Virtual and Augmented Reality: Analysis of Business Implementation in Retail

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Please cite this paper as:
Dragomir, H. and Pelau, C., 2025. Virtual and Augmented Reality: Analysis of Business Implementation in Retail. In: C. Vasiliu, D.C. Dabija, A. Tziner, D. Pleșea, V. Dinu eds. 2025. *11th BASIQ International Conference on New Trends in Sustainable Business and Consumption.* Oradea, Romania, 26-28 June 2025. Bucharest: Editura ASE, pp. 182-187
DOI: 10.24818/BASIQ/2025/11/024

Abstract

Online shopping and the overall use of the internet is changing rapidly, despite the fact that the internet is around for four decades. With the constant increase of users, and therefore also the increase of various interactions with it, such as online shopping, enterprises are forced to explore new, innovative ways to implement in their business model in order to maintain their competitiveness and attract new customers and maintain their current ones. Such technologies are augmented reality and virtual reality. This paper tries to shed some light on the topic of augmented reality and virtual reality and their implementation in different business models as well as their effect and challenges that were faced. This study shows that AR and VR technologies can be implemented by various business models, with different client segments, and have a positive outcome, from the business perspective. Companies tend to be to some extent reluctant in implementing such technologies, because it emphasizes a significant investment for them. Also, because those technologies are still pretty new and unexplored, the reluctance of companies in implementing them tends to be greater. There are so-called "early adopters" as shown in the paper below, and these cases seem to have had a success in adopting such technologies and leveraging their potential in maintain or improving their market position.

Keywords

Virtual reality, augmented reality, retail, impact, experience

DOI: 10.24818/BASIQ/2025/11/024

Introduction

In the last decade we saw a huge, relatively steady, increase in the number of published papers related to augmented and virtual reality (Dragomir et al., 2025). This means that more and more researchers find those 2 topics interesting and it shows that there are specific ways that users can leverage the capabilities in achieving specific needs. Both VR and AR technologies have capabilities to streamline different processes from the business perspective and improve the well-being of enterprises, but this doesn't restrict itself only to the business domain. Education, healthcare, architecture, manufacturing and many more branches can benefit from the implementation of such technologies. However, it is true that some technologies are more easily implemented in one domain than the other. For example, there are more aspects to be considered when trying to implement VR and AR technologies in the education or healthcare system, due to their more specific requirements, lower margin of error and overall user acceptance, which plays a much more important role here, than in the retail domain. Also, there is the topic of which of those two technologies should be implemented. In retail for instance, studies have shown that AR tends to be more attractive since it shows a higher practical value than VR (Boletsis, 2020). It has been shown that such technologies have the ability to generate shopping experiences that are unique compared to the traditional, physical ways of retailing (Berberović et al., 2022). Therefore, companies can implement such technologies to increase their revenue, especially for their own brands, as it can be seen from supermarkets in the retail (Dragomir et al., 2024). Beyond the advantages, these technologies also have some considerable disadvantages for their implementation, such as the specific

requirement of a tailor-made hardware and software and in some cases also mobility problems (Kumari et al., 2019), since in some cases, data transfer is realized via cables in order to generate a more realistic image, or to reduce lag and processing times.

1. Literature review

The current retail market began to shift from regular purchasing activity to a more interactive industry, where the customer is more engaged in the overall shopping experience (Pitke et al., 2023). This is possible through various implementations of AR and VR solutions in the purchasing process. But first, we first need to define the notions of augmented and virtual reality because these 2 terms might get easily used in the wrong context. Therefore, AR or augmented reality refers to leveraging specific virtual elements in the real world, while VR or virtual reality goes beyond and also develops a new reality (Kim et al., 2023). It can be imagined that AR works like an applied filter on an element that exists in the real world. The main difference with VR is that it also builds this element, therefore, nothing that is shown in VR needs to exist in the real world. There are also many deviations and subsidiary forms from those two main technologies that emerged, one of the most spread being the use of so-called MAR or "mobile augmented reality" apps (Dacko ,2017) that refer to augmented reality applications that are used on portable devices such as phones or laptops. It is also shown that some AR solutions seem to be more favored by customers than others (Xue et al., 2022). This is the case between AR apps and magic mirrors, due to the fact that AR apps can be used with the personal phone, but magic mirrors are more limited and people can feel uncomfortable when using them knowing that there are other people waiting in line to do so (Xue et al., 2022).

Companies can leverage the use of AR and VR in their processes and their products and generate brand awareness, promote loyalty, and streamline the purchasing process. For instance, studies have shown that end users show a higher valuation for the companies that offer them such AR or VR capabilities (Dacko, 2017). It has also been shown that such implementation can have a positive impact on the revenue of companies by raising them in the short run (Hilken et al., 2022; Tiutiu et al., 2025). Individual users can benefit from these technologies by visualizing different objects in different environments, as is the case with IKEA and its application. Studies have shown that users of such technologies perceive those features as enjoyable and useful because they don't need to use their mental imagery skills to visualize their product in their desired environment (Iranmanesh, 2024). Therefore, the mental imagery process is positively influenced by such developments (Hilken et al., 2022). This leads to a more streamlined shopping experience and they are more prone to becoming actual customers of IKEA. This intention is also supported by IKEAs so-called "Democratic Design" which focuses on five key elements such as aesthetics, practicality, durability, eco-friendliness and affordability that targets a very broad audience, not a specific client segment (Zhang et al., 2024). On the other side there is also a significant risk that refers to the uncertain outcome of such VR implementation. Despite the fact that such technologies improve the shopping experience, they can be considered as some kind of tools for attracting customers' attention, rather than using them specifically for their initial planned purpose. This is in accordance with the findings from another study that shows that 51% of researched papers out of 129 analysed, were focused on retail in the domain of marketing (Ambika et al., 2023)

Customer acceptance and position regarding these type of technologies are also a key factor to be taken into consideration when deciding to implement specific VR and AR pilot projects, since such projects require a substantial financial backing from the specific enterprise. Studies have shown that consumers tend to have an overall positive view regarding the adoption of such technologies since they try to compensate the lack of interaction with the product that exists on regular online shopping websites (Bonetti et al., 2018). In the near future these types of technologies can become critical factors for enterprises to establish customer engagement (Pitke et al., 2023).

Many articles focus on key aspects that are relatively common to the traditional environments of the retail industry, such as customer emotions, or purchase decisions (Xi and Hamari, 2021). There seems not that many new elements that AR and VR could bring to the table when comparing them to the existing ones, however, they try to maximize the efficiency of the existing ones, such as the ones mentioned earlier. This is uncommon because such technologies are still in the emerging phase, and due to the fact that they are very new and not that much good understood, researchers and companies need to evolve and develop based on a current existing baseline (Xi and Hamari, 2021). It is shown that the use of AR enables the customers to become co-designers or co-creators of the shop or product itself (Caboni et al., 2019). Companies can collect specific data from the customer interaction with AR or VR solutions and analyze them to adapt to the customers' needs and imrove the purchasing decision making process. This can mean

the reshaping of the actual store (Caboni et al., 2019) or replacing the products in a different location where customer traffic is more dense, or where customers tend to purchase that specific product more. This can be then further refined to implement different cross-selling techniques to further boost the revenue of companies.

2. Research Methodology

For this paper, we chose to implement a slightly different approach, including some ideas that were found out by the artificial intelligence using a specific natural language model developed by OpenAI, namely ChatGPT. First, we used more prompts to fine tune our searching methodology and determine if this approach would be valid and useful for our research. Our first prompt that we used was: "give me concrete examples of companies that implemented VR and AR techniques in their products with some useful scientific links referring to it. The companies should be active in the domain of retail". After many iterations of searching and adapting the prompt by modifying specific words to see different results from the program such as exchanging words with synonyms, adding new words or even eliminating some, we identified some interesting topics and specific examples of implementation with regards to AR and VR in big companies. Such topics were related to companies like Nike with their AR implementation that enables users to scan different products and get information regarding those products, IKEA with IKEA Place, Machine-A which is a concept store that partnered with the Institute of Digital Design to create an AR shopping experience, Sephora with its Magic Mirror implementation, Dermalogica with Natalia, a virtual human that helps to train professionals regarding specific product usage. Other companies such as Zara, Lowe's and L'Oreal were also mentioned. After that we filtered them accordingly to their authenticity and validity by analyzing the scientific papers published on Web of Science and the overall information from available from the internet. Topics that were found little to no information regarding the actual implementation, were let aside in favor of those that were found to provide information regarding the implementation of them. Therefore the validation of those implementation was conducted based on the available information from the online field, more specifically number of articles, and number of websites that provided useful information. Following that, we built upon those topics by discussing the method of implementing those technologies either in the shopping experiences or in the end-product itself, as well as the benefits and drawbacks that were or might have been encountered.

For the analysis we focused mainly on AR, and AR based, implementations since these are the easiest to develop and to implement from the ones mentioned earlier. The two most frequently seen types of AR implementations are AR (augmented reality) itself and MAR (mobile augmented reality). Therefore we analyzed the implementation of AR and MAR in different situations and industries, namely in retail with focus on IKEA, in gaming with Pokémon Go and in fashion with Sephora.

3. Results

One of the first, also successful, AR and VR implementations in retail found was the launching of the IKEA Place application (IKEA, 2017). This application lets the user visualize specific IKEA products, mainly furniture products, in their desired environment. The users simply need a device, such as a smartphone with relatively basic technical specifications, an active internet connection, and they can use the application with ease from everywhere. One big downside regarding this whole topic with Ikea is their initial accessibility. Due to the fact that this app was developed with Apples ARKit, this app was only available on IOS devices (IKEA, 2017). In this case although the overall implementation was successful and users enjoyed the use of it, the Android users felt forgotten. This situation was resolved by incorporating this feature into the current IKEA app through the function of IKEA Kreativ feature and also on its website, where users can freely roam in different virtual spaces, creating environments with Ikea products for free. For the mobile app, where IKEA Kreativ is available, users can scan with the phone camera their place or desired environment, then the app processes the taken images and gives the possibility to move forward with the desktop version or with the app itself. After that, it plots automatically the scanned environment, and the user is capable of searching and adjusting the products of IKEA according to his or her personal taste, without the need of an IKEA consultant. The user is also capable of altering the existing objects in the scanned environment, making place for possible new IKEA products. After the removal of objects, the system automatically fills the blank space, according to its surroundings, in order to maintain the accuracy of the environment.

IKEA adopted a lean business model by maximizing the value generated by their products while also reducing the waste generated in their manufacturing process (Li et al., 2012). This is one of the reasons

why IKEA works with its suppliers, to implement new, possible innovative, ways to manufacture furniture without impacting its overall production process (Li et al., 2012). It is also the reason why IKEA implemented a VP or Virtual Prototyping method in the development of specific products (Li et al., 2011). By using such approach, they minimize the possible errors that can appear during the assembly of the products, since the products are made from prefabricated parts (Li et al., 2011).

Some lean aspects can also be seen in their stores. For example, they don't have many employees helping in one area of products like kitchen furniture and products, or living room, or bedroom and its adjacent products, therefore, meaning that they try to minimize their cost with personnel. This concept also emphasizes on the necessity of the customer to select its product from the warehouse after going through their showroom and building it themselves. Consequently, IKEA adopted the so-called DIY or "Do it yourself" methodology.

Another successful implementation of AR technology is the launch of the Pokémon Go application, a mobile location-based game (LBGs), that lets users apply specific online characters, Pokémons, into the real world and chase them in order to collect them (Meschtscherjakov, 2017). The adoption of this app was astonishing between the children, because soon after the launch, everyone was playing it. This whole situation had some positive and negative effects on various key aspects. On the one hand, there was a sudden and huge increase in the Pokémon franchise, which was slowly forgotten and remembered as something from the past. On the other hand, due to the fact that children were so absorbed by this application, there were some serious cases where children were injured because they didn't pay enough attention to their real environment (Gibbs, 2016). To be considered is also the fact that kids were spending more time outside, but on their phone, which is sort of counterintuitive to the scope of being outside and playing in the real life, with real friends. One positive consequence of this situation is the fact that it increased the exercise of the users, since users needed now to actively go and chase Pokémons, some of them going the extra mile of achieving an average distance of 383 km during 2 weeks of playtime (Meschtscherjakov, 2017). Also interesting to note is the fact that Pokémon Go implemented one goal that was easily adapted to the preferences of each end user. The end goal, as their Motto "Gotta Catch'Em All" suggests, is to catch all Pokémons from the Pokedex (Meschtscherjakov, 2017), however, some users derived from this goal and focused only on the process of collecting Pokémons, not necessarily filling their Pokedex. Other users focused more on evolving their existing Pokémons. The primarily reason why this app was such a success is the fact that the users found it fun,

From these 2 implementations, it can be traced the fact that such technologies can be adapted to various target groups. IKEA targets young adults on the lookout for designing possibly their first home, as well as adults that are in the search of redesigning their home. On the other hand, Pokémon Go, targets the younger audience, mainly children and teenagers who are relatively tech-savvy and spend a significant amount of their time playing video games.

Another example of AR integration and adoption can also be seen in the make-up industry, since big brands such as Sephora adopted an augmented reality mirror in order to facilitate their customers to visualize how their products would look, as if the user would have applied those specific products. This technology is based on live-time scanning of the users' face and applying different filters in order to show the result a specific product will have if it were truly applied.

Some key elements of this pilot program were identified and discussed by experts in the domain. Among the pros, the experts debated that such a program will definitely enhance customer engagement, since they offer a new interaction experience for the customer, it will reduce the return rate of the products because the users have a better chance of understanding how the products will look on their skin (ProvenReality, 2024). Talking about the topic of return rate of cosmetics, it needs to be mentioned, that make-up in general is a product that is in most cases nonrefundable if the product itself was opened. The biggest reason behind that is the fact that the product becomes in direct contact with the skin and if the product were to be returned, there may be different bacteria on the remaining product without having a way to remove it. Therefore, the product becomes unusable to other potential customers. The Sephora AR mirror tries to mitigate this situation by applying that visual filter with the product on the scanned face of the person. Among the cons of implementing such a technology, experts say that the current technical limitations are pretty limited and do not show a 100% accurate effect, but this will be drastically improved in the coming years with the advancements made in those technologies (ProvenReality, 2024). Also, aspects such as privacy concerns, the overall dependency of an internet connection and the limited physical sensation have a strong impact on the acceptance of such programs (ProvenReality, 2024).

Conclusions

This paper focuses only on analyzing AR and VR implementation and further develop the current understanding of AR and VR technologies. Due to the nature of the paper, it is limited to represent and interpret the data already available on the internet. However, some interesting facts can be concluded from this, mainly that AR and VR can be implemented in various industries and branches, each potentially having similar or different outcomes. This shows the versatility these 2 types of technologies and further grounds the idea that AR and VR can have a positive impact on the performing enterprise, if implemented in their business models. It is recommended for researchers and companies to understand and further research the impact that such technologies can provide, since they show a significant potential to revolutionize the current retail market by bringing a new, innovative element to the table and facilitating a more user-oriented interactivity and experience.

One approach that can be taken in a future study is the empirical analysis of such interactive technologies, since at the time of writing there is still some gaps in the research field around this subject. Focus groups can also be studied in order to generate some models that can be used to predict future trends and also improvement direction for these technologies, in order to make them more attractive.

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