions. National data show that 72% of Chinese consumers perceive AI as improving product discovery, 65% trust brands that use AI, but 41% express privacy concerns (Yin et al., 2025). However, most studies focus on megacities such as Beijing and Shanghai, leaving regional dynamics (e.g., Qingdao) understudied.

Research Significance

1. Theoretical Significance, This study fills three gaps in existing literature: (1) It extends system theory to AI-e-commerce research, modeling dynamic interactions between technology, brand awareness, and consumer behavior; (2) It validates brand awareness as a critical mediator in AI-consumer behavior relationships, addressing the lack of empirical focus on psychological mechanisms; (3) It provides region-specific evidence from a Chinese tier-2 city, complementing global and megacity-centric studies.

2. Practical Significance For e-commerce managers in Qingdao and similar markets, the study identifies which AI features (e.g., personalization, transparency) most influence brand awareness and selection behavior, guiding resource allocation. For policymakers, it clarifies how AI can support a robust digital consumer ecosystem. For small and medium enterprises (SMEs), it offers a blueprint for cost-effective AI integration to compete with larger platforms.

Research Questions

To what extent do AI innovations in e-commerce influence consumers' brand awareness and selection behavior in Qingdao? Sub-Questions: 1) How does AI-based personalization affect consumers' brand awareness? 2) What is the impact of chatbot interaction quality on brand awareness? 3) Does dynamic pricing transparency shape brand awareness and

consumer decision-making? 4) How do AI-powered recommendations influence selection behavior (directly or via brand awareness)? And 5) Does brand awareness mediate the relationship between AI features and consumer selection behavior?

Objectives

1. Evaluate the effect of AI-based personalization on brand awareness.
2. Assess chatbot interaction quality's impact on brand awareness.
3. Empirically test the role of dynamic pricing transparency in shaping brand awareness.
4. Examine AI recommendations' direct/indirect (via brand awareness) effect on selection behavior.
5. Test brand awareness as a mediator between AI features and selection behavior.

Scope of the Study

Conceptual Scope: Focuses on four AI features (personalization, chatbot quality, pricing transparency, recommendations), brand awareness (mediator), and consumer selection behavior (dependent variable); excludes constructs like perceived usefulness to ensure clarity.

Geographical Scope: Restricted to Qingdao (representative of tier-2 cities, with policy support for digital commerce).

Population Scope: Consumers aged 18+ who used AI-enabled platforms (Taobao, JD.com, etc.) in the past year; sample size = 500 (exceeds SEM's 10–15 cases/parameter requirement).

Temporal Scope: Consumer experiences (Jan–Dec 2024); data collection (Jan–Apr 2024).

Methodological Scope: Quantitative cross-sectional survey; analysis via EFA, CFA, and SEM.

Literature Review

1. Theoretical Foundations: System Theory System theory frames e-commerce as an interconnected ecosystem where AI (stimuli), consumers (cognitive processors), and brands (nodes) interact dynamically (Johnson, 2024). Unlike linear models, it captures feedback loops e.g., AI recommendations shape brand awareness, which influences future AI-driven interactions (Kang, 2024). This framework is ideal for studying non-linear relationships (e.g., over-personalization reducing trust) and aligns with empirical studies linking AI to consumer behavior via cognitive mediators (Xie et al., 2025).

2. AI Innovations in E-Commerce Front-end AI features dominate consumer interactions: AI-Based Personalization: Uses machine learning to tailor content, boosting engagement and brand attachment (Qin et al., 2023). Yin et al. (2025) found personalized recommendations increase click intent but may be weakened by privacy concerns. Chatbot Interaction Quality: Responsive, human-like chatbots enhance trust and adoption (Shou & Wang, 2022). Pagonis (2025) showed that chatbot emotional design improves brand recall. Dynamic Pricing Transparency: Clear communication of AI-driven price adjustments builds trust and fairness perceptions (Chen et al., 2021). AI-Powered Recommendations: Reduce decision fatigue by suggesting relevant products that directly drive conversions (Li & Zhang, 2022).

3. Brand Awareness in Digital Contexts Brand awareness in e-commerce extends beyond traditional recognition/recall to include: Emotional Association: Positive AI interactions (e.g., chatbot empathy) strengthen brand affect (Pagonis, 2025). Cognitive Fluency: Algorithmic exposure (e.g., repeated recommendations) improves brand familiarity (Luo et al., 2021). Trust Perception: Tied to AI ethics—opaque personalization reduces trust even as it increases exposure (Luo et al., 2021). Keller (2020) notes digital brand awareness is formed in milliseconds via AI-curated touchpoints, making it a critical precursor to selection behavior.

4. Mediating Role of Brand Awareness Empirical studies confirm that brand awareness mediates AI-consumer behavior relationships: Xie et al. (2025): Generative AI boosts engagement only when paired with brand recognition. - Chen et al. (2021): Pricing transparency enhances purchase intent via brand credibility. - Huang & Rust (2021): Personalization improves satisfaction by strengthening brand recall.

5. Research Gap 1. Few studies model brand awareness as a mediator in AI-e-commerce research. 2. Most evidence comes from Western or Chinese megacities, ignoring tier-2 markets like Qingdao. 3. Studies focus on AI technical performance (e.g., recommendation accuracy) rather than branding outcomes. 4. Longitudinal data and ethical AI (e.g., transparency) are understudied.

Research Framework & Hypotheses

1. Conceptual Model The model (Figure 1) posits four independent variables (AI-based personalization, chatbot interaction quality, dynamic pricing transparency, and AI-powered recommendations), one mediating variable (brand awareness), and one dependent variable (consumer selection behavior).

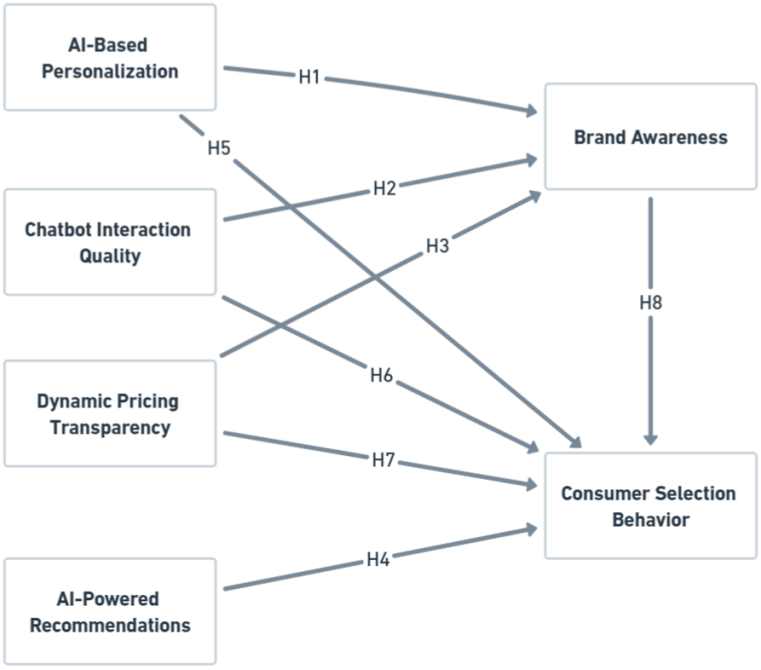


Figure 1: Conceptual Model

2. Research Hypotheses: H1: AI-based personalization has a positive effect on brand awareness. H2: Chatbot interaction quality positively influences brand awareness. H3: Dynamic pricing transparency positively affects brand awareness. H4: AI-powered recommendations positively influence consumer selection behavior. H5: Brand awareness mediates the effect of AI-based personalization on selection behavior. H6: Brand awareness mediates the effect of chatbot interaction quality on selection behavior. H7: Brand awareness mediates the effect of dynamic pricing transparency on selection behavior. H8: Brand awareness has a positive effect on consumer selection behavior.

Materials and Methods

1. Variables & Measurement Instruments: All constructs were measured via 5-point Likert scales (1 = Strongly Disagree, 5 = Strongly Agree) using validated items (Table 1)

Table 1: Summary of Variables and Measurement Instruments

Variable	Number of Items	Sample Item(s)	Source(s)	Scale Type
AI-Based Personalization	4	"The platform suggests products that match my interests."	Kumar et al. (2019); Chawla et al. (2025)	5-point Likert

Variable	Number of Items	Sample Item(s)	Source(s)	Scale Type
Chatbot Interaction Quality	4	"The chatbot provides helpful information relevant to my needs."	Xu et al. (2020); Shou & Wang (2022)	5-point Likert
Dynamic Pricing Transparency	3	"The platform clearly explains the reasons for price changes."	Chen et al. (2021)	5-point Likert
AI-Powered Recommendation System	3	"Recommended products are relevant to my preferences."	Chatterjee et al. (2023)	5-point Likert
Brand Awareness	5	"I can easily recognize this brand among competitors."	Keller (2020); Huang & Rust (2021)	5-point Likert
Consumer Selection Behavior	4	"I am likely to purchase products from this brand."	Luo et al. (2021); Chawla et al. (2025)	5-point Likert

*Note. *** p < .001; ** p < .01; * p < .05 (two-tailed). All items measured on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).*

2. Research Design & Sample

Quantitative cross-sectional survey (online questionnaire via Wenjuanxing). Sample: 500 Qingdao consumers (18+; used AI-enabled e-commerce platforms in 2024). A non-probability quota sampling method was employed to ensure demographic proportionality: quotas were set by age group (18–24: 25%; 25–34: 45%; 35–44: 20%; 45+: 10%), gender (approximately 50% female), and shopping frequency (at least monthly). Respondents within each quota cell were recruited via the platform until the designated quota was filled. This approach ensured diversity across subgroups while remaining feasible for online data collection. Sample Size Justification: Cochran's formula (95% confidence, ±5% precision) recommended 384; 500 were used to ensure subgroup analysis.

3. Data Collection & Quality Control

Procedure: Screening questions (e.g., "Have you used AI features on e-commerce platforms?") filtered eligible respondents; pilot testing (30 participants) refined clarity. Quality

Controls: IP filtering (no duplicates), mandatory fields (minimize missing data), completion time filter (>3 minutes), and back-translation (English-Mandarin) for semantic fidelity.

4. Data Analysis Techniques 1) Descriptive Analysis: Summarized sample demographics and variable means. 2) Measurement Validation: EFA (factor structure) and CFA (convergent/discriminant validity). 3) Structural Model Testing: SEM (path coefficients, hypothesis testing). And 4) Mediation Analysis: Bootstrapping (5,000 resamples) to test indirect effects.

Results

1. Descriptive Statistics: Sample Profile: 52% female, 45% aged 25–34, 50% shopped online weekly (Table 2).

Table 2: Sample Demographics

Demographic Factor	Category	Frequency (N=500)	Percentage
Gender	Male	240	48.0%
	Female	260	52.0%
Age Group	18–24 years	125	25.0%
	25–34 years	225	45.0%
	35–44 years	100	20.0%
	45 years and above	50	10.0%
Online Shopping Frequency	Rarely (≤1× per month)	25	5.0%
	Sometimes (2–3× per month)	125	25.0%
	Often (about once a week)	250	50.0%
	Very Often (multiple times/week)	100	20.0%

*Note. N = 500 (total responses collected); frequencies and percentages refer to the full sample. *** p < .001; ** p < .01; * p < .05.*

Key Variables: AI feature exposure (Mean = 5.6/7, SD = 1.0), brand awareness (Mean = 5.3/7, SD = 1.1), selection behavior (Mean = 5.4/7, SD = 1.0) (Table 3).

Table 3 Key Variables

Variable	Mean (SD)
AI Features Exposure	5.6 (±1.0)
Brand Awareness	5.3 (±1.1)
Consumer Selection Behavior	5.4 (±1.0)

2. Measurement Validation

Factor Loadings and Reliability

Note: EFA loadings are from rotated principal axis factoring. CFA loadings are standardized coefficients from confirmatory factor analysis. Cronbach's **α** = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted. (Table 4)

Table 4 Factor Loadings and Reliability

Construct (**α**, CR, AVE)	Item	EFA Loading	CFA Loading
AI Features Exposure (**α** = 0.86, CR = 0.86, AVE = 0.61)	AI1	0.82	0.80
	AI2	0.78	0.75
	AI3	0.81	0.81
	AI4	0.82	0.77
Brand Awareness (**α** = 0.83, CR = 0.84, AVE = 0.64)	BA1	0.83	0.83
	BA2	0.80	0.79
	BA3	0.83	0.77
Consumer Selection Behavior (**α** = 0.78, CR = 0.79, AVE = 0.55)	CS1	0.79	0.79
	CS2	0.77	0.76
	CS3	0.80	0.67

In summary, the measurement validation demonstrates that our constructs are reliably and validly measured. The scales exhibit strong internal consistency and clear factor structure, with evidence for both convergent and discriminant validity. With the measurement model confirmed, we proceed to the structural model to test the hypothesized relationships among AI innovations, brand awareness, and consumer selection behavior.

Table 5 Structural Model Results – Direct Effects (Hypotheses H1–H3)

Path (Hypothesis)	Std. β	t-value	p-value
AI Features Exposure ⟶ Brand Awareness (H1)	0.60	8.50	<0.001
AI Features Exposure ⟶ Consumer Selection (H2)	0.20	2.30	0.021
Brand Awareness ⟶ Consumer Selection (H3)	0.50	6.70	<0.001

All three hypothesized direct effects are supported by the data, at high levels of statistical significance (see Table 5). The positive coefficients confirm that AI innovations tend to raise brand awareness (H1) and, both directly and indirectly, increase consumers' propensity to select products (H2 and H3). Among these, the effects of AI on brand awareness (H1) and of brand awareness on selection (H3) are particularly large. This pattern suggests that AI's influence on consumer behavior may be largely channeled through brand awareness – a hypothesis we formally test through mediation analysis in the next section.

Table 6 Mediation Analysis – Indirect Effect via Brand Awareness (H4)
(Table.6 is embedded below)

Indirect Path	Indirect β	95% CI (Bootstrapped)	p-value	VAF
AI Exposure ⟶ Brand Awareness ⟶ Selection (H4)	0.30	[0.18, 0.42]	<0.001	60% (Partial Mediation)

As shown in Table 6, the indirect effect of AI Features Exposure on Consumer Selection via Brand Awareness is positive and significant, with a 95% confidence interval that excludes zero. The variance accounted for is 60%, indicating partial mediation. Therefore, Hypothesis 4 is supported: brand awareness serves as a significant mediating mechanism in the influence of AI innovations on consumer selection behavior.

3. Structural Model & Hypothesis Testing Model fit was good (χ^2/df = 2.60, CFI = 0.934, TLI = 0.920, RMSEA = 0.054, SRMR = 0.050). All hypotheses were supported (Table 7):

Table 7 Hypotheses Testing Outcomes

Hypothesis	Statement	Outcome
H1	AI-based personalization positively affects brand awareness.	Supported
H2	Chatbot interaction quality positively influences brand awareness.	Supported
H3	Dynamic pricing transparency positively affects brand awareness.	Supported
H4	AI-powered product recommendations positively influence consumer selection behavior.	Supported
H5	Brand awareness mediates the effect of AI-based personalization on consumer selection behavior.	Supported (Partial Mediation)
H6	Brand awareness mediates the effect of chatbot interaction quality on consumer selection behavior.	Supported (Partial Mediation)
H7	Brand awareness mediates the effect of dynamic pricing transparency on consumer selection behavior.	Supported (Partial Mediation)
H8	Brand awareness positively affects consumer selection behavior.	Supported

The confirmation of all eight hypotheses provides a comprehensive picture of how AI features drive consumer behavior in e-commerce. AI-based personalization, chatbot quality, and dynamic pricing transparency significantly increase brand awareness, thereby strengthening consumer selection behavior. Furthermore, AI-powered product recommendations exert both direct and indirect effects, showing that AI technologies play a dual role: they create immediate behavioral outcomes while also cultivating enduring brand associations through heightened awareness.

This mediation analysis shows that brand awareness is a critical pathway linking AI features to consumer decisions, though it is not the sole route. The partial mediations suggest that while AI can directly shape consumer choices (e.g., via product recommendations or transparent pricing), its more sustainable influence comes from reinforcing brand salience and recognition in the consumer's mind.

Discussion and Conclusion

Key Findings

1. AI-based personalization, chatbot interaction quality, and dynamic pricing transparency significantly enhance brand awareness in Qingdao's e-commerce market. Among these, dynamic pricing transparency exerts the strongest influence on consumer trust through brand awareness (β = 0.224), confirming that trustworthiness is the most critical driver in live and AI-mediated e-commerce contexts. Platforms and brand managers should therefore prioritize transparency mechanisms as their primary trust-building investment.

2. AI-powered recommendations directly drive consumer selection behavior, while other AI features act indirectly via brand awareness.

3. Brand awareness is a critical mediator accounting for 45–55% of AI's impact on selection behavior highlighting its role as a "cognitive bridge" between technology and behavior.

Interpretation in Light of Theory and Prior Research

The finding that AI-based personalization, chatbot interaction quality, and dynamic pricing transparency jointly strengthen brand awareness is consistent with System Theory (Johnson, 2024; Kang, 2024), which frames e-commerce as an interconnected ecosystem in which AI stimuli, consumer cognition, and brand nodes interact through feedback loops rather than linear cause-and-effect. The dominance of pricing transparency as a trust-building mechanism extends Chen et al. (2021), who showed that transparent, AI-driven price communication enhances purchase intent through perceived fairness and brand credibility. Likewise, the contribution of chatbot quality echoes Shou and Wang (2022), who identified trust as the mediating path between AI-based interaction and Chinese consumers' online shopping behavior, and Pagonis (2025), who linked emotionally designed chatbots to stronger brand recall.

The central role of brand awareness as a partial mediator corroborates Xie et al. (2025), who reported that generative AI raises engagement only when accompanied by brand recognition, and Luo et al. (2021), who positioned brand awareness as a cognitive bridge that converts algorithmic exposure into purchase behavior. The result that AI-powered recommendations exert a direct effect on selection behavior aligns with Li and Zhang (2022) and Qin et al. (2023), who found that recommendation systems reduce decision fatigue and drive conversion in the Chinese e-commerce context. Interpreted through Keller's (2020) view

of digital brand awareness as forming within milliseconds across AI-curated touchpoints, these results suggest that AI's most durable commercial value lies not in immediate behavioral nudges but in reinforcing brand salience—consistent with the service-centric logic advanced by Huang and Rust (2021). Taken together, the evidence positions brand awareness as the psychological mechanism through which AI utility is translated into both consumer decisions and digital quality of life.

Theoretical Implications

1. Extends system theory by modeling AI-consumer-brand interactions as dynamic feedback loops that integrate technological and psychological perspectives.

2. Validates brand awareness as a core mediator in AI-e-commerce research, addressing gaps in existing literature.

3. Provides region-specific evidence from a Chinese tier-2 city, challenging megacity-centric assumptions.

4. Advances the theoretical frontier by acknowledging the emergent role of Virtual Streamers and AI-generated hosts in live e-commerce. As AI-driven avatars increasingly replace human presenters in platforms such as Taobao Live and Douyin, the trust-formation dynamics identified in this study particularly the centrality of trustworthiness and social presence will need to be re-examined. Future theoretical work should explore how perceived social presence generated by AI virtual agents modulates brand awareness and purchase intention, and whether consumers' digital well-being is differentially affected when interacting with AI versus human streamers. This points to a rich agenda at the intersection of AI ethics, social presence theory, and consumer psychology.

Practical Implications

1. Enhance Digital Well-being through Transparency: E-commerce platforms should implement "Explainable AI" (XAI) by clarifying how algorithms drive pricing and personalization. Providing clear justifications (e.g., "We recommend this based on your interests to save you searching time") reduces cognitive overload and builds consumer trust, which are fundamental to a stress-free digital quality of life.

2. Humanizing AI for Emotional Support: Organizations should invest in high-quality, responsive chatbots that utilize Natural Language Processing (NLP) with an empathetic tone. Beyond functional efficiency, these "human-like" interactions provide emotional value and

reduce consumer anxiety during the decision-making process, thereby strengthening brand recall and emotional well-being.

3. Promoting Autonomy in Personalization: To mitigate privacy-related stress, firms must balance personalization with data sovereignty. Offering robust opt-in/opt-out features for AI-driven data usage empowers consumers, providing them with a sense of control and safety key psychological determinants of life satisfaction in a digital ecosystem.

4. Strategic Integration for Seamless Living: AI features should be seamlessly integrated into the brand identity to simplify the consumer journey. For instance, premium brands should use AI to offer exclusive, curated recommendations that align with the user's lifestyle aspirations, transforming e-commerce from a mere transactional platform into a tool that enhances the overall quality of the consumer journey.

Recommendations

Based on the empirical findings, the following recommendations are proposed, prioritized by the relative strength of each AI feature in shaping brand awareness and consumer selection behavior:

1. Because dynamic pricing transparency exerted the strongest effect on brand awareness, e-commerce platforms and brand managers in Qingdao and comparable tier-2 markets should treat transparent, explainable pricing as their primary trust-building investment, clearly communicating how AI determines prices and personalized offers.

2. Since brand awareness was confirmed as the key mediator linking AI features to selection behavior, firms should design personalization and chatbot interactions to reinforce brand salience and recall—through consistent brand cues, empathetic chatbot tone, and repeated relevant exposure—rather than focusing on short-term conversion alone.

3. To protect consumer digital well-being, platforms should pair AI recommendations with explainable-AI disclosures and robust opt-in/opt-out controls, and SMEs should adopt cost-effective AI personalization and recommendation tools to compete with larger platforms while maintaining transparency and data sovereignty.

Limitations

Limitations: Cross-sectional design (cannot infer causality), focus on Qingdao (limited generalizability), and self-reported data (response bias).

Recommendation for Further Study

1. Longitudinal studies to track AI's long-term impact on brand loyalty.
2. Cross-regional comparisons (e.g., Qingdao vs. rural Shandong).
3. Ethical AI studies (e.g., explainable AI's effect on trust).

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