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**Data-Driven Marketing**

**Digital Transformation in Fashion: The Role of AI and AR in  
Enhancing Online Customer Experience**

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Master Thesis

presented as partial requirement for obtaining a Master's Degree in Data-Driven Marketing

**NOVA Information Management School**  
**Instituto Superior de Estatística e Gestão de Informação**

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by

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Master Thesis presented as partial requirement for obtaining the Master's degree in Data-Driven Marketing, with a specialization in Digital Marketing & Analytics.

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June, 2024

## **STATEMENT OF INTEGRITY**

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

*[Lisbon, June 2024]*

## ABSTRACT

In an era where the fashion retail landscape is rapidly transitioning from brick-and-mortar stores to digital platforms, there is an emerging focus on the pivotal role that Artificial Intelligence (AI) and Augmented Reality (AR) play in facilitating this transformation. The goal of this thesis is to analyse how these technologies influence Customer Experience and Customer Engagement, addressing a significant research gap in their collective effect on consumer behaviour and purchase intentions. Using a quantitative approach, it assesses experiences across various AI and AR-integrated e-commerce platforms, including renowned names like Amazon, Shein, Adidas and Gucci. This research contributes to a deeper understanding of the synergistic impact of AI and AR, potentially leading to significant advancements in online fashion retail.

## KEYWORDS

Artificial Intelligence; Augmented Reality; Customer Engagement; Customer Experience; E-commerce; Online Fashion Retail

### Sustainable Development Goals (SDG):



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# 1. INTRODUCTION

The evolution of fashion retail has evolved significantly from traditional brick-and-mortar stores to an increasingly digitalized e-commerce landscape. In the old days, fashion retail was characterized by in-person shopping experiences, where tactile and visual aspects played a crucial role. However, the rise of the internet and digital technologies altered the way consumers interact with fashion brands. This shift, not only changed consumer expectations but also compelled fashion retailers to innovate and adapt to a digital marketplace, integrating advanced technologies to enhance Customer Experience and meet the evolving demands of a technology-driven society.

Therefore, the integration of these innovative technologies, particularly Artificial Intelligence (AI) and Augmented Reality (AR), has become integral in the improvement of the effectiveness of the fashion industry. This evolution reshaped traditional business models, fostering the digital marketplace. As a result, fashion retailers have adapted by creating virtual spaces and implementing omnichannel strategies, thereby enriching Customer Experiences and driving sales in a highly competitive environment (Cao, 2018).

The integration of AI and AR into e-commerce has been pivotal in overcoming the inherent limitations of online shopping. Notably, the limitations in assessing product attributes, such as quality, texture, and fit, due to the absence of a tangible shopping environment, lead to increased return rates and consumer dissatisfaction (Zhang et al., 2017). Furthermore, the lack of personal interaction and secure transaction processes exacerbates the hesitancy of consumers towards online fashion purchases (Rashad Yazdanifard, 2011; Santos et al., 2022).

This represents a challenge for online fashion retailers since they are losing potential customers due to their uncertainty about buying online. In addition, previous studies demonstrated the significant role of trust in shaping consumer's attitudes and acceptance of AI technologies (Choung et al., 2023), implying it can also be a challenge for shopping online, if it does not provide the sufficient reliability and trustworthiness to consumers. In order to overcome this challenge, companies must adapt to this technological evolution, and integrate Artificial Intelligence and Augmented Reality in their e-commerce platforms, to provide a better experience to their customers. Chatbots and Recommendation Tools, for instance, revolutionize customer service assistance and offer personalized product suggestions, respectively, enhancing customers' decision-making process and the overall experience (Pillarisetty & Mishra, 2022). Visual Search came to improve the accuracy and satisfaction of the shopping experience, allowing customers to search specifically for the items they need through image. Furthermore, Virtual Try-On (VTO), an AR application, enables customers to virtually try on clothes, thus reducing return rates and increasing consumer confidence (Dagan et al., 2023). In summary, AI and AR are pivotal tools in resolving the inherent issues of this industry, thereby contributing to the sector's evolution.

Even though there are recent investigations into the importance of the integration of AI and AR tools in e-commerce, there is a lack of comprehensive studies into their impact on consumer behaviour and decision-making in the online fashion retail context (Pillarisetty & Mishra, 2022). Moreover, there remains a gap in understanding the full spectrum of AI's capabilities beyond consumer engagement. This includes the research into how AI and AR reshape the entire e-commerce experience together, and how they can leverage both efficiency and effectiveness of online retail, especially in the fashion industry. This identifies a significant research gap in the domain of this industry, highlighting the need for further scholarly exploration to fill this void.

Hence, this research aims to comprehensively analyse the impact of Artificial Intelligence tools on Customer Experience and Customer Engagement in the online fashion retail context. Moreover, it will explore the potential of AR in resolving specific challenges of online shopping, such as difficulties in product attribute assessment and issues with sizing and fit, to devise strategies that reduce return rates and boost consumer confidence. This leads to the following Research Objectives of the study:

1. RO1: "How can Artificial Intelligence influence the overall Customer Experience in online fashion retail?"
2. RO2: "How can Augmented Reality influence the overall Customer Experience in online fashion retail?"

Therefore, this research delves into how AI and AR can overcome digital shopping challenges through enhancing product visualization, personalization, and user interaction. By leveraging AI's capabilities in Visual Search, Chatbots and Recommendation Tools, and AR's potential in creating immersive shopping experiences, the aim is to reduce the uncertainty and dissatisfaction associated with online fashion, thus increasing customers' engagement and experience. Furthermore, it will address how the trust that consumers feel with the technology in use influences their overall experience while shopping online.

In light of this observation, it leads to the research question (RQ) of this study: "How does the integration of Artificial Intelligence and Augmented Reality enhance the overall Customer Experience in the context of online fashion retail?".

The present study involves designing a survey (quantitative approach) with targeted questions on User Engagement, Trust in the Technology and Customer Experience. Participants will be surveyed through popular online platforms to ensure diverse responses. The goal is to focus on the application of these technologies in e-commerce, such as Virtual Try-On (VTO), Recommendation Systems, Chatbots, and Visual Search Tools. The data collected will be analysed using the statistical tool SmartPLS, to identify key trends and patterns, and the findings will be interpreted and reported, highlighting their relevance to the research objectives and contributions to the field.

To achieve the research objectives, it will be necessary to resort to the collected data from the online survey, and then perform the correspondent analysis alongside analytical tools such as Smart PLS.

The survey will present different scenarios to the respondents through videos, with experiences of shopping on a website with integrated AI and AR. Following this approach, the aim is to gain relevant insights from consumers' opinions, identify patterns in their preferences, and extract valuable information regarding their experience in this topic. Therefore, it will be possible to draw conclusions regarding how the integration of AI and AR in these e-commerce websites enhances the overall Customer Experience, and uncovers the challenges and barriers associated with the adoption of these transformative technologies.

The structure of the thesis is crafted to provide a comprehensive exploration of the subject matter. Section 2 delves into an extensive review of pertinent literature, establishing a solid theoretical foundation of the current usage of these technologies for the study. Then, Section 3 will approach the Conceptual Model of the study, presenting the correlation between the variables under examination. Following this, Section 4 delineates the Methodology, articulating the research design, methods of data collection, and analytical techniques employed in the study. Section 5 is dedicated to the examination of the Results, and Section 6 is the Discussion, where findings are critically analysed and discussed in light of the existing literature. The final section 7 serves as the Conclusion, synthesizing the key findings and offering suggestions for future inquiry in the field.

## **2. LITERATURE REVIEW**

### **2.1. FASHION RETAIL**

This section will initially define the concept of retailing and an analysis of its history, with the intent of providing a solid background of the fashion retail market. In order to develop a comprehensive study of this theme, there is a need to understand these industry's global dimensions. Consequently, an analysis will be conducted to trace the evolutionary trajectory of fashion retail, encompassing its progression from conventional brick-and-mortar retail stores to the necessity for adaptation to e-commerce retail.

#### **2.1.1. THE HISTORY OF RETAILING**

Retailing constitutes a socio-economic system characterized by a set of activities that involve facilitating the direct sale of goods or services directly to ultimate buyers. As such, retailing serves not only to fulfill the essential daily necessities but also to foster the emergence of new lifestyles and prosperity in the community (Hameli, 2018; McCormick et al., 2014).

##### **2.1.1.1. FROM TRADITIONAL TO ONLINE FASHION RETAIL**

The inception of conventional retail stores occurred during the 1800s, with a primary emphasis on the sale of merchandise (McCormick et al., 2014). In the twentieth century, these stores have evolved into clothing-based establishments, offering a greater and more diverse product range. This marks the birth of fashion retail: at first, consumers confined their purchases to the nearest convenience store, acquiring only what was deemed necessary.

However, over the following five decades, consumer behaviour shifted towards a preference for more options at more competitive pricing, being willing to go further in the search for optimal choices at favorable prices (Hameli, 2018).

Approximately a century later, the Internet arrived into the world. During the 1980s it was witnessed the initiation of commercialization efforts associated with the Internet, involving the establishment of competitive and private networks, as well as the development of commercial products incorporating Internet technology. During this period, dozens of vendors seek to integrate this technology into their products, facing however with challenges related to its effective management and user interaction strategies.

In response to this evolving landscape, Dan Lynch, a prominent developer of the TCP/IP protocols, conducted several workshops aimed at providing knowledge to these vendors on how to navigate this technology. It was through these proactive initiatives that the commercialization of the Internet gained momentum on a global scale (Leiner et al., 2003).

Hence, in a retail environment led by multichannel retailers, the Internet has revolutionized and will continue to revolutionize the retail sector in the years ahead (International Journal of Electronic Commerce, 2014, p.97). Retailers have realized the potential of the Internet in several different ways: providing information, facilitating two-way communication with consumers and the collection of their data, and promoting goods and services. Overall, the Internet came to overcome the benefits of traditional commerce (Doherty & Ellis-Chadwick, 2010).

As a result, traditional brick-and-mortar stores were forced to adapt to this market evolution and shift from the physical marketplace to the virtual market place (Doherty & Ellis-Chadwick, 2010). This was when the term “e-commerce” was raised.

E-commerce can be defined as a business strategy in which enterprises generate revenue by selling their products and services via the Internet (Cao, 2018). It involves online transactions between businesses (B2B), businesses and consumers (B2C), and consumers trading with other consumers (C2C). E-commerce allows a wide range of different activities, such as online retail, internet banking, and electronic payments, among others. The proliferation of e-commerce has been a transformative force in the global economy, reshaping traditional business models and fostering a digital marketplace.

In the realm of online retail, consumers can access a more extensive and diverse range of products, benefit from lower prices, enjoy convenient shopping experiences, and obtain detailed product information, surpassing what is typically offered in traditional brick-and-mortar retail settings. Simultaneously, the advent of online commerce, commonly referred to as e-commerce, accompanied by digital innovation, presents various advantages for businesses. E-commerce empowers firms with enhanced accessibility to consumers, facilitating market expansion and increased sales. Additionally, through e-communication, businesses can gain a deeper understanding of consumer demand, thereby enhancing the overall consumer experience (Lee & Leonas, 2018).

With this new tool established in the market, the fashion sector has begun to develop new virtual spaces instead of focusing on opening physical stores (Aiolfi & Sabbadin, 2019). In the early years of e-commerce growth, the typical e-commerce consumer was a technologically proficient male with low expectations of the online purchase experience. However, with the rapid evolution and expansion of the market, this target began to change to a female consumer with lower incomes, but with very high expectations of the online purchase experience (McCormick et al., 2014).

Thus, the big challenge for the retailers started to be the management of all the touch points, while guaranteeing a unique brand experience for the customers. As a result, a new retailing strategy was raised, termed “omnichannel”, which provides a synergic management of the

touch points in order to optimize the Customer Experience. According to Aiolfi and Sabbadin (2019), it can be defined as the set of activities involved in selling goods or services through multiple channels simultaneously, with full consumer interaction and complete integration managed by the retailer.

Omnichannel is one of the most significant innovations in the fashion industry. The involvement level in a fashion purchase decision affects the decision-making process, influencing positively Customer Experience and sales. Therefore, it is important to understand customer's decision-making stages for fashion, considering the role of risk and the brand, in order to implement a successful omnichannel fashion retail strategy (Lynch & Barnes, 2020). Nowadays, consumers use many, if not all the available sales channels at the same time when making purchases including online channels, mobile devices, and the physical store (Aiolfi & Sabbadin, 2019). Furthermore, it is mandatory to highlight the importance of these channels to be customer-centric, which therefore will contribute to customer satisfaction (McCormick et al., 2014).

## **2.2. FACTORS THAT INFLUENCE ONLINE CUSTOMER EXPERIENCE**

Before delving into the explanation of the main technologies that will be analysed in the present research, it is essential to understand the multifaceted dynamics that shape online Customer Experience.

Starting with Customer Engagement, previous research defends that this variable improves the online Customer Experience by creating a connection between consumers and brands, resulting in improved loyalty and corporate success. E-retailers may build immersive shopping experiences that increase online shoppers' engagement and pleasure by leveraging tailored communication and interactive platforms. This positive engagement is critical for increasing repeat purchase behaviour and brand loyalty, as engaged customers are more likely to experience satisfying interactions that exceed their expectations (Ahmad et al., 2022).

Perceived Ease of Use is another factor on the behaviour of the consumer towards the online shopping. According to Eneizan et al. (2020), perceived ease of use refers to the user's belief that a technology is straightforward and requires minimal effort to operate. This study also refers that users who are already very familiar with online shopping feel less risk on this activity rather than consumers who do not experience it that much. The authors also tested positively one of the hypothesis of their study, which defends that the ease of use of a website has a positive relation on the trust felt by consumers on shopping online.

In addition to Customer Engagement and the Perceived Ease of Technology use by consumers, another variable tested for its influence on online Customer Experience is Technology Trustfulness. Two different studies revealed the importance of this variable in the effect of

Customer Experience. Consumers demonstrated an improved experience with online shopping when they feel their privacy is under protection, providing a trustworthy and reliable shopping process (Choung et al., 2023; Rose et al., 2012). Another previous study (Foroudi et al., 2018a) identifies two types of consumers: those knowledgeable and committed to learning about online shopping technology, and older consumers reluctant to use smart technology due to age or caution. Hence, Customer Experience on websites varies based on the level of trust in the technology. Therefore, online retailers are challenged to encourage acceptance and willingness to learn how to use technology among consumers.

In summary, grasping the dynamics of online Customer Experience is crucial for improving e-commerce success. Studies highlight the importance of Customer Engagement, Perceived Ease of Use and Technology trust in shaping this experience. Personalized and interactive experiences foster loyalty, while ease of use builds trust in online shopping, enhancing customer satisfaction and experience. Varying levels of trust in technology among consumer groups emphasize the importance for e-retailers to adjust and educate to instill confidence in their platforms, ensuring a positive and safe online shopping experience for all users.

### **2.3. THE ROLE OF TECHNOLOGY IN E-COMMERCE**

Digital technologies have become central to people's lives, seamlessly integrating a variety of devices and offering multifaceted accessibilities. Among these emerging technologies, there are Artificial Intelligence and Augmented Reality, which together play a pivotal role in enhancing the efficiency of the fashion business. These advancements, not only are responsible for elevating the user experience, but also contribute to an overall improvement in the consumer value proposition. Therefore, every fashion brand that effectively adapts these technologies to its business model will gain a competitive advantage (Cao, 2018).

Nevertheless, before delving into the potential enhancements facilitated by these technologies, it is imperative to assess the areas that indeed require improvements. Consequently, understanding the predominant opportunities and challenges inherent in online shopping is essential.

#### **2.3.1. OPPORTUNITIES AND CHALLENGES IN SHOPPING ONLINE**

The rise of online shopping has redefined the dynamics of fashion retail, presenting a spectrum of opportunities and challenges for consumers and businesses. This sector will provide not only insights regarding the plenty of benefits and advantages of shopping online, when compared to the traditional purchase process, but also some risks and limitations (Santos et al., 2022).

### **Opportunities: Consumer Perspective**

In the realm of consumer advantages, online shopping presents plenty of opportunities. For consumers, the expansive inventory available online ensures a diverse selection of products, fostering a marketplace with a wide array of choices. The ubiquity of online shopping also enables consumers to make purchases at their convenience, transcending temporal and spatial constraints. The robust competition within the online marketplace also stands out by driving its prices downward, providing consumers with affordability and facilitating straightforward comparisons among different brands. Furthermore, the accessibility of comprehensive product information, encompassing details such as origin, manufacturers, pricing, features, and materials, empowers consumers with an informed decision-making process.

The absence of waiting lines in online transactions not only streamlines the purchasing experience but also affords consumers valuable time savings while minimizing inconveniences. Additionally, the convenience of online shopping eliminates the necessity for consumers to physically travel to brick-and-mortar stores, resulting in tangible time and cost savings associated with transportation (IEEE Consumer Electronics Society et al., n.d.; Rashad Yazdanifard, 2011; Santos et al., 2022).

### **Opportunities: Organizational perspective**

For organizations, the online platform offers an avenue to access a global market, enabling businesses to connect with suppliers and consumers on an international scale with minimal associated costs. The transition to online retailing presents the potential for reducing operational costs related to product processing, physical storage, and distribution. Consequently, this may lead to a reduction in the requisite workforce, including the sales team. Overall, the initial investment for businesses venturing into the online market is relatively modest.

### **Challenges: Online Shopping**

Conversely, online shopping poses distinct challenges and risks that warrant consideration. A notable challenge lies in the perceived risk felt by consumers, who may exhibit discomfort when providing their card information on e-commerce websites, often resulting in the abandonment of shopping carts. Insecurity regarding payment information is a prevalent concern among consumers, wherein fears of personal information being sold or exchanged among disparate online platforms contribute to apprehensions surrounding online transactions.

The absence of a tangible shopping environment also poses challenges as consumers encounter difficulties in gaining perceptual awareness of the quality, texture, and appearance of goods. The limited direct interaction with products on online platforms underscores the challenge of assessing product attributes. Issues related to size and fit present ongoing

challenges, as consumers grapple with the uncertainty of whether clothes purchased online will align with expectations in terms of style, colour, and size. This uncertainty contributes to the potential for increased return rates.

The absence of a real shopping environment, coupled with the lack of personal interaction and recommendations from sales personnel, is a significant drawback in online shopping. Some consumers value the tangible experience offered by in-store environments.

Logistical limitations, including delayed deliveries, incorrect product shipments, or damages during transportation, constitute potential pitfalls that may impact the overall efficiency and reliability of the online shopping experience for consumers (IEEE Consumer Electronics Society et al., n.d.; Rashad Yazdanifard, 2011; Santos et al., 2022).

### **2.3.2. IMAGE INTERACTIVE TOOLS**

Image Interactive Tools (IIT) are website features designed to enhance product experiences for online shoppers by allowing them to view products from different angles, customize design features, and visualize how apparel items look on their bodies or avatars to assess garment fit and appearance (Baytar et al., 2020). IIT thus allows the manipulation of the products, disposing of several features such as mix and match, zoom in/out, and 360° view of the products, among others. These features will therefore reduce the perceived product risk and increase the entertainment value of the online shopping experience (Pillarisetty & Mishra, 2022). Consequently, Image Interactive Tools are sophisticated technologies that enhance user engagement in both Artificial Intelligence and Augmented Reality.

In AR, IITs facilitate users to engage with virtual elements overlaid in the real world, increasing the perception and understanding of their surroundings. In AI, these tools help in processing and interpreting visual data, assisting AI systems in recognizing patterns, analysing images, and making decisions based on visual inputs.

Particularly in the context of online fashion retail, IITs are essential in offering interactive and personalized experiences, such as Virtual Try-Ons and product visualization, thereby enhancing Customer Experience, Satisfaction, and Engagement.

Further sections 2.3.3 and 2.3.4 will comprehensively explore this incorporation of Image Interactive Tools (IIT) in Artificial Intelligence and Augmented Reality. This analysis will delve into how IIT enhances and intersects with these advanced technologies, highlighting its crucial role in the evolution and functionality of these technologies.

### **2.3.3. ARTIFICIAL INTELLIGENCE**

In the ever-evolving world of e-commerce, the integration of Artificial Intelligence (AI) has emerged as a transformative force, redefining the dynamics of customer behaviour and brand influence. As information and communication technologies advance, companies are increasingly turning to AI as an innovative tool to enhance the e-commerce experience. This sector explores the synergy between e-commerce and AI, delving into their intrinsic benefits and evaluating the significance of AI in shaping consumer interactions within the context of online fashion retail. With a focus on existing studies, the goal is to illuminate the pivotal role AI plays in influencing customer satisfaction, building brand trust, and ultimately driving success in the dynamic landscape of digital commerce (Pillarisetty & Mishra, 2022).

Although often associated with robotics, AI encompasses a wide technological spectrum, including machine learning, natural language processes, and object detection. Its ability to attract customers through personalized interactions has become a strong tool, significantly enhancing the revenue for e-retailers. However, beyond Customer Engagement, AI is reshaping the entire e-commerce experience in several different ways. This thesis will go deep into analysing the integration of Chatbots, Recommendation Tools, and Visual Search in online fashion retail. The aim is to understand at what point these tools influence Customer Experience, and how Customer Engagement might act as a mediator, influencing positively these connections.

For this understanding, it is important to highlight some definitions that will allow a better interpretation of the usage of these tools in e-commerce.

**Customer Experience:** Online Customer Experience is composed of four dimensions, such as informativeness (cognitive), entertainment (affective), social presence (social), and sensory appeal (sensory) (Pillarisetty & Mishra, 2022). Nowadays, the main idea is to create the most memorable experiences for the customers, instead of the physical product itself. Thus, customers are allowed to interact with the website most entertainingly and engagingly.

**E-satisfaction:** Customers' evaluations of their online retail experience compared to brick-and-mortar stores (Pillarisetty & Mishra, 2022). The same authors defend that Customer Satisfaction results from two factors: the satisfaction from their most recent online purchase and the cumulative satisfaction and online Customer Experience (OCE) built over time with a particular website or e-retailer (Pillarisetty & Mishra, 2022).

**Customer Personalization:** Customization of the entire shopping experience, based on individual preferences, from awareness to post-purchase. Personalized recommendations boost customer satisfaction and loyalty, being able to simplify customer decision-making (Pillarisetty & Mishra, 2022).

### 2.3.3.1. CHATBOTS

AI-Chatbots are the newest customer service, involved in websites, available 24 hours a day. According to Fedorko et al. (2022), the main purpose of a chatbot is to automatically address questions, respond to basic voice commands, and offer product recommendations through a natural language processing system. Artificial Intelligence allowed the substitution of physical people for virtual assistants, which are fully responsible for customer communication. This technology uses AI techniques to communicate as humans, providing instant messages on websites or mobile apps. Chatbots can make the customer ask the right questions and requests, which can help them find certain products, compare different products, track their order status, and help them with their payments. Therefore, this AI tool is supposed to provide solutions and interact with customers, always learning due to its deep learning algorithms (Pillarisetty & Mishra, 2022).

Amazon is the largest online retailer and technology provider and has already adopted AI in its customer service improvements. The company has created Rufus (Figure 1), an “expert shopping assistant trained on Amazon’s product catalogue and information from across the web to answer customer questions on shopping needs, products, and comparisons, make recommendations based on this context, and facilitate product discovery in the same Amazon shopping experience customers use regularly.” (Amazon, 2023). Therefore, Rufus is a generative AI-powered expert shopping assistant, designed and trained to improve customer service on its website.

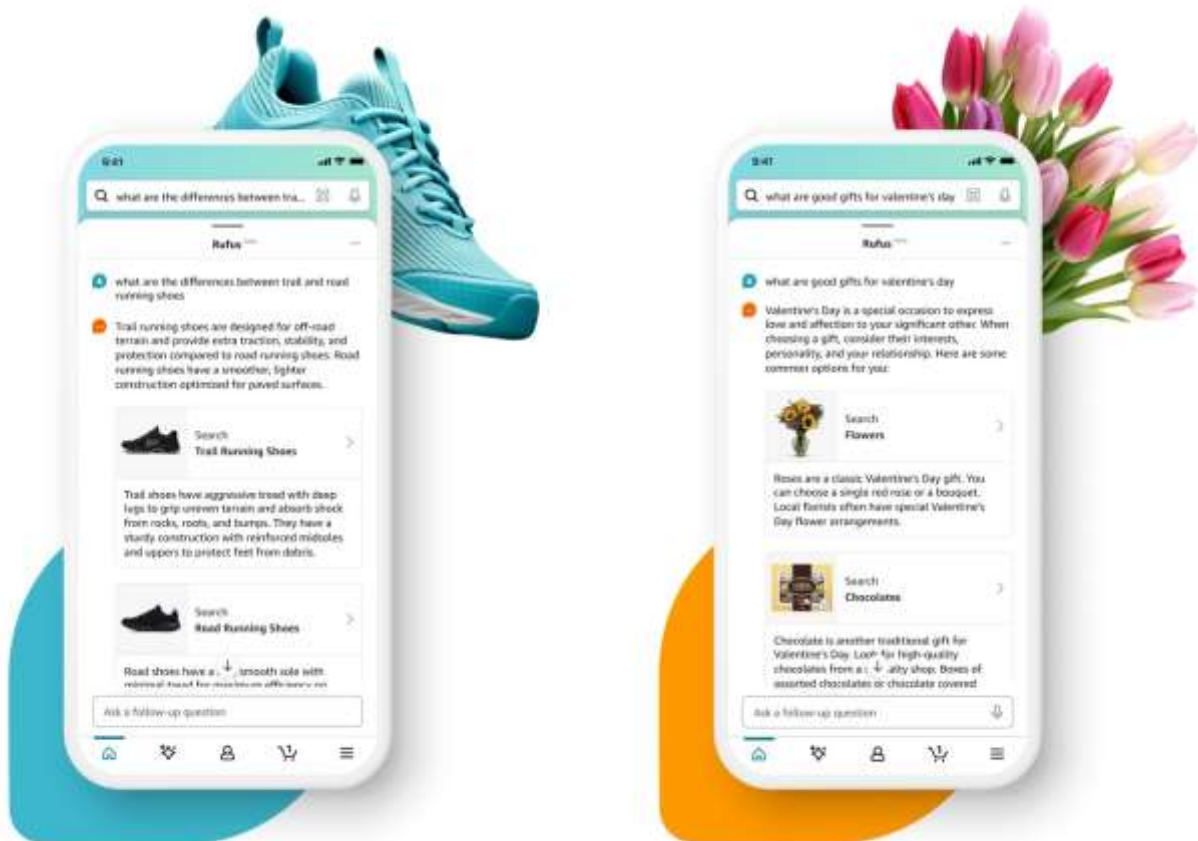


Figure 1 – Rufus: Amazon AI-Chatbot

### 2.3.3.2. RECOMMENDATION TOOLS

According to Pillarisetty and Mishra (2022), Recommendation Engines are machine learning algorithms that offer product recommendations tailored to a customer's individual history, ensuring that the suggestions closely align with their needs. These tools suggest a mix-and-match clothing product recommendation that complements customers' choices, creating opportunities for cross-selling and upselling. Therefore, according to the customer profile, this tool will relate to the ones liked or browsed in the past. Based on this information about comparisons, it is possible to create a preference history of the customer. These machine-learning algorithms have indeed the aim of providing personalized options to customers that will simplify their decision-making process (Fedorko et al., 2022; Pereira et al., 2022; Sruthi & Prabhu, 2022).

Adidas is a German athletic apparel and footwear corporation, one of the largest sportswear manufacturers in the world. The company has already partnered with an Artificial Intelligence platform to automatically generate completed recommended outfits when customers browse for a product. Leveraging data on customers' past selections, behaviours, and preferences within the online store, Adidas employs AI to furnish each customer with a recommendation feature, termed "You may also like". Consequently, the likelihood of customers favouring the suggested products is considerably enhanced, given that these recommendations are meticulously curated based on their historical navigation patterns on the website.

Figure 2 illustrates the navigation paths of two distinct consumers on the website, each searching for different products. Despite their varied journeys, both consumers eventually click on the same product. At this juncture, the AI-powered feature "Também podes gostar de" comes into play, offering personalized recommendations to each consumer. These suggestions are tailored specifically to the unique navigation paths they have followed during their visit.

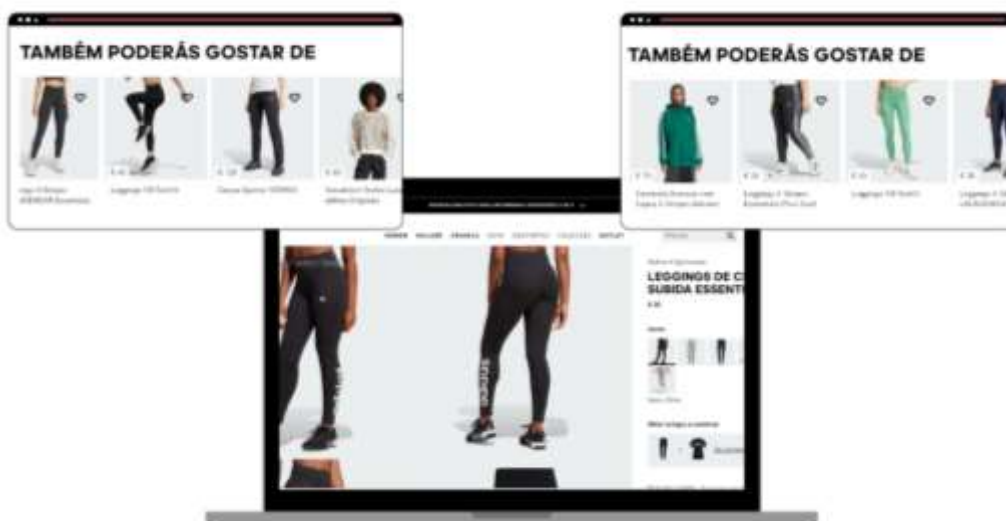


Figure 2 – Adidas Website: AI-Recommendation Tool

#### 2.3.3.4. VISUAL SEARCH

Visual Search in e-commerce allows customers to find listed items or catalogue products by using an image instead of traditional keywords (Dagan et al., 2023). This tool involves using Artificial Intelligence to analyse images submitted by users to find and recommend similar products. The aim is to enhance the shopping experience by allowing customers to search using images instead of words, leading to more accurate and satisfying results. For e-commerce and fashion retailers, Visual Search offers significant advantages: it simplifies the search process, increases Customer Engagement and Satisfaction, and potentially boosts sales by providing more precise product matches and recommendations. This innovative approach adapts to the visual essence of fashion retail, facilitating the search for customers to easily find their desired products, thus enhancing the overall online shopping experience (Dagan et al., 2023; Fedorko et al., 2022).

Visual Search holds significant potential for the fast fashion industry, as it can simplify the experience in a rapidly evolving inventory. This is particularly beneficial for customers seeking a specific item or trend but might lack the vocabulary to accurately describe or search for it (McDowell & Manoff, 2018).

ZARA is one of the fast-fashion brands that already have adopted this tool on its app, allowing customers to upload an image that can be matched to similar corresponding items in the brand's assortment (Figure 3).

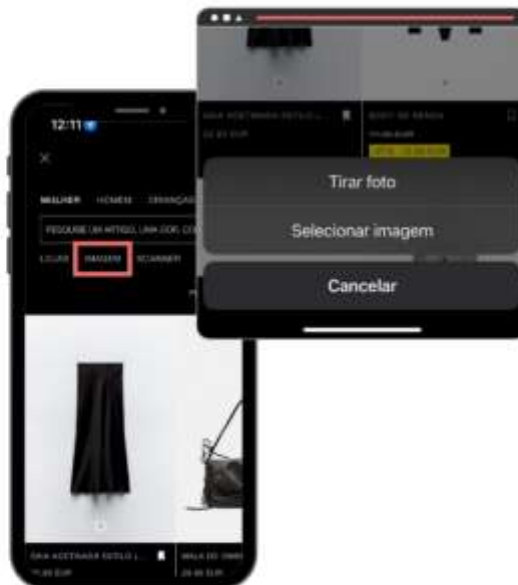


Figure 3 – ZARA Website: AI-Visual Search Tool

#### **2.3.4. AUGMENTED REALITY**

Augmented Reality (AR) is a technology that seamlessly integrates virtual content into a user's field of view, enabling practical applications such as assisted reality and immersive experiences in which virtual elements are practically indistinguishable from real ones (Kumar, 2022). In short, AR refers to an interactive technology that has the aim of integrating physical environments with virtual elements, such as information or images.

In the e-commerce world, particularly online fashion retail, AR's impact is distinctly transformative. This technology bridges the gap between virtual shopping and the tangible experience of a physical store, by integrating virtual components – such as images, videos, or interactive data – into the real environment. Therefore, AR has the goal of enhancing user's perception of reality, providing an immersive experience. Furthermore, this technology offers a unique way for consumers to interact with products before purchasing, enhancing Customer Engagement and decision-making (Lu & Smith, 2007).

##### **2.3.4.1. VIRTUAL TRY-ON**

Virtual Try-On (VTO) technology, a subset of Augmented Reality applications, is revolutionizing the online fashion retail context, enhancing consumer interaction with products. This innovative tool has the aim of blending digital and physical shopping experiences, providing a mix of utilitarian and hedonic values to consumers. VTO refers to website features that enable users to generate and alter images of products or surroundings in order to imitate or even improve their real-world experience with those things or environments (Zhang et al., 2017).

Utilizing this technology, users can select complementary clothing items from the online store and experiment with various combinations at their leisure, allowing them to view the ensembles on the screen. This capability provides customers with an enhanced visualization of the apparel's fit and style, facilitating a more informed purchasing decision. The applicability of VTO in the online fashion sector is diverse, providing both utilitarian and hedonic value to customers. It effectively mitigates the "suit, fit and match" dilemma that addresses online purchases, by enabling a realistic preview of outfits in a virtual setting. This reduces the uncertainty associated with online shopping, potentially enhancing customer consumer satisfaction and reducing return rates (Zhang et al., 2017).

Augmented Reality for Virtual Try-On is an approach that has been gaining popularity in online shopping, as consumers can see how the garments and accessories fit on their bodies, without spending time creating and customizing avatars that look like themselves, through a library of parametric models (Baytar et al., 2020).

Gucci is an example of a luxury brand that has innovatively implemented AR technology in its mobile app. This feature provides a unique Virtual Try-On experience through its smartphone app. The brand first launched this tool for its Ace sneakers, however, it developed into

different product categories, such as make-up, eyewear, nail art, and watches (Figure 4). In the case of watches, customers simply point the camera of their smartphones towards their wrist while using Gucci's app. This enables them to see how the different watches look on their wrist, viewing from various angles and in different variants, which helps in visualizing the product more effectively.

Adidas is another example of a brand that effectively adopted AR into its app (Figure 5). This feature allows customers to virtually try on Adidas' most iconic sneaker models, with the aim of increasing online conversions and reducing product returns due to style or look issues. AR try-on technology have been seen as a significant innovation in online shopping, making the experience more interactive and engaging for customers.



Figure 4 - Gucci App: AR Try-On

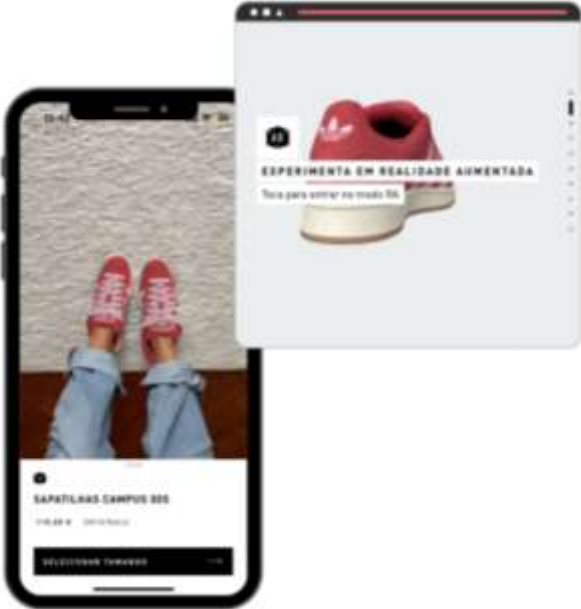


Figure 5 - Adidas App: AR Try-On

### 3. RESEARCH MODEL

The model proposed (Figure 6) in this study offers an approach to the understanding of how the integration of AI-enabled and AR-enabled technologies can improve the Customer Experience in the context of online fashion retail. Furthermore, it provides an overview of how consumers' Trust in Technology affects their online purchasing experience.

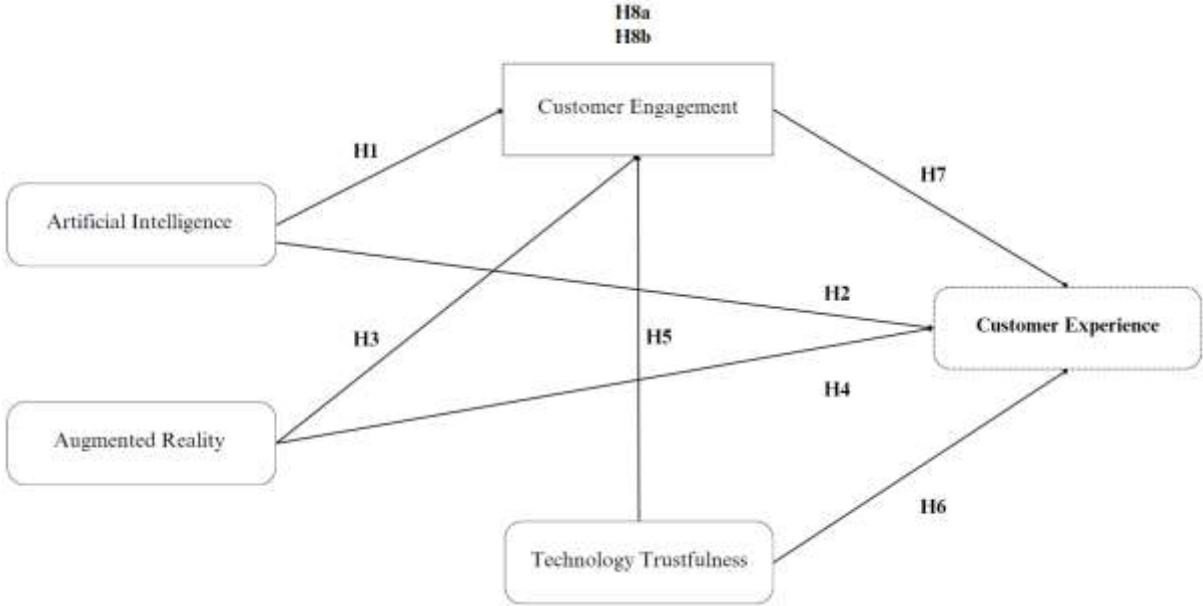


Figure 6 - Research Model

Different types of variables, which are discussed below, compose the model: a dependent variable, three independent variables and one mediator variable. A discussion of the present model with supporting hypothesis will be further presented, explaining the correlations between these variables which will be tested in the next chapter.

As previously delineated, the objective of this study is to meticulously examine the effect of AI and AR-driven technological applications and consumer’s Trust in Technology on the overall Customer Experience, with a particular focus on the online fashion retail sector. Consequently, the hypothesis for this research must be constructed upon a foundation of established scholarly work.

#### Independent Variables

In the present study, the independent variables are AI and AR-enabled technologies and Technology Trustfulness, which are hypothesized to influence, affect or cause variations in another variable, known as dependent variable. These three independent variables are the inputs that will be observed to examine their effects on the dependent variable, which is the outcome or effect that this study is proposed to investigate.

- Artificial Intelligence (AI) technologies: how AI is used in online fashion retail (Chatbots, personalized Recommendation Tools and visual search).
- Augmented Reality (AR) technologies: the applications of the usage of AR (Virtual Fitting Rooms).
- Technology Trustfulness: the trust felt by customers in technology.

## **Artificial Intelligence**

According to previous research, it is posited that the integration of Chatbots within Customer Experience frameworks serves to enhance the overall Customer Experience, suggesting a positive correlation between Chatbot deployment and Customer Satisfaction (Chen et al., 2021). Leveraging the human conversational capabilities of AI Chatbots, through both text messaging and voice recognition systems, plays a crucial role in enhancing Customer Engagement. These technologies not only support decision-making but also offer personalized, interactive, and engaging service interactions, thereby fostering stronger customer relationships and reducing uncertainty. Hence, this facilitates a deeper understanding of products, underscoring the significance of Chatbots in improving customer service.

Recent studies also indicate that the adoption of Visual Search functionalities could significantly elevate Customer Experience and improve Customer Engagement. A survey conducted by ViSenze, which is a company specializing in visual content, revealed that a significant majority of Millennials and Generation Z (62%) consumers prefer Visual Search capabilities above other emerging technologies (Dagan et al., 2023).

The third AI-driven technology that this study aims to study is AI-Personalized Recommendation Systems. According to previous studies, these systems simplify the decision-making process of consumers, resulting in a more immersive, engaging and user-friendly shopping experience (Wu & Chi, n.d.). As highlighted in the previous chapter of the present study, Personalized Recommendations provide users with products that are closer to each customer's unique tastes and purchasing history.

Therefore, based on these findings, the present research aims to test the following hypotheses:

**H1:** *The use of Artificial Intelligence in online fashion retail influences positively Customer Engagement.*

**H2:** *The use of Artificial Intelligence in online fashion retail influences positively Customer Experience.*

## **Augmented Reality**

Existing research has established that engaging experiences facilitated by Augmented Reality technologies contribute significantly not only to enhancing brand engagement, but also to enriching product knowledge and facilitating the purchasing process. Therefore, such enjoyable AR interactions are correlated with elevated brand engagement and an enhanced propensity toward purchase intentions. Furthermore, consumers who perceive these AR experiences as particularly gratifying are more likely to persist in utilizing the service or endorse it to others, as indicated by Bialkova & Barr (2022).

Then, the following hypothesis was formulated:

***H3:** The use of Augmented Reality in online fashion retail influences positively Customer Engagement.*

***H4:** The use of Augmented Reality in online fashion retail influences positively Customer Experience.*

## **Technology Trustfulness**

Another critical variable that this research intends to examine is the extent to which consumer trust in these technologies positively influences the Customer Experience on the website.

Authors of previous research pointed shopping enjoyment and trust as highly significantly determinants in the adoption of technology by customers (Foroudi et al., 2018b), implying a positive correlation between technology trust and shopping enjoyment.

Then, the following hypothesis were formulated:

***H5:** Technology Trustfulness in online fashion retail influences positively Customer Engagement.*

***H6:** Technology Trustfulness in online fashion retail influences positively Customer Experience.*

## **Customer Experience – The Dependent Variable**

Therefore, the dependent variable is the one this study seeks to explore and understand how it is influenced by the independent variables. Hence, Customer Experience is what this research is compromised to measure, examining whether it changes in response to the usage of Artificial Intelligence and Augmented Reality, as well as the Technology Trust in fashion retail websites.

- Customer Experience: general assessment of the online shopping experience.

## **Customer Engagement – The Mediator Variable**

The mediator variable plays a crucial role in elucidating the process through which independent variables influence the dependent variable. In other words, this variable acts as an intermediate in the cause-and-effect relationship between AI/AR technologies and Customer Experience. Therefore, the mediator variable of this investigation is:

- Customer Engagement: the level of interaction and involvement of the customer and the website platform.

As previously shown, these two technologies have an impact on Customer Engagement. On one hand, AI-driven technologies facilitate the decision-making process and the way consumers navigate the website to find products. This way, consumers are able to get to what they want more simply, since they are offered products they are more likely to buy, having the possibility to clarify any question they have in a very accessible way. On the other hand, with AR-driven technologies, consumers can engage with products much more interactively, leading to an improved engagement with the brand and increasing the possibility of purchase.

Furthermore, previous studies on e-retailing consumers have proved that Customer Engagement has a positive impact on Customer Experience, implying that increased engagement leads to an increased experience (Zaid & Patwayati, 2021).

Therefore, based on these findings, the present study developed the following hypotheses:

**H7:** *Customer Engagement in online fashion retail influences positively Customer Experience.*

**H8a:** *Customer Engagement positively mediates the relationship between Artificial Intelligence and Customer Experience.*

**H8b:** *Customer Engagement positively mediates the relationship between Augmented Reality and Customer Experience.*

## 4. METHODOLOGY

The upcoming chapter will delve into the necessary information to effectively address all the research questions and hypotheses. The exploration will start with a detailed discussion of the research approach adopted in the study. Subsequently, an analysis of the methods used for data collection will be done, along with the analysis and measurements of the variables. It will describe all the measures used to evaluate the survey responses, as well as the attributes of the database to clarify its composition. Furthermore, it will present the sample characteristics in order to explore respondent details and identify trends.

### 4.1. RESEARCH APPROACH

The current investigation employed a three-phase methodology, comprising the Research and Discovery Phase, the Development Phase, and the Results and Conclusion Phase, to accomplish its objectives.

As shown in Figure 7, each phase has been divided into separate responsibilities that are required to achieve the stated goals.



Figure 7 – Research Methodology

During Phase 1, extensive research was undertaken on the application of emerging technologies within the online fashion retail sector, leading to the formulation of the research question. Utilizing scholarly databases such as Science Direct and Scopus, an array of academic papers were reviewed. This examination focused on assessing the several effects these technologies exert on the Customer Experience, facilitated the deeper comprehension of the underlying research problem.

In the Development Phase, the Conceptual Model was built according to a literature review that investigated the relation between the independent variables (Artificial Intelligence, Augmented Reality and Technology Trustfulness) and the dependent variable (Customer Experience). Moreover, a mediator variable (Customer Engagement) was added to the model, to enrich the relation between the constructs. The items of each construct were adapted from the literature, leading to a total of 17 items.

Afterwards, a survey was built with the intent of collecting information regarding the influence that AI-tools (Chatbots, Visual Search, Recommendation Systems) and AR-tools (Virtual Try-On) have on the experience of costumers while shopping online. Questions related to demographics were included, in order to be possible to analyse the responses based on different segments (age and gender). Different scenarios were presented to the respondents, each of them showing experiences of shopping on a retail website/app that integrates AI and AR, through videos. The survey was addressed online. The sample of the collected data achieved 220 respondents.

After the survey distribution, data processing was conducted, followed by the development of the analysis. Excel was used to organize and standardize the collected data, and was further explored using Smart-PLS software. When testing the conceptual model, the results were good, with the variance of the dependent variables reaching 72%. Finally, the results were analysed to interpret and discuss the findings.

In pursuing this methodology, the objective is to derive meaningful insights from consumer opinions, highlight patterns in their preferences, and gather critical information regarding their experience with this subject matter. Consequently, this will enable the drawing of conclusions regarding the impact of integrating AI and AR technologies into e-commerce platforms on enhancing the overall Customer Experience, while also revealing the challenges and obstacles tied to the adoption of these innovative technologies.

## **4.2. TYPE OF RESEARCH AND METHODOLOGY USED**

The methodology used in this master's dissertation was grounded in natural science, as it involves developing specialized concepts which are then used to construct laws, models and theories explaining the nature of reality. Theories are the center of natural science, being evaluated based on their trustfulness and explanatory power, ensuring consistency with observed facts and predictive accuracy (March & Smith, 1995).

The method used to collect data in this investigation was the Survey Method, since it allows the processing and analysis of data more easily, through the development of computer-aided statistical programs. Furthermore, each individual is allowed to answer the same questions, which emphasizes the easiness of the collection of data of a large sample (March & Smith, 1995).

Descriptive analysis is the first step in the process of analysing data. It is a method which provides detailed, precise and objective sensory information about products, elaborating a lot of metrics such as means, medians, percentages, allowing a comprehensive statistical evaluation of the subjects in matter. This method also allows to identify efficiently outliers through residual analysis, providing interesting and useful insights into data dispersion. Additional advantages include its ability to produce statistically reliable data, its flexibility in

application across various industries, and its capability to enhance data collection efficiently, supporting robust data analysis and making it valuable for quality control and marketing applications (Kemp, Hort, & Hollowood, 2018).

### **4.3. MEASUREMENT MODEL AND VARIABLES ANALYSIS**

The constructs and their associated items are presented in the following Table 1, which systematically categorizes the variables examined in this study alongside their corresponding items. The study is composed of Qualitative and Quantitative variables. Qualitative variables are Gender and Age. Quantitative variables are Artificial Intelligence, Augmented Reality, Technology Trustfulness, Customer Engagement and Customer Experience.

Table 1 begins with Artificial Intelligence, which examines customer interactions with diverse AI features within online fashion retail, comprising 3 items measured via a Likert Scale. Augmented Reality follows, exploring user perceptions of Virtual Try-On features and their efficacy in addressing online shopping uncertainties, represented through 3 Likert Scale items. Technology Trustfulness evaluates the impact of technological trust on online shopping experiences through 3 items. Customer Experience assesses online shopping perceptions in an AI/AR context, aiming to derive insights on satisfaction and purchase intentions with 4 items. This variable refers to the overall perception and impression a customer has on a brand/product, based on all interactions and touchpoints throughout their entire journey. Finally, Customer Engagement measures the enthusiasm and interaction with technology in fashion retail, through 4 items, all evaluated using a Likert Scale. At first sight, this variable can be confused with the previous one. To clarify, while engagement is about active participation and interaction, experience is about the overall perception and satisfaction with the brand.

In order to analyse the collected data, non-parametric tests were employed, specifically using the technique of Partial Least Squares Structural Equation Modelling (PLS-SEM). The main goal of this technique is to maximize  $R^2$  values of the model's latent endogenous variables. Therefore, Smart-PLS software was used as the analytical tool to determine which variables best explain the model.

Construct	Items	Original Items	Adapted from original items	Scale	Source
Artificial Intelligence	AIG1	AI-enabled shopping is much easier and simpler.	AI tools provide an easier and simpler online shopping experience.	Likert Scale: 1 - "strongly disagree" to 5 - "strongly agree"	Bhagat et al., 2023
	AIG2	AI-enabled shopping increases efficiency.	AI increases the efficiency of online shopping.		
	AIG3*	I prefer AI-enabled e-retailing.	I prefer shopping in online fashion retailers that use AI features.		
Augmented Reality	AR1	The AR try-on of products provides a high level of interactivity.	The AR Virtual Try-On of products provides a high level of interactivity.	Likert Scale: 1 - "strongly disagree" to 5 - "strongly agree"	Bialkova & Barr, 2022
	AR2	I find BRAND's AR experience easy to use.	I find AR Virtual Try-On tools easy to use.		
	AR3	I would purchase a product using BRAND's virtual try-on.	I would purchase a product using Virtual Try-on.		
Technology Trustfulness	TT1	I trust that my privacy is protected when using AI virtual assistants.	I trust that my privacy is protected when using AI features while shopping online.	Likert Scale: 1 - "strongly disagree" to 5 - "strongly agree"	Choung et al., 2023
	TT2	Internet shopping is reliable.	I believe that shopping in online stores with AI/AR technologies integrated is reliable.		Rose et al., 2012
	TT3	Internet shopping is a trustworthy experience.	Shopping online in an AI/AR environment is a trustworthy experience.		
Customer Experience	CX1	I am satisfied with my experience.	I am satisfied with this online shopping experience.	Likert Scale: 1 - "strongly disagree" to 5 - "strongly agree"	McLean & Wilson, 2019
	CX2	It is nice to test products in the e-retailing.	It is nice to engage with the products in an AI/AR-enabled retail website.		
	CX3	It is likely that I repurchase from online shopping websites in the near future.	I am likely to purchase from an AI/AR-enabled online shopping website in the near future.		Bhattacharya et al., 2019
	CX4	I feel enjoyment when purchasing from online grocery retail products.	I feel enjoyment when purchasing from AI/AR-enabled online fashion retail products.		Jami Pour et al., 2021
Customer Engagement	CE1	I am enthusiastic about mobile shopping apps.	I am enthusiastic about AI/AR-enabled online shopping websites.	Likert Scale: 1 - "strongly disagree" to 5 - "strongly agree"	Alaiwan et al., 2020
	CE2	Using mobile shopping apps stimulates my interest to learn more about these apps.	Using AI/AR in online shopping stimulates my interest to learn more about these technologies.		
	CE3	I will recommend using mobile shopping apps to other people.	I will recommend using AI/AR tools while shopping online to other people.		
	CE4	I prefer using mobile shopping above other shopping channels.	I prefer using AI/AR tools in online shopping websites rather than the normal websites.		

Note: (\*) The item AIG3 was deleted due to weakness in the respective discriminant validity analysis, and therefore was not included as measurement component of the "Artificial Intelligence" construct in this research.

Table 1 – Items Description

#### 4.4. SAMPLE AND DATA COLLECTION

As mentioned before, in the Development Phase of the present research, the method used in this data collection study was the Qualtrics survey. The study technique began with acquiring data from the inquiries, aged over 18 years old, resulting in a wide range of responses. The data was collected, processed, and cleaned from Qualtrics data set, excluding eventual respondents who did not complete the survey. Once the validated inquiries were filtered, they were applied using SmartPLS with bootstrapping analysis. Afterward, the data was analysed and compared to results from previous studies.

Surveys are predominantly employed when researchers seek to analyse and collect data from a broad spectrum of respondents. The objective is to ascertain their attitudes, beliefs, expectations, and behaviours concerning the subject in question. This quantitative method is particularly well-suited for studies necessitating a large sample size, which would be challenging and time-consuming to observe using qualitative methods (Peter M. Nardi, 2018).

The survey of this study was designed using Qualtrics, based on questions from expert articles (Bhagat et al., 2023; Bialkova & Baar, 2022; Choung et al., 2023; Rose et al., 2012; McLean & Wilson, 2019; Bhattacharya et al., 2019; Jami Pour et al., 2021; Alalwan et al., 2020).

First, a Pilot Test was conducted, with a sample of 33 observations to optimize the process. The results were reliable and valid. However, one of the items (AIG3) exhibited a discriminant validity of less than 0.7. Consequently, this item was removed before submitting the questionnaire to the overall sample.

Following this removal, the survey was subsequently distributed to the overall sample, online. The survey was active for two weeks, resulting in a total of 220 respondents, all over 18 years old.

As mentioned before, the dataset is composed of 2 qualitative variables (age and gender), and 5 quantitative variables (AI, AR, Technology Trustfulness, Customer Experience, and Customer Engagement).

All the criteria were evaluated on a 5-point Likert scale, from 1 to 5, being "1 - Strongly Disagree" and "5 - Strongly Agree". The selection of the variables for this analysis was guided by the themes deemed most pertinent for the study, as well as the potential relationships among them.

Initially, the database was exported to Excel to structure the information and conduct the analysis of the categorical variables. Subsequently, a descriptive analysis was carried out, as outlined below, to provide a characterization of the sample.

Based on Table 2, it is possible to draw several insights regarding the age and gender distribution of the respondents of the survey. The gender distribution reveals a slight majority of female respondents, accounting for 61% (135 respondents) of the sample. In contrast, male

respondents constitute 39% (85 individuals). This indicates a significant predominance of female participants compared to males in the survey.

The age distribution further highlights distinct demographic trends among respondents. The majority of participants fall within the [18-24] age group, representing 47% (104 respondents) of the sample. This suggests that the survey primarily engaged young adults. The next age groups are quite similar to each other, starting with inquiries between [45-54] years old, who represent 17% (37 respondents) of the sample. Both [25-43] and [55-64] age groups represent 15% of the sample, accounting 33 and 32 respondents, respectively. The least represented age group is [35-44], representing only 6% (14 respondents) of the total sample.

Overall, the survey primarily captures the perspectives of young adults, with a balanced but smaller representation from middle-aged groups.

Distribution		Total Frequency: 200%	
Gender	Feminine	135	61%
	Masculine	85	39%
Age	[18-24]	104	47%
	[25-34]	33	15%
	[35-44]	14	6%
	[45-54]	37	17%
	[55-64]	32	15%
	[Above 64]	0	0%

**Table 2 – Sample Characterization**

## 5. RESULTS

Given the exploratory nature of the present investigation, Partial Least Squares (PLS) was employed – a non-parametric statistical method based on variance and oriented towards forecasting. As highlighted by previous studies, Hair et al. (2014) identified that the most significant reasons for using PLS-SEM are its suitability for handling non-normal data, small sample sizes, and formatively measured constructs.

In the dataset under examination, no outliers or missing values were detected. Therefore, there was no need to exclude responses or apply imputation techniques. The study's required minimum sample size is calculated as ten times the number of items (17), resulting in a necessary minimum of 170 participants. This criterion has been verified in the analysis, as the survey gathered 220 answers.

The following two chapters will be focused on the results of two different models. The first one is the Measurement Model, which specifies the relationship between the latent variables (constructs) and the observed indicators (manifest variables). Therefore, this model aims to evaluate the reliability and validity of the constructs. The Structural Model is more focused on testing the theoretical model and the hypothesis of the study.

The results of the Research Model reveal that Customer Engagement is the variable that most significantly influences Customer Experience when shopping online with integrated AI/AR technologies. Although the direct effects of Artificial Intelligence and Augmented Reality on Customer Experience are present, they are comparatively lower than the effects of the other variables in the model. Notably, Artificial Intelligence exerts a greater influence on Customer Experience compared to Augmented Reality. Additionally, the analysis highlights that the trust customers feel in emerging technologies critically influence their overall online shopping experience.

### 5.1. MEASUREMENT MODEL

The Average Variance Extracted (AVE) is a KPI (Key Performance Indicator) responsible for the assessment of the convergent validity of constructs in Structural Equation Modelling (SEM). Therefore, AVE represents the average proportion of variance in the observed variables that is explained by the underlying latent construct to which these variables are theoretically related (Santos & Cirillo, 2023). Hence, this KPI has the aim of checking if the indicators of each construct are highly correlated to each other, confirming they are all measuring the same construct. An AVE of 0.50 or higher indicates good convergent validity, meaning that the construct explains more than half of the variance in its indicators.

In this case (Table 3), all variables were above 0.5, indicating that the quality of the measurement of the model is supported, and all the indicators are well-chosen and effectively measure their respective constructs.

Constructs	Average Variance Extracted (AVE)	Composite Reliability (CR)	Cronbach's Alpha
Artificial intelligence	0.818	0.900	0.781
Augmented Reality	0.626	0.834	0.706
Technology Trustfulness	0.769	0.909	0.851
Customer Engagement	0.672	0.891	0.835
Customer Experience	0.676	0.893	0.840

**Table 3** – Average Variance Extracted, Composite Reliability and Cronbach's Alpha.

After verifying the convergent reliability of the constructs of the model, it is important to test its reliability, which refers to how consistently the measurement model accurately measures the intended latent constructs (Ahmad et al., 2016). The internal consistency of a measurement can be assessed based on two different criteria: Composite Reliability and Cronbach's Alpha, which have both to be above 0.7.

These two measurements are the most common ones used for internal consistency, being responsible for the analysis of the reliability based on the interrelationship of the observed items (Ab Hamid et al., 2017).

Composite Reliability (CR) allows the measurement of the internal consistency of a set of indicators representing a latent construct. Alpha and omega are two popular methods for assessing Composite Reliability. If the scale is confirmed to be unidimensional, alpha can be used. Otherwise, omega is recommended as it provides a more accurate reliability estimate. A recommended threshold for CR is greater than 0.7, as it demonstrates that the construct is being measured with a satisfactory level of reliability (Sujati et al., 2020). The current model reveals that all constructs have an adequate level of confidence, as indicated in Table 3, with Composite Reliability values exceeding 0.7. This indicates that the items consistently represent the underlying constructs, supporting the validity of the constructs and confirming that the items are accurately measuring their intended constructs. Moreover, a high level of CR implies that measurement error is minimized, which is essential for the model's accuracy.

Cronbach's Alpha is another important indicator responsible for measuring the internal consistency reliability. It is suitable for reflective measurement models and is considered acceptable if it is above 0.7 (Taber, 2018). In this case, this indicator also shows great values for all the constructs, as they are all greater than 0.7.

Hence, the values for Average Variance Extracted, Composite Reliability and Cronbach's Alpha exceed the required thresholds of 0.5, 0.7 and 0.7, respectively. This indicates that the latent variables are sufficiently reliable and valid for testing the conceptual model.

Once the reliability and validity of the constructs are established, it is also crucial to test if the variables are distinct from one another. This can be assessed through discriminant validity, based on two different methods: Cross Loadings and Fornell-Larcker's.

First, the Cross Loadings criteria, which examines if each item's loading on its assigned construct is higher than its loadings on other constructs (Ab Hamid et al., 2017). Discriminant Validity is supported when indicators load more strongly on their respective constructs than on any other construct, which is verified in all cases (Table 4).

	Artificial Intelligence	Augmented Reality	Customer Engagement	Customer Experience	Technology Trustfulness
Artificial intelligence	0,905				
Augmented Reality	0,389	0,791			
Customer Engagement	0,389	0,584	0,820		
Customer Experience	0,460	0,560	0,786	0,822	
Technology Trustfulness	0,183	0,322	0,443	0,566	0,877

**Table 4 – Cross Loadings**

The following criteria is the Fornell-Larcker's, which compares de square root of the Average Variance Extracted (AVE) of each construct with the correlations between the construct and other constructs in the model. This value must be greater than the construct's highest correlation with any other construct (Ab Hamid et al., 2017). As shown in Table 5, this evidence is verified, meaning that the constructs in the model exhibit discriminant validity.

	Artificial intelligence	Augmented Reality	Customer Engagement	Customer Experience	Technology Trustfulness
AIG1	0,881	0,316	0,282	0,385	0,130
AIG2	0,928	0,382	0,409	0,443	0,194
AR1	0,441	0,786	0,429	0,409	0,179
AR2	0,320	0,763	0,377	0,374	0,251
AR3	0,199	0,823	0,552	0,522	0,320
CE1	0,414	0,504	0,894	0,735	0,379
CE2	0,319	0,426	0,751	0,539	0,288
CE3	0,294	0,510	0,861	0,713	0,417
CE4	0,240	0,470	0,765	0,563	0,360
CEX1	0,354	0,421	0,542	0,784	0,525
CEX2	0,440	0,487	0,709	0,856	0,445
CEX3	0,316	0,499	0,637	0,823	0,482
CEX4	0,397	0,432	0,685	0,823	0,419
TT1	0,064	0,238	0,295	0,376	0,812
TT2	0,204	0,339	0,441	0,545	0,909
TT3	0,186	0,260	0,408	0,541	0,906

**Table 5 – Fornell-Larcker**

Hence, since both the Cross Loading and Fornell-Larcker criteria are satisfied, it can be inferred that the constructs in the model show robust discriminant validity. This suggests that each construct is empirically unique from the others and that the indicators are accurately linked to their corresponding constructs, ensuring that the constructs are reliably and validly measured. This enhances the overall trustworthiness and strength of the measurement model, implying that the data is suitable for additional structural analysis and hypothesis testing.

In order to detect multicollinearity in the present model, the Variance Inflation Factor (VIF) was checked. Multicollinearity occurs when independent variables in a model are highly correlated, which can lead to inflated standard errors and unreliable coefficient estimates (Daoud, 2018), turning it difficult to determine the individual effect of each predictor on the dependent variable. In general, the higher the VIF, the stronger the multicollinearity. A VIF value of 5 or more indicates a significant collinearity problem among indicators in formatively measured constructs (Purwanto & Sudargini, n.d.).

Table 6 highlights that these values are within the acceptable range (between 1 and 5), not demonstrating problems of collinearity.

Variance Inflation Factor (VIF)	
AIG1	1,695
AIG2	1,695
AR1	1,432
AR2	1,425
AR3	1,309
CE1	2,554
CE2	1,635
CE3	2,162
CE4	1,612
CEX1	1,715
CEX2	2,078
CEX3	1,859
CEX4	1,904
TT1	1,793
TT2	2,354
TT3	2,371

**Table 6** – Variance Inflation Factor (VIF)

In addition to the Fornell-Larcker criterion, which has already been analysed to assess discriminant validity, this study also employ the Heterotrait-Monotrait Ratio (HTMT) for a more rigorous evaluation. While Fornell-Larcker criterion provides preliminary insights into construct distinctiveness, the HTMT technique provides greater sensitivity and specificity in detecting discriminant validity issues (Ab Hamid et al., 2017). By using HTMT analysis, the aim is to confirm that the model’s components are actually different and that the observed connections are reliable and valid. If the value of the HTMT is higher than the threshold (0.90), then it can be concluded that there is lack of discriminant validity.

	AI	AR	Customer Engagemt	Customer Experience	Texhnology Trustfulness
AI					
AR	0,537				
Customer Engagement	0,470	0,742			
Customer Experience	0,562	0,710	0,927		
Technology Trustfulness	0,207	0,401	0,513	0,661	

**Table 7** – Heterotrait-Monotrait Ratio (HTMT)

From the HTMT results (Table 7), the values are confirmed to be within the accepted range, with the exception of the ratio (0.927) between Customer Engagement and Customer Experience. Given that the HTMT value of 0.927 is very close to the accepted threshold of 0.90, it may raise some concerns about discriminant validity. However, this value is only marginally above the threshold, suggesting that the constructs are not excessively overlapping. Furthermore, if the Cross-Loadings and Fornell-Larcker criterion values are within acceptable limits, it indicates that the constructs maintain an acceptable level of discriminant validity. Therefore, despite the HTMT value suggesting some degree of similarity between the constructs, the overall evidence supports continuing with the analysis. This decision was based on the consideration that the constructs are sufficiently distinct for the study's purposes, as validated by multiple criteria.

## 5.2. STRUCTURAL MODEL

Once the measurement model has been assessed, focusing on the relationships between latent variables and their observed indicators, the next step is to examine the relationships between the latent variables themselves by conducting the structural model analysis.

$R^2$  is a statistical measure that represents the proportions of the variance in the dependent variable that is explained by the independent variables in the model. Thus, this criterion is a key measure used to assess the predictive ability of the structural model. The values of  $R^2$  range from 0 to 1, whereas a high value indicates a greater explanatory power (Purwanto & Sudargini, n.d.).

From Table 8, it is possible to highlight that the model explains 72% ( $R^2 = 0,720$ ) of the variance in Customer Experience, indicating a strong explanatory power.

	R-square	R-square adjusted
Customer Experience	0,720	0,708

**Table 8** – R-square and R-square adjusted

Afterwards, the goal is to understand the path significance. Bootstrapping is a technique used for assessing the accuracy and stability of statistical estimates. This method allows the setting of confidence intervals and estimating significance levels from the re-sampled distribution (Choi, 2016). This technique was applied with the aim of understanding the path significance, with a number of observations of 220, to gather insights regarding the predictive capacity of the structural model with a resampling of 3,000 iterations. For a parameter estimate to be considered statistically significant at the 0.05 significance level, the absolute T-value should be higher than 1.96. From Table 9, it is possible to draw that all latent variables are statistically significant, as they present a t-value greater than 1.96 ( $p\text{-value} < 0.05$ ), thus confirming the following hypothesis proposed: H1, H2, H3, H4, H5, H6, H7.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics ( O/STDEV )	P values
AI -> Cust Engagemt	0,172	0,179	0,059	2,900	0,004
AI -> Customer Exp	0,169	0,168	0,051	3,315	0,001
AR -> Cust Engagemt	0,429	0,432	0,060	7,111	0,000
AR -> Customer Exp	0,096	0,096	0,049	1,972	0,049
Cust Engagemt -> Customer Exp	0,542	0,542	0,048	11,397	0,000
Tech Trust -> Cust Engagemt	0,274	0,269	0,068	4,043	0,000
Tech Trust -> Customer Exp	0,260	0,259	0,040	6,465	0,000

**Table 9** – Bootstrapping

Based on the results of the Structural Equation Modeling (SEM) analysis, all the hypothesis proposed in the research model were validated. Each path coefficient ( $\beta$ ) was statistically significant, as indicated by p-values less than 0.05. The standardized path coefficients demonstrated strong relationships among all the constructs, with each hypothesis showing a significant effect as follows:

- Hypothesis 1 (H1): The positive relationship between Artificial Intelligence (AI) and Customer Engagement (CE) was supported ( $\beta = 0.0172$ ,  $p < 0.01$  \*\*\*).

- Hypothesis 2 (H2): The positive relationship between AI and Customer Experience (CX) was supported ( $\beta = 0.168, p < 0.01$  \*\*\*).
- Hypothesis 3 (H3): The positive relationship between Augmented Reality (AR) and CE was supported ( $\beta = 0.429, p < 0.01$  \*\*\*).
- Hypothesis 4 (H4): The positive relationship between AR and CX was supported ( $\beta = 0.096, p < 0.05$  \*\*). However, this relation has a lower significance when compared to the other hypothesis, as it has a  $p = 0.049$ .
- Hypothesis 5 (H5): The positive relationship between Technology Trustfulness (TT) and CE was supported ( $\beta = 0.274, p < 0.01$  \*\*\*).
- Hypothesis 6 (H6): The positive relationship between TT and CX was supported ( $\beta = 0.260, p < 0.01$  \*\*\*).
- Hypothesis 7 (H7): The positive relationship between CE and CX was supported ( $\beta = 0.542, p < 0.01$  \*\*\*).

The analysis of the model thus demonstrates varied strengths in the relationships among the constructs. The hypothesis with the strongest and most significant relationships are H7, H3 and H5, all exhibiting robust positive relationships with highly significant p-values. Consequently, the model confirms that Artificial Intelligence, Augmented Reality and Technology Trustfulness have a positive influence on Customer Engagement and Customer Experience. However, the latent variable which explains the most Customer Experience is Customer Engagement, with a  $\beta = 0.542 (p < 0.01)$ . This means that when the value placed on online Customer Experience increases by one standardized unit, an individual's Customer Engagement increases by 0.542 standardized units. From the Bootstrap analysis, it is also possible to highlight that the model explains 72% of the variable Customer Experience.

In contrast, H4, which revealed a positive influence of Augmented Reality in Customer Experience, although supported, displayed the weakest significance among the hypotheses, suggesting that while the effect is present, is less pronounced than the other relationships within the model.

In order to test hypothesis H8a and H8b, it was also performed a mediating effects analysis by assessing the individual significance of the mediator, using modified versions of the overall structural model. Variance Accounted For analysis reveals that Customer Engagement have complementary effects on the impact of Artificial Intelligence and Augmented Reality on Customer Experience, being a partial mediator. Moreover, this variable has almost a total mediation between AR and Customer Experience, as it is very close to 80%. Therefore, H8a and H8b are also confirmed.

	Total effect (mediated)	Direct effect	Indirect effect	VAF	Conclusion
AI -> Customer Exp	0,262	0,169	0,094	<b>36%</b>	Partial mediation
AR -> Customer Exp	0,328	0,096	0,232	<b>71%</b>	Partial mediation
Tech Trust -> Customer Exp	0,409	0,260	0,148	<b>36%</b>	Partial mediation

**Table 10** - VAF (Variance Accounted For)

The Standardized Root Mean Square Residual (SRMR) is an important goodness-of-fit statistic for structural models, particularly in the context of Partial Least Squares Structural Equation Modelling (PLS-SEM). Models with sample SMR values < 0.08 are generally considered a good fit (Shi et al., 2018), indicating that the model efficiently reproduces the observed data and appropriately captures the connections between the variables. The SRMR result for this analysis is 0.063, confirming the appropriateness and resilience of the suggested structural model (Table 10).

	Saturated model	Estimated model
SRMR	0,061	0,063

**Table 11** – Standardized Root Mean Square Residual

## 6. DISCUSSION

### 6.1. FINDINGS

In addressing the identified research gaps, this investigation has significantly contributed to the understanding of how AI and AR tools impact the entire e-commerce experience of customers, leveraging both the effectiveness and efficiency of online fashion retail.

The proposed model effectively highlights the relationships between the use of AI and AR technologies and their impact on Customer Experience, with the variance of the dependent variables reaching 72%. The model confirms that AI technologies, such as Chatbots, Personalized Recommendation Systems, and Visual Search Tools, significantly enhance Customer Experience. It also confirms that both Augmented Reality tools, such as Virtual Try-Ons, and Technology Trustfulness improve Customer Experience. Furthermore, Structural Equation Modelling was used to test the hypothesis, demonstrating they were all confirmed.

First, the latent variable that best explains Customer Experience is Customer Engagement ( $\beta = 0.572$ ). The variables included in this construct are related to the level of enthusiasm, interest, recommendation, and preference for using AI/AR technologies in fashion retail websites. Respondents rated the importance of these factors, on average, as a 3 on a scale from 1 to 5. Such perceptions are in accordance with previous existing studies, which confirmed that Customer Engagement has a positive impact on Customer Experience, implying that increased engagement leads to an enhanced experience (Zaid & Patwayati, 2021). Therefore, the level of engagement and interaction of consumers have a positive influence on enhancing their experience while shopping online, in the fashion retail sector. This confirms hypothesis **H7**: *Customer Engagement in online fashion retail influences positively Customer Experience.*

Technology Trustfulness also revealed to be a critical variable in this research, relating to the trust consumers feel regarding the privacy of their data, the reliability of online shopping with these technologies, and their overall trust in the experience. On average, respondents rated these factors as 3 on a scale from 1 to 5. This construct is the second one that better explains both Customer Experience ( $\beta = 0.260$ ,  $p < 0.01$ ) and Customer Engagement ( $\beta = 0.274$ ,  $p < 0.01$ ) of shopping online with AI/AR technologies integrated. This insight is aligned with previous studies which pointed that there is a positive correlation between technology trust and shopping enjoyment (Foroudi et al., 2018; Zhang et al., 2019), implying that the greater the trust consumers feel in the technology in use, the greater their experience will be. This result demonstrates the importance of consumers' trust in the websites and technologies they use for shopping, as it significantly impacts their experience. Therefore, the following hypotheses were confirmed: **H5**: *Technology Trustfulness in online fashion retail influences positively Customer Engagement*; **H6**: *Technology Trustfulness in online fashion retail influences positively Customer Experience.*

The model also validates that Customer Engagement plays a mediating role, enhancing the overall Customer Experience when these technologies are employed in online fashion retail. This mediation is almost total between AR and CX (VAF = 71%), and only partial between AI and CX (VAF = 36%), meaning that Customer Engagement has a greater influence in enhancing Customer Experience for AR technologies rather than AI's. Thus, the following hypotheses were confirmed: **H8a**: *Customer Engagement mediates positively the relationship between Artificial Intelligence (AI) use and Customer Experience*; **H8b**: *Customer Engagement mediates positively the relationship between Augmented Reality (AR) use and Customer Experience*.

However, when comparing the direct effects of Artificial Intelligence ( $\beta = 0.158$ ) to Augmented Reality ( $\beta = 0.078$ ) on Customer Experience, the first one represents a greater influence on the overall experience felt by customers, rather than the second one.

Starting with Artificial Intelligence, this construct is related to the level of simplicity, ease, and efficiency of online shopping with its tools integrated, as well as the preference for fashion websites with AI features over traditional ones. However, it should be noted that item AIG3, which corresponds to the level of preference for AI-feature websites, was eliminated due to a lack of discriminant validity and is not included in the final analysis. Respondents gave high importance to these factors, with an average rating of 4 on a scale from 1 to 5. These findings are aligned with previous existing research, which highlights that AI chatbots play a crucial role in enhancing Customer Engagement, suggesting a positive correlation between chatbot deployment and customer satisfaction. The same author also proved that the usability of the chatbot has a positive influence on the extrinsic values of Customer Experience (J. S. Chen et al., 2021). Additionally, AI-Personalized Recommendation Systems are proven to simplify the decision-making process of consumers, leading to a more engaging and user-friendly shopping experience (Wu & Chi, n.d.). Therefore, this confirms the following hypothesis: **H2**: *The use of Artificial Intelligence in online fashion retail influences positively Customer Experience*. This suggests that the variable Artificial Intelligence enhances the online shopping experience according to respondents, due to its ease, simplicity, efficiency and overall performance. Furthermore, this technology ranks as the third most significant factor of the present study in explaining Customer Experience.

On the other hand, Augmented Reality is related to ease of use, interactivity, and its consideration as a useful tool for purchasing fashion products online. Respondents rated the importance of these factors highly, with an average rating of 4 on a scale from 1 to 5. Such perceptions are in accordance with previous existing studies, which confirm that AR tools add value to the Customer Experience throughout different stages of their journey (Flavián et al., 2019). Another study shows that customers' attitudes towards this technology predict their intention to purchase garments online, influenced by perceived usefulness, enjoyment, and privacy risk (Zhang et al., 2019). Therefore, consumers perceive the value of Augmented Reality in terms of ease of use, level of interactivity, and purchase intentions as positively influencing their online shopping experience in the fashion retail sector. However, within the

conceptual model of this investigation, this variable is the least explanatory for Customer Experience. Even so, the following hypothesis was confirmed - **H4**: *The use of Augmented Reality in online fashion retail influences positively Customer Experience.*

Although AI is the technology that better explains Customer Experience, AR shows a stronger correlation with Customer Engagement ( $\beta = 0.429$ ). This indicates that despite the conceptual similarity between CX and CE - showed by the Heterotrait-Monotrait Ratio (HTMT) - and the potential for these concepts to be conflated, the respondents were able to distinguish their differences effectively. This distinction is evident in the differing values observed when analysing the impact of these technologies on Customer Engagement and Customer Experience.

Nevertheless, both technologies demonstrate a positive correlation with Customer Engagement (AR:  $\beta = 0.429$ ; AI:  $\beta = 0.172$ ). This can be corroborated by previous studies, which conceptualize that Augmented Reality within mobile applications is expected to provide an entertaining experience for customers (McLean & Wilson, 2019). Other studies also revealed that AI-based devices with high levels of interactivity enable consumers to be more engaged. The same author demonstrated that the interaction between intelligent customer service robots and consumers can lead them to benefit from the creation of value, both for themselves and the enterprise (Gao et al., 2023). Thus, the findings of the present investigation regarding the positive correlation between AI and CE are consistent with literature already in existence, which also supports that this technology can provide customers with an outstanding service experience, resulting in Customer Engagement, whereas a good experience motivates customers to have more engagement with the company (Y. Chen et al., 2022). Therefore, both of the following hypotheses were confirmed: **H1**: *The use of Artificial Intelligence (AI) in online fashion retail influences positively Customer Engagement*; **H3**: *The use of Augmented Reality (AR) in online fashion retail influences positively Customer Engagement.*

Furthermore, the survey results provided valuable information about consumers' intentions to buy items from websites that use these innovative technologies. On a scale of 1 to 5, the item CX3, which is connected to the likelihood of purchasing from this sort of technology, had an average rating of 4. Additionally, the average rating for item CE3 was 3, which included the intention to recommend to other people shopping online using AI/AR tools. Another item with an average rating of three is AR3, which evaluates the willingness of respondents to purchase a product using VTO. The findings indicate that respondents are actually motivated by these technologies and are willing to purchase products with them integrated, indicating favourable customer behaviour and purchase intentions.

In essence, the proposed model effectively highlights the relationships between the use of AI and AR technologies and their impact on Customer Engagement and Experience, revealing that AI has a greater impact on this influence than AR. These findings answer the Research Question of this study: *“How does the integration of Artificial Intelligence and Augmented*

*Reality enhance the overall Customer Experience in the context of online fashion retail?'*. The trust in technology felt by consumers was also proved to be an important factor in this investigation, as a variable that influences Customer Experience in this industry. Besides, all the hypotheses were supported by the statistical analysis, and the results extracted demonstrate similarity with the literature.

## **6.2. THEORETICAL CONTRIBUTIONS**

By leveraging existing theories on Customer Experience and Customer Engagement, this research provided clear evidence of its theoretical contributions. First, these results complement and extend previous research, confirming that AI not only simplifies the shopping process but also increases Customer Experience by providing personalized and efficient service. This highlights the potential of AI to enhance consumer engagement and interaction, which contributes to the wider knowledge of the technology's role in e-commerce.

In addition, the AR contribution is noteworthy since it emphasizes how unique AR is at bridging the gap between online and offline shopping experiences. By allowing customers to visualize products in a more interactive and immersive way, AR improves the whole buying experience and reduces uncertainties related to product fit and appearance. This finding supports the expanding corpus of literature advocating for the integration of AR in e-commerce to enhance Customer Engagement and Experience, as well as Satisfaction.

Additionally, the findings highlight how important it is for customers to trust in the security, reliability, and personal protection of AI and AR technologies, to improve the entire shopping experience. This suggests that trustworthiness is not only a facilitator but also a crucial element of satisfying Customer Experiences, adding a new dimension to the theoretical frameworks of technology acceptance. This realization emphasizes how crucial it is to create transparent and secure AI/AR systems, in order to increase Customer Engagement, experience, and loyalty.

To conclude, this study not only builds upon a condensed and extensive literature review but also introduces new insights into the impact of AI and AR technologies on consumer behaviour in online fashion retail, as they demonstrate more willingness to recommend and purchase products in online platforms with AI/AR integrated.

## **6.5. MANAGERIAL IMPLICATIONS**

It is also critical to take into account the practical implications this study encounters. First and foremost, organizations should prioritize the integration of AI Chatbots, Personalized Recommendation Systems and Visual Search Tools into their online platforms, as they have been proven to significantly enhance Customer Experience by offering personalized and

efficient service. Businesses should invest in advanced AI algorithms for implementation to be able to analyse customer data to deliver tailored recommendations and real-time assistance.

Secondly, given the benefits of AR tools, online fashion merchants ought to begin adopting these technologies to bridge the gap between online and offline shopping experiences. To effectively implement Virtual Try-Ons, retailers can develop mobile applications or website features that allow customers to visualize products in an immersive and interactive way.

Furthermore, organizations should guarantee the security of their digital platforms and the appropriate handling of client data concerning privacy and care. Building trust can be facilitated by providing clear communication about data usage policies.

In essence, online fashion retailers should begin integrating AI and AR strategically, by focusing on personalization, interactivity, engagement, and trust. This implementation will allow organizations to be able to enhance Customer Experience, drive satisfaction, and foster long-term loyalty. To remain competitive in the rapidly changing digital marketplace, putting these ideas into reality will require a holistic approach that combines technological investments with strategic management and customer-centric practices.

#### **6.4. LIMITATIONS AND FUTURE WORK**

Despite the significant contributions of this study, several limitations must be acknowledged. The sample size, while sufficient for the statistical analyses performed, may not fully capture the diversity of the broader consumer population in online fashion retail. Future research should aim to include a larger and more diverse sample to enhance the generalizability of the findings.

Another drawback is the fact that the survey was only distributed in the Portuguese market. This limits how far the findings may be applied to other demographic groups and global marketplaces. How consumers behave, accept and value technology can differ considerably among cultures and geographical areas. To obtain a more comprehensive and varied viewpoint on the impacts of AI and AR on Customer Experience, as well as the importance of Technology Trust in this interaction, future studies ought to think about disseminating the survey over international marketplaces.

The findings of this study have significant implications for the future of research in e-commerce, as it provides solid foundation for further exploration into more specific aspects of AI and AR applications in various retail contexts. One key direction for future research is to explore the long-term effects of AI and AR on customer loyalty and retention. While this study has demonstrated their favourable impact on immediate Customer Engagement and Experience, it is interesting to comprehend how these technologies impact long-term customer interactions. Additionally, the role of Customer Engagement as a mediating variable creates further possibilities for investigating the specific elements of engagement that may

have the most relevance. Future research could dive into the different dimensions of CE, such as emotional, cognitive and/or behavioural engagement, to ascertain which aspects are particularly impacted by AI and AR technology.

## 7. CONCLUSION

This thesis has investigated how Augmented Reality (AR), Artificial Intelligence (AI) and Technology Trustfulness (TT) might revolutionize the online fashion retail sector, with particular attention to how these technologies affect Customer Experience and Engagement. The research provides compelling empirical data illustrating how AI technologies, such as Chatbots, Visual Search, and Personalized Recommendation Systems, significantly improve online purchasing by providing effective and tailored services. Conversely, it has been demonstrated that AR tools - in particular, Virtual Try-On features - improve Customer Engagement by establishing dynamic and engaging retail environments. The study emphasizes the pivotal role of Customer Engagement as a mediator between the use of AI/AR and the Customer Experience. Improved customer experiences were found to be substantially correlated with high customer enthusiasm, curiosity, and preference for AI/AR technologies. The report also highlights the significance of technology to be trusted, revealing how positive customer experiences rely on faith in the security, privacy, and reliability of AI and AR technologies.

The model proposed in this research, which explains a significant portion of the variance in Customer Experience, provides insightful information on the different but complementary roles that AI and AR play in influencing customer behaviour in the digital retail sector. On one hand, Artificial Intelligence is revealed to have a higher impact on the overall online shopping experience of customers. On the other hand, Augmented Reality demonstrates a higher influence on the engagement felt by consumers in this online process. These findings complement and extend existing literature, offering useful implications for businesses aiming to enhance their digital strategies and improve customer satisfaction.

In conclusion, this thesis has provided a thorough analysis concerning how AI and AR affect consumer involvement and the overall online fashion shopping experience. The knowledge gathered from this investigation offers a solid foundation for more research and useful applications, emphasizing the importance of continued innovation and strategic integration of these technologies to drive customer satisfaction and loyalty in today's digital world.

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## 9. ANNEXES

### Annex 1 - Survey

Start of Block: Intro

Dear participant,

As part of the Data Driven Marketing Master's degree with specialization in Digital Marketing & Analytics at NOVA IMS, I am developing a study on the **impact** that today's emerging technologies, such as **Artificial Intelligence** and **Augmented Reality**, have in the context of **online fashion retail**.

This survey will take **3 minutes** to complete. If you would like any clarification about this study, please contact researcher Joana Dray by email at 20220149@novaims.unl.pt

**Informed consent:** I declare that I am 18 years old or over and agree to participate in this research. I declare that I have been informed that my participation in this study is voluntary and that I can withdraw from this survey at any time without any penalty, and that all data is confidential. I understand that I will evaluate the responses and that this study does not offer serious risks.

- Yes, I agree to participate. (1)
- No, I do not agree to participate. (2)

End of Block: Intro

Start of Block: Demography

Q1 Gender

- Male (1)
- Female (2)
- Prefer not to say (3)

#### Q2 Age

- 18-24 years old (1)
- 25-34 years old (2)
- 35-44 years old (3)
- 45-54 years old (4)
- 55-64 years old (5)
- 65+ years old (6)

#### Q3 Level of Education

- High School (2)
- Bachelor's degree or equivalent (completed or on-going) (4)
- Master's degree (completed or on-going) (5)
- PhD (finished or on-going) (6)

End of Block: Demography

Start of Block: Artificial Intelligence - Chatbots

Q7 This section delves into the transformative impact of **Artificial Intelligence (AI)** across online fashion retailers, specializing in **Chatbots** and **Visual Search Tools**.

To answer the next questions, **please watch the following videos** about **Rufus** (48 seconds) - an expert shopping assistant trained in **Amazon's** product catalogue, and about **SHEIN** (23 seconds).

Q13 Based on your previous **experience with Artificial Intelligence** integrated in fashion websites, and from **what you learned with the videos** so far, please answer the following questions.

For each question you should indicate the degree to which you agree with each statement, ranging from 1 – “Strongly Disagree” to 5 – “Strongly Agree”.

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
AI tools provide an easier and simpler online shopping experience. (2)	•	•	•	•	•
AI increases the efficiency of online shopping. (5)	•	•	•	•	•
I prefer shopping in online fashion retailers that use AI features. (4)	•	•	•	•	•

End of Block: Artificial Intelligence - Chatbots

Start of Block: Block 3

Q14 This section delves into the transformative impact of **Augmented Reality (AR)** across online fashion retailers, specializing in the **Virtual Try-On tools**.

To answer the next questions, **please watch the following video** (21 seconds).



Q15 Based on what you **learned with this video**, or your **previous experience with Augmented Reality** integrated in fashion websites, please answer the following questions.

For each question you should indicate the degree to which you agree with each statement, ranging from 1 – “Strongly Disagree” to 5 – “Strongly Agree”.

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Stongly Agree (5)
The AR Virtual Try-On of products provides a high level of interactivity. (1)	•	•	•	•	•
I find AR Virtual Try-On tools easy to use. (3)	•	•	•	•	•
I would purchase a product using Virutal Try-On. (4)	•	•	•	•	•

End of Block: Block 3

Start of Block: Block 4

Technology Trust For each question you should indicate the degree to which you agree with each statement, ranging from 1 – “Strongly Disagree” to 5 – “Strongly Agree”.

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I trust that my privacy is protected when using AI features while shopping online. (1)	•	•	•	•	•
I believe that shopping in online stores with AI/AR technologies integrated is reliable. (2)	•	•	•	•	•
Shopping online in an AI/AR environment is a trustworthy experience. (3)	•	•	•	•	•

End of Block: Block 4

Start of Block: CX

Q18 For each question you should indicate the degree to which you agree with each statement, ranging from 1 – “Strongly Disagree” to 5 – “Strongly Agree”.

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I am satisfied with this online shopping experience. (1)	•	•	•	•	•
It is nice to engage with the products in an AI/AR-enabled retail website. (2)	•	•	•	•	•
I am likely to purchase from an AI/AR-enabled online shopping website in the near future. (3)	•	•	•	•	•
I feel enjoyment when purchasing from AI/AR-enabled online fashion retail products. (4)	•	•	•	•	•

End of Block: CX

Start of Block: CE

Q19 For each question you should indicate the degree to which you agree with each statement, ranging from 1 – “Strongly Disagree” to 5 – “Strongly Agree”.

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I am enthusiastic about AI/AR-enabled online shopping websites. (1)	•	•	•	•	•
Using AI/AR in online shopping stimulates my interest to learn more about these technologies. (2)	•	•	•	•	•
I will recommend using AI/AR tools while shopping online to other people. (3)	•	•	•	•	•
I prefer using AI/AR tools in online shopping websites rather than the normal websites. (4)	•	•	•	•	•

## Annex 2 – Ethics Committee



This is to certify that

Project No.: **DDMKT2024-5-255616**

Project Title: **Thesis\_JoanaDray\_20220149**

Principal Researcher: **Joana Dray**

according to the regulations of the Ethics Committee of NOVA IMS and MagIC Research Center this project was considered to meet the requirements of the NOVA IMS Internal Review Board, being considered **APPROVED** on 5/25/2024.

It is the Principal Researcher's responsibility to ensure that all researchers and stakeholders associated with this project are aware of the conditions of approval and which documents have been approved.

The Principal Researcher is required to notify the Ethics Committee, via amendment or progress report, of

- Any significant change to the project and the reason for that change;
- Any unforeseen events or unexpected developments that merit notification;
- The inability of the Principal Researcher to continue in that role or any other change in research personnel involved in the project.

Lisbon, 5/25/2024

NOVA IMS Ethics Committee  
ethicscommittee@novaims.unl.pt

