Redefining E-Commerce Experience: An Exploration of Augmented and Virtual Reality Technologies

Mohammad Al Khaldy, Department of Business Intelligence and Data Analytics, University of Petra, Amman, Jordan
Abdelraouf Ishtaiwi, Data Science and Artificial Intelligence, University of Petra, Amman, Jordan
Ahmad Al-Qerem, Computer Science Department, Faculty of Information Technology, Zarqa University, Zarqa, Jordan
Amjad Aldweesh, College of Computing and IT, Shaqra University, Shaqra, Saudi Arabia*
Mohammad Alauthman, Department of Information Security, Faculty of Information Technology, University of Petra, Amman, Jordan
Ammar Almomani, School of Computing, Skyline University College, Sharjah, UAE & Al-Balqa Applied University, Jordan
Varsha Arya, Department of Business Administration, Asia University, Taiwan & Department of Electrical and Computer Engineering, Lebanese American University, Beirut, Lebanon*

ABSTRACT

Integrating virtual reality (VR) and augmented reality (AR) technology into online stores enables more immersive and engaging shopping experiences, which is crucial for businesses to succeed in today’s competitive e-commerce market. These technologies offer unique, personalized experiences that consider the preferences and requirements of each customer. This research aims to understand better the most recent developments in AR and VR technology, and how these technologies might be used in e-commerce. Multiple databases were used to conduct a thorough search, and the inclusion criteria focused on using AR and VR in e-commerce. A total of 55 papers were found and categorized based on the research methodologies and issues used. Based on the findings of the research paper, it can be concluded that integrating AR and VR technologies in e-commerce has significant potential to improve various aspects of the online shopping experience.

KEYWORDS
Augmented Reality, eCommerce, Immersive Technology, Online Marketplace, Virtual Reality

DOI: 10.4018/IJSWIS.334123
*Corresponding Author

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INTRODUCTION

Immersive technology such as Virtual Reality (VR) and Augmented Reality (AR) have attracted much attention and have been widely adopted in various sectors, including the marketplace. While AR superimposes digital content over the real world to improve the user’s reality experience, VR refers to a computer-generated simulation of a three-dimensional environment that can be explored and interacted with. Immersive technology revolutionizes how consumers purchase, engage with products, and experience online retail environments in the marketplace context (dos Santos & Osório).

E-commerce has rapidly grown, but online shopping still lacks key elements of physical retail experiences. AR and VR are immersive technologies that can enhance e-commerce by providing more realistic product interactions and personalized experiences. For example, AR allows customers to visualize furniture in their homes or try on digital clothing (G. Singh, Malhotra, & Sharma, 2022). VR creates simulated retail environments for browsing and social interactions (S. Singh, Kumar, & Rao, 2022). Integrating these technologies into e-commerce can increase engagement, satisfaction, and sales (Deveci, Pamucar, Gokasar, Köppen, & Gupta, 2022). However, there are still challenges around technical capabilities, user acceptance, and integration with existing platforms. This paper analyzes recent research on AR and VR in e-commerce to highlight developments, benefits, and limitations.

It is impossible to overestimate the importance of VR and AR in online commerce. These technologies can completely transform online purchases by bridging the gap between the physical and digital worlds through immersive, interactive experiences (Roca, Hernández, Sancho, García, & Alesanco, 2020). Customers can virtually try on clothes, see furnishings in their homes, test makeup, browse virtual businesses, and more with VR and AR. Retailers can exhibit their items more engaging and individualized with the help of VR and AR, enhancing customer engagement, conversion rates, and satisfaction (Uhm, Kim, Do, & Lee, 2022).

As established shops and startups experiment with these technologies to improve their online presence and acquire a competitive edge, the adoption of immersive technology in the marketplace is picking up speed. To successfully integrate immersive technology in the marketplace, several factors must be carefully considered, including customer behaviour, user experience, technological issues, and commercial ramifications (Kshetri, 2018b). To fully use VR and AR in the marketplace and maintain an edge in the rapidly changing digital market, businesses must understand these requirements.

The current state of AR and VR technologies in the marketplace and commerce is rapidly changing as more companies adopt and integrate them (Scarle et al., 2012). Many well-known merchants and marketplace platforms are integrating VR and AR into their online shopping experiences to give customers more immersive and interactive ways to explore and interact with products. For instance, fashion businesses use VR and AR to enable virtual clothing try-on, furniture retailers let customers see how furniture might look in their homes, and beauty brands provide virtual makeup trials (Lee, 2020). New and established companies also use VR and AR to upend conventional marketplace business models and provide consumers with inventive and distinctive buying experiences. The increasing affordability of immersive technologies, technological breakthroughs, and shifting customer expectations toward more immersive and engaging online experiences drive the expanding acceptance of VR and AR in the marketplace (Kamoonpuri & Sengar, 2023). As a result, VR and AR are changing how customers shop online and the marketplace landscape, which presents new opportunities and problems for businesses in the digital age.

AR and VR applications can enhance e-commerce in areas like:

- **Product visualization:** 3D/AR product views improve assessment and reduce returns. IKEA Place lets customers preview home furniture at scale using AR (Palacios-Ibáñez, Navarro-Martínez, Blasco-Esteban, Contero, & Camba, 2023).
- **Virtual try-on:** AR allows digital clothing try-on, increasing confidence and lowering returns (Liu et al., 2020). Makeup brands like Sephora and L’Oreal offer virtual trials using AR.

Social shopping: VR facilitates interactions with other shoppers, experts, and influencers. Group AR experiences enable collaborative shopping (Roggeveen & Sethuraman, 2020).

Immersion: Realistic VR stores simulate brick-and-mortar shopping. Multisensory experiences with haptics and ambient audio boost immersion.

These capabilities enhance traditional e-commerce by allowing more informed purchases, personalized engagements, and interactive experiences closer to physical retail.

In summary, this research has the following objectives: to review the literature on the current state of VR and AR for e-commerce.

1. To identify key advancements and developments in VR and AR for e-commerce.
2. To identify the major challenges facing developing and implementing VR and AR in e-commerce.
3. To provide recommendations for future research in VR and AR for e-commerce.

This study aims to contribute to understanding how VR and AR may be effectively integrated into the marketplace strategies to promote consumer engagement, improve user experience, and drive business success by reviewing the existing research and finding gaps in the literature.

The remaining parts of this paper as follows: background about e-commerce, AR and VR technologies, and immersive-based marketplace are presented in section 2. The methodology applied in this research is given in section 3. Then, in section 4 demonstrate the research results, followed by a discussion in section 5.

Background

E-Commerce a Brief History and Milestones

The term “e-commerce,” often known as “electronic commerce,” describes the exchange of products and services over the internet. E-commerce originated in the early days of the internet, with the first documented online transaction taking place in 1994 when a Stanford University student utilized the internet to order a pizza (Kshetri, 2018a). Since then, the e-commerce market has experienced exponential growth, and by 2025, it is anticipated that online retail sales will exceed $7 trillion, see figure 1.

Figure 1. Retail ecommerce sales worldwide (Yuen, 2022)
E-commerce development has gone through several unique phases. The first stage of e-commerce, the “early days,” ran from the middle of the 1990s to the beginning of the 2000s. Online retail at the time was still in its infancy, with only a few companies offering products and services there. These early online stores mainly dealt with products like gadgets, music, and books (Feindt, Jeffcoate, & Chappell, 2002; Le & Liaw, 2017).

The “dot-com boom,” the second e-commerce stage, started in the late 1990s and continued until the early 2000s. This period saw a sharp rise in companies selling products and services online, and venture capital poured into the sector. Many of these companies specialized in selling digital material and other intangible products and services like software. However, many of these enterprises failed when the dot-com bubble burst in 2001 (Oliveira & Toaldo, 2015).

The third stage of e-commerce started in the middle of the 2000s and is still going strong today. The widespread acceptance of e-commerce by both consumers and businesses defines this period. Online retail sales have increased dramatically over the past few years, and more products and services are now offered. New business models and technology have also evolved, like social commerce and mobile commerce, figure 2.

The evolution of e-commerce with new technologies like artificial intelligence, virtual reality, and blockchain is part of the fourth phase of e-commerce, which is now underway. For instance, virtual reality increases product visualization and visualization, while AI chatbots and recommendation systems are used to better the consumer experience. Utilizing blockchain technology, internet transactions are now more secure and trustworthy (Li & Karahanna, 2015).

Since the first online transaction in 1994, e-commerce has substantially evolved. The early years, the dot-com boom, and widespread adoption are just a few of the distinct phases the business has experienced. Today, e-commerce is developing further thanks to the incorporation of cutting-edge technologies like blockchain, VR, and AI.

OVERVIEW OF IMMERSIVE TECHNOLOGIES

Ivan Sutherland first proposed the idea of “The Ultimate Display” in the 1960s, a head-mounted display that could completely immerse viewers in a virtual world (Steinicke & Steinicke, 2016). VR, however, was restricted to research facilities and military uses for many years due to financial and...
technological barriers. With consumer-grade VR gadgets like the Sega VR headset and Nintendo Virtual Boy, VR became increasingly well-liked in the 1990s (Bown, White, & Boopalan, 2017). However, these early attempts at commercializing VR were largely unsuccessful due to problems including motion sickness, poor visuals, and a lack of exciting content.

The first commercial AR gaming system, ARQuake, mixed virtual aspects with the actual environment, was when AR technologies started gaining popularity (Thomas et al., 2000). New opportunities for AR were made possible with the introduction of smartphones with in-built cameras and sensors, with uses ranging from mobile gaming to location-based services.

With the release of the Oculus Rift, a ground-breaking VR device that gave users high-quality immersive experiences, VR saw its breakthrough moment. This triggered a VR research and development boom and the arrival of well-known tech giants like Google, Microsoft, and Sony into the industry (Kenney & Pon, 2011).

Similar to how Pokémon Go, released in 2016 and quickly became a global hit, it helped AR become more widely known by showcasing its potential for gaming and location-based experiences. Following this, Apple and Google each released their respective ARKit and ARCore frameworks, giving developers the means to make mobile device augmented reality (AR) experiences (Oufqir, El Abderrahmani, & Satori, 2020).

Since then, technology, software, and tools for content creation have advanced, and VR and AR technologies have continued to grow quickly. Consumers now have easier access to VR thanks to the emergence of more potent and reasonably priced VR devices like the Oculus Quest and the PlayStation VR. With the emergence of wearable AR gadgets like Microsoft HoloLens and Google Glass, which have found uses in healthcare, education, and business, AR has also made tremendous progress (M. Zhang et al., 2018).

Generally, the broad use of VR and AR in various fields, including gaming, entertainment, education, healthcare, and eCommerce, has been made possible by breakthroughs in hardware, software, and content creation tools. Human-computer interaction is expected to change due to the ongoing development of VR and AR technologies since they will alter how we perceive and engage with the virtual and real worlds.

DEFINITION AND CONCEPTS OF IMMERSIVE-BASED MARKETPLACE

The idea of an immersive-based marketplace is to use VR and AR technologies in online purchasing. AR creates an immersive and engaging experience by enabling users to see and interact with virtual items in actual environments (Dubey, Bhardwaj, Upadhyay, & Ramnani, 2023). Virtual try-on for apparel and cosmetics, virtual house staging for properties, and virtual product visualization for home furnishings are just a few examples of immersive-based marketplace applications (Lee, 2020). Commerce powered by augmented reality can increase product visibility, lower returns, and boost customer engagement and satisfaction.

The creation of virtual retail environments where customers can browse, interact with products, and make purchases, on the other hand, is a key component of the immersive-based marketplace. Applications may include virtual marketplaces, showrooms, and storefronts. In addition to offering individualized suggestions and enabling social interactions with other users to foster a sense of presence and community, it can offer a distinctive and immersive buying experience (Dincelli & Yayla, 2022).

Product visualization, virtual try-on, virtual shopping environments, personalized recommendations, and social interactions are fundamental ideas behind an immersive-based marketplace. Users who visualize things can make better decisions since they can see how the products would seem in their real setting (Merle, Senecal, & St-Onge, 2012). Before making a purchase, customers can digitally try on clothing and cosmetics, which lowers returns and boosts customer happiness. Users can explore and interact with products in virtual shopping environments, which create a fully realistic and interactive shopping experience. Utilizing user information and
interests, personalized recommendations make targeted product recommendations. Social interaction commerce can include online purchasing with friends, sharing suggestions, and participating in online communities or events.

The adoption of immersive technologies in the marketplace has been sparked by technological breakthroughs, shifting consumer expectations, and intensifying commerce industry competitiveness. But some issues must be resolved, including user acceptance, technological constraints, privacy and security worries, and integration with already-existing e-commerce platforms. The necessity for top-notch technology and software and flawless interface with current commerce systems are examples of technological restrictions. For user acceptance, overcoming obstacles like unfamiliarity with immersive technologies and worries about privacy and security in virtual worlds is necessary. The smooth integration of AR and VR experiences with current online purchasing procedures, payment systems, and inventory management is required for integration with commerce platforms (Adams et al., 2018; Cannavo & Lamberti, 2020; Kulal, Li, & Tian, 2022).

To sum up, immersive-based marketplaces have become ground-breaking technologies that provide distinctive and engaging buying experiences. Product visualization, virtual try-on, virtual shopping environments, personalized recommendations, and social interactions are some concepts behind the immersive-based marketplace. The adoption of AR and VR in the marketplace is anticipated to continue expanding, impacting the future of online purchasing and redefining how customers interact with products in the digital space despite the obstacles that still need to be solved.

METHODOLOGY

Section 1 of this research addresses the requirement for this review. Based on the goals in Section 1, four research questions are suggested, and they are as follows:

1. What cutting-edge AR and VR technologies are currently being used in e-commerce?
2. How do these technologies improve the user experience in e-commerce?
3. What are the difficulties and restrictions of implementing and creating immersive-based e-commerce?
4. What are the potential research directions?

In this review study, we employed a comprehensive literature review methodology to examine the current state of immersive technologies for marketplace. Using appropriate keywords and phrases like “commerce and VR”, “commerce and AR”, “ecommerce and metaverse”, “marketplace and VR”, “marketplace and AR”, “marketplace and metaverse”. We thoroughly searched academic databases such as IEEE, EBSCO, ProQuest, ScienceDirect and SCOPUS. Additionally, we looked for related theses, dissertations, and conference papers. We looked over the publications’ titles and abstracts and chose those with the strongest connections to the subject of our study. We also reviewed the chosen papers’ reference lists for other pertinent material.

This selection aims to cover the domain and criteria literature and present a worldwide view of researcher efforts. Figure 3 demonstrates that the final set number of articles is 440, which resulted from ScienceDirect, IEEE, EBSCO, ProQuest, and EBSCO accounting for 34, 37, 73, 105, and 191 articles, respectively.

Two processes were conducted in this research: searching the literature sources and screening and filtering. These processes aim to select articles that are most related to our field. The screening and filtering process consisted of two stages. The first one eliminated the duplicates and unrelated articles by reading the title and abstract of each article. The second stage filtered the articles from the first stage through a full reading of each article. The authors who conducted these processes used the same eligibility criteria. We used a mix of keywords that contained “marketplace” OR “e-commerce”
OR “retail” With keywords such as “Virtual reality”, “Augmented Reality”, or “Metaverse” in different variations and combined by the “OR” operator. The exact query text is shown on top of Figure 2, as we can see as a result, we assessed 55 articles. Using this methodology, we could recognize significant trends, obstacles, and possibilities in the industry and get a thorough grasp of AR and VR’s state of the art in the marketplace.

RESULTS

This study found 440 articles from 5 databases: IEEE, EBSCO, ProQuest, ScienceDirect, and SCOPUS. The breakdown was explained in the previous section in figure 2. The total number of duplicated articles from the databases is 320 articles, which were excluded because of duplication. Then, after reading each of the 120 articles, we eliminated 65 articles, thereby having 55 articles left in the final list of included articles. To determine the general map for the final set of articles, we conducted a thorough reading to determine the major purpose of these articles. The applied diverse studies ranged from seeking to build AR and VR frameworks for online retail to evaluating designed frameworks for virtual marketplaces. These articles discussed various effects of using immersive technologies in the marketplace, such as customer behavior, product visualization, virtual try-on, customer experience, personalization, social shopping, and creating immersive experiences.

The 55 papers analyzed employed various research methodologies, explained in the table. Studies focused on assessing VR/AR technologies using lab experiments, surveys, field tests, and data analysis. User feedback highlighted desired features and adoption challenges. Conceptual models explained relationships between VR/AR attributes and consumer responses. Literature reviews summarized progress and open research questions.

CUSTOMER BEHAVIOR

According to current research, AR and VR technology significantly impact marketplace client behavior. With these technologies’ immersive and engaging shopping experiences, customers may become more engaged, satisfied, and likely to make more purchases. Customers may envision things in actual environments thanks to AR technology, which has been found to boost the perceived value of goods and lower the likelihood of returns. Customers can explore and interact with products in a simulated retail environment created by VR technology, which has been found to boost the sensation of presence and emotional engagement in the buying experience. Also, clients may receive a more
accurate and thorough portrayal of products thanks to AR and VR technologies, which may help them make better purchasing decisions.

(J.-H. Kim, Kim, Park, & Yoo, 2022) looked into how AR and VR influence user perceptions and actions in virtual shopping environments. Moreover, they discussed the difference between AR and VR in how they influence consumer behavior reactions. Their research finds that VR shows significant mediation for relationships between vividness, sensory brand app experience, and interactivity and attitude towards technology, while AR does not; sensory brand app experience, attitude, and behavioral intention are significant in both AR and VR settings.

(Barta, Gurrea, & Flavián, 2023) use a mixed method approach in AR to reduce cognitive dissonance and promote purchase behaviors by minimizing the apparent similarity of alternatives and
uncertainty of over-choice. Use AR reduces cognitive dissonance through perceived similarity and confusion caused by over-choice; lower cognitive load enhances purchase intentions and willingness to pay more for the product; AR improves decision-making in commerce shops with a wide assortment of similar products.

(Xue, Parker, & Hart, 2023) Examine AR value to physical fashion retail, define the most effective form, and assess AR’s impact on consumer behavior. This paper discovers that participants have a positive attitude towards AR shopping adoption, improving consumer satisfaction and boosting purchase intention, and designing useful AR apps that provide substantial functional benefits with enjoyment-oriented elements will encourage consumers to engage in high-street physical retail.

(van Esch et al., 2019) Explores the influence of Anthropomorphism on consumers’ perceptions of AR in the retail environment. They improve that Anthropomorphism influences consumers’ experiences of AR and their attitudes toward brands that use it. Brands benefit when managers make AR a key part of the retail experience. As a result, this study offers significant theoretical and application-based consequences for managers.

Anastasia & Yulianti (Anastasia & Yulianti, 2021) proposed using a conversational Virtual Agent to address issues related to system recommendation, lack of human presence, and privacy concerns. The solution was implemented in Shopee e-commerce by modifying their product recommendation system. They observed that Virtual Agent could help e-commerce gather user preferences, provide clear and direct information about user data usage, and help users find products and promotions. Usability testing showed that the prototype was efficient and helpful for user experience.

(Min, 2020) used VR to design an e-commerce logistics distribution path display system that can improve the timeliness of updating path information, correct display errors, and improve reliability. The system involved hardware and software components and was tested using simulation. The system’s design involved hardware (logistics vehicle positioning module using GIS and GPRS) and software (3D modeling software to establish the background of path display) components. The system was tested using simulation. He finds that it improved the timeliness of updating path information, corrected display errors, and improved reliability. Simulation results showed that the display error of the system was less than 5%.

(Kowalczyk, Siepmann, & Adler, 2021) Built a consumer behavior model and compared augmented reality and web-based product presentations. The study determines that while web-based product presentations are more practical, augmented reality (AR) generates better immersion and delight. Affective and cognitive reactions to the qualities of the AR help shape behavioural responses (reuse and buy intention). Retailers should improve system quality, product informativeness, and reality congruence for media to be more useful and interactive.

(Fang, Zhang, Şensoy, & Magnenat-Thalmann, 2014) Proposed a five-sense feedback-oriented reputation mechanism for virtual marketplaces (V.M.s). The proposed reputation method is preferred by users over conventional ones in virtual machines (V.M.s). Five-sense feedback is used in the reputation process, and it is both objective and subjectivity aligned as necessary. Compared to cutting-edge approaches, the subjectivity alignment for reputation computation (SARC) methodology can more precisely model sellers’ reputations.

**PRODUCT VISUALIZATION (VIRTUAL STORE)**

Product visualization and virtual stores are two important benefits of immersive technologies in the marketplace. Product visualization refers to the ability of customers to see and interact with products in a more realistic and detailed way. With VR and AR, customers can view products from multiple angles, zoom in on specific features, and even “try on” or “test drive” products virtually. This enhanced product visualization can help customers make more informed purchase decisions and reduce the likelihood of returns. It can also provide a more engaging and immersive shopping experience, increasing customer satisfaction and loyalty.
(Papagiannidis, Pantano, See-To, & Bourlakis, 2013) Examine determinants of users’ simulated experience in virtual stores and its impact on engagement. The experiment compares users’ perceptions of a standard 2D online store and an enhanced, immersive 3D store. Immersive 3D environments have more potential to rival traditional shopping in terms of experience, leading to higher sales and consumer satisfaction.

(Zeng & Richardson, 2016) establish design rules for virtual-commerce platforms, enabling designers to create effective retail environments. The research results argue that consumers expect a vivid shopping environment with authentic product features; Hedonically motivated consumers are more open to v-commerce; Consumers aged 18-34 consider interactivity, personalization, and social networking critical.

(R. Kim, 2022) proposes a UX design model for virtual shopping as an alternative to in-store retail during and after the pandemic. The author demonstrates that VR shopping can be a new turning point for shopping, focusing on psychological stimulation and social shopping.

(Hassouneh & Brengman, 2011) Examine the value of virtual worlds (V.W.s) in the internationalization of small and medium-sized businesses (SMEs). The paper offers a paradigm for internationalization utilizing V.W.s. It assesses their potential as a source of market knowledge, a tactical tool for internationalization, and a business platform for actual, tangible products. The study suggests a plan for SMEs to establish prosperous enterprises in metaverses, leveraging virtual worlds as a source of market knowledge, a tactical tool for internationalization (testing marketing programs and developing brands), and a business platform for real-world and virtual goods.

VIRTUAL TRY-ON

Virtual try-on is another benefit of VR and AR in the marketplace, which allows customers to “try on” products virtually before making a purchase. Virtual try-on technology uses AR to superimpose a virtual image of the product onto the customer’s real-world environment, allowing them to see how the product looks on them without actually having to try it on physically.

(Javornik et al., 2021) Investigate how AR characteristics can support luxury brands and identify four strategic approaches for deploying AR. The authors argue that AR enhances luxury attributes and enables brands to enhance customer journeys and brand experiences. Luxury brands deploy AR through four strategic approaches: ephemeral elevation, auratic amplification, bespoke personalization, and effortless continuation.

(Lu & Smith, 2010) compare the usability of an augmented reality (AR) e-commerce system with a traditional e-commerce system. The results show that the AR e-commerce system can provide more information and direct experiences to online customers, allowing for better purchasing decisions.

(Chavan, Kamtankar, Jagtap, Patil, & Pakale, 2021) They developed an AR system that allows users to virtually try electronic appliances at home to enhance the shopping experience. Their methodology compares Marker-based and markerless techniques to place realistic 3D models and provide a virtual try-on experience. The authors argue that AR system helps businesses grow, maintain social distancing, and bridge the gap between online and offline shopping experiences.

(Periyasami & Periyasamy, 2022) Examine the metaverse’s influence on existing business models, focusing on the fashion and retail industry. The authors show that the metaverse offers promising opportunities for marketing and advertising, and its connection with Gen Z will benefit businesses in the future.

(Billewar et al., 2022) Focus on three-dimensional (3D) E-Commerce technology, examining how VR and AR can help address limitations and improve E-Commerce operations. The study explores how VR and AR can offer more precise product information in 3D E-Commerce environments and enhance the virtual store experience with AR assistants.

(Gonçalves, Meirinhos, Filipe, Melo, & Bessa, 2022) Investigates the effects of product contextualization and gender in an immersive VR application where users can explore a commercial
product with a “hands-on” experience. The authors determined that Contextualization and gender did not impact any dependent variables. Therefore, presenting a product in its Context does not significantly benefit it. Thus, opting for a neutral context would be preferable to save computational costs and the human resources necessary to build and run higher-complexity environments to contextualize the product.

(Yu & Pan, 2013) proposed to improve online clothing sales by reconstructing the virtual environment of e-commerce clothing and dividing the system into three subsystems: cloth exhibition, cloth fitting, and cloth designing. The authors suggested dividing the e-commerce clothing system into three subsystems to enhance user experience and service content. The proposed division can help improve user experience and the online clothing sales process.

(Wang, Xue, Mei, & Li, 2013) use Cult3D and information management technologies for 3D interactive online product displays. Authors Implement Cult3D and information management technologies for creating high-quality, small file-size web3D models.

Chodos and Stroulia (Chodos & Stroulia, 2008) present a system combining 3D visualization with product information for an enhanced shopping experience. The developed system uses Second Life and retailer APIs and examines its economic viability.

(Alzayat & Lee, 2021) Study the capacity of the consumer to touch things, a crucial element of one’s retail shopping experience, which has been the subject of numerous research. A VR retail experience was compared to an internet retail website. The results prove that the VR retail environment is more effective than an online retail website in creating hedonic and utilitarian shopping value.

(Elordi, Segura, Goenetxea, Moreno, & Arambbarri, 2012) They have developed innovative interfaces for a web-based virtual reality platform to improve the e-shopping experience. Research of traditional marketing and sales techniques and their transfer to 3D VR environments; use of Web 3D technologies. Thus, 3D VR environments provide a more intuitive e-shopping experience, like visiting a real shop.

Reference (Wu, Xie, Yao, & Lin, 2010) proposes a 3D e-commerce platform framework using VR and VRML. Design and propose a framework based on SOA and Struts2, combined with VRML. A complete solution for designing a 3D e-commerce platform using VR and VRML is presented.

**CUSTOMER EXPERIENCE**

AR and VR technologies can create a virtual environment where customers can visualize how products will look or even try them out virtually. This can increase customer engagement, reduce the need for physical product displays, and decrease the likelihood of returns due to mismatched expectations. Additionally, these technologies can provide customers with personalized product recommendations based on their shopping history and preferences, further enhancing the overall shopping experience.

(Vaidyanathan & Henningssson, 2023) Outline guidelines for applying augmented reality’s design thinking methodology for better consumer experiences. The outcomes explain that the design thinking method is useful in designing effective AR services—corresponding Principles for implementing the design thinking method in the specific Context of AR for enhanced customer experiences.

(Fan, Chai, Deng, & Dong, 2020) discusses the influence of AR adoption on online consumers’ product attitudes from a cognitive perspective. Authors discovered that environmental embedding and simulated physical control could reduce consumers’ cognitive load, enhance their cognitive fluency, and improve their product attitude. Product type can moderate the influence of AR characteristics on cognitive fluency.

(Martínez-Navarro, Bigné, Guixeres, Alcañiz, & Torrecilla, 2019) Studied the effectiveness of different VR formats and devices in a virtual store environment and analyzed the relations between a sense of presence, brand recall, and purchase intention. They determine differences in purchase intention depending on the VR format and device used, with no differences in the sense of presence.
and affect by VR format and device. VR influences consumers’ purchase intention in virtual stores through emotions, a sense of presence, the virtual environment’s effect, and brand recall.

(Zhao, Baghaei, Schnack, & Stemmet, 2021) Investigate the effects of store atmospherics on user experience, stress levels, and behaviour in a virtual store environment. Authors argue that the Presence/absence of avatars can be an important aspect of store atmospherics and a potential antecedent of perceived presence in a simulated retail environment.

(Fu et al., 2021) designed a virtual avatar called Miebo to replace real avatars for live streaming and present a set of highly feasible virtual avatar application schemes. Authors employ the parameters that produced the most effect on Miebo’s emotions of “Sadness”, “Happiness”, “Surprise”, and “Anger” were “Upset”, “Grin mouth”, “Open mouth big”, and “Eyes closed”, respectively. The platform “Virtualfull” allowed users to create their virtual avatars.

(Shi, Yu, Da, Chen, & Zeng, 2019) Train reinforcement learning policies for better commodity search in Taobao using a simulator (Virtual-Taobao) learned from historical customer behavior data. The results show that Virtual-Taobao faithfully recovered essential properties of the real environment, and policies trained purely in Virtual-Taobao demonstrated significantly superior real-world performance compared to traditional supervised approaches through online A/B tests.

(Prisha, Neo, Ong, & Teo, 2017) proposes a conceptual e-commerce security framework to combat identity theft and protect user identity while supporting e-commerce activities and enhancing user experience. Authors argue that the conceptual security framework was designed to be secure and robust and enhance user experience while transacting in e-commerce websites.

(Alimamy & Al-Imamy, 2022) Explore the relationship between the perceived quality of the AR experience on customer perceived value and the mediating influence of attitude on this relationship. They found that experience quality created through AR directly impacts customer attitudes, and attitudes towards AR positively influence customer perceived value.

(Papadopoulou, 2007) demonstrates how virtual reality may improve the customer experience compared to traditional web stores and help build customer trust in online purchasing settings. This study develops a prototype virtual shopping mall environment examined in a lab setting using an empirical study based on a model for increasing confidence in e-commerce. The author specifies that customers would prefer VR shopping environment over a conventional web store and would facilitate the assessment of the vendor’s trustworthiness.

(Poushneh & Vasquez-Parraga, 2017) Investigated how augmented reality (AR) affects retail user experience (UX), user happiness, and purchasing intent. This study found that by affecting several product quality characteristics, AR substantially impacts UX, affecting user happiness and purchase intent. Four user experience characteristics—pragmatic quality, aesthetic quality, hedonic quality through stimulation, and hedonic quality by identification—are combined to generate the third-order formative construct, UX.

(Meegahapola & Perera, 2017) Development of a smartphone-based Mixed Reality Application (SPMRA), to explore how the shopping experience of customers can be enhanced through Mixed Reality (M.R.), Augmented Reality (AR), and Virtual Reality (VR). They are convinced that with a low-cost, simple-to-use, smartphone-based mixed reality platform, SPMRA can gamify the entire in-store buying experience.

(Jeong, Yi, & Kim, 2022) Propose a ground-breaking business plan for a brand-new electronic commerce platform that integrates live commerce with metaverse using digital twin technology to get beyond the drawbacks of current online buying. The suggested platform attempts to improve the shopping experience by empowering vendors to provide creative content and plan concept spaces to build brand recognition and devoted followings. The suggested new intermediate platform improves the shopping experience by enabling customers to interact virtually with brands and product features. Sellers might establish concept locations and provide creative content in the metaverse to build brand recognition and a following of devoted customers.
(N. Kim & Lee, 2021) investigate how consumers experience the retail environment visually and establish a foundation for deeper insights into visual merchandising strategies. The authors employed eye-tracking and virtual reality experiments to examine visual attention and emotional arousal in reaction to spatial and design features in an immersive retail environment. They looked at real-time indicators of customer interest and emotional reactions during the retail experience. The research results show that consumers' visual attention and emotional arousal responded differently to specific areas of interest according to different spatial arrangements in the sales and service areas. Statistically analyzed gender differences in consumer responses and correlated between visual attention and emotional arousal.

PERSONALIZATION

Personalization in terms of AR and VR in the marketplace refers to the ability of these technologies to provide a customized and tailored shopping experience for individual users. With the help of AR and VR, commerce retailers can collect and analyze data on user behaviour, preferences, and interests. This data can then be used to create personalized recommendations, product suggestions, and offers for each user, enhancing their overall shopping experience and increasing the likelihood of purchasing.

(Sina & Wu, 2022) explore the impacts of retail greenery and correlated colour temperature on consumers' emotions, perceptions (pleasure, arousal, perceived merchandise quality), and responses (satisfaction and purchase intentions) in virtual reality fashion stores. Shopping orientations (utilitarian/hedonic) were also examined as a moderator. The authors find that consumers prefer a retail greenery application over a non-retail one. Cool lighting creates higher arousal than warm lighting. Significant interaction effects exist between a retail greenery application and correlated colour temperature and moderating effects of shopping orientations (utilitarian/hedonic).

(Khatri et al., 2022) investigates the possibility of classifying consumers based on the Big Five personality domains using their behaviour while performing different tasks in a virtual shop. The study aims to recognize consumers’ personality traits using behavioural measures from VR hardware, including eye-tracking, navigation, posture, and interaction. The study finds that open-mindedness can be classified using eye gaze patterns, extraversion is related to posture and interactions, while conscientiousness and negative emotionality require a combination of signals. Combining all measures and tasks provides better classification accuracy for all personality domains. The study indicates that a consumer’s personality can be recognized using the behavioural sensors included in commercial VR devices during a purchase in a virtual retail store.

(Chittaro & Ration, 2000) Explore the introduction of adaptive features in VR interfaces for e-commerce. The authors present and discuss ADVIRT, an adaptive VR store prototype. ADVIRT demonstrates the potential of adaptive features in VR interfaces for e-commerce applications.

(Tan, Chandukala, & Reddy, 2022) Investigated AR ‘s impact on online retail sales and implemented an Empirical investigation using data obtained from an international cosmetics retailer. (Alam, Susmit, Lin, Masukujjaman, & Ho, 2021) A structured questionnaire survey of 233 retail stores in Malaysia; a PLS-based structural equation modelling technique was used to analyze the data to explore the factors affecting adopting AR technology in the retail sector. The results show that other elements, such as perceived utility, attitude, competitive pressure, customer pressure, perceived cost, and technological understanding, have a substantial impact on the desire to employ AR technology in retail stores, aside from external support and trading partner pressure; The association between self-efficacy and behavioural intention, as well as the relationship between perceived usefulness and behavioural intention, are both mediated by attitude.

(Chiu, Ho, Yu, Liu, & Mo, 2021) Identified ARRA user benefits predictors in the retail food chain. Herein, User satisfaction and user continuance intention mediate the relationship between quality perspective (system, service, and information quality) and user benefits. ARRA can be used to create effective marketing strategies.
SOCIAL SHOPPING

VR and AR can help social shopping by providing customers with a more immersive and interactive shopping experience, allowing them to engage with products and connect with other shoppers more socially.

(Pizzi, Scarpi, Pichierri, & Vannucci, 2019) Determines four measured outcome variables: Hedonism, utilitarianism, store satisfaction, and perceived assortment size. Authors argue that VR has a negative impact on satisfaction that is moderated by perceived assortment size. VR elicits utilitarianism and hedonism, which mediate the impact of the channel on store satisfaction differently but equally. Overall, consumers reported high levels of all measured outcome variables after exposure to the VR experience. In addition, behaviours in the VR-based and physical stores compare quite well.

(Gadalla, Keeling, & Abosag, 2013) Conceptualized Metaverse Retailing service quality (MR-SQ) determinants. The authors explore four overarching determining elements of MR-SQ: customer service, product dimension, store dimension, and 3D platform dimension. MR-SQ presents opportunities for retailers to enhance social experience, responsive service, and creative co-production opportunities. They also provide a framework for guidance for retailers to improve service quality in 3D Metaverse stores, as well as for future research.

(Papagiannidis, Pantano, See-To, Dennis, & Bourlakis, 2017) Examine determinants of users’ simulated experience in virtual stores and its impact on engagement. Authors find that Immersive 3D environments have more potential to rival traditional shopping in terms of experience, leading to higher sales and consumer satisfaction.

(Wenzel & Copeland, 2022) Explores how knowledge of social responsibility within the apparel industry creates a sense of social responsibility concern, leading to purchase intention, while moderated by using and perceiving virtual reality (VR) and augmented reality (AR). The study aims to understand the willingness of Gen Z to use AR and VR tools within their shopping experience. The research finds that Gen Z is willing to use AR and VR tools within their shopping experience, given more experience with these technologies. Overall, AR and VR can shape social responsibility concerns and purchasing intentions within the apparel industry.

(Tian & Wang, 2022) develop a neural network algorithm for sales dynamics prediction of virtual community knowledge sharing in cross-border e-commerce. The proposed sales prediction method had higher accuracy than exponential regression and shallow neural networks. The deep learning prediction method combining unstructured data such as images provided a more accurate sales prediction method for short life cycle products in e-commerce and an effective deep learning method for management practices.

(X. Zhang, 2021) designed a new retail marketing strategy combining virtual reality and 5G mobile communication by combining virtual technology and 5G mobile communication technology to design and realize a 3D virtual fitting system set.

(Erdmann, Mas, & Arilla, 2021) They have investigated the influence of immersion (experiential dimension), AR devices, technological complexity (technical dimension), subjective norms (social dimension), and perceived value of AR smart glasses (ARSG) on the intention to make an online purchase using AR technologies. Two types of ARSG from industry leaders and AR retail apps were used in an experiment by the ESIC Tech Lab to create an augmented value-based adoption model. 253 people’s survey responses were used. The main findings show that the perceived value of ARSG for online purchases is increased by technical complexity while the net value of consumers’ economic cost-benefit analyses is decreased. Consumers’ online purchase intentions are significantly influenced favourably by the experiential and social AR components (immersion and subjective norm), which are superior predictors to the purely economic cost-benefit analysis, (through usefulness and difficulty). Additionally, it has been discovered that consumer technical innovation directly increases online purchase intention through ARSG.
(Phillips Melancon, 2011) They have applied an Online survey methodology with a sample of 106 reality- and fantasy-based V.E.s users to determine how to customize communications for a successful marketing plan by examining motivational, usage, and demographic differences in virtual environments (V.E.s) across reality-based platforms and fantasy-based ones. According to the study, reality VE users are more engaged in VE than fantasy users and are more driven to seek out social connections. Fantasy users are likelier to be male, younger, and participate in VE with family members. The accomplishment and manipulation of others drive them. Marketing results may be improved if communications are tailored according to VE type.

CREATE AN IMMERSIVE EXPERIENCE

AR and VR technologies have the potential to create immersive experiences in e-commerce. These technologies can provide customers with a virtual environment to explore and interact with products in a simulated 3D environment. AR technology allows customers to visualize products in real-life settings, such as trying on clothes or placing furniture in their homes. This creates a more immersive and personalized shopping experience, which can increase customer engagement and satisfaction. VR technology can create a fully immersive virtual shopping experience, allowing customers to browse and interact with products like a physical store. This can provide a unique and memorable shopping experience, increasing customer loyalty and encouraging repeat purchases. Overall, AR and VR technologies have the potential to create immersive and engaging shopping experiences in e-commerce, which can lead to increased sales and customer satisfaction.

(Palacios-Ibáñez et al., 2023) Evaluate the products simultaneously and independently in a non-immersive environment and an AR, VR experience. Authors maintain that Visual media influences product perception, with differences more pronounced in specific product categories; immersive media can highlight some product attributes, and joint evaluation can minimize differences.

(Yim, Chu, & Sauer, 2017) Explores the effectiveness of AR as an e-commerce tool using two products (sunglasses and watches) and compares it to a conventional website. Authors find communication benefits by generating greater novelty, immersion, enjoyment, and usefulness, resulting in positive attitudes toward medium and purchase intention, compared to web-based product presentations. Immersion mediates the relationship between interactivity/vividness and the AR condition’s outcome variables (usefulness and enjoyment). Participants’ subjective opinions about AR are examined through opinion mining.

(Falk, Le, & Morandotti, 2022) Discuss the challenges and opportunities in developing immersive multisensory experiences for the metaverse. Authors suggest stimulating other senses, incorporating affective computing, and brain-computer interfaces are essential for truly immersive experiences.

(Zeng & Richardson, 2016) investigate whether customers prefer an immersive virtual reality format for information search rather than a static picture format in an e-commerce context. The proposed model suggests that confirmation, enjoyment, and perceived diagnostic of presentation formats can directly affect online customers’ continuance intention to use the website.

(Swilley, 2016) Analyzed the benefits of using metaverse and augmented reality technologies in the Context of electronic commerce and mobile commerce to investigate how augmented reality and the metaverse may improve the online purchasing experience and foster engagement, enthusiasm, and brand experience. The author recommended that retailers develop more robust online shopping experiences using metaverse and augmented reality technologies to enhance user engagement and experience.

FINDINGS AND DISCUSSION

This study aims to present updated and state-of-the-art findings on the research about the evaluation of immersive technologies in the marketplace to highlight research trends. In this section, we will condense the study’s results and offer solutions to the issues it raised, described in Section 3 of the paper.
Q1: What Cutting-Edge AR and VR Technologies are Currently Used in the Marketplace?

Innovative Augmented Reality (AR) and Virtual Reality (VR) applications in commerce have attracted much interest recently. Based on a thorough examination of 55 publications obtained from five significant databases, including IEEE, EBSCO, ProQuest, ScienceDirect, and SCOPUS, we have examined the current state of AR and VR technologies employed in the industry in this review paper.

The results of this study showed that numerous studies that have been applied to the field of augmented reality and virtual reality technologies in the market have concentrated on a variety of topics, including consumer behaviour, product visualization, virtual try-on, customer experience, personalization, social shopping, and creating immersive experiences.

Customer behaviour is one of the primary areas where AR and VR technologies have been discovered to have a big impact. These technologies’ immersive and interesting purchasing experiences may boost client engagement, contentment, and the likelihood of making more purchases. By enabling buyers to picture things in genuine settings, AR technology has been demonstrated to increase the perceived value of products, which can lower the risk of returns. In contrast, it has been discovered that VR technology, which enables customers to explore and interact with objects in a virtual retail environment, increases the feeling of presence and emotional engagement in the purchasing experience.

In addition, it has been shown by the studies examined in this review paper that AR and VR technologies can positively affect consumers’ decision-making and purchase intentions. By increasing perceived similarity and reducing cognitive load, AR has been demonstrated to minimize cognitive dissonance and uncertainty in choosing products, increasing buy intentions and readiness to pay more for goods. Additionally, it has been discovered that using augmented reality in physical fashion retail increases customer happiness and purchase intent, particularly when augmented reality apps offer significant functional benefits and enjoyment-oriented components.

It has been demonstrated that AR and VR technologies can help virtual or conversational agents handle problems with system recommendations, a lack of human presence, and privacy concerns in e-commerce platforms regarding personalization and social buying. To improve the overall user experience, virtual assistants can collect user preferences, offer straightforward information about data usage, and assist customers in finding products and promotions. Additionally, it has been discovered that incorporating VR into the design of e-commerce logistics distribution path display systems improves the timeliness of updating path information, corrects display flaws, and increases reliability, all of which can ultimately lead to a more efficient and seamless online shopping experience.

The studies considered in this review paper have also shown how crucial system quality, product informativeness, and reality congruence determine how consumers react to AR and VR technologies on the market. As an illustration, the effectiveness of AR systems and the clarity of product presentations in AR can substantially impact consumers’ affective and cognitive responses, which in turn can affect behavioral responses like the intention to reuse and buy. Similarly, a more precise and successful strategy for virtual marketplaces has been proposed: aligning subjective views of vendors’ reputations with objective feedback-oriented reputation mechanisms.

Overall, this review paper’s findings indicate that cutting-edge AR and VR technologies are being applied to improve consumer behavior, decision-making, personalization, and social purchasing. It is crucial to keep in mind that there are still areas in need of additional research and development, including enhancing system quality, product informativeness, and reality congruence, as well as addressing issues with privacy concerns, human presence, and data usage in online marketplaces.

Future studies in this area can investigate the market potential of AR and VR technologies and enhance the development of immersive and interesting shopping experiences for consumers.

Q2: How Do These Technologies Improve the User Experience in e-Commerce?

The results of this study show numerous significant ways that e-commerce user experiences are being improved by AR and VR technologies. Thanks to AR and VR technologies, customers can view and
engage with things more engagingly and realistically. In order to digitally try on clothes, imagine furniture in their homes, or see how the makeup would look on their faces, users of AR can overlay digital content onto the real world. Contrarily, virtual reality (VR) creates a wholly imaginary world where consumers can peruse and engage with products in a made-up retail environment. The user experience is improved by the more realistic visualization and interaction of products, which results in an engaging and interactive shopping experience.

Additionally, shopping experiences that are individualized and tailored can be made possible through AR and VR technologies. Users’ preferences can be gathered, browsing and purchase patterns can be examined, and personalized product recommendations can be made using AR and VR. This degree of personalization can result in more relevant and customized purchasing experiences, boosting consumer happiness and encouraging additional purchases. Users can virtually try on garments or accessories that suit their body type, skin tone, or preferred styles, for example, which helps them make purchases with greater assurance.

Furthermore, AR and VR technologies can enhance the user experience by lowering uncertainty and cognitive strain. For instance, AR can give consumers access to information such as product details, costs, and reviews in real time, removing the need for customers to conduct separate online searches for this data. Visitors of VR may also benefit from a more natural and realistic method to browse a virtual store, with spatial audio and visual cues directing visitors to various sections or goods. As a result, people may regard shopping as more accessible and more convenient, with less cognitive load and effort necessary for decision-making.

Additionally, AR and VR technology can improve group purchasing occasions. AR can allow customers to share AR experiences with others and ask for feedback or recommendations, making purchasing more participatory and social. Through virtual social spaces where users can connect, share recommendations, and participate in virtually shared events or activities, VR can help encourage social buying. The social component of AR and VR technologies can increase user engagement and satisfaction in e-commerce on a whole new level.

Finally, AR and VR technologies can reduce e-commerce’s prevalent problem of product returns. AR and VR can help users make more educated purchase decisions by enabling them to digitally try on things or picture them in their physical context, leading to fewer returns due to difficulties with size, fit, or style. Enhancing customer happiness and lowering operational return expenses can help consumers and retailers.

This review paper shows that AR and VR technologies enhance the user experience in e-commerce by allowing for more immersive and realistic product visualization, facilitating personalized and customized shopping experiences, lowering cognitive load and uncertainty, enhancing social shopping experiences, and potentially reducing product returns. It is crucial to remember that there are still obstacles to be resolved, such as technology constraints, privacy issues, and user acceptance problems. Integrating AR and VR technologies into e-commerce platforms can advance with continued research and development, ultimately giving consumers more engaging, practical, and delightful buying experiences.

**Q3: What are the Difficulties and Restrictions of Implementing and Creating an Immersive-Based Marketplace?**

The technical limits of AR and VR technologies are one of the main challenges in creating an immersive-based market. Although AR and VR have grown quickly in recent years, hardware constraints remain in device processing speed and battery life, tracking and sensing precision, and graphics and visual effects calibre. The seamless integration of AR and VR into an e-commerce platform may be hampered by these technological constraints, which may also impact the overall user experience and immersion.

The intricacy of producing and managing immersive material presents another difficulty. Much content must be created and managed for immersive-based marketplaces, including 3D modelling, texturing, animation, and interactivity. Producing realistic, high-quality, immersive material can take
time, money, and specialized knowledge. Additionally, maintaining and managing immersive material can be difficult because it frequently needs to be updated and maintained to maintain accuracy, relevancy, and performance. This may be a hindrance for smaller companies or platforms with fewer resources.

**Q4: What are the Potential Research Directions?**

Virtual commerce is a fast-developing discipline with exciting potential for further study. It includes VR and AR technology in the context of e-commerce. To identify possible study directions in virtual commerce, we identified and examined the existing literature to highlight areas in this review paper with a high potential for further investigation and development:

1. **User experience in virtual commerce:** This research focuses on comprehending and enhancing the user experience in virtual shopping environments. This includes examining user preferences, behaviours, and perceptions, assessing the influence of immersive technologies on consumer decision-making, and creating guidelines for user-centred design.

2. **Personalization and recommendation in virtual commerce:** This research area focuses on creating personalized and context-aware recommendations in virtual shopping environments, utilizing user preferences and contextual data to present specialized product recommendations, and assessing the efficiency of personalized recommendations in promoting customer satisfaction and loyalty in virtual commerce.

3. **Trust, privacy, and security in virtual commerce:** This research area is concerned with establishing trust and ensuring privacy and security are maintained in online shopping environments. This includes examining user trust in virtual commerce platforms, developing privacy-preserving technologies, and figuring out how users feel about data security and privacy.

4. **Aspects of virtual commerce that are social and collaborative:** Include developing social features and functionalities for virtual shopping experiences as well as investigating cooperative shopping scenarios in virtual environments. This research focuses on how social cues and influences affect consumer behavior in virtual commerce.

5. **Optimizing virtual shopping experiences for various devices and platforms:** Assessing the efficacy of omnichannel strategies in virtual commerce, and understanding the dynamics and challenges of integrating virtual commerce into multichannel and omnichannel retail strategies are the main objectives of this research direction.

6. **Implications of virtual commerce for ethics, law, and society:** This research focuses on how virtual commerce affects ethics, law, and society. It also addresses legal and regulatory issues like consumer protection and intellectual property rights.

**RECOMMENDATIONS AND FUTURE RESEARCH**

Despite the promise of AR and VR for enhancing e-commerce, particular challenges were uncovered:

- **Technical constraints:** Issues with visual quality, tracking, and hardware limit immersion. Content creation and management require extensive resources.
- **User adoption:** Consumers may be hesitant about new interactions or concerned about privacy. Unfamiliarity with VR/AR poses adoption barriers.
- **Platform integration:** Integration with existing e-commerce platforms demands alignment of VR/AR experiences with backend systems.

Ongoing improvements in VR/AR software, computing capabilities, and content creation tools can help overcome these limitations. User education and personalized experiences can promote adoption. Testing integrations and aligning with e-commerce infrastructure will enable deployment at scale.
Based on the findings, key recommendations include:

- **Enhance content quality**: More realistic models, physics, lighting, and textures boost realism.
- **Improve system performance**: Reducing latency and improving tracking enhances immersion.
- **Align reality congruence**: Congruence between real and virtual worlds influences acceptance.

Future research directions include exploring multisensory experiences, affective computing for personalized engagements, next-generation interfaces, and emerging metaverse applications.

**CONCLUSION**

This research reveals AR and VR have massive potential for transforming online shopping through enhanced visualization, interactivity, and immersion. Real challenges exist around technology constraints, user adoption, and integration complexity. However, rapid progress is being made. E-commerce providers should actively explore AR and VR to engage customers in more compelling, personalized shopping journeys. These technologies provide opportunities to redefine digital commerce in the coming decades. This study offers a thorough overview of the quickly developing topic of using augmented and virtual reality in e-commerce. The paper’s 55 research review results, which included product visualization, virtual try-on, customer experience, personalization, social buying, and immersive experiences, reveal many crucial areas where AR and VR might profoundly alter the e-commerce market. These innovations could increase client engagement, boost sales, and provide e-commerce companies a competitive edge in the online market. Using AR and VR to produce even more realistic and captivating experiences in virtual environments is a crucial study avenue for further investigation.

Overall, the review study’s findings highlight the importance of ongoing research and funding in AR and VR technologies for e-commerce. E-commerce businesses must keep ahead of the curve by utilizing these technology improvements to improve the online buying experience as customer needs change in the digital world. Incorporating AR and VR technology in e-commerce is a tremendous opportunity for businesses to stand out and prosper in the digital marketplace since it can profoundly change how we interact with virtual worlds.

**CONFLICTS OF INTEREST**

The author declares that there is no conflict of interest regarding the publication of this paper.

**ACKNOWLEDGMENT**

Author Amjad Aldweesh would like to thank the Deanship of Scientific Research at Shaqra University for Supporting this Research.
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