

Impact of AR/VR on Online Sales

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Abstract: *AR and VR technologies experience intensive evolution that radically alters the environment of online sales with the possibility to provide customers with immersed, interactive and personalized shopping experiences. The changes of interactive reality/virtual reality (AR/VR) on online sales are discussed in the context of how these technologies affect consumer decision-making, visualization of the product, and generate possibilities to new variants of e-commerce businesses. By thoroughly examining the existing tendencies in the industry and with the use of examples, this study determines the following major advantages: customer engagement, enhanced conversion rates, and customer satisfaction. Moreover, the paper discusses difficulties experienced by businesses in implementing AR/VR on their online platforms such as current technology, expenses and consumer adjustment. The paper sets out a conclusion that, the AR/VR technologies offer a bright future of online sales through the transformation of how goods are advertised and sold.*

Keywords: Augmented Reality, Virtual Reality, Online Sales, E-commerce, Consumer behavior, Product Visualization, Customer Engagement, Conversion Rates, Immersive Shopping, Technology Integration

I. INTRODUCTION

The emergence of the digital technologies has significantly transformed the retail sector, particularly, the sale online. Among the most outstanding additions are Augmented Reality (AR) and Virtual Reality (VR) that have presented new models of engaging consumers with products within the digital space. With online shopping still bearing the ascendancy, companies are investigating such immersive technologies to provide improved and personalized services to their consumers, narrowing the difference between reality and virtual realities. AR overlays computerized data over the real world whereas VR is a fully immersive 3 dimensional environment, which can both be used to introduce the consumer to innovative experiences. (Alvarez, R., & Gonzalez, S., 2020).

This paper will address the profound effect of the AR/VR technology on online sales and how it has affected consumer-buying behavior and made more sales conversions, among other positive contributions to customers. With consumers demanding more and more personalized and engaging experiences while shopping, businesses are finding ways to stay on par such as with AR/VR, producing a more dynamic, consumer-centric marketplace. There are however challenges that have been presented by the adoption of these technologies in terms of costs, technological infrastructure and consumer readiness. Based on this study, we expect to evaluate the advantages, challenges, and the possible future of AR/VR in relation to e-commerce. Through recognizing these effects, companies can be better prepared in the future of online shopping and fine tune their strategies to accommodate immersive technologies that will render growth and customer retention. (Bai, X., & Zhang, T., 2018)

The paper will explore how AR/VR is going to shift the online shopping experience and what the strategies can be to increase the efficiency of these tools in online selling.

1.1 Evolution of Online Retail: The Digital Shift

Online retail has just continued to make the transition towards a more personal, convenient and immersive shopping experience. Over the years, e-commerce has transformed itself to advanced levels that bring an interactive feature where customers can browse, buy and review products without necessarily leaving their homes. Digitization in retail has been enabled by the revolution in internet connection, mobile, and the systems, as well as increased interest by the customers



in the convenience of online retailing.(*Anderson, C., & Fuchs, M., 2016*). Plain transactional processes found in early e-commerce platforms are being superseded, with technologies such as artificial intelligence (AI), big data analytics, and in recent years, Augmented Reality (AR) and Virtual Reality (VR), allowing online retail to create more rich and interactive experiences. A challenge to this growth is that consumers now demand the same level of immersion in their internet experience as they receive with in-store shopping, and that is encouraging companies to employ the use of these new technologies. This digital transformation is changing the way consumers shop and as a result, businesses are having to employ new methods to remain competitive in this fast changing digitalized shopping environment.(*Banerjee, S., & Liu, M., 2017*)

1.2 Introduction to Augmented Reality and Virtual Reality

One of the technology categories that had experienced a boost in the recent years is AR and VR, mostly in the context of gaming, education, and more and more in e-commerce. AR deals with superimposing the virtual over the physical, often using a computerized device such as a smart-phone, tablet, or AR smartglasses. The technology enables the consumer to view and interact with virtual things in their actual world to give a better product visualization and a more interactive shopping experience. (*Brum, C., & Patel, R., 2021*)As an example in online retail, AR offers customers the ability to virtually "try on" clothes, visualize furniture within their homes or see how makeup will look on their faces prior to making a purchasing decision. VR however, is a fully virtual system that isolates the real world altogether. VR produces fully immersive three-dimensional worlds where consumers can have a look around the product/entire store as though they were there in person. These have been highly effective technologies in optimizing the customer experience to an extent that the traditional online retailing cannot. With e-commerce taking a new direction, the AR and VR technologies are becoming a vital part of the business as consumers are getting more demanding in the digital world.(*Bhardwaj, P., & Varma, A., 2019*).

1.3 The Growing Role of AR/VR in E-Commerce

The application of Augmented Reality (AR) and Virtual Reality (VR) in e-commerce is fast growing and is transforming consumer buying trends when shopping online. Such advancements are finding their way to the online platforms, to create a more interactive, engaging and immersive experience when connecting with the products. AR is also allowing customers to see and experience products in their actual world setting: an example is trying on clothes, viewing furniture in their residence or even attempting a design option in real-time.(*Chen, X., & Lee, H., 2020*). On the contrary, VR is blurring time and space and making consumers viscerally experience the world and environments around them, walking through virtual stores, being able to touch 3D products or interact with a simulation that will help them better understand the features of a product. The faster that businesses are implementing these technologies, the more critical that they are in online retail, in terms of product discovery, consumer engagement, and the eventual sale. Retailers are not only trying to create memorable shopping experience but they are also using AR/VR to help increase consumer confidence to make a purchase by providing virtual try-before-you-buy. The increasing use of AR/VR in online shopping is transforming the way that retail works and it helps to eliminate the restrictions posed on online storefronts.(*Cao, J., & Liu, X., 2016*).

1.4 Understanding the Impact of AR/VR on Consumer Behavior

VR and AR technologies have a tremendous impact on consumer behavior as they change the system of customer interaction with products and purchasing decision-making. Traditionally online shopping has been a one sided exercise whereby the people relying on images, text and reviews to make good choices. Nevertheless, AR and VR are featuring more immersive and interactive experiences that allow learning more about products prior to a purchase. (*Cheng, Z., & Li, W., 2022*). AR enables the consumer to experience products through a virtual context, meaning they get a visual representation of how a product will appear or work in their own premises; this enables them to feel more certain and also feel more satisfied with a purchase. VR, however, provides an opportunity to experience a product within a completely fake scenario, where people can test the products and change variations of the products, as well as attend virtual educational shows, which can resemble real life situations. The change in consumer behavior has been described as higher interaction, less uncertainty, and the increased probability to purchase because of the help of AR/VR experiences



to erase the boundaries of online shopping. The technologies can also manipulate the emotional attachment to products, even making them exciting and personal. Finally, AR/VR are the effective instruments to alter consumer demands that force business owners to adjust to a more action-oriented online sales environment.(*Choi, K., & Kim, B., 2021*)

1.5 The Need for Enhanced Shopping Experiences in the Digital Age

As the world of e-commerce develops, shoppers are requiring more and more sophisticated and interactive buying experiences. The current online commerce environment demanding far more than a static catalogue of product photos and descriptions is rapidly transforming the status quo with regard to online shopping. Customers have come to demand personal, interact with and immersive experiences simulating a tactile and sensory experience in a real store. The development of mobile technologies, AI, and advanced data analytics allow retailers more opportunities than ever before to deliver a suite of actionable customer-centric shopping experiences.(*Chun, M., & Oh, J., 2023*). VR and AR stand front and center with this change in the digital landscape, providing transformative capabilities in enabling online shopping by way of better visualizations of products, accompanying the opportunity to virtually try products (think virtual make-up testing), and the ability to immersively shop in a wholesome sense. They are the technologies that also fill the gap between on-and in-store shopping and enhance the convenience, speed and accessibility of shopping process, in general. The desire to have shopping experiences enhanced in the digital age is fueled by the need to have more individualized shopping experiences, less uncertainty about the decision to be made and have more pleasurable and time-saving shopping experiences. Due to this, it is the responsibility of businesses to adopt the use of these latest technologies so as to ensure that they stay on top of their businesses and address the various needs of the contemporary consumers.(*Eren, F., & Demir, A., 2022*)

1.6 How AR/VR Bridge the Gap Between Physical and Virtual Shopping

AR and VR technologies are of particular importance in creating a link between real and online shopping experiences. The e-commerce version of traditional online shopping cannot provide sensory and experience aspects of the conventional store shopping where shoppers have the opportunity to touch and feel, and experience products before purchasing them. The use of AR technology to superimpose the image of virtual objects over real-life situations bridges that divide as consumers can view how a car or a new chair would look in their home or what a pair of shoes would look like on the person.(*Fitzgerald, P., & Nash, D., 2020*). This builds a unique experience that integrates the ease of online shopping and the commercial delight of a brick retail. VR, however, provides a fully immersive world, so customers can virtually visit a virtual store or showrooms where they can interact with the products as though they are in the real world. Through the power of these immersive, interactive platforms, AR and VR online shopping is increasing consumer confidence and satisfaction and resulting in greater customer engagement and conversion rates as it makes online shopping feel realistic and personalized.(*Gupta, R., & Bhattacharya, S., 2018*).

1.7 Consumer Expectations and Technological Advancements

The needs of consumers are changing at a very fast rate due to technological changes in e- trade. Digital technologies are in a constant process of advancement, therefore, consumers demand further improved, immersive, and individual shopping experiences. The emergence of AI, machine learning and data analytics raised the objectives of personalization to a considerable height, and now, AR and VR are further increasing these goals.(*Haller, M., & Rodriguez, C., 2021*). Customers do not merely want to browse through products over the web anymore, they want to experience them as they would offline store with a level of engagement that only an offline store may have given them in the past. This has been catalyzed by hardware, including smartphones, VR headsets and AR glasses, which are becoming more common and accessible to the masses. Consumers too are demanding quicker and more user-friendly experiences, instantaneous feedback and an easy to navigate path that AR and VR capabilities alone can provide. As these technologies figure it out further, consumers are likely to require even more in the way of accurate customization of their products, enhanced virtual fitting rooms, and more realistic virtual representations of the store itself. Electronic commerce companies should continually be abreast of these expectations in order to be competitive and to keep tech-savvy consumers who will always be seeking a new advanced experience.(*Han, D., & Wang, L., 2023*).



1.8 The Benefits of AR/VR in Online Sales

The potential of transferring AR and VR technologies online selling has numerous meaningful advantages both to businesses and consumers. Among the major benefits is the improved product visualization. With the help of AR, customers have the opportunity to see how the products will look like in the environment they live in, which enhances purchase confidence and minimizes uncertainty. As an example, furniture stores have implemented AR that allows customers to place the furniture in their houses virtually to check how it fits in place and how well it goes with the space before making their purchase.(*Hernandez, S., & Gomez, L., 2019*). VR, in turn, offers the full-featured shopping experience where the customers get to survey the whole virtual stores or products collections in 3D, making their purchase decisions more qualified. Among the other main advantages include the minimization of returns. By enabling the customers to virtually experience the product prior to buying one, AR and VR can result in products that satisfy the clients and reduce returns and exchanges. In addition, the technologies have the ability to enhance customer experience by providing the customers with memorable and one-of-a-kind shopping experiences that make customers want to visit the stores and stick around. As businesses add AR/VR, they can provide an extremely customized shopping experience, which helps them develop a competitive advantage in an already-competitive online retail environment. This capability to involve the customers into something more active and emotionally involved leads to greater sales and customer satisfaction as well.(*Kim, M., & Kang, J., 2020*)

1.9 Challenges in Integrating AR/VR into E-Commerce Platforms

With apparent advantages of using AR and VR in e-commerce, it has various challenges when it comes to integrating the technologies into current platforms. The implementation cost can be cited as one of the biggest hindrances. AR/VR technology experience creation can be expensive in terms of technology, infrastructure, and skills, and therefore smaller companies with limited resources may not be in a position to make the investments. Also, there exist the technical barriers involving interoperability with various systems and devices.(*Lee, S., & Lee, J., 2017*). AR/VR programs may be restricted by a shortage of available hardware, e.g., VR headsets or smartphones with AR capabilities, among which not all consumers will have access. The second problem is that it is hard to design and update the AR/VR content, because this needs some special skills on 3D modeling, software development and user experience. Additionally, businesses and consumers have a learning curve to go through, since not every person is used to working with AR/VR capabilities. Turning over a new leaf can be another obstacle to businesses educating the consumer and pushing them to adopt. Lastly, we have the issues of privacy and data security since AR/VR experiences tend to collect personal and behavioral data, this necessitates businesses to comply with privacy guidelines and secure that information is guarded.(*Liu, Y., & Wu, L., 2022*).

1.10 The Future of Online Sales: AR/VR as a Game-Changer

AR and VR are going to change the future of online sales considerably. With time as these technologies develop further, they will provide more enhanced and sleek shopping experiences. The emergence of AI and machine learning also in conjunction with AR/VR is one of the main directions of its growth as it leads to even more personalized and dynamic retail experiences. To illustrate, it can be suggested that with AI it will be possible to develop adaptive virtual stores that alter depending on the preferences, behaviours and past purchases of a consumer which serves to further the sense of a customised in-person shopping experience. (*Ma, H., & Yang, F., 2019*) Also, as 5G networks become increasingly usable, it will enhance the AR and VR to an incredible degree, allowing much faster load times and more fluid interactions, as well as higher resolution graphics, all of which will be crucial to the scaled adoption of AR/VR in e-commerce. In the future we are likely to see business opportunities being provided with fully immersive, virtual shopping malls or interactive brand experiences as customers can explore, try, and buy products in 3D environments regardless of where they are physically located in the world. Through such innovations, AR and VR will become key elements of the e-commerce process, enabling the business to invite the customers to interact with the business in new ways and eventually increase sales and customer retention. As the technology becomes mature its capability of providing real life related experience will make it a crucial tool of future of online retailing.(*Ma, Y., & Zhang, J., 2021*).



II. OBJECTIVES OF THE STUDY

1. To examine how AR/VR technologies can change the consumer purchasing behavior and decision-making during the online retail.
2. To assess vaccine and community online shopping experiences in terms of product visualization and interactivity thanks to AR and VR.
3. To single out the main opportunities and issues of the AR/VR integration into the e-commerce platform.
4. To find out the future potential of an interaction in reshaping online sales and retailing to be influenced by AR/VR technologies.
5. To determine the technological and consumer preparedness of AR/VR permeation in the e-commerce.

III. RESEARCH METHODOLOGY

The type of research methodology adopted in this study is a combination of both qualitative and quantitative research approaches that are needed to consider and evaluate the effects of using a mixture of AR/VR technologies on online retail. A survey with a heterogenous sample of consumers was completed who cover different demographics in order to collect information about their experience and viewpoints in the application of AR/VR in e-commerce. The research methods used to collect the data aimed at several important areas: how consumers purchase products and how a product is visualized; the interactivity of a product, the degree of satisfaction with AR/VR technology in online purchase situations. Moreover, the opinion of specialists was solicited regarding the possible advantages and obstacles of the AR/VR implementation, as well as the future outlooks in terms of the online sales reformation. In the research methodology, there was softer analysis of the willingness of the consumers as well as the e-commerce platforms to implement these technologies with the use of Likert scale to measure the level of satisfaction and readiness. These findings were subsequently interpreted to give a clear picture of how AR/VR can be used to improve online shopping and the future of e-commerce therein.

IV. DATA ANALYSIS

The information obtained through the survey was examined with the help of both comparative and descriptive statistic. Means and percentages were descriptive statistics to indicate how consumers responded to various attributes of AR/VR use including usage, product visualization, product interactivity, and issue satisfaction. Comparative analysis was used to quantify the effects of differences between the groups that experienced AR/VR and those that never had. As an example, consumer buying behaviours and spending habits have been compared pre and post-implementation of AR/VR technologies, with notable improvements in how confidently consumers are buying and how frequently they are doing so. The data also indicated the main advantages of AR/VR, namely the better visualization of products and customer engagement, with 85 percent of the respondents stating the latter was a positive influence. In the same survey however, implementation cost and consumer technology readiness (both 60%) were stated as challenges. The study of future potential showed a high level of expectations around the AR/VR and its capacity to improve online sales, such as conversion rates, and customization of the products. Finally, the study also measured the technological and consumer readiness in respect to AR/VR adoption where the technological readiness was high (80%), and consumer readiness was average (65%). The insights provided by these findings allow making conclusions about the changes in e-commerce in the future and identifying those areas that should be enhanced.

Table 4.1: Enhancement of Online Shopping Experience through AR/VR

Customer Group	Product Visualization (No AR/VR)	Product Visualization (AR/VR)	Interactivity (No AR/VR)	Interactivity (AR/VR)	Overall Satisfaction (Scale 1-5)
Group A	2	4	3	5	4
Group B	3	5	2	4	3
Group C	1	5	1	5	5
Group D	2	4	2	5	4



Group E	3	5	2	4	4
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This table highlights the difference that AR/VR technology has on online shopping experiences in five customer groups. In product visualization the scores of all groups were rated much higher with AR/VR meaning that the product is better represented. All groups also experienced a level of increased interactivity when using AR/VR and all but one group had a significant boost in interactivity. Manufacturers and retailers should note, however, that score of overall satisfaction was lower with AR/VR by a margin in both groups, meaning that the technology has not played so well with the overall shopping experience, at least when it comes to product interaction and visualization. Group C had the greatest change, with their satisfaction rate going up, from 1 to 5, upon the application of AR/VR.

Table 4.2: Benefits and Challenges of AR/VR in E-commerce

Benefit/Challenge	Percentage of Respondents (%)
Benefits	
Improved Product Visualization	85%
Enhanced Customer Engagement	78%
Increased Conversion Rates	72%
Challenges	
High Implementation Costs	60%
Consumer Technology Readiness	55%
Limited Content Availability	50%

The table below indicates the major advantages and issues to consider when introducing AR/VR to online shopping, depending on the answers. The value of AR/VR is evident among the consumers as 85 percent of them reported increased product visualization, 78 percent responded that customers are more engaged, whereas conversion rate is reported to be improved by 72 percent. Nevertheless, there are also major obstacles with 60 percent complaining of high costs of implementation, 55 percent worrying about lack of technical preparedness of the consumers leaving 50 percent saying they are limited by lack of content that can be used or offered in their online stores.

Table 4.3: Future Potential of AR/VR in Reshaping Online Sales

Future Impact Factor	Percentage of Positive Responses (%)
Increased Online Conversion Rates	80%
Enhanced Product Customization	75%
Improved Virtual Shopping Experience	70%
Widespread Adoption in Retail	65%
Greater Consumer Trust in Virtual Products	60%

The following table highlights the brighter prospects of AR/VR in e-commerce industry as per the positive consumer feedback. The biggest excitement is felt on the growth of online conversion rates, as 80 percent of leaders believe it will improve. The improvement of product customization is right next with 75%. Enhanced online shopping experiences are anticipated by 70%, as is the spreading use of the technology in stores and increased consumer confidence in virtual products with 65% and 60% of respondents, respectively, predicting these future trends.



Table 4.4: Technological and Consumer Readiness for AR/VR Adoption

Readiness Factor	Consumer Readiness (%)	Technological Readiness (%)
Awareness of AR/VR Technologies	65%	80%
Availability of AR/VR-Compatible Devices	50%	70%
Consumer Trust in AR/VR Shopping Experience	60%	75%
Ease of Integration with Current E-commerce Platforms	55%	65%

This table can assess the preparedness of the AR/VR use in e-commerce, where consumer readiness is compared to technology readiness. In regard to consumer preparedness, 65 percent are familiar with AR/VR technologies, 60 percent feel confident with the AR/VR shopping process, and 55 percent feel that AR/VR can be easily introduced to the current e-commerce systems. Technological preparedness is tweaked a notch up, as 80 percent of the respondents affirmed that the presence of devices that support the use of AR/VR, 75 percent indicate that technology has the capacity to elicit trust among the consumers and 65 percent affirm that integration with the e-commerce systems can take place. This indicates that technology is more prepared but consumers are not quite there yet, especially in their preparedness in terms of availability of devices and reliance on them.

V. CONCLUSION

In summary, AR/VR technology incorporated in e-commerce has had a tremendous possibility in optimizing the shopping activities through online stores by making products visualizable, stimulating customers, and enlivening confidence to a customer regarding his/her buying decision. As the research indicates, although the benefits of the NFC can be rather impressive in terms of conversion rates and interactivity, there are still challenges involved, including high costs of implementation and a different readiness level among consumers. In spite of this, there is a great hope that AR/VR has a future in transforming online purchases which both consumers and the technology suppliers are holding such dissimilar displays of willingness. It seems that as the technologies on which AR/VR is based evolve, the likelihood of a great shift in the way online retailing is conducted increases, in particular, as consumer confidence and technological compatibility increase.

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