

RESEARCH ON THE INFLUENCE OF BIG-DATA ANALYTICS CAPABILITY, DIGITAL PLATFORM QUALITY, AI RECOMMENDATION ACCURACY, ONLINE SERVICE INNOVATION, AND E-SERVICE QUALITY ON BRAND LOYALTY*

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Abstract

This study aims to: 1) examine the impact of Big Data Analytics Capability (BDAC) on e-commerce brand loyalty; 2) determine the impact of Digital Platform Quality (DPQ), Artificial Intelligence Recommendation Accuracy (AIRA), Online Service Innovation (OSI), and Electronic Service Quality (ESQ) on brand loyalty; and 3) compare the relative explanatory power of these five predictor variables in an integrated regression model. This study employed a quantitative cross-sectional survey method, surveying 400 e-commerce consumers with recent shopping experience. The questionnaire used a 5-point Likert scale, and descriptive statistics, Cronbach's alpha coefficient, Pearson correlation coefficient, multicollinearity diagnostics, and multiple regression analysis were used to analyze the mean scores of each variable. The results show that: 1) All five predictors have a significant positive impact on brand loyalty, with DPQ ($B = .297$, $p < .001$) and ESQ ($B = .285$, $p < .001$) having the most significant effects; 2) BDAC

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also has a significant positive impact ($B = .196, p < .001$), while AIRA ($B = .104, p = .008$) and OSI ($B = .104, p = .010$) have smaller but still significant effects; 3) The model explains 42.9% of the variance in brand loyalty ($R^2 = .429$, adjusted $R^2 = .422$, $F(5,394) = 59.17, p < .001$). The findings suggest that e-commerce companies should first improve platform performance and e-service execution, while using analytics, recommendation accuracy, and service innovation as supplementary means to build user loyalty.

Keywords: Big data analytics capabilities, digital platform quality, AI recommendation accuracy, e-service quality, brand loyalty, e-commerce

Introduction

E-commerce has become a core area of competition because today's digital platforms integrate product discovery, comparison, payment, logistics tracking, after-sales communication, and loyalty management into a single service interface. Brand loyalty is strategically important due to the still low switching costs in online marketplaces, as it fosters repeat purchases, word-of-mouth marketing, and reduces reliance on high-cost customer acquisition. Recent research on digital and omnichannel experiences confirms that consumer loyalty is enhanced when digital channels create convenient, consistent, and value-added experiences (Cuesta-Valiño et al., 2023).

In e-commerce, loyalty is no longer solely determined by product attributes or price. It is shaped by the entire digital experience, including platform usability, information accuracy, personalization relevance, transaction security, service responsiveness, fulfillment reliability, and the company's ability to continuously improve its online service systems. New technologies such as artificial intelligence, virtual assistants, automated interaction tools, and analytics-enabled interfaces are transforming the customer experience process and changing how consumers evaluate experience quality (Hoyer et al., 2020).

This study focuses on five technology-driven, experience-oriented predictors of brand loyalty: BDAC, DPQ, AIRA, OSI, and ESQ. Constructing an integrated model is crucial because previous research often examined these factors separately, while e-commerce operations combine them in practice. Analytics capabilities enhance customer understanding, recommendation accuracy reduces search workload, platform quality facilitates transactions, service innovation improves convenience, and e-service quality maintains customer trust in order fulfillment and problem resolution.

The research question is that while e-commerce companies invest heavily in data, AI recommendation systems, digital platform upgrades, and service innovation, managers still need empirical evidence to determine which factors have the strongest explanatory power when considering all predictors simultaneously. Therefore, this study provides a decision-relevant model that compares customer-facing digital quality factors with organizational analytics capabilities to explain brand loyalty.

Objectives

1. To determine the influence of Big-Data Analytics Capability (BDAC) on Brand Loyalty in e-commerce.
2. To assess the influence of Digital Platform Quality (DPQ) on Brand Loyalty in e-commerce.
3. To evaluate the influence of AI Recommendation Accuracy (AIRA) on Brand Loyalty in e-commerce.
4. To examine the influence of Online Service Innovation (OSI) on Brand Loyalty in e-commerce.
5. To investigate the influence of E-Service Quality (ESQ) on Brand Loyalty in e-commerce.

6. To compare the relative explanatory strength of BDAC, DPQ, AIRA, OSI, and ESQ in predicting Brand Loyalty.

Literature Review

Brand loyalty refers to a consumer's attitude and behavioral commitment to consistently purchase, recommend, and prefer a particular brand when faced with other options. In the digital commerce space, brand loyalty is particularly vulnerable because consumers can compare prices, delivery conditions, product ratings, and competing platforms within seconds. Research on digital and omnichannel retail shows that brand loyalty is enhanced when technology improves convenience, channel consistency, perceived value, and the quality of the shopping experience (Cuesta-Valiño et al., 2023).

BDAC (Business Decision Analytics) describes a company's ability to collect, integrate, analyze, and apply large amounts of customer and operational data to support decision-making. In e-commerce, BDAC can support customer segmentation, demand forecasting, churn prediction, personalization, inventory planning, and proactive service recovery. While customers may not directly observe data analytics, they can experience its benefits through more accurate recommendations, more timely communication, and faster-responding service decisions. The capability perspective aligns with recent information systems research demonstrating that AI-related and data-driven capabilities, when integrated with business processes, can become organizational resources that enhance creativity, learning, and performance (Mikalef & Gupta, 2021).

DPQ reflects customer evaluations of a platform's usability, reliability, accessibility, information accuracy, transaction security, navigation ease, and interface clarity. Platform quality is crucial as it impacts both initial and subsequent interactions with digital brands. Recent empirical research from C2C e-commerce indicates a positive correlation between website quality and user

satisfaction and customer loyalty, suggesting that platform performance remains a key driver of loyalty even when products are offered by multiple sellers (Üsas et al., 2024).

AIRA refers to the relevance, usefulness, timeliness, transparency, and comfort of algorithmic recommendations for customers. In e-commerce, recommender systems can reduce information overload and guide product discovery, but their effectiveness depends on whether customers perceive the system as accurate and non-intrusive. Recent research suggests that recommendation transparency can enhance consumer trust by increasing perceived effectiveness and reducing discomfort, supporting the expectation that accurate and explainable recommendations can boost user loyalty (Li et al., 2024).

Online Service Innovation (OSI) refers to a company's ability to launch or improve online service features, processes, and interaction mechanisms. Examples include AI-based customer support, real-time e-commerce functionality, personalized membership programs, convenient payments, improved return processes, and more flexible order fulfillment. Digital transformation research emphasizes that companies must reconfigure their capabilities, channels, and business models to address evolving customer expectations, providing a theoretical basis for viewing online service innovation as a means of enhancing user loyalty (Verhoef et al., 2021).

Electronic Service Quality (ESQ) refers to the user's perceived excellence in electronic service delivery, including efficiency, fulfillment, response speed, problem resolution, and privacy or security guarantees. EESQ is expected to be a significant driver of user loyalty because even with advanced platform technology, poor delivery, slow responses, or unfair problem resolution can quickly erode user trust. Empirical research from the e-commerce field shows that service quality dimensions and satisfaction contribute to building customer

loyalty, particularly in terms of reliable order fulfillment and efficient problem-solving (Sheu & Chang, 2022; Uzir et al., 2021).

Based on this literature review, this paper proposes the following five hypotheses: H1: BDAC has a positive impact on brand loyalty; H2: DPQ has a positive impact on brand loyalty; H3: AIRA has a positive impact on brand loyalty; H4: OSI has a positive impact on brand loyalty; H5: ESQ has a positive impact on brand loyalty.

Methodology

This study adopted a quantitative, explanatory, cross-sectional survey design. This design is appropriate because the research objective is to test the statistical association between multiple predictor variables and Brand Loyalty at one point in time. The unit of analysis was the individual e-commerce customer, and eligible users were required to have recent purchasing experience and sufficient familiarity with platform performance, recommendation functions, and e-service processes.

The sample consisted of 400 valid responses. This sample size exceeds common multiple-regression rules of thumb for five predictors, including Green's guidelines for overall model testing and individual predictor testing. The questionnaire used 5-point Likert-scale items to measure six constructs: BDAC, DPQ, AIRA, OSI, ESQ, and BL. Each construct was measured by four items. Composite construct scores were calculated as the mean of their items.

Data analysis was conducted in four stages. First, descriptive statistics were used to summarize respondent characteristics and construct distributions. Second, Cronbach's alpha was used to assess internal consistency. Third, Pearson correlations were reported to examine bivariate relationships among constructs. Fourth, multiple regression was used to test the five hypotheses, with BL as the dependent variable and BDAC, DPQ, AIRA, OSI, and ESQ as independent variables.

Variance inflation factor (VIF) values were examined to assess multicollinearity. This approach follows standard quantitative social-science reporting guidance for regression analysis (Field, 2024; Hair et al., 2019).

Results

The survey results show that the sample included 232 female respondents (58.0%), 161 male respondents (40.2%), and 7 respondents of other genders (1.8%). The most concentrated age group was 25-34 years old (36.2%), followed by 18-24 years old (23.2%) and 35-44 years old (22.0%). Regarding purchase frequency, 32.5% of respondents purchased 3-5 times per month, 30.8% purchased 1-2 times per month, 28.2% purchased 6-10 times per month, and 8.5% purchased 11 times or more per month. Shopee (41.2%) and Lazada (36.8%) were the most frequently mentioned major shopping platforms, followed by TikTok Shop (13.8%) and Amazon/other platforms (8.2%).

Table 1. Descriptive statistics and reliability of constructs (N = 400)

Var.	Mean	SD	Min	Max	α
BDAC	3.565	0.621	1.75	5.00	0.678
DPQ	3.557	0.619	1.75	5.00	0.684
AIRA	3.501	0.650	1.50	5.00	0.722
OSI	3.519	0.640	1.50	5.00	0.705
ESQ	3.530	0.661	1.25	5.00	0.731
BL	3.566	0.624	1.50	5.00	0.672

Construct means were above the scale midpoint, indicating moderately positive evaluations of e-commerce experience and loyalty. The standard deviations show sufficient dispersion for correlation and regression analysis.

Table 2. Pearson correlations among constructs (N = 400)

Var.	BDAC	DPQ	AIRA	OSI	ESQ	BL
BDAC	1.000	0.252	0.103	0.257	0.236	0.379
DPQ	0.252	1.000	0.275	0.226	0.296	0.487
AIRA	0.103	0.275	1.000	0.249	0.183	0.292
OSI	0.257	0.226	0.249	1.000	0.239	0.322
ESQ	0.236	0.296	0.183	0.239	1.000	0.481
BL	0.379	0.487	0.292	0.322	0.481	1.000

The correlation matrix shows that all five predictor variables are positively correlated with BL. The bivariate variables with the strongest correlation to BL are DPQ ($r = .487$) and ESQ ($r = .481$), indicating that platform quality and service performance are particularly important for user loyalty.

Table 3. Multiple regression results predicting Brand Loyalty (N = 400)

Pred.	B	SE	t	p	VIF	Result
BDAC	0.196	0.041	4.791	< .001	1.14	Yes
DPQ	0.297	0.042	7.036	< .001	1.21	Yes
AIRA	0.104	0.039	2.682	.008	1.13	Yes
OSI	0.104	0.040	2.587	.010	1.17	Yes
ESQ	0.285	0.039	7.350	< .001	1.17	Yes

Model summary: $R = .655$; $R^2 = .429$; adjusted $R^2 = .422$; $F(5,394) = 59.17$, $p < .001$. VIF values ranged from 1.13 to 1.21, indicating that multicollinearity was not a serious concern.

The regression results support all five hypotheses. DPQ and ESQ show the largest unique coefficients, indicating that platform performance and service execution are the most important loyalty drivers in the model. BDAC is also

statistically significant, suggesting that analytics capability contributes to loyalty beyond direct platform and service perceptions. AIRA and OSI are significant but smaller in magnitude, indicating that recommendation accuracy and innovation strengthen loyalty most effectively when built on a reliable platform and strong service foundation.

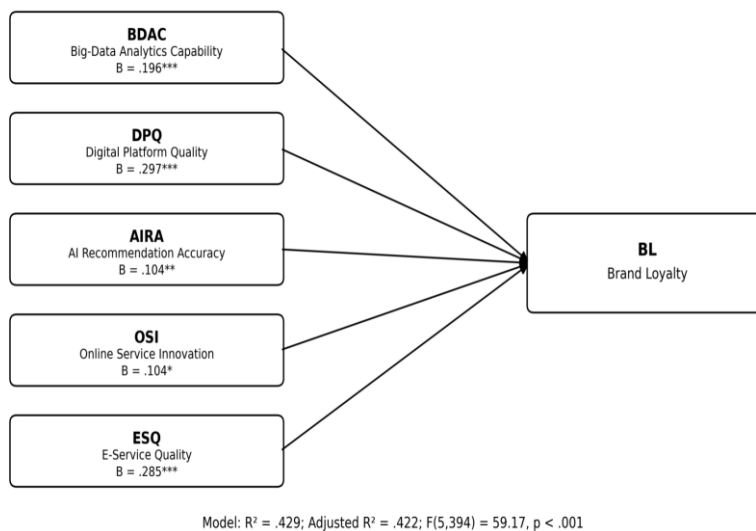


Figure 1. Conceptual results model

Discussion

According to Objective 1, the significant positive impact of BDAC on brand loyalty ($B = .196$, $p < .001$) indicates that analytics capability is not merely a back-end technology resource, but a customer-facing value capability. Customer loyalty is enhanced when data is transformed into useful customer knowledge, timely communication, demand forecasting, and improved service decisions. This finding aligns with the findings of Mikalef and Gupta (2021), who noted that AI-related organizational capabilities, when supported by appropriate resources and processes, can enhance creativity and performance.

According to Objective 2, DPQ has the greatest impact on brand loyalty ($B = .297, p < .001$). This implies that customers respond strongly to platform usability, reliable access, accurate information, transaction security, and a smooth navigation experience. This finding is consistent with the findings of Ūsas et al. (2024), who found that website quality and user satisfaction can predict consumer loyalty in C2C e-commerce. Therefore, platform quality should be considered a core loyalty infrastructure, not merely a technological attribute.

According to Objective 3, AIRA has a positive, but small, impact on brand loyalty ($B = .104, p = .008$). This finding is consistent with the findings of Li et al. (2024), who argued that recommendation transparency can enhance consumer trust by improving perceived effectiveness and reducing discomfort. However, the small coefficient in this study suggests that recommendation accuracy alone is insufficient to build strong loyalty unless customers simultaneously experience reliable platform operations and trustworthy service delivery.

According to Objective 4, OSI has a significant impact on brand loyalty ($B = .104, p = .010$), but its impact is smaller than that of DPQ and ESQ. This result is consistent with digital transformation research, which argues that innovation creates value when companies reconfigure capabilities, processes, and business models to meet evolving customer expectations (Verhoef et al., 2021). This study suggests that online service innovation should focus on solving actual customer problems rather than simply adding new features.

According to Objective 5, ESQ has the second largest impact on brand loyalty ($B = .285, p < .001$). This finding aligns with the findings of Sheu and Chang (2022), who highlighted the role of service quality dimensions in e-commerce satisfaction and loyalty. Furthermore, it is consistent with the research of Uzir et al. (2021), who noted the critical importance of service quality, perceived value, and trust in delivery-related customer satisfaction. The results confirm that

customers cannot maintain loyalty when fulfillment, support, privacy, or problem-solving capabilities are weak.

According to Objective 6, the relative explanatory power comparison shows that DPQ and ESQ have stronger predictive power than BDAC, AIRA, and OSI. This pattern has theoretical significance because analytics, recommendation systems, and innovations typically create indirect or enabling value, while customers directly experience platform quality and service execution in each transaction. Therefore, the findings are largely consistent with recent research in digital customer experience, which emphasizes that technology can create loyalty when it improves the customer journey rather than being implemented for the sake of technology itself (Hoyer et al., 2020).

Recommendation

E-commerce businesses should prioritize the quality of their digital platforms. Managers should improve page load speed, mobile usability, search and filtering capabilities, product information accuracy, inventory visibility, payment stability, and transaction security. Research by Ūsas et al. (2024) supports this recommendation, linking website quality to customer loyalty; research by Cuesta-Valiño et al. (2023) also shows that digitalization and omnichannel experiences can enhance customer loyalty.

Businesses should improve the quality of their e-services through reliable order fulfillment, clear return and exchange processes, rapid customer support, transparent problem resolution, and clear privacy protections. Monitoring metrics should include complaint rates, response times, delivery accuracy, refund completion times, and after-sales satisfaction. Research by Sheu and Chang (2022) and Uzir et al. (2021) supports this recommendation, demonstrating the correlation between service quality, satisfaction, and trust and customer loyalty in e-commerce and delivery environments.

Businesses should develop BDAC (Business-Driven Customer Experience) into a responsible customer experience capability, not just a technology investment. Businesses should integrate browsing, transaction, service, and feedback data, while establishing data quality control, privacy governance, and clear customer value use cases. This aligns with the views of Mikalef and Gupta (2021), who emphasize that AI-related capabilities only create business value when supported by organizational resources and processes.

AI recommendation systems should be evaluated from a customer-centric perspective. Retailers should monitor the relevance, diversity, repetitiveness, interpretability, privacy comfort, and perceived usefulness of recommendations, rather than relying solely on predictive metrics. Simple explanatory cues, such as recommendations based on recent browsing history, can reduce user discomfort, and enhance trust, consistent with the views of Li et al. (2024).

Online service innovation should be problem oriented. New features should address real pain points, such as slow service response, inconvenient returns, weak tracking capabilities, fragmented membership benefits, or inflexible payment methods. According to Verhoef et al. (2021), digital innovation should be combined with process reengineering and capability restructuring; otherwise, innovation may remain superficial and fail to improve customer loyalty. Finally, future research should test the model across different e-commerce categories, comparing marketplace platforms, brand-owned stores, social e-commerce channels, and cross-border e-commerce platforms. Future research could also examine mediating variables such as customer satisfaction, perceived trust, perceived value, and perceived personalization to explain how BDAC, AIRA, and OSI translate into customer loyalty outcomes.

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