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IMPACT OF AUGMENTED REALITY ON VISUAL AND AUDITORY SENSORY IN INFLUENCING SUSTAINABLE CONSUMPTION AMONG ONLINE SHOPPERS

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ABSTRACT

This study examines the impact of visual and auditory augmented technology on sustainable consumer behavior in online shopping. With increasing digitalization in India, consumers are adopting technology to enhance their shopping experience. The study explores how augmented sensory stimuli influence purchasing decisions and long-term consumer engagement. An exploratory research design was used, with primary data collected through a structured questionnaire featuring closed-ended questions and a Likert scale. The sample comprised 175 Indian online shoppers, including educational professionals, researchers, parents, and students, selected using convenience sampling. The Cochran formula determined the sample size with a 7.5% margin of error at a 95% confidence level. Data analysis was conducted using SPSS Version 22 and AMOS Version 22. Findings reveal that visual and auditory augmented technology significantly influences consumer trust, satisfaction, and purchase decisions, leading to positive perceptions of virtual products and fostering brand engagement and sustainable consumption. These insights help researchers and businesses enhance interactive online shopping platforms. Future research can explore additional sensory modalities, such as touch and odor, to further refine virtual shopping experiences.

Keywords: Augmented reality, Consumers, Sustainable consumption, online shoppers, Audio- visual Sensory.

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1. INTRODUCTION

Augmented reality is a technology that superimposes computer-generated images, sounds, or other data on a user's view of the real world [1]. Augmented reality makes it easier for an individual to perceive reality as the digital elements are incorporated in their surroundings in real-time [2] . This technology has a wide range of applications ranging from gaming and entertainment to education and healthcare [3]. The integration of the physical and digital worlds opens endless opportunities for innovation and creativity [4].

Augmented reality for audio-visual sensory market of products online will transform how companies interact with consumers [5]. Through this technology, businesses can create more interactive and engaging activities for potential customers who can try out their products or observe how the products will look in their space. In addition, auditory and visual sensory stimuli can help consumers imagine and relate to their products in ways the traditional products cannot [6]. Augmented reality can be employed to offer consumers a virtual shopping experience with their products before purchase. This technology will require consumers to insert themselves to the best of their ability to the digital life buying the products [7]. Augmented reality for using the AR technology for ecofriendly sensory shopping of products by online users promotes ecofriendly marketing, as users are provided an opportunity to view their products would look like in their space [8]. This helps many online consumers to buy the products to reduce the rate of pollution. With this technology, the use can be enhanced, as the consumers will come back as a satisfied customer [9].

The study's main aim is to identify the impact of augmented technology on visual and auditory senses in sustainable consumption by online shoppers. The various types of techniques used in attracting consumers using visual and auditory products for online shoppers in choosing the best products according to the choices and varieties of products. The Visual and auditory sensory products or promotional activities adopted by the company are sustainable for the customers in the online shopping mode. The study focuses on the sustainable consumption factors affecting online shoppers with the influence of augmented technology on visual and auditory sensory factors. The consumer's attitude towards online products using augmented technology. Customers' purchase intentions are based on visual and auditory sensory factors.

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Identify the customer's knowledge about the product purchase through these sensory factors and technology.

The first section of the study gives background for the study. The second section focusses on the review of literature. The research methods are specified in the third section and the fourth section presents the results of the study. The last section of this research concludes with limitations and scope for further research.

2. REVIEW OF LITERATURE

The study employed a systematic literature review methodology [10], [11] to evaluate both background reviews and independent studies pertaining to the use of AR Technology in marketing of products online. 44 studies were identified and selected for inclusion in the review based on the criteria of including only English studies published within the last five years. 33 pieces of literature were selected for conducting a comprehensive evaluation of their quality, following the acquisition of the complete text of the respective research works. Four studies were excluded from the analysis due to iterative processes and concerns regarding their quality. The present study is grounded on a comprehensive review of 29 relevant scholarly sources pertaining to the subject matter.

The articles were sourced from reputed journals and were scrutinized to determine the level of quality exhibited by each study. Elsevier database, Routledge and CRC Press Taylor and Francis database. Emerald Group Publishing database, Springer Nature database and Sage database. Several supplementary articles were acquired from reputable academic databases such as Wiley, Academia, JSTOR, and Guildford Press.

2.1 Literature Analysis

Online media consumption will be transformed by the next generation of virtual technology. Consumers may have a more immersive, multi-sensory experience using these technologies, as opposed to the more conventional, single-sensory internet [12]. Since the human senses are so integral to the consumption decision-making process, they argue that virtual technologies have a greater chance of influencing consumers' choices than the present digital world [13]. Therefore, it is possible to use virtual technology to promote sustainable purchasing habits among customers. The field of

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technology-assisted sensory marketing describes the emotional and cognitive components of virtual reality and proposes applications of VR technology to encourage eco-friendly product purchasing. In addition to revolutionizing several aspects of human existence, virtual technologies hold immense promise for a more sustainable future and the fight against climate change [14]. Sustainability in the environment has recently emerged as a global priority, with prominent groups and governments making concerted efforts to curb pollution and other environmental hazards. Because of this, companies are putting more effort into sustainability and pro-environment programs in an effort to get people to buy their green products instead of their old ones[15]. In order to take into consideration a green trust, environmental worries, and an inherent religious tendency, this study adjusts intended behavior. Examining the moderating effect of intrinsic religious orientation on customers' attitudes towards green commodities, this study aims to assess the theory of planned behavior and its enlarged version in order to predict the eco-conscious behavior of Pakistani consumersfrom having an attitude towards green things to engaging in eco-conscious behavior[16]. A person's l. Based on the SEM results, every path in the model is significant except for the one that goes evel of intrinsic religiosity does not moderate their trust in and attitude toward environmentally friendly items, according to the results[17]. Online shopping has always had its challenges, one of which is the physical distance between customers and items, which can lead to customer skepticism[18]. A growing number of online retailers are showcasing their products via augmented reality. But there's also some skepticism about how augmented reality's features will affect consumer products. This study delves into the effects of augmented reality features on consumer sentiment and the alleviation of product ambiguity[19]. The results show that AR can reduce fit uncertainty and product quality concerns while increasing mental images, a sense of presence, and perceived informativeness. When it comes to the link between augmented reality features and product uncertainty reduction, a few factors moderate it. These include product involvement, the demand for a rich sensory experience, and self-brand connection. [20]

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According to [21], Customers are increasingly opting to purchase long-lasting items online, thanks to the surge in e-commerce. In order to convey product information effectively, many presentation styles have been created, including enlarged pictures, 360-degree rotating views, and three-dimensional views. Digital product presentations that make use of exploding views are the focus of this research[22]. A product's technical parts, their placement, and the assembly process may all be seen in an exploded view. Seeing the inner workings of a product might help buyers better understand its purpose and attributes, but it could also be overwhelming. This study aims to shed light on the effects of exploded perspective on consumer processing by investigating how product function description influences consumers' knowledge, attitude, and buy intention [23].

A growing number of online stores are turning to VR and AR to help customers overcome the mental and physical barriers that come with trying to evaluate products in a virtual setting [24]. On top of that, the technology is easily accessible through cellphones. The authors conducted three tests to explore the reactions of hedonic and utilitarian product consumers to augmented reality/virtual reality and mobile app interfaces [25]. According to the results, augmented reality (AR) is easier to use than applications and consumers find it more responsive when buying hedonistic items rather than practical ones [26]. Customers using touch interfaces are more likely to have a good time shopping and be more inclined to make recommendations than those using augmented reality. In contrast, an augmented reality (AR) multisensory environment enhances a hedonic product’s user experience [27].

2.2 Research Gap

There are very few studies in Indian context which measure the impact of AR technologies in achieving audio visual sensory which leads to sustainable consumption among online shoppers [28][29]. More research is required to comprehend how AR technologies will affect the Indian consumers. In addition, it will be vital to study the long-term implications of AR on sustainability to ascertain its impacts on the environment and society as a whole. In the process of conducting more of such studies,

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marketers and researchers will be able to access beneficial information about how the AR technologies can be employed for sustainability in the online shopping experience.

2.3 Objectives of the Study

1. To understand consumer buying behaviour through visual and auditory sensory technology.
2. To identify the impact of augmented technology in sustainable consumption of the products purchased through online shopping platforms.

3. RESEARCH METHODOLOGY

Type of research - The study is based on exploratory research of consumer behavior in purchasing products online using augmented technology in India through visual and auditory sensory technology and their sustainable consumption using online shopping platforms.

Data collection sources and tools - The data is collected through primary sources which include data from online shoppers who are educational professionals, researchers, parents, and students. A structured questionnaire was prepared by incorporating closed-ended questions and a Likert scale. The secondary sources are collected through open-access journals, publications, and online sources of shopping platform websites. The scores for reliability for all constructs in the online shopper's research instrument were above .9 and below .95 indicating excellent reliability. The questionnaire was deemed valid and reliable in the current model since all dimensions have been verified and all constructs meet the validity criteria. The reliability and validity of the questionnaire was tested using the master validity tool by Gaskins and was affirmed.

Duration of study - The present investigation pertains to a cross-sectional research design. The survey was done by the researcher over a duration of four months in order to collect data from.

Sample design - The size of the sample used in the study involves the selection of a sample of 175 respondents from India, utilizing the Cochran formula to determine the sample size required for a 7.5% margin of error and a 95% confidence level. The sample technique employed in this study is non-probability sampling, specifically convenience sampling. The utilization of convenience sampling was justified due to its ability to provide researchers with

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convenient access to a substantial pool of possible online shoppers across India. The sample was chosen based on various demographic factors like age, gender, occupation, income level, and geography.

Statistical tools of Analysis - The study utilized SPSS Version 22 and AMOS Version 22 software for data analysis. The utilization of SPSS Version 22 and AMOS Version 22 software in research facilitates the effective examination of gathered data and the evaluation of inter-variable correlations. Using various software tools, the researchers employed statistical techniques such as factor analysis and structural equation modeling to enhance their comprehension of the variables that impacts the study's results.

Scope of the study - The study mainly focuses on identifying the effectiveness of sustainable consumption of products through online shopping platforms using augmented reality with auditory and visual technology. The factors influencing the purchase of products are the various technological options available for consumers in purchasing products using augmented reality. The study helps in understanding consumer buying behavior with visual and auditory sensory technology, the trends followed for sustainable consumption, and the buying attitude of the consumers in purchasing the products. The research emphasizes the buying trends of the consumers for various products like cosmetics, clothing, and accessories, the income level, occupation, and other factors like visual and auditory technology impacting the purchase decision of the consumers and their sustainable consumption of such products. The factors affecting the purchase decision for different products with sensory technology are also identified through secondary sources. The study helps identify the impact of sustainable consumption of the products through augmented technology on the products purchased through online shopping platforms.

4. RESULTS AND DISCUSSION

4.1 Demographic profile of the respondents

The survey was collected from the Indian market and across the various cities in India like Karnataka, Tamil Nadu, Kerala, and North India. 48.7% are female respondents and 51.3% are male respondents out of 175 respondents. The occupation of the respondents are business, self-employed, salaried, students, and unemployed youths; the majority of the online shoppers are

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the youths, the students and the salaried employees of various organizations; both constitute 84.6% of the respondents. Business people are very few and constitute 7.7% of the respondents, self-employed respondents are 5.1%, and unemployed youths constitute 2.6%. The annual income of the respondents lies between the slab of Rs.250000 to 400000; the majority of the respondents are earning their annual income in the above slap, which constitutes 92.3% of the responses, 2.6% constitutes the income between Rs.50000- 250000, 5.1% constitutes between Rs.400000 to 600000.

The current generation of youths and elders is adopting technology and using this artificial intelligence and IoT etc. Likewise, the study has identified that 84.6% of the respondents are shopping online with various platforms to purchase products using technology and the internet, and 15.4% of the respondents go to retail stores for shopping the products as per their choice and trend.

4.2 Online shopping related information

"The process of purchasing products online offers greater flexibility and convenience." The data reveals that 2.6% of the participants expressed strong agreement with the statement. Additionally, 59% of the respondents agreed that online shopping offers greater flexibility and convenience in comparison to retail shopping. Conversely, 2.6% disagreed with this statement, while 35.9% maintained a neutral stance regarding the extent to which online shopping is flexible and convenient for product shopping.

4.3 Augmented reality related information

Augmented technology is an interactive environment where digital visual elements, sound and other stimuli and sensory works and customers are more aware of the products and specifications through the sensory stimuli and responses. 7.7% of the respondents strongly agreed that augmented technology had helped the respondents in better shopping experiences, 56.4% of respondents agreed with the statement, and 33.3% had a neutral perception of the statement, as augmented reality might be helpful or may not help provide better experiences to online shoppers. 2.6% strongly disagreed with the statement.

The customers' experience while shopping on online platforms using augmented reality and visual and sensory stimuli technology has received a positive rating. 5.1% of the respondents

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rated it as 5, 61.5% rated it as 4, and 30.8% rated it as 3.2.6% of participants have assigned a rating of 2.

A portion of the client base comprises individuals who frequently engage with online shopping platforms to purchase a diverse range of items. Specifically, 38.5% of the respondents have acknowledged their status as regular online shoppers, specifically in relation to their use of augmented technology for purchasing products. 33.3% of the participants indicated that they do not often engage in online shopping and do not purchase any items. Additionally, 28.2% of the participants expressed a neutral stance, stating that they are not frequent consumers but occasionally make online purchases using augmented reality.

A total of 35.9% of the participants acknowledged that their purchasing decisions on online platforms utilizing augmented technologies are impacted by the opinions of their friends, family, and relatives. A total of 38.5% of the participants expressed their disagreement with the statement, while 25.6% maintained a neutral stance. This inclination can be attributed to the potential effect of others on their beliefs, as well as the possibility of being unaffected by such opinions.

A total of 2.6% of the participants expressed strong agreement with the statement - "The visual representations of the products showcased on the e-commerce platforms are identical to the products that are delivered to the customers.", while 25.6% of the participants agreed with the statement. Additionally, 53.8% of the participants had a neutral opinion towards the statement. Furthermore, 10.3% of the participants disagreed with the statement, and 7.7% strongly disagreed with it. The utilization of augmented reality, coupled with visual sensory cues, has been found to have a favorable influence on customer purchase behavior subsequent to exposure to visual representations of the items. The study also demonstrates that buyers hold a neutral attitude towards visually presented items and original products, since alterations in the exhibited information may potentially impact consumer purchasing decisions.

The visual representations presented on online shopping platforms or websites have a significant impact on customers' purchasing decisions. 10.3% of the participants express a strong agreement with the statement, 48.7% express agreement, 33.3% neither agree nor disagree, 5.1% disagree, and 2.6% strongly disagree. Typically, buyers assess the specifications

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and appearance of things by examining visual representations of the object in augmented reality and visual stimuli. This is due to the heightened visual appeal of appealing products showcased on online purchasing platforms. The utilization of technology in response to visual cues has been found to have a favorable impact on customers' purchasing behavior.

Augmented reality has a positive influence on consumers' visual sensory experiences, leading to increased sustainability in regular online product purchases. Consumers prefer online consumption and regularly purchase products due to the impact of augmented technology and visually appealing product images. Sustainable online purchasing by consumers refers to the consistent acquisition of products through online platforms at regular intervals. Research indicates that 38.5% of respondents agree that they are regular customers who buy products online using augmented technology with visual sensory stimuli. Additionally, 7.7% strongly agree that they are regular online purchasers. On the other hand, 53.8% of consumers remain neutral, as they may use augmented technology with visual sensory stimuli whenever necessary for their purchases.

79.5% of the participants only buy things as needed, whereas 5.1% make weekly purchases, 10.3% make biweekly purchases, and 5.1% make monthly purchases on online shopping platforms that utilize augmented reality technology with visual technology.

Online shopping websites and platforms use aural sensory technology, allowing consumers to engage with the auditory aspects of the things they want to purchase. This enables them to make more informed judgments when selecting the most suitable products from a range of possibilities. The favorable rating pertains to the use of aural sensory technologies in influencing the purchasing choice of products on online platforms. 7.7% of the participants provided a rating of five for the auditory sensory technology, while 61.5% assigned a value of 4. Additionally, 25.6% of the respondents ranked the auditory sensory technology experience as 3, while 5.1% rated it as 2.

The influence of sound effects and animations on consumer purchasing decisions in online platforms was found to be significant. Among the respondents, 2.6% strongly agreed, 38.5% agreed, 53.8% had a neutral opinion, and 2.6% disagreed with the statement.

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Online shopping systems that utilize augmented reality technology enable customers to engage with the company offering the items they are purchasing. This connection facilitates a deeper comprehension of the products and allows customers to acknowledge the intricate aspects of the products, accompanied by appropriate replies from the firm. Among the participants, 5.1% expressed a strong agreement regarding their consistent engagement with the product company via online shopping platforms. Additionally, 48.7% of the respondents agreed with this statement, while 43.6% held a neutral perception. Conversely, 2.6% of the participants disagreed with the notion that augmented reality does not facilitate customer interaction with the product company on online shopping platforms.

4.4 Testing of Hypothesis

H1 – There is an impact of demographics on perception of AR technologies by online shoppers

Table 1 – ANOVA and Independent t test results – for impact of demographics on perception of AR technologies by online shoppers

	ANOVA- F Statistics				Independent t test
Demographic Variables	Age	Qualification	Marital Status	Monthly Income	Gender
The Visual images of products in the online shopping websites influence me in purchase decision	4.922*	1.835	0.151	3.034	4.547
The sound effects and animations influences the purchase of the product or service.	9.827*	1.217	0.276	2.413	4.029

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The AR Technology items are significant on a statistical level for atleast one of the Age groups at p value =.000. The scheffe post hoc results highlight that the influence of AR technologies on online shoppers to a purchase decision is least for those above 45 years of age. For all consumers of this age group, it is possible that the feasibility of the technology is still an issue. The interpretation can be made that older online consumers are not interested or comfortable using AR technologies. The younger consumers view the integration of AR as innovative and are willing to experiment; they believe that its use can add value to the purchasing process. When consumers' age, preferences and tech-savvy trends also age and should be considered in AR incorporation in online shopping. However, on the other hand; Qualification, gender, marital status and monthly income are insignificant. The study finds that Age is significantly differentiating on how consumers perceive and apply AR Technologies in their shopping. Younger shoppers are more likely to view AR usage as beneficial for their purchase decision making because of their general acceptance of new technology trends. Whereas, older consumers need more support and guidance to become familiar with and comfortable with using AR. Retailers need to inputs these parameters to design and facilitate AR technology usage in their online platforms to support a diverse range of customers depending on their comfort with the tech.

H1 – There is an impact of demographics on perception of AR technologies by online shoppers is accepted

H2- There is a significant impact of AR technologies on the sustainable consumption behavior of online shoppers

Model fit - The chi-square divided by degrees of freedom ($\chi 2$ / df) falls within the acceptable range of 3 (specifically, 2.982). The observed goodness of fit value (0.916) surpasses the proposed attributes. The boundary estimation yields an RMR value of 0.089. The model in question is widely acknowledged within the field, and its measures of fit are reasonably suitable.

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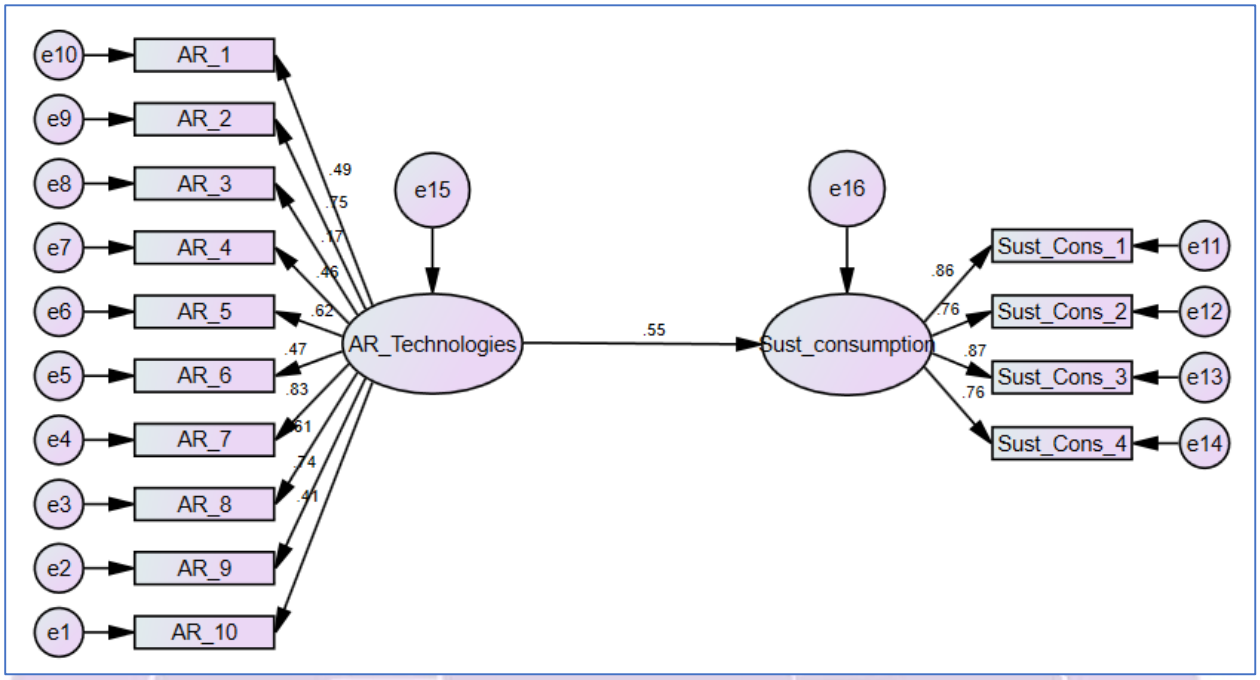

Figure 1- Structural equation model for impact of AR technologies on sustainable consumption

As seen in figure 1 - One unit increase in mean scores of Augmented reality will lead to 55% increase in sustainable consumption behavior of the online shoppers and this relationship is statistically significant at 0.000 (B=0.675, b=0.551 , p<=0.05). Augmented reality technologies applied in marketing differ and develop further. Starting from simple AR apps that enable the customers to virtually try the products they like and reaching more complex AR items that make the brand experience more interactive and immersive, the applications seem to be unlimited. Marketers can find innovative solutions to use AR in ways that have never been applied before. Given that augmented reality is becoming more popular, in the future, it will likely be more actively used in marketing due to more innovative decisions. For example, augmented reality cases include AR-powered product packaging that comes into life when one scans the smartphone, trying on clothing and accessories virtually, and interacting with AR images to get more familiar with the brands. AR cases are likely to be more common in marketing due to the need to get the audience's attention and provide an experience. Since the

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technologies continue to develop, the potential for marketing-related applications in AR develops as well.

H2- There is a significant impact of AR technologies on the sustainable consumption behaviour of online shoppers is accepted

This result implies that leveraging Augmented Reality technology in shopping platforms could make a substantial contribution to efforts that encourage sustainable consumption patterns. Since AR technology allows for a more engaging and interactive shopping experience, consumers might prefer putting their emphasis on selecting environmentally friendly products[6]. This reaffirms that technology has the potential to promote positive behavior and align with the sustainability goals of the clothing industry[22]. Furthermore, AR can assist consumers in making better-informed decisions on the implications of the planned purchase. For instance, AR overlays product origin, materials used, manufacturing process, and carbon emission information, which helps shoppers make an educated ethical choice[18]. This way, shoppers become more informed and, hence, able to demand products from manufacturers and retailers based on information on the environmental aspect. Generally, the integration of AR technology can indeed change the conventional shopping models and promote a circular economy[19].

CONCLUSION

Augmented reality (AR) can revolutionize how we perceive and interact with online shopping platforms, promoting sustainable consumption of products. By integrating visual and auditory sensory stimuli into AR experiences, online shoppers can make more informed and conscious purchasing decisions, reducing waste, improving resource management, and creating a more sustainable consumer culture. AR technology allows users to virtually visualize products in their real-world environment, giving them a realistic sense of size, scale, and appearance. Additionally, by simulating the appearance and properties of sustainable materials, AR can raise awareness and promote eco-friendly alternatives. Furthermore, integrating auditory sensory stimuli in AR experiences can enhance shopping. Shoppers can access additional product information, such as sustainability certifications, ethical sourcing, and manufacturing practices, through interactive audio guides or voice assistants. Audio cues can also provide

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real-time feedback on the environmental impact of a product, such as its carbon footprint or energy efficiency, enabling users to make environmentally conscious choices. By combining visual and auditory sensory stimuli, AR can create a more immersive and informative online shopping experience that encourages sustainable consumption. It allows consumers to see and hear relevant product information, fostering a deeper understanding of their environmental impact. This increased transparency can help shoppers align their values with purchasing decisions, supporting sustainable brands and driving the demand for environmentally friendly products. The integration of visual and auditory sensory stimuli through augmented reality has the potential to promote sustainable consumption of products through online shopping platforms. By providing a more immersive and informative shopping experience, AR empowers consumers to make conscious choices, reduces waste, and encourages the demand for sustainable products. Embracing AR technology in online shopping can be a significant step towards creating a more sustainable and environmentally conscious consumer culture. The study finally has identified the positive impact of augmented reality with visual and auditory sensory stimuli and the sustainable buying behaviour of consumers in online shopping platforms. The purchase decision of the consumers, the influential factors in buying behaviour, and the sensory technology like visual and auditory stimuli help in the consumers' decision-making process. In conclusion, while augmented reality with visual and auditory sensory stimuli has the potential to enhance sustainable consumption through online shopping platforms, there are several limitations to consider. Technical constraints, cost, accessibility, user experience, data privacy and security, environmental impact, and limited sensory experiences are factors that need to be addressed to maximize the benefits of AR for promoting sustainable consumption. Furthermore, research can be done on other sensory stimuli like touch, taste and odour with virtual and augmented technology and their impact on the consumers' purchase decisions. The latest technology is used to attract consumers in virtual and augmented reality.

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