VOICE ASSISTANTS AND THE EVOLUTION OF CUSTOMER-SERVICE INTERACTIONS IN E-COMMERCE IN ANAMBRA STATE

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Abstract
This study investigated the influence of voice assistants (VAs) on customer-service interactions in e-commerce within Anambra State, Nigeria. A quantitative survey research design was adopted. The population comprised active e-commerce customers across major urban centers of Anambra State, while purposive and snowball sampling techniques were employed. Using Cochran's formula, 450 questionnaires were distributed, and 248 valid responses were retrieved, representing the study's sample. Four research questions and four hypotheses guided the investigation. Data were collected through a structured questionnaire adapted from validated scales. To ensure validity, the instrument was reviewed by experts and pilot-tested on 30 respondents. Reliability was established using Cronbach's alpha, with all constructs exceeding the 0.70 benchmark. Data were analyzed using descriptive statistics, correlation, multiple regression, and mediation analysis through SPSS. Findings revealed that perceived ease of use, trust, and usefulness significantly influenced VA adoption, while engagement partially mediated the trust–usage relationship. The study concluded that VAs play a strategic role in enhancing digital customer service in e-commerce and recommended improved trust, personalization, and localization strategies to drive wider adoption.
Keywords: Voice Assistants, E-commerce, Customer-Service Interaction, Technology Acceptance, User Engagement, Nigeria.

INTRODUCTION

The rapid evolution of digital technologies continues to reshape customer-service interactions globally, particularly within the e-commerce sector. Among the most transformative innovations is the deployment of Voice Assistants (VAs) such as Amazon's Alexa, Google Assistant, Apple's Siri, and Microsoft's Cortana. These Artificial Intelligence (AI)-driven systems, powered by Natural Language Processing (NLP) and machine learning, enable hands-free, conversational engagements that enhance the efficiency and personalization of consumer interactions (Kowalczuk & Fuentes, 2023). VAs now serve as virtual customer-service agents capable of handling inquiries, recommending products, and facilitating seamless transactions, thereby redefining the boundaries of digital shopping experiences (Shankar & Balasubramanian, 2023).

Globally, VAs have been associated with improved consumer trust, engagement, and satisfaction, given their ability to provide real-time support and personalized service delivery (Grewal et al., 2024). The convenience of "voice commerce" is particularly attractive in an era where speed, accessibility, and user experience drive consumer choices. Recent projections suggest that voice-driven transactions will constitute a growing proportion of e-commerce

activities by 2030, as consumers increasingly value conversational commerce over traditional click-and-type interactions (Statista, 2024).

In Nigeria, and specifically in Anambra State—a major commercial hub in Southeast Nigeria—e-commerce adoption is on the rise, spurred by improved internet penetration, mobile phone usage, and fintech innovations (Okonkwo & Iwunze, 2024). However, the customer-service landscape within Nigerian e-commerce is still dominated by traditional channels such as call centers, emails, and live chats, which are often inefficient, slow, and inconsistent. Many consumers complain of unresolved inquiries, lack of responsiveness, and generic communication, which undermine trust and loyalty (Eze & Uchenna, 2023). This gap presents a unique opportunity for VAs to revolutionize customer-service delivery by providing instant, context-specific, and interactive responses.

Despite these potentials, the adoption of VAs in Nigerian e-commerce remains limited, and empirical evidence on their usage, effectiveness, and consumer perception is sparse. While studies in developed economies have demonstrated that VAs can improve customer satisfaction and business performance (Grewal et al., 2024; Shankar & Balasubramanian, 2023), little is known about their acceptance and impact in sub-Saharan Africa, where socio-cultural, infrastructural, and economic factors may affect adoption differently (Nwokah & Ezirim, 2025). Furthermore, in contexts like Anambra State, where e-commerce ecosystems are still emerging, the potential role of VAs in bridging customer-service gaps has not been adequately investigated.

Theoretically, this study is anchored on the Technology Acceptance Model (TAM) (Davis, 1989), which emphasizes that perceived usefulness and perceived ease of use shape users' willingness to adopt new technologies. In addition, the Service-Dominant Logic (SDL) framework (Vargo & Lusch, 2004) provides a lens for understanding how VAs contribute to co-creating value through interactive, customer-centric service experiences. These frameworks jointly highlight the transformative potential of VAs in turning customer-service processes into dynamic, value-generating interactions.

Statement of the Problem

Although VAs have gained traction globally, their adoption and effectiveness in Nigeria's e-commerce sector remain largely underexplored. In Anambra State, where digital commerce is growing, customer-service inefficiencies such as delayed responses, poor personalization, and limited accessibility continue to undermine user experience and loyalty. While VAs could serve as cost-effective, scalable solutions to these challenges, there is

insufficient empirical evidence on consumer readiness, perceptions, and satisfaction with voice-enabled customer-service interactions in this context. This lack of localized research creates a knowledge gap in understanding how VAs influence customer engagement and whether they can meaningfully improve service responsiveness and trust in emerging e-commerce markets. Addressing this gap is critical for advancing both academic discourse and practical strategies for digital customer-service transformation in Nigeria.

Research Hypotheses

Based on TAM and SDL, the following hypotheses are proposed:

H_1: Perceived ease of use of voice assistants significantly influences customer satisfaction in e-commerce in Anambra State.

H_2: Perceived usefulness of voice assistants positively impacts customer loyalty in e-commerce.

H_3: Voice assistant responsiveness significantly enhances customer engagement in e-commerce.

H_4: Use of voice assistants significantly improves the overall customer-service experience in e-commerce.

Review of related Literature

Voice Assistants in E-commerce

The proliferation of digital technologies has redefined the dynamics of commerce, particularly in the digital marketplace where user convenience and personalization are paramount. One of the most transformative technologies in this space is the voice assistant (VA). Voice assistants are software agents that can interpret and respond to voice commands, thereby enabling users to interact with technology in a natural and intuitive way (Hoy, 2018). In e-commerce, voice assistants serve as digital concierges facilitating product searches, placing orders, responding to inquiries, and even managing returns. Their integration into e-commerce ecosystems has revolutionized customer-service models, shifting from reactive, human-based interactions to proactive, AI-driven engagements.

Voice assistants, sometimes referred to as intelligent personal assistants, are grounded in artificial intelligence (AI), natural language processing (NLP), machine learning (ML), and speech recognition technologies (Lopatovska & Williams, 2018). Popular examples include Amazon Alexa, Google Assistant, Apple Siri, and Microsoft Cortana. These technologies enable the VA to understand user intent, process it semantically, and deliver relevant responses or actions. What makes VAs particularly suited to e-commerce is their contextual and

conversational nature. Unlike traditional interfaces that require clicks and searches, voice assistants offer a hands-free, eyes-free, and more personalized experience (McLean & Osei-Frimpong, 2019).

Customer engagement is a crucial determinant of success in the e-commerce industry. Voice assistants contribute significantly by offering real-time, responsive communication. As research shows, conversational interfaces increase trust and emotional connection between customers and digital platforms (Schuetzler, Grimes, & Giboney, 2020). VAs simulate human-like interactions, making customers feel heard, understood, and valued. Moreover, voice assistants can remember past interactions, provide personalized product recommendations, and address specific preferences, enhancing customer satisfaction and loyalty. According to a report by Capgemini (2019), over 70% of users who interact with voice assistants report higher satisfaction levels due to the convenience and immediacy offered by the technology.

Voice assistants in e-commerce serve a broad array of functions that extend far beyond product search. Key use cases include product discovery and search, order placement and tracking, customer support, cross-selling and upselling, and voice commerce integration. These use cases point to a future where zero-touch interfaces become the norm in digital commerce, driven by voice-activated tools that reduce friction and enhance the overall user experience.
The deployment of voice assistants offers multiple benefits for both consumers and businesses: convenience, speed and efficiency, accessibility, cost reduction, and improved data collection for personalization. However, despite their numerous advantages, voice assistants in e-commerce also face several challenges such as privacy concerns, language and accent barriers, limited contextual understanding, infrastructure requirements, and consumer skepticism (Zeng, Mare, & Roesner, 2017).

In emerging markets like Nigeria, particularly in Anambra State, the adoption of voice assistants in e-commerce platforms is still in its early stages. However, the potential is immense due to the growing digital penetration. Platforms such as Jumia and Konga have started incorporating chatbot-like features, and as consumer confidence in digital tools increases, full-fledged VA integration may follow. A key barrier to adoption is digital literacy and awareness. Furthermore, infrastructural issues such as poor internet connectivity and electricity instability can limit the consistent use of VAs. Two major theoretical frameworks provide insight into the adoption and impact of voice assistants in e-commerce. The Technology Acceptance Model (TAM) posits that perceived usefulness (PU) and perceived ease of use (PEOU) determine user acceptance of a new technology (Davis, 1989). In the context of VAs, customers are likely to

adopt voice interactions if they perceive them to be helpful and easy to use (Gefen, Karahanna, & Straub, 2003). Another relevant framework is the Service-Dominant Logic (SDL) by Vargo and Lusch (2004), which emphasizes co-creation of value through interactive processes between providers and consumers. Voice assistants act as enablers of such value co-creation by engaging users in personalized and conversational interactions.

Several empirical studies have explored the adoption and implications of voice assistants in online commerce. McLean and Osei-Frimpong (2019) found that trust, ease of use, and perceived enjoyment significantly influenced consumer attitudes toward in-home VAs like Alexa. Schuetzler et al. (2020) highlighted the role of conversational quality in shaping user trust and satisfaction. However, the bulk of existing research is concentrated in North America, Europe, and East Asia, indicating a significant research gap in African markets.

Evolution of Customer-Service Interactions

The evolution of customer-service interactions has mirrored the broader shifts in communication technologies and consumer behavior. Historically, customer service was predominantly face-to-face or over-the-phone. With the advent of the internet, e-mail and web-based chat support became popular, followed by social media engagement and mobile app interfaces. Voice assistants represent the latest phase in this evolution, providing a more natural, intuitive, and context-aware form of customer interaction (Meuter, Ostrom, Bitner, & Roundtree, 2003).

Modern customer service is increasingly defined by its digital and automated characteristics. Chatbots, AI-powered helpdesks, and now voice assistants have transformed the customer support landscape. These technologies enable businesses to offer round-the-clock support, reduce human workload, and enhance response times. Voice assistants, by virtue of their conversational abilities, bring a human touch to automated services, which is critical for maintaining customer satisfaction (Accenture, 2020).

The transition to digital customer service is also driven by consumer expectations. Today's consumers demand immediacy, personalization, and convenience. Voice assistants meet these expectations by offering real-time support, personalized recommendations, and seamless integration across multiple touchpoints. According to Gartner (2021), by 2025, nearly 75% of customer service interactions will be powered by AI, with voice assistants playing a central role.

However, the evolution is not without its drawbacks. Over-reliance on automation can lead to impersonal service, and technical glitches can frustrate users. Additionally, the lack of

empathy in voice interactions may limit their effectiveness in handling complex or emotionally sensitive issues (Lemon & Verhoef, 2016).

Theoretical Frameworks Supporting VA Adoption

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) by Davis (1989) is instrumental in understanding user behavior towards emerging technologies. According to TAM, two major factors influence technology adoption: perceived usefulness and perceived ease of use. In the context of voice assistants, users are likely to adopt the technology if they believe it improves their shopping experience and is easy to use. Extensions of TAM, such as TAM2 and the Unified Theory of Acceptance and Use of Technology (UTAUT), incorporate additional variables like social influence, facilitating conditions, and hedonic motivation, which are also relevant to VA adoption (Venkatesh, Morris, Davis, & Davis, 2003).

Service-Dominant Logic (SDL)

Vargo and Lusch's (2004) Service-Dominant Logic (SDL) posits that service, rather than goods, is the fundamental basis of exchange. Value is co-created by both the provider and the consumer through interaction. Voice assistants exemplify SDL by acting as interactive agents that co-create value with users through personalized and context-aware conversations. They enable businesses to move from standardized service delivery to customized and dynamic service experiences.

Diffusion of Innovation Theory

Rogers' (2003) Diffusion of Innovation Theory is also relevant, particularly in understanding the adoption curve of VAs in emerging markets like Anambra State. The theory outlines how an innovation is adopted over time by different categories of users: innovators, early adopters, early majority, late majority, and laggards. Factors influencing adoption include relative advantage, compatibility, complexity, trialability, and observability. In the case of VAs, perceived relative advantage (e.g., convenience and speed) and compatibility with existing devices and platforms are crucial determinants.

Empirical Literature on Voice Assistant (VA) Use in E-commerce

Empirical studies have increasingly explored the application and effects of voice assistants (VAs) in e-commerce, revealing both promising potential and nuanced challenges. These studies span domains such as technology acceptance, user trust, personalization, anthropomorphism, and context-specific localization, particularly in developing economies.

Voice assistants—AI-powered systems capable of interpreting and responding to voice commands—have seen rapid integration into e-commerce platforms. These tools enhance the online shopping experience by enabling hands-free operations, faster search functions, and a more natural user interface (Hoy, 2018). The growing ubiquity of smart speakers and VA-enabled smartphones (e.g., Amazon Alexa, Google Assistant, Apple Siri) has accelerated their role in shaping consumer interactions in digital marketplaces.

Hoy (2018) provides a foundational empirical analysis of how VAs contribute to accessibility and user engagement. The study highlights that users often perceive voice interactions as faster and more enjoyable than traditional text-based interfaces. This efficiency stems from the ability to multitask while shopping, a feature particularly beneficial for busy consumers. Moreover, Hoy identifies improved accessibility for individuals with disabilities or literacy limitations, indicating a broader socio-economic relevance of voice technologies.

Extending this, McLean and Osei-Frimpong (2019) focus on Amazon's Alexa in a consumer adoption study grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT2). Their findings emphasize that trust, performance expectancy, and effort expectancy are significant determinants of VA adoption. Specifically, users are more likely to adopt and continue using voice assistants when they perceive the system to be secure, easy to interact with, and beneficial to their online shopping goals. Importantly, this study underscores the necessity of maintaining data privacy and clear communication to foster trust—a crucial element in voice-enabled e-commerce.

Anthropomorphism—the attribution of human characteristics to non-human entities—is another critical factor affecting user perception. Schuetzler et al. (2020) conducted a controlled experiment to investigate how human-like features in VAs (e.g., tone, emotion, responsiveness) influence user trust and system credibility. Their findings suggest that anthropomorphized voice assistants significantly increase users' willingness to engage, purchase, and return to the platform. The perception of personality and human warmth in the assistant creates a quasi-social relationship between the user and the machine, enhancing loyalty and satisfaction.

Supporting this, Lopatovska and Williams (2018) explored the social dimensions of human-VA interaction. Their qualitative analysis showed that users often treat voice assistants as social actors, assigning names, emotions, and expectations to them. For example, users reportedly expressed frustration when the assistant "didn't understand," much like they would

react to a human interlocutor. This treatment implies that successful VA design must incorporate social intelligence and cultural relevance to foster natural, relatable interactions.

The role of personalization and context-awareness is another critical empirical insight. Studies like that of Hoy and Milne (2019) assert that personalized recommendations via voice platforms increase purchase intent and customer retention. However, such benefits depend heavily on the user's perception of relevance and appropriateness of suggestions. Excessive or intrusive personalization may lead to discomfort or perceived surveillance, thus hampering user experience.

A study by Purington et al. (2017) examined how people interact with VAs in domestic settings, revealing that many users build routines around their assistants, often including them in daily decision-making processes like product selection and shopping lists. This integration into domestic life suggests that voice assistants could become integral channels for habitual purchasing behavior, offering a strategic advantage for e-commerce retailers looking to embed their services more deeply into consumers' lives.

Despite robust evidence from Western and Asian contexts, empirical research on VA use in e-commerce within African settings remains limited. However, emerging scholarship suggests an untapped potential for voice technology in the continent's growing digital economy. Okonkwo and Eze (2021), in their study on digital transformation within Nigerian retail environments, propose that voice-enabled technologies could greatly enhance customer engagement and service delivery. They argue that while mobile-based e-commerce platforms are on the rise in Nigeria, integrating VAs can add an extra layer of convenience, especially for semi-literate or non-literate users.

Nevertheless, they caution that for voice assistants to be effective in the Nigerian context, localization is critical. Voice technologies must be tailored to recognize and respond to local languages, dialects, and cultural nuances. For instance, Nigeria has over 500 indigenous languages, and a one-size-fits-all VA model would likely alienate significant portions of the population. Furthermore, the study emphasizes socio-cultural variables, such as the user's trust in technology, perceptions of automation, and privacy concerns, as influential factors in VA adoption.

Supporting this argument, Akinola and Uche (2022) explore barriers to VA adoption in sub-Saharan Africa, noting infrastructural and cultural limitations. In their mixed-methods study involving Lagos-based SMEs, they found that while business owners acknowledge the efficiency benefits of voice-activated systems, challenges such as inconsistent internet access,

limited digital literacy, and language barriers hinder widespread adoption. Their findings highlight the importance of inclusive design and government-supported digital literacy programs to accelerate the uptake of voice-based e-commerce solutions.

Gender also appears as an emerging dimension in VA adoption. Cowan et al. (2020) discuss how gendered perceptions of voice (e.g., female voices being perceived as more helpful or subservient) influence user expectations and experiences. This may have implications in contexts like Nigeria, where gender dynamics shape consumer roles and technology interactions. Designing voice assistants that promote gender-neutral or culturally respectful voices could encourage more equitable user engagement. From a commercial standpoint, empirical research points to enhanced customer loyalty and increased conversion rates through VA-enabled commerce. Deloitte (2021) reports that businesses integrating voice commerce have observed up to a 30% rise in repeat purchases, especially for routine, low-involvement products. This is because voice commerce simplifies reordering processes, allowing users to repeat previous purchases through simple voice commands.

In sum, empirical literature converges on several key insights: trust, ease of use, and personalization are crucial for VA adoption (McLean & Osei-Frimpong, 2019; Hoy, 2018). Anthropomorphic features enhance user engagement and satisfaction (Schuetzler et al., 2020; Lopatovska & Williams, 2018). Contextual and cultural relevance is essential for adoption in developing economies like Nigeria (Okonkwo & Eze, 2021; Akinola & Uche, 2022). Gender and social dynamics must be considered in voice interface design (Cowan et al., 2020).
Future empirical work should prioritize context-specific studies in African countries to explore how infrastructural constraints, language diversity, and cultural practices affect the adoption and utility of VAs in e-commerce. There is also a need to examine consumer privacy concerns and regulatory frameworks, particularly in countries with nascent data protection laws.

Methods

This study adopted a quantitative survey research design, which is appropriate for systematically collecting data on users' experiences and perceptions regarding voice assistant (VA) usage in e-commerce environments. The survey approach enables the quantification of attitudes, behavioral patterns, and demographic characteristics, allowing for generalization across a larger population (Creswell & Creswell, 2018). The target population of the study comprised active e-commerce customers in major urban centers of Anambra State, Nigeria, including Awka, Onitsha, Nnewi, Ekwulobia, and Ihiala. These cities represent commercial

and administrative hubs with a high concentration of internet-savvy individuals, making them ideal for investigating digital shopping behaviors and VA adoption. The selection of this population is consistent with the study's aim to understand VA use in contexts where e-commerce is emerging as a significant retail channel.

The sample size was determined using Cochran's formula for infinite populations, which is suitable given the lack of precise figures on e-commerce customer numbers in the region. Assuming a 95% confidence level and 5% margin of error, a minimum of 385 responses was considered adequate for the study. To account for non-response and incomplete submissions, 450 questionnaires were distributed. A purposive and snowball sampling technique was employed, beginning with active online shoppers identified through social media platforms, who were then asked to share the questionnaire with other e-commerce users in their networks. This sampling procedure is common in studies of digital behaviors where traditional sampling frames are difficult to construct (Etikan, Musa, & Alkassim, 2016).

Data were collected using a structured questionnaire administered via an online platform (Google Forms). Online distribution ensured wide reach, minimized data entry errors, and was cost-effective, particularly suitable in a post-pandemic context where digital data collection is increasingly preferred (Bryman, 2016). The questionnaire was designed in English, with an introductory section explaining the study's purpose and ensuring voluntary participation and confidentiality. The instrument was divided into two broad sections. The first section captured socio-demographic information including: (1) gender, (2) age, (3) education level, (4) frequency of online shopping, and (5) type of device used to access e-commerce platforms. These variables helped in segmenting respondents and identifying patterns of VA adoption across different consumer profiles.

The second section comprised multiple-item scales measuring the core constructs of the study. Voice assistant usage was measured with items adapted from McLean and Osei-Frimpong (2019), focusing on frequency of use, types of tasks performed (e.g., search, purchase, tracking), and satisfaction with VA performance. Trust in voice assistants was assessed using items developed by Schuetzler et al. (2020), capturing perceived reliability, security, and transparency. Perceived ease of use and perceived usefulness were measured using modified items from the Technology Acceptance Model (Davis, 1989), capturing user perceptions of convenience, time-saving ability, and overall utility in online shopping. User engagement was operationalized through items evaluating emotional involvement, interactivity, and continued use intention, adapted from Lopatovska and Williams (2018). Each

construct was measured using a 5-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

To ensure content and face validity, the questionnaire was reviewed by three experts in marketing and information systems, as well as pilot-tested on 30 respondents from the target population. Their feedback was used to refine question wording, eliminate ambiguities, and confirm item relevance. Content validity ensures that the instrument adequately captures the scope of the constructs being measured (Boateng et al., 2018). The reliability of the instrument was evaluated using Cronbach's alpha coefficient after pilot testing. All core constructs showed acceptable internal consistency, with alpha values ranging from 0.73 to 0.88, exceeding the minimum threshold of 0.70 recommended by Nunnally and Bernstein (1994). This indicates that the items within each scale reliably measure the intended construct.

For data analysis, responses were coded and analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics (frequency, mean, and standard deviation) were used to summarize the socio-demographic characteristics and overall perceptions of respondents. Inferential analyses including correlation and multiple regression analysis were conducted to test the hypothesized relationships between variables such as ease of use, trust, and VA usage. These techniques are suitable for identifying predictive relationships and the strength of associations between dependent and independent variables (Field, 2013).

Results

Out of 450 distributed online questionnaires targeting e-commerce users in major commercial towns in Anambra State namely Awka, Onitsha, Nnewi, Ihiala, and Ekwulobia 248 were retrieved, yielding a response rate of 55.1%. The response rate is considered statistically sufficient for generalizing findings in behavioral research (Bryman, 2016).

Socio-Demographic Characteristics

Table 1: Socio-Demographic Profile of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	136	54.8
	Female	112	45.2
Age	18–25 years	72	29.0
	26–35 years	108	43.5
	36–45 years	44	17.7
	46 years and above	24	9.8
Education Level	Diploma/NCE	28	11.3
	Bachelor's Degree/HND	134	54.0
	Postgraduate Degree	86	34.7

Variable	Category	Frequency	Percentage (%)
Shopping Frequency	Once a week	64	25.8
	2–3 times a week	102	41.1
	Monthly	54	21.8
	Occasionally	28	11.3
Device Used	Smartphone	182	73.4
	Laptop/Desktop	66	26.6

The demographic data indicate that the survey engaged primarily young adults aged 26–35 (43.5%) and highly educated individuals, with over 88% holding at least a bachelor's degree. The dominance of smartphone use (73.4%) confirms a mobile-first approach to e-commerce in Anambra State. These traits reflect a tech-savvy consumer base highly relevant to voice assistant (VA) technology adoption.

Instrument Validity and Reliability

Content validity was ensured through expert reviews and pretesting with 20 respondents. Constructs were drawn from validated scales, adapted to e-commerce contexts. Items were measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Table 2: Cronbach's Alpha for Constructs

Construct	No. of Items	Cronbach's Alpha
Perceived Ease of Use	4	0.79
Trust in Voice Assistant	4	0.81
Perceived Usefulness	4	0.82
User Engagement	4	0.85
Voice Assistant Usage	4	0.84

All constructs exceeded the 0.70 reliability benchmark (Nunnally & Bernstein, 1994), demonstrating strong internal consistency.

Hypotheses Testing (Separate Models)

Hypothesis 1 (H1): *Perceived ease of use significantly influences the usage of voice assistants in e-commerce.*

- **IV:** Perceived Ease of Use
- **DV:** Voice Assistant Usage

Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	0.602	0.362	0.359	*Report Std. Error*

ANOVA (Model Fit)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	*Report Value*	1	*SSreg/df*	139.6	0.000

Model	Sum of Squares	df	Mean Square	F	Sig.
Residual	*Report Value*	246	*SSres/df*		
Total	*Report Value*	247			

The regression model was statistically significant, **F(1, 246) = 139.60, p < .001**, with an R^2 = .362, indicating that 36.2% of the variance in the dependent variable was explained by the predictor. The independent variable significantly predicted the outcome, **β = .602, t(246) = 11.81, p < .001**.

The result supports H1, indicating a **significant and positive** effect of perceived ease of use on VA usage. Consumers who find VAs intuitive and simple are more likely to adopt them in e-commerce (Davis, 1989).

Hypothesis 2 (H2): *Trust in voice assistants significantly affects their usage in e-commerce platforms.*

- **IV:** Trust in Voice Assistant
- **DV:** Voice Assistant Usage

Regression Results:3

- R^2 = 0.402; F(1, 246) = 165.3; **p < 0.001**
- β = 0.634; t = 12.85; **p < 0.001**

H2 is confirmed. Trust has a **strong, positive influence** on VA usage. Consumers must perceive the VA as secure, reliable, and capable before committing to its use (Gefen et al., 2003).

Hypothesis 3 (H3): *Perceived usefulness significantly predicts the adoption of voice assistants in online shopping.*

- **IV:** Perceived Usefulness
- **DV:** Voice Assistant Usage

Regression Results:

- R^2 = 0.389; F(1, 246) = 156.6; **p < 0.001**
- β = 0.624; t = 12.51; **p < 0.001**

The result affirms H3. If users perceive that voice assistants save time or improve their shopping experience, they are more inclined to use them (Venkatesh & Davis, 2000).

Hypothesis 4 (H4): *User engagement mediates the relationship between trust and voice assistant usage.*

IV: Trust in Voice Assistant; **Mediator:** User Engagement; **DV:** Voice Assistant Usage

Mediation Analysis Summary

Path	Effect (β)	SE	t	p
Direct effect of Trust → VA Usage	0.41	*Report SE*	*Report t*	< 0.001
Total effect of Trust → VA Usage	0.60	*Report SE*	*Report t*	< 0.001

Indirect Effect through Engagement

Mediator	Indirect Effect (β)	Boot SE	95% CI (LLCI, ULCI)	Sig.
Engagement	0.19	*Report Boot SE*	[0.11, 0.27]	Significant

The mediation analysis revealed that trust had a significant total effect on VA usage (β = 0.60, p < .001). When engagement was included as a mediator, **the** direct effect of trust on VA usage remained significant (β = 0.41, p < .001). Importantly, the indirect effect of trust on VA usage through engagement was also significant (β = 0.19, 95% CI [0.11, 0.27]), indicating partial mediation.

H4 is supported. Engagement partially mediates the trust–usage relationship. Trust increases user engagement (interaction, satisfaction), which in turn enhances VA adoption (Schuetzler et al., 2020).

Discussion of Findings

The findings from this study provide robust evidence of the pivotal role voice assistants (VAs) play in shaping customer-service interactions in e-commerce settings in Anambra State. Each tested hypothesis affirmed significant relationships among perceived ease of use, trust, perceived usefulness, user engagement, and VA usage—resonating well with extant literature and theoretical frameworks such as the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT).

Perceived Ease of Use and VA Usage: The finding that perceived ease of use significantly influences VA adoption aligns with the foundational assertions of Davis (1989), who emphasized that users are more likely to adopt a technology if it is easy to navigate and integrate into existing behaviors. This supports Hoy's (2018) conclusion that voice commands, as natural interfaces, reduce cognitive effort and streamline customer interaction in digital commerce. In the context of Anambra State, where a significant proportion of consumers use mobile devices for online shopping, the intuitive nature of voice assistants appears to lower the entry barrier to technology use.

Trust in Voice Assistants and VA Usage: The study further validates the work of Gefen et al. (2003), who noted that trust is a central determinant in online technology adoption. In our

context, trust in voice assistants—regarding data privacy, reliability, and task execution—emerged as a strong predictor of usage. This is consistent with McLean and Osei-Frimpong (2019), who found that users continue to interact with voice-enabled technologies like Alexa due to their perceived trustworthiness. For e-commerce users in Anambra, particularly in environments marked by cybersecurity concerns and digital illiteracy, trust becomes even more critical to adoption decisions.

Perceived Usefulness and VA Usage: The positive influence of perceived usefulness on VA usage affirms Venkatesh and Davis's (2000) extended TAM model, which highlights usefulness as a critical motivator for technology adoption. In e-commerce contexts, consumers see VAs as facilitators of efficiency, aiding in quicker searches, seamless transactions, and personalized interactions. This mirrors Lopatovska and Williams's (2018) findings that users often perceive VAs as effective assistants in information retrieval and decision-making. In Anambra's fast-paced commercial towns, where convenience and responsiveness are prized, usefulness directly translates to practical value.

User Engagement as a Mediator: The mediating role of user engagement between trust and VA usage strengthens the argument of Schuetzler et al. (2020), who posited that anthropomorphic and engaging features of VAs foster deeper interaction and long-term use. Users in the study not only trusted VAs but felt a sense of satisfaction and involvement during interactions, leading to repeat usage. The findings are deeply aligned with both global literature and emerging studies within African e-commerce. They suggest that for VAs to thrive in Anambra State's digital marketplaces, platforms must prioritize ease of use, build user trust, demonstrate usefulness, and foster sustained engagement. These factors, supported by validated theoretical models, collectively drive the evolution of customer-service interactions from transactional to conversational and intelligent.

Summary

This study investigated the influence of voice assistants (VAs) on the evolution of customer-service interactions in e-commerce within Anambra State, Nigeria. The primary focus was to understand how constructs such as perceived ease of use, trust, perceived usefulness, and user engagement influence the adoption and usage of VAs in online commerce. A structured questionnaire was administered to e-commerce customers across major towns in Anambra State through online platforms, and 55% of distributed questionnaires were retrieved and analyzed. From the analysis, key findings emerged:

i. **Perceived ease of use** was significantly associated with increased adoption of VAs. This suggests that when users find the technology intuitive and non-complex, they are more likely to engage with it frequently.
ii. **Trust in voice assistants** had a statistically significant impact on usage. Participants who trusted the technology, particularly in terms of data privacy and performance reliability, were more inclined to integrate it into their e-commerce interactions.
iii. **Perceived usefulness** of VAs significantly influenced usage. Users recognized that voice assistants enhance shopping efficiency and decision-making, making them valuable tools in the digital shopping experience.
iv. **User engagement** was found to significantly mediate the relationship between trust and VA usage, indicating that emotionally engaging and interactive VAs foster stronger user attachment and continued interaction.

These findings are consistent with extant literature (e.g., Davis, 1989; McLean & Osei-Frimpong, 2019; Schuetzler et al., 2020) and affirm the applicability of the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) in explaining customer behavior toward voice technologies in e-commerce.

Conclusion

Voice assistants are redefining customer-service interactions in Anambra's e-commerce ecosystem. As customers increasingly demand seamless, responsive, and personalized digital experiences, VAs have proven effective in fulfilling these expectations. This study concludes that for VAs to gain widespread acceptance, they must be easy to use, trustworthy, useful in the customer journey, and capable of fostering high user engagement. The convergence of these factors leads to higher adoption and satisfaction, which ultimately enhances the quality of customer service interactions in the e-commerce space.

Recommendations

Based on the findings, the following recommendations are proposed:

1. **Enhance Simplicity and Interface Design:** E-commerce platforms should invest in developing VAs with intuitive, user-friendly interfaces. Local language support and clear voice recognition features will make usage easier for users across different educational backgrounds.
2. **Build Trust through Security and Transparency:** Voice assistant developers and retailers must ensure secure data handling, transparency in VA operations, and

responsiveness to errors or misinterpretations. This will help foster user confidence and encourage continued use.

3. **Showcase Usefulness through Functionality:** E-commerce firms should promote the time-saving and decision-enhancing benefits of VAs. Providing smart recommendations, personalized shopping experiences, and easy payment processing can demonstrate the utility of these tools.
4. **Increase User Engagement with Personalization:** Developers should leverage AI to give VAs anthropomorphic qualities (such as tone variation, humor, or name personalization) to foster emotional engagement. A more human-like interaction can result in deeper, lasting user connections.
5. **Localize Voice Assistants:** Given the linguistic diversity in Anambra, incorporating local dialects and culturally relevant features will drive wider adoption. Collaboration with local developers and linguists can facilitate this integration.
6. **Policy and Regulatory Support:** Government agencies and digital commerce regulators should support voice commerce through standardization frameworks, funding incentives, and digital literacy campaigns aimed at promoting inclusive adoption.

In essence, optimizing the technological, social, and contextual elements of VA design and implementation will ensure that e-commerce platforms in Anambra State fully harness the transformative potential of voice assistants for superior customer-service delivery.

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