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AI-POWERED INNOVATIONS IN E-COMMERCE AND THEIR EFFECT ON BUSINESS PERFORMANCE

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Abstract

E-commerce platforms integrate Artificial Intelligence (AI) applications to enhance business performance metrics across various dimensions. This study aims to assess AI-powered innovations in the Nigerian e-commerce and their effect on business performance. The study focused on AI-driven personalization, AI-powered automation, and AI-enabled fraud detection. The study employed survey research design which involves the use of structured questionnaire to collect data from online shoppers. The selection of the participants was based on purposive sampling technique. 50 copies of questionnaire were administered to Nigerian online shopper, 41 copies were dully filled and considered valid for the purpose of this research. The data collected was analyzed using descriptive statistics and linear regression. Findings revealed that AI-driven personalization has a significant positive effect (β = 0.386, t = 2.610, p = 0.013) on customer satisfaction and loyalty. Also, AI-enabled fraud detection has a significant positive effect (β = 0.437, t = 3.036, p = 0.004) on customer security and trust. However, AI-powered automation has an insignificant positive effect (β = 0.270, t = 1.752, p = 0.088) on operational efficiency and customer engagement. The study

Keywords: Artificial Intelligence, AI-powered innovations, e-commerce, customer satisfaction, business performance

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concludes that AI does not only improve business performance, it also nurture customer relationship management, build customer retention, and helps e-commerce businesses to stay competitive in a rapidly evolving marketplace. Thus, the study recommends that E-commerce platforms should improve the functionality of AI-driven automation tools.

Introduction

The Nigerian e-commerce sector, worth billions of dollars constitutes a critical part of the country's digital economy and continues to expand as consumers increasingly prefer the convenience of online transactions, access to a wide range of products, and competitive pricing (Olarinde, et al. 2024). Over the past decade, the e-commerce sector has grown rapidly, driven by higher internet penetration, increased use of mobile devices, and the widespread adoption of online shopping habits (Sharma et al., 2023). E-commerce businesses in Nigeria face intense competition, making the adoption of innovative technologies to improve customer experience increasingly crucial (Emielu, 2022). Zairi (2012) defined business performance as a measure of a company's efficiency, effectiveness, and overall success in achieving desired outcomes, such as profitability, operational efficiency, customer satisfaction, and market share. The performance of modern businesses in the digital economy largely depend on how effectively they integrate and leverage artificial intelligence technologies (McAfee & Brynjolfsson, 2017). In Nigeria, E-commerce platforms like Jumia, Konga, and PayPorte have implemented AI-driven solutions to cater to the demands of a digitally savvy customer base, particularly targeting young consumers and urban residents who are highly active online (Patel, 2024). AI technologies have the potential to greatly improve customer engagement by personalizing product recommendations, automating customer support, streamlining logistics processes, and providing real-time responses (Patil, 2024). Aside personalization, AI-driven innovations also facilitate the automation of e-commerce processes, thereby enhancing operational efficiency. For instance, AI-powered Chatbots in e-commerce greatly enhanced customer engagement during product selection by providing more accurate suggestions, handling customer inquiries in real-time, providing instant support and assistance, thus, improving customer satisfaction, and delivering a better overall user experience (Rahevar & Darji, 2024). The integration of AI innovations in e-commerce also helps e-commerce platforms to achieve operational efficiency through integrated information systems by leveraging AI for accurate demand forecasting and automated restocking, thus, reducing inventory waste (Grewal et al., 2017). The integration of artificial intelligence and machine learning algorithms within predictive analytics tools empowers organizations to detect and manage fraudulent activities while strengthening

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defenses against cyberattacks (Patil, 2025). Implementing AI-driven security protocols enhances online customer trust and platform reliability, thereby increasing overall business credibility and boosting customer engagement (Doddipatia et al., 2025). Studies shown that business models leveraging AI foster greater customer loyalty and enhance operational performance, ultimately leading to higher sales (Etuk et al., 2025; Kulkarni, 2024).

In light of the rapid adoption of AI in the e-commerce industry and the need to uphold customer satisfaction and loyalty, this study examined AI-powered innovations in e-commerce and their contributions to business performance in Nigeria.

Statement of the Problem

E-commerce in Nigeria has experienced rapid expansion over the past decade, driven by increasing internet penetration, the widespread adoption of mobile technologies, and the rise of a growing middle class with stronger purchasing power (Etuk et al., 2025). Despite the rapid expansion of e-commerce globally and in emerging markets, many online businesses in Nigeria continue to face significant operational challenges including high volumes of customer inquiries, inconsistent service quality, time constraints, limited resources, and the complexities of managing multiple communication channels (Tom Alexander & Jasper Andreas, 2022). These challenges contribute to low customer satisfaction, intensify competitive pressure, and ultimately lead to declining profitability for many e-commerce firms (Saliu et al., 2019). Traditional commerce relies heavily on manual processes, generic customer interactions, and static decision-making systems which no longer meet the expectation of today's digital age customers, who demand speed, personalization, accuracy, convenience, high-quality information, and seamless service experiences (Kishan & Bang, 2021). As a result, e-commerce businesses are rapidly investing in innovative technologies to enhance customer experiences and to remain competitive and meet evolving customer (Etuk et al., 2025).

Thus, this study assessed AI-powered innovations in e-commerce (AI-driven personalization, AI-powered powered automation, AI-enabled fraud detection) and investigate their contribution to business performance metrics (customer satisfaction and loyalty, operational efficiency and customer engagement, and customer security and trust).

Objectives of the Study

The general objective of the study is to examine the AI-powered innovations and assess their effect on business performance with a view to enhancing business performance and customer retention in the Nigerian e-commerce sector.

The specific objectives are to:

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i. assess the effect of AI-driven personalization on customer satisfaction and loyalty in the Nigerian e-commerce sector.
ii. examine the effect of AI-powered automation on operational efficiency and customer engagement on Nigerian e-commerce platforms.
iii. evaluate the effect of AI-enabled fraud detection on customer security and trust within Nigerian e-commerce platforms.

AI-powered Innovations in E-commerce Industry

Artificial intelligence (AI) has emerged as a transformative force in the e-commerce industry, facilitating the delivery of personalized and efficient services while fundamentally redefining how firms operate and engage with customers (Bezditnyi, 2024). Artificial intelligence (AI) plays a pivotal role in driving innovation within the e-commerce industry by enabling personalized, efficient, and customer-oriented digital services (Tom Alexander & Jasper Andreas, 2022). E-commerce platforms, particularly in emerging markets such as Nigeria, are increasingly adopting artificial intelligence to address challenges related to intense competition, evolving consumer preferences, and operational inefficiencies.

Components of AI-powered Innovations

The following are some of AI-powered innovations in e-commerce:

i. Personalized Recommendations: AI-powered recommendation systems deliver personalized product recommendations that align with individual consumer interests by processing customer data such as browsing history, purchase behavior, and stated preferences, (Carole et al., 2024). This enhance customer engagement, build their loyalty and foster customer retention. For instance, e-commerce platforms like Jumia and Konga use collaborative filtering methods to generate personalized product suggestions for users.
ii. Automation of Process: AI automation tools such as Chatbots, voice assistants, and virtual assistants help businesses optimize supply chain operations, inventory management, and order processing, leading to lower operational costs and improved overall performance (Ojika et al., 2024). Also, they help to answer customer queries and provide real-time support at reduced response times, thus, enhancing shopping experiences (Nithya et al., 2024). For example, virtual assistants such as Alexa and Google Assistant enhance functionality by integrating with other systems and executing voice-activated commands.
iii. Fraud Detection and Security: AI analyzes transaction patterns and user behavior to identify anomalies, which form the basis for safeguarding against online fraud and data breaches (Pappas et al., 2018). AI has the capacity to predict and detect

cyber threat, this enables businesses to safeguard customer data and operations, thereby enhancing customer trust in the platform and protecting e-commerce platform's reputation (Duan et al., 2019). For instance, Shopify offers built-in fraud analysis tools that evaluate order risk by analyzing transaction patterns and details, enabling suppliers to detect potentially fraudulent orders before they are processed.

Challenges of AI-Driven Services in E-Commerce

Despite the well-recognized benefits of AI in e-commerce, studies also revealed various challenges that businesses encounter when deploying AI technologies. These challenges are outlined below:

i. Data Privacy: E-commerce services depend heavily on consumer data to operate effectively. This dependence raises concerns regarding the security and ethical use of personal information, particularly in regions where data protection regulatory frameworks remain underdeveloped (Sikder & Allen, 2023). Transparency and strict adherence to data protection laws are essential for building consumer trust and ensuring regulatory compliance (El-Annan & Hassoun, 2025).

ii. Substantial costs of AI system development and deployment: The significant financial investment required for advanced AI infrastructure and skilled personnel makes it challenging for smaller e-commerce businesses to compete and effectively implement AI-driven technologies (Liang & Hongtao, 2025). This financial barrier often leaves smaller e-commerce businesses at a competitive disadvantage relative to larger players with more substantial financial and technological resources (Nazir & Roomi, 2021).

iii. Bias in AI models: Biases within AI algorithms present risks to customer experience and inclusivity, as inadequately designed systems may generate inequitable outcomes that result in customer dissatisfaction or foster discriminatory behavior (Scatiggio, 2022).

iv. Complexity of AI technologies: The implementation and management of AI systems necessitate skilled personnel, which can create a significant obstacle for small and medium-sized enterprises (SMEs) with limited resources (Zavodna et al., 2024).

v. Low levels of digital literacy and inadequate internet infrastructure: Low digital literacy and insufficient internet infrastructure further impede the adoption of AI-driven services in emerging markets such as Nigeria (Alice & Ebuka, 2024). Many users often encounter difficulties in navigating these advanced technologies, and poor connectivity in rural and underserved regions exacerbates the problem (Correa & Pavez, 2016).

Empirical Review

Rahevar & Kaushik (2025) carried out a study on the impact of artificial intelligence innovation on e-commerce and their effect on business performance. This study examines the impact of artificial intelligence (AI) technology on e-commerce customer satisfaction, operational performance, and security management. This study employed descriptive research design incorporating both quantitative and qualitative approaches to assess the influence of AI on commercial business success. A total of 328 respondents participated in the study, comprising 220 e-commerce professionals and 108 regular customers from Gujarat State, India. Mixed sampling techniques including purposive and convenience sampling were used to gather insights from both operational and consumer perspectives. The findings indicated that AI-driven personalization have a strong positive effect on customer satisfaction and loyalty, demonstrating that personalized recommendation systems enhance customer experiences and strengthen long-term relationships with e-commerce platforms. Additionally, AI-based automation tools significantly improved operational efficiency while reducing organizational costs, confirming their essential role in performance enhancement. Furthermore, the deployment of AI-powered fraud detection systems enhanced security levels and increased customer trust in e-commerce platforms. High R^2 values for security and trust highlights the substantial role of AI in strengthening platform reliability and safeguarding transactions. Overall, the study demonstrated that AI adoption in e-commerce optimizes business operations, enhances security mechanisms, and contributes to sustained market success, underscoring AI's critical role in shaping the future of e-commerce.

Similarly, Kulkarni (2024) explored AI-powered innovations in e-commerce and their effect on business performance. This study examines the impact of AI-powered innovations on customer satisfaction, operational efficiency, and security within e-commerce platforms. A descriptive research design was adopted, incorporating both quantitative and qualitative methods to evaluate the influence of AI on overall business performance. The study sampled 300 respondents, including 200 e-commerce professionals and 100 regular customers from Bengaluru and Chennai in South India. A mixed sampling approach, combining purposive and convenience sampling, was employed to capture insights from both operational and consumer perspectives. The findings revealed that AI-driven personalization was found to have a strong positive impact on customer satisfaction and loyalty. High mean scores for satisfaction and loyalty, along with robust regression results, indicated that personalized recommendation systems enhance customer engagement and retention. AI-powered automation tools significantly improved operational efficiency and reduced costs. Regression analysis demonstrated that AI-driven automation accounts for a substantial proportion of improvements in efficiency and cost reduction, underscoring its critical role in optimizing

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business performance. Finally, AI-enabled fraud detection systems were shown to enhance platform security and strengthen customer trust. Positive regression coefficients confirm that these systems increase security levels, thereby fostering greater trust in e-commerce platforms. The high R^2 values for both security and trust further emphasize AI's pivotal role in shaping the future of e-commerce. Overall, the study highlights the transformative potential of AI innovations in e-commerce, demonstrating their capacity to enhance customer experiences, optimize operational processes, and strengthen security, ultimately contributing to improved business performance in the e-commerce sector.

Furthermore, Etuk et al. (2025) analyzed the influence of AI-driven services on customer perception in the Nigerian e-commerce sector. This study examined the influence of AI-driven services on customer perceptions within the Nigerian e-commerce sector. The study employed a survey research design, data were collected from 384 respondents representing diverse customer demographics across Nigeria. The findings indicated that AI-driven personalization significantly enhances customer satisfaction by providing relevant, convenient, and time-efficient shopping experiences, AI-powered customer service tools, including chatbots and virtual assistants were found to improve customer engagement through timely and effective support, AI technologies positively influenced customer trust and loyalty. However, concerns related to data privacy and transparency remained notable barriers to full adoption. The study highlighted the need to address digital literacy gaps, enhance the effectiveness of AI tools, and strengthen customer trust through robust data protection and transparency measures in order to maximize AI's potential within Nigeria's unique socio-economic context. Overall, the findings offer actionable insights for e-commerce platforms seeking to leverage AI for sustainable growth and long-term customer retention in emerging markets.

Methodology

This study adopted a survey research design which involves the use of structured questionnaire for data collection. 50 copies of questionnaire were administered to Nigerian customers who shop on e-commerce platforms such as Jumia, Konga, PayPorte. These e-commerce platforms are the most prominent in Nigeria that had adopted AI technologies in the business operations. The selection of the participants was based on purposive sampling technique. The questionnaire was divided three sections. Section 1 collected data on the demography of the respondents (gender, age, education level, digital literacy level, and frequency of online shopping), section 2 assessed AI-powered innovation in E-commerce such as AI-driven personalization, AI-powered automation, and AI-enabled fraud detection while section 3 assessed business performance of e-commerce platforms including customer satisfaction and loyalty, operational efficiency

and customer engagement, and customer security and trust. The indicators for each of the construct employed a 5-point Likert scale ranging from strongly disagree to strongly agree, where 1 = strongly disagree, 2 = disagree, 3 = moderately agree, 4 = agree, 5 = strongly agree. The data collected were analyzed using descriptive statistics and linear regression analysis on Statistical Package for Social Sciences (SPSS) software. The equation for the regression analysis is presented below:

$$\mathrm{BUP} = \beta_0 + \beta_1 \mathrm{AIP} + \beta_2 \mathrm{AIA} + \beta_3 \mathrm{AIF} + \varepsilon \quad (1)$$

Where:
BUP represents Business Performance proxied by customer satisfaction and loyalty, operational efficiency and customer engagement, and customer security and trust.
AIP represents AI-driven personalization
AIA stands for AI-powered automation
AIF represents AI-enabled fraud detection
β0 stands for Regression constant
β1, β2, β3 represent Coefficients of independent variables
ε stands for error term

Response Rate

A total of 50 copies of questionnaire were administered among the respondents. 41 copies were dully filled and considered valid for the purpose of this research.

Demography Characteristics of Respondents

Table 1 presents the demography of the respondents. Majority of the respondents are male (70.7%) while the female account for 29.3%. This is an indication that more men than women engage in online shopping. Most respondents fall within the 18-25 years age group (46.4%) followed by 26-35 years age group (39.0%). This indicates that younger and middle-aged online shoppers are the primary users of Nigerian e-commerce platforms. The 36-45 years age group and above 45 years age group represents 7.3% each, which account for a smallest proportion of the respondents. This implies that older aged customers have lower engagement with e-commerce platforms. The results of education level revealed that 63.4% of the respondents are undergraduate, 22.0% are postgraduate and 14.6% are high school students. As regards the digital literacy level of the respondents, 61% had medium digital literacy level, 22.0% had high digital literacy level and 17.0% had low digital literacy level. Furthermore, the results established that 53.7% of respondents engaged in online shopping 3-5 times in a month, 39.0% engaged in online shopping 1-2 times in a month and 7.3% of respondents engaged in online shopping 6-10 times in a month.

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Table 1: Demographic Information of Respondents

Category	Demographic Variables	Frequency	Percentage
Gender	Male	29	70.7
	Female	12	29.3
	Total	41	100
Age Group	18-25 years	19	46.4
	26-35 years	16	39.0
	36-45 years	3	7.3
	Above 45 years	3	7.3
	Total	41	100
Education Level	High School	6	14.6
	Undergraduate	26	63.4
	Postgraduate	9	22.0
	Total	41	100
Digital Literacy Level	Low	7	17.0
	Medium	25	61.0
	High	9	22.0
	Total	41	100
Frequency of Online Shopping in a Month	1-2 times	16	39.0
	3-5 times	22	53.7
	6-10 times	3	7.3
	Total	41	100

Source: Researcher's field survey (2025)

Effects of AI-driven Personalization on Customer Satisfaction and Loyalty

Table 2 shows the regression analysis of AI-driven personalization on customer satisfaction and loyalty. The R^2 value of 0.149 indicates that 14.9% of the variation in customer satisfaction and loyalty is explained by AI-driven personalization. AI-driven personalization has a significant positive effect ($\beta = 0.386$, $t = 2.610$, $p = 0.013$) on customer satisfaction and loyalty. This implies that for each unit increase in AI-driven personalization, customer satisfaction and loyalty is predicted to increase by 0.386 points.

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This concurs with the findings of Rahevar & Kaushik (2025) which established that personalized recommendation systems enhance customer experiences and strengthen long-term relationships with e-commerce platforms.

Table 2: Regression Results of Effects of AI-driven Personalization on Customer Satisfaction and Loyalty

Model Summary

Model	R	R Square	Adjusted R square	Std. Error of the Estimate
1	0.386[a]	0.149	0.127	2.06634

a. Predictors: (Constant), AI-driven Personalization

Source: Researcher's field survey (2025)

Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std. Error	Beta		
(Constant)	8.546	2.151		3.972	0.000
AI-driven Personalization	0.401	0.154	0.386	2.610	0.013

a. Dependent Variable: Customer Satisfaction and Loyalty

Source: Researcher's field survey (2025)

Effects of AI-powered Automation on Operational Efficiency and Customer Engagement

Table 3 shows the regression analysis of AI-powered automation on operational efficiency and customer engagement. The R^2 value of 0.073 indicates that 7.3% of the variation in operational efficiency and customer engagement is explained by AI-powered automation. AI-powered automation has an insignificant positive effect ($\beta = 0.270$, $t = 1.752$, $p = 0.088$) on operational efficiency and customer engagement. This implies that for each unit increase in AI-powered automation, operational efficiency and customer engagement is predicted to increase by 0.270 points. The fact that AI-powered automation is not significant implies that it is not a strong predictor of operational efficiency and customer engagement. This study is in tandem with Etuk et al. (2025) who revealed that AI-powered automation tools improve customer engagement through timely and effective support.

Table 3: Regression Results of Effects of AI-powered automation on Operational Efficiency and Customer Engagement.

Model Summary

Model	R	R Square	Adjusted R square	Std. Error of the Estimate
1	0.270[a]	0.073	0.049	2.27762

a. Predictors: (Constant), AI-powered Automation

Source: Researcher's field survey (2025)

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Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std. Error	Beta		
(Constant)	9.240	2.464		3.751	0.001
AI-powered Automation	0.306	0.175	0.270	1.752	0.088

a. Dependent Variable: Operational Efficiency and Customer Engagement

Source: Researcher's field survey (2025)

Effects of AI-enabled Fraud Detection on Customer Security and Trust

Table 4 shows the regression analysis of AI-enabled fraud detection on customer security and trust. The R^2 value of 0.191 indicates that 19.1% of the variation in customer security and trust is explained by AI-enabled fraud detection. AI-enabled fraud detection has a significant positive effect ($\beta = 0.437$, $t = 3.036$, $p = 0.004$) on customer security and trust. This implies that for each unit increase in AI-enabled fraud detection, customer security and trust is predicted to increase by 0.437 points. This corroborates the findings of Kulkarni (2024) which established that AI-powered fraud detection systems enhanced security levels and increased customer trust in e-commerce platforms.

Table 4: Regression Results of Effects of AI-enabled Fraud Detection on Customer Security and Trust

Model Summary

Model	R	R Square	Adjusted R square	Std. Error of the Estimate
1	0.437[a]	0.191	0.170	1.77438

a. Predictors: (Constant), AI-enabled Fraud Detection

Source: Researcher's field survey (2025)

Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std. Error	Beta		
(Constant)	9.142	1.679		5.444	0.000
AI-enabled Fraud Detection	0.376	0.124	0.437	3.036	0.004

a. Dependent Variable: Customer Security and Trust

Source: Researcher's field survey (2025)

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Conclusion

Artificial Intelligence has become a crucial driver of innovation within the Nigerian e-commerce sector**.** AI-driven personalization significantly improve customer satisfaction and loyalty by tailoring their shopping experiences to individual preferences. Also AI-powered automation tools such as chatbots, voice assistants, and virtual assistants play a crucial role in enhancing customer engagement and optimize operational efficiency. Also, AI-enabled fraud detection systems reinforced security by creating a safer environment for both businesses and consumers, which in turn enhance customer trust and reliability in e-commerce platforms. AI does not only improve business performance, it also nurture customer relationship management, build customer retention, and helps e-commerce businesses to stay competitive in a rapidly evolving marketplace.

Recommendations

Following the outcome of this study and the conclusion, the following recommendations are thereby proffered:

- E-commerce platforms should improve the functionality of AI-driven automation tools such as chatbots and virtual assistants by prioritizing inclusivity and integrating multilingual capabilities in order to enhance customer engagement and operational efficiency.
- E-commerce platforms should build customer trust and security by implementing rigid data protection measures and maintaining transparency in AI usage policies.
- Furthermore, e-commerce platforms should focus on refining their AI personalization tools by incorporating more diverse datasets to improve the relevance and accuracy of product recommendations.
- Also, e-commerce Platforms should also invest in regular updates and user feedback mechanisms to align their services with evolving customer preferences and technological trends.

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