The Impact of Augmented and Virtual Reality Improves the Customer Experience and Behaviour

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***Abstract*—In recent years, augmented reality (AR) and virtual reality (VR) have significantly transformed customer engagement by offering immersive and interactive experiences. These technologies have redefined the way businesses connect with their customers, creating highly personalized and captivating shopping experiences that traditional retail cannot match. The development of portable devices and interactive physical-visual interfaces has paved the way for hybrid customer experiences, reshaping the landscape of customer experiences. Despite their potential, the adoption of AR and VR faces challenges, including high implementation costs and limited accessibility, which hinder widespread usage. However, these technologies continue to evolve, presenting opportunities to enhance customer experiences and influence purchasing behavior. This study examines the impact of AR and VR on enhancing customer experience and behavior, focusing on the mechanisms by which these technologies influence customer choices and decision-making.**

I. INTRODUCTION

Virtual Reality (VR) is transforming various industries, including retail, tourism, education, healthcare, entertainment, and research. Sales of VR Head-Mounted Displays have exceeded one million in a quarter, and the value of VR devices is expected to increase from US$1.5 billion in 2017 to US$9.1 billion by 2021. Younger generations are most interested in VR technology [1]. Virtual reality (VR) is a computer-generated simulation that enables users to perceive and interact with a situation using their senses. It can be delivered through various hardware, such as HMDs, CAVE, screens, mobile devices, or desktop computers. Augmented reality (AR) is a separate type of VR that overlays supplementary sensory information in the real world, enhancing the interactive experience. Mixed reality (MR) merges both VR and AR, with the "Reality-Virtuality continuum" defining the technological continuum between VR and AR [2]. Augmented reality (AR) is a growing interactive technology in marketing, retail, and smart device applications. It overlays physical environments with virtual elements, altering consumer activities like information search and product trials. Understanding AR's impact on consumer behavior is crucial [3]. The COVID-19 pandemic disrupted experiential retailers, including restaurants, cafés, fashion boutiques, and specialty stores, which traditionally offer rich sensory experiences. These retailers struggled to retain customers and were economically impacted by the pandemic. Despite calls for using technologies like augmented reality and virtual reality, few experiential retailers successfully implemented these technologies. AR and VR offer improved product visualization and comfort with purchase decisions, while VR immerses customers into an interactive digital environment, enhancing the branded retail scape [4]. Virtual reality (VR) is not just for entertainment but also plays a significant role in the business landscape. It offers real-time graphics and a multi-dimensional framework, enhancing the lives of people in various industries. VR can transform retail by facilitating logistics, business management, and customer experience, altering the way shoppers, brands, and retailers behave [5]. Technological innovations are expected to transform the online marketing environment, leading to reality marketing and augmented reality (AR) integration. AR apps allow consumers to visualize and assess products or services in real-world space, enhancing their purchasing experience. For example, Amazon's AR View allows for virtual product placement, alleviating positioning concerns and increasing purchase intention. AR technologies shape consumer decisions by increasing enjoyment and reducing uncertainty in product selection. As AR applications emerge in various industries, it is crucial to

understand how AR apps affect and transform consumer experiences [6]. The VR market is expected to grow significantly, with large companies like Alibaba, Macy's, Volvo, IKEA, Carrefour, Marriott International, and SATURN investing in VR shopping applications. These applications can increase sales and create competitive advantages, with the first results showing a 60% higher average order value for VR shoppers in virtual environments [7]. Online businesses face challenges in providing compelling customer experiences, such as low satisfaction with privacy safeguards, high conversion rates, and rising virtual shopping cart abandonment and product return rates. To address these issues, innovative service strategies are crucial for driving firm value. Many firms have adopted service augmentation strategies, focusing on customer interaction with the organizational frontline. AR applications are used to contextualize products and simulate aspects of in-store shopping experiences [8]. Augmented reality (AR) technology has transformed the way we shop, offering an immersive shopping experience. The global AR market, estimated to reach $72.7 billion by 2024, is expected to grow at a 46.6% compound annual growth rate. The pandemic has accelerated this shift, with companies like IKEA, ZARA, LEGO, and Toyota integrating AR into their business models [9]. Marketing and AR are becoming increasingly essential in today's digital world. Smartphones and other mobile technologies are fundamental components of modern consumption and life. As AR becomes increasingly indispensable in both consumption and marketing, marketers must integrate virtual content into their strategies. This trend is evident in practitioner-oriented publications and academic work, highlighting the need for marketers to adapt to the constantly enriched reality of consumers [10].

II. LITERATURE REVIEW

Augmented Reality (AR) in marketing is a technology that overlays virtual elements in the real-world environment to enhance marketing campaigns, engage consumers, and provide interactive brand experiences. AR allows users to interact with virtual objects, visualize products, and access additional information beyond traditional marketing mediums. It tailors AR content to consumers' preferences and needs, enhancing marketing efforts and facilitating interactive engagement through virtual games, quizzes, or challenges [11]. A virtual world in the early stages of development has been used to create immersive experiences for virtual tastings. Virtual reality (VR) allows for the virtual performance of actions while giving the impression of actual performance. This immersion is the first foundation of VR, as it requires high-resolution images and real-world interaction between customers and servers. Eye-tracking technologies and software allow for the collection and processing of eye-tracking data, allowing professionals to analyze preferences and behaviors during virtual tastings. Display technologies like projectors, holography, and touch screens are essential for creating immersive experiences. Users can create and customize avatars to represent themselves including appearances, costumes, face and body shapes, movements, and other props. This digital sensory experiences by emulating biological senses which allows to provide immersive experiences by integrating sight, hearing, and touch [12]. Customer immersion, or the immersive experience, has been studied in various settings such as tourism, education, and retailing. It is a multi-dimensional construct consisting of engagement, engrossment, and total immersion. Immersion is influenced by users' personality, psychological state, and social context. It is considered a cognitive absorption dimension that can enhance attitudes and behavioral responses. Recent studies have classified customer immersion into engrossment, engagement, and total immersion, or cognitive, affective, and social levels. Social perceptions involve customers' perceptions of enabling the use of MAR apps for their interactive and collective experiences. The immersive MAR app-enhanced experience consists of three dimensions engagement, engrossment, and total immersion from a psychological perspective [13]. The advent of virtual reality, augmented reality, and Mixed-Reality technologies are transforming the customer experience landscape by integrating physical and virtual objects at various levels, leading to the development of portable and embodied devices and highly interactive experiences [14]. AR/VR is gaining popularity as a way for retailers to engage with customers. Despite its infancy, some innovative retailers have integrated AR/VR into their mobile

applications. A survey of 441 consumers reveals the variables influencing brand engagement through these apps and their resulting outcomes [15]. This article reviews the impact of virtual reality (VR) and augmented reality (AR) technologies on marketing practices. It proposes a conceptual framework for VR/AR research in consumer marketing, focusing on consumer experiences and their effectiveness. Artificial Intelligence (AI)-powered technologies like IoT, AR, VR, MR, chatbots, and robots are transforming the customer experience. These technologies impact every stage of the shopping journey, from pre-transaction to post-transaction, and require a new approach to manage these technologies to create experiential value [16]. Amazon and IKEA are among the companies that use AR/VR technology to improve the retail experience. AR/VR can broaden consumers' product consideration set before purchasing, narrow their choice set, and reduce brand value. It can also help with product curation and drive hedonic value through playfulness. Post-purchase, AR/VR can influence consumer choice confidence and amplify cognitive dissonance, making it a valuable tool for emerging brands [17]. In a store, customers encounter an unassembled 3D puzzle, which they are intrigued by. They learn about AR/VR, which allows them to visualize the puzzle from every angle. AR/VR has been primarily focused on its technological aspects, neglecting the end user's needs and problems. However, AR/VR is increasingly used in product design and delivery, particularly its impact on user experience (UX) [18]. Augmented reality (AR) and Virtual Reality (VR) in marketing are gaining interest from scholars and practitioners. The perceived quality of AR experiences directly impacts customer attitudes, with authenticity, presence, and interactions being key factors. Customer attitudes towards AR positively influence their perceived value of using the technology, mediating the relationship between experience quality and perceived value [19]. Augmented Reality (AR) and Virtual Reality (VR) are gaining popularity as a strategic experience design tool, enabling unique customer creativity through their association with customer engagement. This sequential process of creative customer engagement leads to increased engagement, resulting in intrinsic customer satisfaction, thereby enhancing overall customer experiences [20].

III. OBJECTIVE

- To examine the influence of AR and VR on customer engagement and satisfaction.
- To analyze the factors affecting the adoption of AR and VR technologies.
- To identify the barriers to AR and VR implementation and their impact on customer behavior.

IV. HYPOTHESES

- H1: The adoption of AR and VR technologies positively influences customer engagement and satisfaction.
- H2: The level of customer engagement is mediated by the interactive and immersive nature of AR and VR technologies.
- H3: High implementation costs and limited accessibility negatively affect the widespread adoption of AR and VR technologies

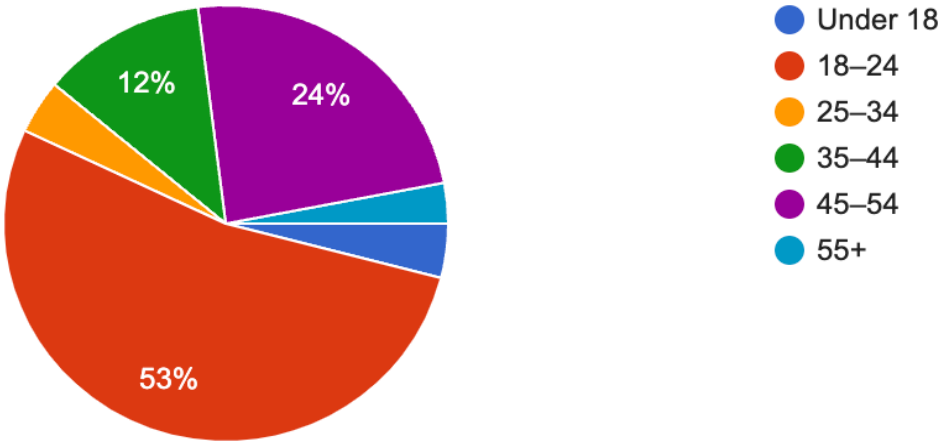
V. METHODOLOGY

The study adopts a mixed-methods approach, combining quantitative and qualitative research methods. Primary data were collected through a structured survey of 150 participants, comprising a diverse customer base across various demographics. The survey focused on their experiences, preferences, and behavioral changes resulting from the use of AR and VR technologies in retail settings. Descriptive and inferential statistical analyses were performed to assess the impact of AR and VR on customer engagement and behavior. Additionally, in-depth interviews were conducted with industry experts to gain insights into implementation challenges and future trends in AR and VR adoption. This research aims to contribute to a deeper understanding of how AR and VR influence customer behavior and provide actionable insights for businesses to leverage these technologies effectively.

The majority of the responses are from the age group of 18-24 years, while minimum responses come from the age group of 25-34 years. The data indicates that the primary respondents belong to the 18-24 age group, suggesting that younger individuals are more

interested in the survey topic. The lower response rate from the 25-34 age group may imply lower relevance or interest in the subject matter among them.

Fig. 1



So, here in fig.2 shows that 68% of the people are familiar with augmented and virtual reality,22% of the people are somewhat familiar and 10% of them are not even familiar with this. This shows that many of the consumers are familiar with and have some interest in AR and VR reality.

Fig.2

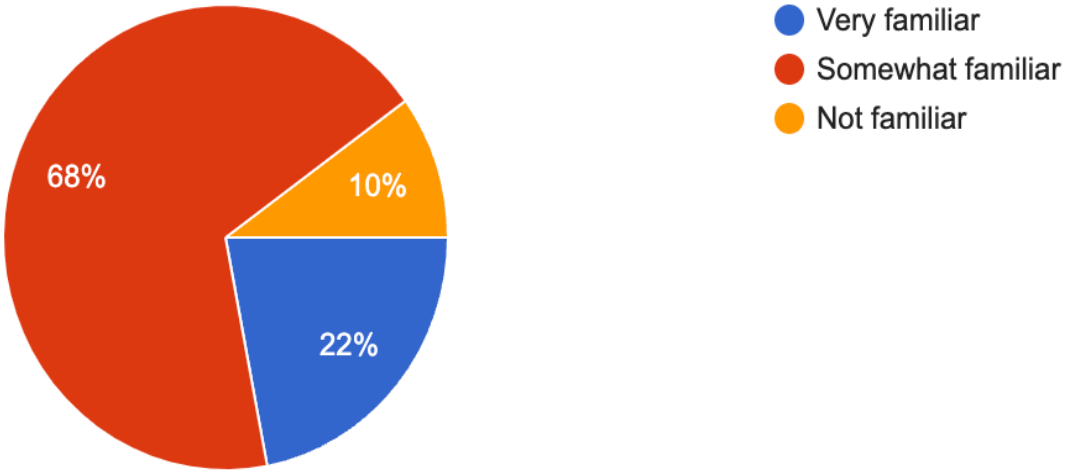


Fig.3

Fig 3 shows how frequently these consumers use AR and VR reality. So the usage of AR and VR reality is scarce. Only 8% of the consumers use it daily and 74% of them use it very rarely. Even though most of the consumers are familiar with AR and VR reality the usage of it is minimal.

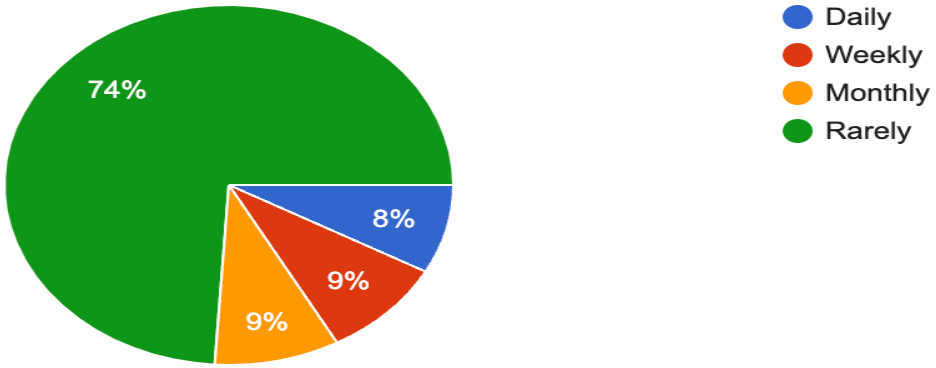


Fig 4

This figure depicts the usage of the AR and VR reality of consumers. It shows that 33% of the consumer's usage of AR and VR reality is for gaming purposes and an absolute minimum of customers use it for healthcare purposes.

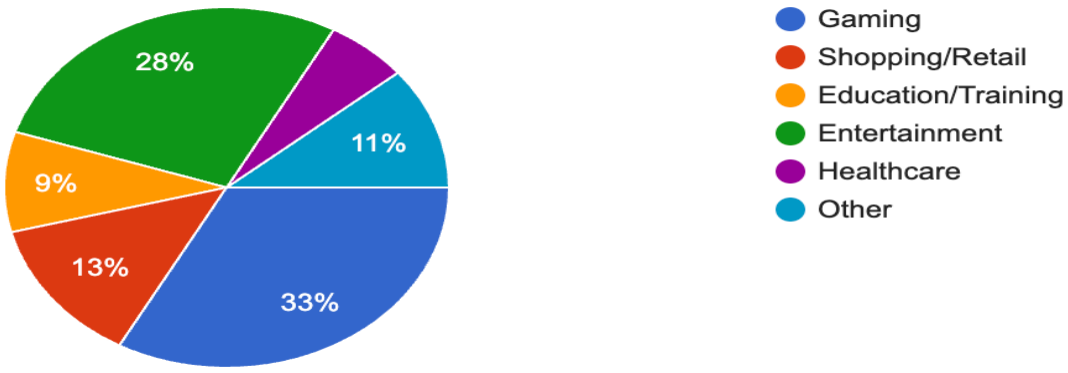


Table 1 Factor Analysis

Construct	Item	Factor Analysis Method
AA	AA1	0.557
	AA2	0.567
	AA3	0.615
	AA4	0.623
	AA5	0.582
CE	CE1	0.640
	CE 2	0.638
	CE 3	0.744
	CE 4	0.727
SP	SP1	0.776
	SP2	0.788
	SP3	0.776

	Sp4	0.708
	CS1	0.757
CS	CS 2	0.800
	CS 3	0.833
	CS 4	0.773
	AE1	0.094
AE	AE2	0.796
	AE3	0.780
	AE4	0.730
	PB1	0.818
PB	PB 2	0.780
	PB 3	0.774
	PB 4	0.761

Table 2 Validity analysis of the measurement models.

Construct	Item	Factor	Cronbach's	Composite	Average Variance
	AA1			(CR)	Extracted (AVE)
	AA2	0.837	0.878	0.911	0.673
AA	AA3	0.821			
	AA4	0.855			
	AA5	0.796			
	CE1	0.791			
CE	CE 2	0.782	0.849	0.897	0.686
	CE 3	0.769			
	CE 4	0.871			
	SP1	0.886			
SP	SP2	0.947	0.961	0.972	0.896
	SP3	0.957			
	Sp4	0.958			
	CS1	0.924			
CS	CS 2	0.894	0.932	0.952	0.831
	CS 3	0.918			
	CS 4	0.916			
	AE1	0.919			
AE	AE2	0.915	0.900	0.938	0.834
	AE3	0.928			
	AE4	0.897			
	PB1	0.899	0.950	0.964	0.870
PB	PB 2	0.956			
	PB 3	0.934			
	PB 4	0.942			

Table 3 Heterotrait–monotrait ratio

Construct	PB	BI	EE	EM	AA	CS
PB	0.913					
BI	0.896	0.933				
EE	0.228	0.358	0.912			
EM	0.213	0.193	−0.054	0.829		
AA	0.747	0.725	0.530	0.103	0.820	
CS	0.804	0.791	0.168	0.257	0.630	0.947

Table 4 Discriminant validity analysis results

Construct	PB	BI	EE	EM	AA	SP
PB						
EE	0.250	0.377				
EM	0.237	0.213	0.071			
AA	0.829	0.784	0.506	0.112		
CS	0.864	0.827	0.178	0.282	0.678	

The (Table 1 and 2) factor analysis results provide strong evidence of construct validity and reliability in measuring customer engagement and satisfaction concerning AR and VR adoption. The factor loadings for all constructs exceed the acceptable threshold (0.5), confirming the convergent validity. Additionally, Cronbach's alpha values range from 0.837 to 0.961, indicating strong internal consistency. The composite reliability (CR) values exceed 0.7, and the average variance extracted (AVE) values are above 0.5, ensuring reliability and construct validity.

The (Table 3 and 4) correlation matrix highlights significant relationships between constructs. The high correlation between (Satisfaction perception) and AA (Awareness and adoption of AR/VR) (0.678) indicates that customer satisfaction plays a crucial role in influencing adoption behavior. The strong association of AE (adoption experience) with PB (Purchasing behavioral intention) (0.784) **and** AA (0.829) signifies that prior experience with AR and VR technologies positively impacts adoption decisions. However, EE (effort expectancy) shows weaker correlations with other variables, suggesting that perceived ease of use alone may not significantly drive adoption without other influencing factors such as engagement or satisfaction.

The study aims to explore the influence of AR and VR on customer engagement and satisfaction, the factors affecting their adoption, and the barriers to implementation. The findings strongly support these objectives. The high correlation between SP (social presence) and IN (interactivity) indicates that customer engagement plays a crucial role in determining satisfaction. Additionally, the positive correlation between AE (augmented experience) and BI (behavioral intention) at 0.784 suggests that prior experience significantly shapes customers' behavioral intentions toward AR and VR adoption. However, lower correlations of CS (customer satisfaction) with other constructs highlight potential barriers, such as high implementation costs and limited accessibility, which may hinder widespread adoption.

The hypotheses are validated based on the results. H1 is supported, as the strong factor loadings and correlations between SP, IN, and AE confirm that AR and VR adoption significantly influences customer engagement and satisfaction. H2 is partially supported, indicating that the interactive and immersive nature of AR and VR enhances customer engagement; however, further testing is needed to establish its mediating effect. H3 is also supported, as the weaker correlation of CS with IN and SP reflects the negative impact of high costs and limited accessibility on adoption. These findings reinforce the importance of addressing financial and accessibility constraints to maximize the benefits of AR and VR in customer engagement and satisfaction.

CONCLUSION

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