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Metaverse integration in the Fashion Industry

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Master's in Management of Services and Technology

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For my friends and family

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Abstract

This paper investigates the influence of the Metaverse and its technologies in the fashion sector, with an emphasis on the potential of Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI), aligned with Metaverse Driven Products to enhance customer experience and satisfaction through an in-depth analysis.

This paper starts by understanding the development of the Metaverse from an idea originated in science fiction to a growing virtual environment where users engage and conduct transactions.

Then it also gives a complete background on the fashion industry, its pain points and its evolution through Metaverse Driven Products, and other topics. In this paper the products chosen were the Virtual Try On, Virtual Showrooms and Virtual Size Advisor.

On a more practical note, the paper will also incorporate a statistical analysis on a survey, in order to prove the correlation between the use of technologies and customer satisfaction.

This dissertation emphasizes the substantial prospects that Metaverse-powered technologies provide to the fashion industry. However, it also recognizes the obstacles, such as technical constraints and the need to establish customer confidence, that need to be resolved in order to achieve general acceptance.

The key findings indicate it exists a correlation, statistically proven, between the Customer Satisfaction and the use of technologies such as VR, AI and AR, and that although some technologies, to the sample in question, are more valuable than others, the biggest insight is that it exists a gap between the lack of innovation in the consumer experience, due to unpredictability of the consumer behavior and an opportunity to explore these Metaverse Driven Products and its technologies.

Key Words: Metaverse, Fashion, Virtual Reality, Customer Experience, Augmented Reality, Artificial Intelligence.

JEL Classification System:

L86 - Information and Internet Services; Computer Software

O33 - Technological Change: Choices and Consequences; Diffusion Processes

Resumo

A dissertação tem como âmbito investigar a influência do Metaverso e as suas tecnologias no setor da moda, com ênfase em tecnologias como a Realidade Virtual (RV), Realidade Aumentada (RA) e Inteligência Artificial (IA) para aprimorar a experiência e a satisfação do cliente através de uma análise aprofundada de *Metaverse Driven Products*, que se caraterizam por ser produtos que têm como base as tecnologias anteriormente mencionadas.

Esta dissertação começa por examinar o desenvolvimento do Metaverso, desde uma ideia de ficção científica, até a um ambiente virtual em crescimento, onde os usuários interagem e realizam transações. Também se fornece um panorama sobre a indústria da moda, seus *pain points* e o comportamento dos consumidores dentro desse setor.

De uma forma mais prática, a dissertação contemplará uma análise estatística a fim de provar a correlação entre o uso de tecnologias e a satisfação do cliente, através de um questionário. Neste questionário, para além de comprovar a relação entre os tópicos, permite também fazer uma outra análise relacionada com os *Metaverse Driven Products*, de modo a perceber quais os mais impactantes para o consumidor.

As principais conclusões indicam que, embora exista uma correlação forte entre as tecnologias usadas nos *Metaverse Driven Products* e a satisfação do consumidor, verificada através de testes estatísticos, e que tecnologias, para a amostra em questão, sejam mais valiosas do que outras, o maior insight é que existe um *gap* entre a falta de inovação na experiência do consumidor, e uma oportunidade de exploração dos produtos.

Palavras-chave: Metaverso, Moda, Realidade Virtual, Experiência do Cliente, Realidade Aumentada, Inteligência Artificial.

Sistema de Classificação JEL:

L86 - Serviços de Informação e Internet; Software de Computador

O33 - Mudança Tecnológica: Escolhas e Consequências; Processos de Difusão

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1. Introduction

1.1 Context

The digital age has brought significant changes in several industries, with the fashion sector being one of the most affected (Hämmerle , 2020). With ongoing technological advancements, industries are presented with innumerable options to diversify customer experience and improve customer satisfaction, however, it is poorly explored (Villepelet, L., 2020).

The Metaverse, originated from the realm of science fiction (Stephenson, 1992), has emerged as a digital frontier that holds the potential to revolutionize our experience with technology, with the fashion sector being one promising industry to start.

Since 2007, the development of the Metaverse has been continuous, with notable milestones, especially in 2022, signifying important progress in this technology. Established companies like Meta, previously known as Facebook, has already started including Metaverse features into their business practices. (Ball, 2022). Notwithstanding these advancements, the majority of firms are not yet prepared to totally adopt the Metaverse in their operations. The main obstacle lies in the fact that the technology, although showing potential, has not yet reached a level of maturity (Marr, 2022).

The fashion sector has been one of the earliest adopters of Metaverse technologies, in order to improve customer interaction and provide an immersive environment. Nevertheless, the incorporation of the Metaverse gives a unique proposition to further transform the sector. Incorporating virtual reality (VR), augmented reality (AR), and artificial intelligence (AI), can provide a mix of physical and digital experiences, that can establish a framework for consumer engagement. The potential of these technologies is in their capacity to generate immersive and customized purchasing experiences, which can greatly augment customer satisfaction and loyalty (Hilken et al., 2017). The Metaverse is not only a tool for fashion firms, but rather a revolutionary platform that has the potential to facilitate, be more dynamic, captivating, and environmentally friendly commercial operations (Tapscott, 2019).

The fashion sector, specifically, encounters a notable opportunity in incorporating the Metaverse and its technologies, particularly in improving consumer experience, which can be one of the touching points where companies can create value and differentiate.

Furthermore, there is a deficiency in consumer preparedness and comprehension of the Metaverse, its technologies and its possible uses in daily shopping processes. Although early adopters and younger communities demonstrate enthusiasm for virtual and augmented reality experiences, the wider consumer base remains reluctant, primarily because of limited exposure

or comprehension of how these technologies might improve their shopping experiences (Hilken et al., 2017; Poushneh, 2018).

One topic that also contributes to this opportunity gap and investigation problem addressed in this chapter, is the fact that, in the last years, companies are struggling to find some product innovative enough to transform the customer experience. Companies do not risk investing as much because customer behavior has become unpredictable (Grewal, Roggeveen, & Nordfält, 2017). However, it's important to highlight that only a few companies are investing in developing their customer experience through immersive products, making it an underappreciated opportunity (Lemon & Verhoef, 2016). Being one of the first to take this initiative can be a game-changing feature for customers and a critical success factor for companies, especially in industries where customer experience significantly influences purchasing behavior (Rust & Huang, 2014; Verhoef et al., 2021).

1.2 Investigation Problem

The problem to be addressed is the lack of vision by the fast fashion companies in immersive technology integration in the consumer experience, with a future perspective of a seamless integration of the Metaverse.

This is due to the constantly changing consumer behavior becoming riskier to be differentiator in this part of the chain. This problem can be solved by understanding the market, on what it needs and what are they afraid of.

Since 2007, the development of the Metaverse has been continuous, with notable milestones, especially in 2022, signifying important progress in this technology. Established companies like Meta, previously known as Facebook, has already started including Metaverse features into their business practices. (Ball, 2022; McDowell, 2022). Notwithstanding these advancements, the majority of firms are not yet prepared to totally adopt the Metaverse in their operations. The main obstacle lies in the fact that the technology, although showing potential, has not yet reached a level of maturity (Marr, 2022).

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1.3 Objectives

The objectives are as follows:

1. To assess whether integrating Metaverse Driven Products (through AI, AR and VR) with traditional online channels significantly enhances overall customer satisfaction in the fashion industry.
2. To Explore the Potential of Metaverse-Driven Products in Enhancing Customer Experience.
3. To Assess Consumer Perceptions and Attitudes Towards Metaverse Technologies in Fashion.

1.4 Hypothesis

For this dissertation, the first step will be by guaranteeing that the use of technologies correlates with the customer satisfaction, through statistical tests, applied in a survey. These hypothesis will be subject to a p-test and a Chi-Squared Test.

The hypothesis is as following:

H0: Integrating Metaverse driven Products based on AI, VR and AR in offline and online channels does not significantly enhances overall customer satisfaction in the fashion industry.

H1: Integrating Metaverse driven Products based on AI, VR and AR in offline and online channels significantly enhances overall customer satisfaction in the fashion industry.

1.5 Research Questions

1. Can Metaverse-driven technologies, such as Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI), enhance customer satisfaction in the fashion industry?
2. To what extent does the integration of Metaverse-driven strategies influence consumer behavior and purchasing decisions in the fashion industry?

2. Literature Review

2.1. Metaverse Origins

The term "*metaverse*" firstly appeared in a novel, from Neal Stephenson's 1992 *Snow Crash*. The metaverse, as portrayed in the novel, is a virtual reality domain where individuals participate in interactive encounters with both each other and digital entities in a shared and immersive environment.

There is no universally agreed-upon definition of the Metaverse, since scholars and experts have different interpretations of its meaning and purpose. Dwivedi (2022) define the "Metaverse" as a linked digital realm that has the potential to become a seamlessly integrated world of virtual realities. However, Daisie. (2021) has a simpler, yet technical definition. “a virtual reality that can provide a replica of the real world founded on a bedrock of blockchain technology.

On other terms, and instead of a technical definition, (Newton, C. et al 2021) defines the Metaverse as “as a social and cultural phenomenon, potentially shaping the future of social interactions, gaming, and digital collaboration. It represents a shift towards a more embodied internet where users are not just observers but participants in a digital world”.

With different interpretations of this upcoming technology, the paper will consider a definition that combines the various perspectives:

The metaverse is a technologically advanced and linked digital realm that combines virtual reality (VR), augmented reality (AR), and blockchain technology. It allows users to engage in immersive experiences, communicate with others through virtual avatars, and participate in social, gaming, and economic activities. It signifies a progression of the internet, improving user involvement and eliminating geographical limitations in a continuous, interactive environment.

The term Metaverse gained popularity with Mark Zuckerberg's decision to rebrand Facebook as Meta, making it the first firm to officially invest in the Metaverse (Meta Platforms,

2021). In 2021, they have made substantial investments and want to continue investing in the next years.

Nevertheless, the Metaverse is now in its initial stage of growth, and nowadays, there is insufficient technological advancement to fully integrate the metaverse into society (McKinsey & Company et al 2023).

First and foremost, a computer infrastructure is necessary (McKinsey & Company et al 2023). In certain gaming scenarios, there is a certain number of individuals allowed on an online server and is meant to prevent resource overload. In the Metaverse, there will be a greater need for internet connectivity among people and additionally, cellphones currently lack the necessary visual processing units to deliver the immersive experience that the Metaverse is intended to provide (Marr, 2022).

The second topic is to the network architecture, specifically addressing the issue of latency that obstructs the user from utilizing the platform to its fullest potential (Doherty et al., 2018). This limitation arises due to the platform's requirement for a high frame rate per second (Doherty et al., 2018). This can also occur when there is a delay in the transport of data, resulting in a delay for the user in accessing material ((McKinsey & Company et al 2023).

The third topic is with the interface hardware, namely the dominance of flat screens in the market for computers, televisions, and smartphones in recent years (Jerald, 2016). However, the shift towards Augmented Reality (AR) and Virtual Reality (VR) is unavoidable and individuals may anticipate the incorporation of augmented reality (AR) or other technologies into their smartphones, allowing them to access the Metaverse via their mobile devices, in the next couple of years (Jerald, 2016).

2.2. Technological Infrastructure and Scalability of the Metaverse

The implementation of the Metaverse in the fashion industry requires a highly developed technological infrastructure that must be capable of supporting immersive environments, high levels of interactivity and data management and processing.

The skeleton of the Metaverse is a focus point for researchers and industry practitioners, as for example, cloud computing that allows the offloading of intensive computational tasks in

remote data centers (Armbrust et al., 2010).. This is crucial for the Metaverse as it requires an enormous processing power that, in most part of the devices, is not available yet.

One other key component of Metaverse's infrastructure is the network architecture. For example, 5G technology, recently developed can offer significantly faster internet data transfer rates as well as lower latency, which is a major development in comparison with the past devices and networks developed (Andrews et al., 2014). 5G technology is ideal for supporting real time, high bandwidth applications that are required for the Metaverse, however, there is still imminent challenges, that faces threats through this technology. The adoption of 5G network requires a major change in infrastructure than can delay the potential of the technology and the development of immersive environments such as the Metaverse (Zhang et al., 2017).

As the Metaverse keeps evolving, the demands for other products such as GPU's (Graphics Processing Units) and VPU's (Vision Processing Units) will increase. This is due to the technological advancements that will require a more robust processor that can handle the graphics.

The scalability of the Metaverse is also dependent on the efficiency of the data management and storage solutions, as it generates enormous amount of data, user interactions, transactional records that have to be processed efficiently (Zhao et al., 2018). Blockchain technology can offer potential solutions for managing this data in a secure way (Tapscott, 2019).

2.3. Is the Metaverse driving investment?

The interest in this technology has exploded throughout the world, according with Google trends in May 2022. Google searches for metaverse skyrocketed last year, and metaverse online gaming platform Roblox reportedly hit over 55 million daily active users in February 2022 (McKinsey and Company Report, Value Creation in the Metaverse)Meta committed more than 10 billion dollars into its Reality Labs division which makes metaverse-related hardware such as VR goggles. Microsoft planned a 69-billion-dollar acquisition of a gaming company Activision Blizzard would "provide building blocks for the metaverse according to Microsoft in January 2022.

The McKinsey and Company Report, Value Creation in the Metaverse, mentioned the three main investors in this early development of the Metaverse have been:

- **Large Tech Companies:** Including Apple, Microsoft, Nvidia, Meta, and Alphabet, are actively working to shape the metaverse.
- **Venture Capital:** That are investing seriously in the space, one example is the metaverse technology business Improbable, which raised $150 million led by Andreessen Horowitz and SoftBank, and the NFT marketplace OpenSea, which raised $300 million at a $13.3 billion value in a fundraising round headed by Paradigm and Coatue.
- **Corporations:** brands outside of technology are investing money in their aspirations to succeed. Disney, for example, invested in Epic Games, the company that makes well known game Fortnite, and assigned a top executive to supervise its metaverse strategy.

2.4. How are companies currently using the Metaverse?

The main industries to introduce to the customers certain specificities of the Metaverse were the fashion and gaming industries (Alexandrova, E., & Poddubnaya, M. 2023) The fashion industry has initiated preliminary investigations into virtual spaces, employing partnerships with well-known online games such as Roblox and Fortnite (Jing Daily et al., 2021). This requires designing and selling digital apparel and accessories, many of which enhance real-world collections (Google Trends, 2022).

Gucci, a luxury fashion brand, made a foray into the virtual fashion market by charging about 6 dollars for a virtual replica of its “Dionysus” bag on Roblox .When the virtual goods were resold, their value increased significantly (Jing Daily et al., 2021).

This project, as one of multiple examples, highlight how virtual fashion can increase brand awareness and engagement while also opening new revenue streams through the sale of virtual goods and subsequent resale The distinction between virtual and actual encounters is becoming increasingly blurred as technology develops and becomes more ingrained in our daily lives (Dugal, J. et al 2023).

Non-fungible tokens (NFTs) have also been on the verge of enthusiasm for fashion companies. One such example is Adidas' partnership with Bored Ape Yacht Club, which resulted in sales exceeding $100 million (Schiffer, Z. 2021)

2.5. Metaverse Driven Products

The concept of Metaverse Driven Products is exclusively for the use of this paper, and it gathers products that can be integrated into the Metaverse using its foundational technologies such as AR, VR, and AI.

Such products can be:

- Virtual Showrooms.
- Virtual Try-On.
- Virtual Size Advisor.

2.5.1. Virtual Showrooms

A virtual showroom is an online platform that allows customers to go around a brand's products in a three-dimensional virtual setting. This immersive environment is constructed with virtual reality (VR) and augmented reality (AR) technology, enabling users to enjoy a lifelike simulation of actual retail encounters. Customers can explore the showroom, engage with products, and examine objects from various perspectives. (Jauhiainen, et al 2023).

Virtual Showrooms can be an optimal add-on, for when the Metaverse is fully developed as it enables consumer to pursue a high level of interaction and involvement, allowing users to view objectives in a visually immersive environment that incorporates levels of interaction increasing purchasing percentage (Jauhiainen, et al 2023).

Tommy Hilfiger adopted virtual showrooms to offer both buyers and media a three-dimensional, interactive experience during fashion weeks. In response to the pandemic, which had suspended in-person events, the brand introduced a virtual showroom in 2020 to exhibit their Fall 2020 collection (PVH Corp, et al 2022). The virtual environment provided visitors

with the opportunity to explore the collection in a completely immersive, 360-degree digital setting, enabling them to magnify products and observe them with great precision.

Virtual showrooms utilize VR and AR technology to generate a feeling of being physically there and lifelike, which goes beyond the capabilities of conventional internet shopping. This interactive encounter amplifies customer involvement, captivating their focus and cultivating a more profound affiliation with the brand.
This technology has significant potential; however, challenges remain, particularly in terms of the environment's creation, which requires a high investment in technology and specialized knowledge (Ometov et al., 2022). One other concern is the potential misuse of personal information, which raises issues regarding data privacy and security. It is important to have strong safeguards for data privacy and maintain transparency in the collection and utilization of data to build customer confidence (Ometov et al., 2022).

2.5.2. Virtual Size Advisor (VSA)

The Virtual Size Advisor is a computer program that utilizes consumer-provided data to suggest the optimal garment sizes.This technology is a “one step back” from the Virtual Try On, as this technology only takes in consideration the sizes and does not provide any frontend for the customer to see how it looks on him. Users often enter precise measurements, such as height, weight, and body proportions, into the system. The system then uses machine learning algorithms and apparel databases to assess this data and produce individualized size suggestions. This technology can utilize feedback from prior purchases and returns to enhance its suggestions, resulting in a more precise match for future purchases (Webelight et al 2023).

This Metaverse Driven Product is allows consumers to engage with their digital avatars and visually assess how various sizes and styles would suit them in a virtual environment (Webelight et al 2023). This integration facilitates a more captivating and dynamic shopping experience, as consumers have the chance to explore several clothing choices inside a virtual setting.

One example is in 2018, ASOS, a prominent e-commerce apparel retailer, launched its Fit Assistant solution to assist customers in choosing the appropriate size for their clothing. Through the analysis of body measurements of comparable shoppers and their level of satisfaction with fit, the system generates tailored recommendations. ASOS's virtual size

advisor seeks to mitigate the elevated rates of returns commonly seen in online purchasing, especially in the fashion industry, by guaranteeing enhanced precision in tailoring the fit.

The VSA improves the customization of the buying experience. Consumers are provided with customized suggestions that are specifically adapted to their own body profiles, resulting in a higher level of confidence when making purchase decisions (Pantano et al., 2017). This customization enhances the bond between customers and companies by showcasing a dedication to comprehending and satisfying individual requirements and preferences (Poushneh & Vasquez-Parraga, 2017).

However, like other Metaverse-driven products, challenges lie ahead, particularly in terms of sizing inaccuracies. These technologies rely on algorithms that use inputs like height, weight, and body shape, but these data points alone do not account for individual variations in body proportions or brand-specific sizing discrepancies (Blázquez, 2014). Consequently, clients may continue to receive poorly fitted items, resulting in dissatisfaction and elevated return rates.

2.5.3. Virtual Try-On

Virtual Try-On uses augmented reality (AR) and virtual reality (VR) technology to provide a digital portrayal of clothing articles that may be overlaid onto a user's digital avatar or real-time picture. The user is usually required to submit their body measurements, which are then used by the system to create a tailored fit simulation. The virtual garment is designed to accurately simulate how it would fit on the user's body by utilizing advanced algorithms and 3D modeling techniques. This simulation takes into consideration several elements such as cloth drape, stretch, and movement (Mir,. A et al 2020)

In 2019, Nike introduced its Nike Fit functionality, an augmented reality (AR) application that assists consumers in seeing how they looked with the shoes even though they did not possess it in real life. This technology can be intricately related with the Virtual Size Advisor because this example from Nike combined both. Customers can electronically scan their feet using a smartphone camera to access the Nike app, which then offers accurate sizing suggestions tailored to their foot measurements. The technology is especially beneficial for consumers who are purchasing shoes online, as customizing the fit has historically posed a difficulty (Nike, 2019).

Virtual Try-On is considered an evolution of the Metaverse-driven product, with an advanced interface that allows consumers to be represented in 3D, to avatars in virtual environments. The ability to simulate garment fitting with such accuracy can be critical in reducing return rates and facilitating faster purchase decisions. For the highest accuracy, the model must learn from the specific store's garment database to reflect the brand's unique sizing, thereby improving fit precision.

It addresses sizing and fit issues by allowing consumers to visually assess how garments will fit in real-time, thus decreasing the likelihood of returns and exchanges. These advancements in AI-driven technology contribute to an enhanced customer experience, providing users with a greater level of confidence when making purchase decisions.

However, as the other products, challenges lie ahead, and problems with size fit predictions can still be a relevant obstacle. Nevertheless, one other obstacle is the creation of an environment where it creates value for the feature to be recognized by the consumers. This problem is more general as there it is not developed enough to be differentiator.

2.6. Fashion Industry in 2023

The fashion industry has been suffering some setbacks over this year as consumer behavior has shifted rapidly and the ongoing technological advances made it harder for companies to adapt to these changes.

Some changes such as high inflation, consumers deciding to tighten their budgets which highly influences luxury brands, the intensification over sustainability issues, fair pay, and good working conditions have also stood throughout the year, and being social media recognition a big concern for the fashion companies, being charged with poor working conditions would have damaged the reputation of the brand.

According to 3Dlook (et al,.2023), throughout the year, these have been the greatest challenges for the industry:

1. **The Sustainability Gap**

According to McKinsey, 15% of fashion executives list sustainability as one of their top three concerns. This is due to pressure from customers expecting changes and laws.

2. **Consumer Behaviour**

Fashion is one of the top three categories that Gen Z and Millennial consumers are projected to spend, and they are also predicted to fuel the industry's revival. However, luring these clients will need a dedication to creativity. The investment in technology might bring a more predictive consumer behavior and a more disruptive factor on the companies that explore the technology to make the consumer journey a better experience.

2.7. Fast Fashion

This notion began to acquire traction during the Industrial Revolution; with the advent of new textile machinery, clothing began to be manufactured in immense quantities and dimensions. Globalization posed a threat to the luxury fashion industry, and the emergence of "New Fashion" resulted in the entry of companies that are now formidable rivals of Gucci and Louis Vuitton. Fast fashion, like fast cuisine, is intended to be mass-produced; Zara is the first brand that comes to mind when the term is mentioned. The company's business model is predicated on bulk production during the height of a trend. They can sell at a reduced price because they attain economies of scale through mass production. As soon as one trend reaches a state of saturation in the market, another one emerges, and the cycle continues (SCM Glove (n.d)).

However, concerning to their ecological footprint, the fast-fashion business model is regarded very seriously; it not only has severe negative ecological but also ethical effects, as the products in this sector are bought, worn, and discarded (Bhardwaj & Fairhust, 2010).

Fast fashion has an extremely short lead time from a logistical standpoint, as it is typically produced in the weeks following fashion shows. Once manufacturers determine what is "trendy" in the fashion industry, it takes them approximately three weeks to stock storefront windows with the items. Customers are particularly drawn to these types of establishments because they offer the newest trends at exorbitant prices, often at the expense of a perilous infringement upon human rights. For example, the Rana Plaza, a Bangladeshi factory that has collapsed. This phenomenon serves to bring attention to issues about human rights violations and safety protocols within worldwide supply chains.

2.8. Customer Experience in the Fast Fashion Industry

The fast fashion industry has dramatically transformed the landscape by rapidly producing inexpensive, trendy clothing that appeals to consumers worldwide. This business model, characterized by small lead times and low production costs, which seem the best conditions for this industry, economically, however there are some conditions to have in mind when considering customer experience. (Joy et al., 2012).

Customer experience in this sector requires examining various factors, including product quality, brand perception, environmental impact, and technological integration (Pookulangara & Shephard, 2013).

One of the factors is the brand perception that can greatly influence the customer experience in the Fast Fashion Industry. Companies such as Zara have built strong brand identities by constantly delivering the latest trends at affordable prices guaranteeing the customer satisfaction through price and lead time, thereby establishing trust and recognition ((Tokatli, 2008). Brand perception can be built by marketing strategies appealing to the scarcity and exclusivity, even though the fast fashion industry is not exclusive, but they are aggressive in terms of price, and so can encourage to impulsive purchasing decisions.

However, the same strategies can lead to consumer frustration if expectations are not met, highlighting the delicate balance that must maintain to ensure positive experiences (Barnes & Lea-Greenwood, 2006).

One other factor is the environmental impact that has gained industry's attention in the last couple of years, as consumers are becoming more environmentally conscious. The fast fashion industry has been the main target, in the negative aspect, for not complying with the environmental issues, such as waste production and resource depletion.

Brands addressing these concerns by implementing sustainable practices and transparent communication can improve customer experience by aligning with consumer values (Kozlowski et al., 2012). Fast-Fashion companies have not been at the optimal point for environmental and ethical concerns. For example, Rana Plaza, a Bangladeshi factory that has collapsed due to its rotten state, showing lack of consideration for the workers.

Technological integration is another critical factor in shaping customer experience in the fast fashion industry. The evolution of e-commerce and mobile applications has revolutionized the interaction between the consumers and the brands. Companies that effectively can leverage these digital platforms can enhance the customer experience by offering personalized recommendations and seamless purchasing processes. However, these technological

advancements require continuous innovation to keep the consumer engaged (Pantano & Viassone, 2015).

Social media platforms can also be powerful tools for fast fashion brands to engage with consumers, build communities, and drive brand awareness. User-oriented content and influencer collaborations enhance brand visibility and credibility (Jin & Phua, 2014). However, negative reviews or social media backlash can quickly damage a brand's reputation, underscoring the importance of effective online reputation management (Pfeffer et al., 2014).

The affordability is also a very important topic of fast fashion, as it appeals to a broad consumer base, offering access to the latest trends without significant financial investment (Gabrielli et al., 2013). While low prices are attractive, they can also lead to perceptions of low quality, necessitating a careful balance between pricing and perceived value.

2.9. Omnichannel in the Fast-Fashion Industry

The fast fashion industry has revolutionized how consumers engage with fashion by emphasizing rapid lead times and accessibility. This industry is heavily reliant on omnichannel strategies to enhance customer experience, enabling brands to reach consumers through various touchpoints, such as physical stores, online platforms, and mobile applications (Huang & Benyoucef, 2013).

The fast fashion industry has transformed how consumers engage with fashion, by having the latest trends in a fast lead time and accessible through multiple channels. The industry is highly relevant on accessibility and omnichannel strategies, enabling brands to reach consumers through multiple touch points such as social media, physical stores, online platforms and others (Huang & Benyoucef, 2013).

This strategy allows for consumers to browse through multiple channels without having to worry where the products location is, therefore increasing convenience and accessibility (Verhoef et al., 2015).

Brand like H&M or Zara have developed robust e-commerce platforms that complement their experience besides the physical store, making it easy for easy transition between online and offline shopping experiences (Piotrowicz & Cuthbertson, 2014).

Social media can be another crucial factor of the omnichannel strategies as it serves like a platform for engagement and customer interaction (Amed et al., 2019). It also allows for brands to communicate directly with the market, in order to get feedback and providing an even more consolidated customer experience. Contents such as influencer partnerships amplify the brand engagement, visibility and credibility, directly influencing purchasing decisions. (Gensler et al., 2013).

Inventory management is also essential when having a robust omnichannel strategy in the fast fashion industry. The industry and its brands must maintain and accurate inventory information across all warehouse and also cross referencing them to produce product availability and minimize customer frustration (Gallino & Moreno, 2014). The use of data analytics tools can help the fast fashion brands to optimize inventory levels and predict consumer demand. (Hübner, Holzapfel, & Kuhn, 2016).

2.10. Customer Satisfaction Models

SERVQUAL Model (Service Quality Model)

Developed by Parasuraman, Zeithaml, and Berry in 1988, the SERVQUAL model is a highly popular paradigm for assessing service quality. The concept suggests that customer satisfaction is influenced by the discrepancy between customer expectations and their evaluations of the service actually provided. The service quality model known as SERVQUAL delineates five distinct dimensions:

- **Tangibles:** refer to the physical aspects of service delivery,
- **Reliability:** measures the ability to consistently deliver the promised service accurately,
- **Responsiveness:** evaluates the willingness of service providers to help customers and provide prompt service,
- **Assurance:** encompasses the knowledge and employees and their ability to inspire trust and confidence,
- **Empathy:** involves providing caring and individualized attention to customers.

The SERVQUAL approach is especially valuable in-service sectors because the satisfaction of customers directly depends on the quality of interactions between them and service providers.

Expectancy-Disconfirmation Model

The Expectancy-Disconfirmation Model, proposed by Richard L. Oliver in 1980, is a widely recognized model in the field of consumer behavior research. Based on this paradigm, customer satisfaction is mainly influenced by the contrast between customers' pre-purchase/service expectations and their evaluations of the actual performance of the product or service after implementation (Oliver, 1980). The model comprises three essential elements:

- **Expectations**: The beliefs that customers hold about the expected performance of a product or service.
- **Perceived Performance**: The actual performance as perceived by the customer after using the product or service.
- **Disconfirmation**: The gap between expectations and perceived performance, which can be positive (when performance exceeds expectations), negative (when performance falls short of expectations), or neutral.

Disconfirmation = Performance Score – Expectation Score

The phenomenon of positive disconfirmation is associated with consumer satisfaction, whereas negative disconfirmation is linked to discontent. This paradigm is extensively employed in many areas, such as retail and service sectors.

2.11. Consumer Adoption and Behavior in Virtual Environments

In order for Metaverse Driven Products to be successful in the fast fashion industry, it relies heavily on consumer adoption and behavior in these virtual environments. The consumers interaction with these technologies is crucial for ensuring acceptance and integration in the industry. The behavior is often studied through technology acceptance and customer satisfaction models such as the SERVQUAL Model and the EDM (Expectancy Disconfirmation Model) explained in the previous point (McKinsey & Company, 2022).

Researches have shown that consumer are attracted to virtual spaces that offer a high degree of interactivity and customization, that allow them to control their virtual identities (Yee et al., 2007; Schultze & Leahy, 2009). For the Metaverse, as an environment and its technologies and

products derived from, to succeed, they must offer similar opportunities for consumers to engage in a highly personalized manner.

Nevertheless, the problems with the technologies are their challenging adversities that they oppose, particularly related to data collection and personal information, that can be barriers towards usage of the platform for the customers (Bélanger & Crossler, 2011). Therefore, they must prioritize transparency and data security. One other obstacle that is not related with the industry but with the current degree of technology that cannot deliver, yet the immersive environment expected and that is not evenly distributed throughout all the consumers (Hilbert, 2011).

Since the Metaverse can take a few years of development and may take some time to be fully operational, the use of tools like the Virtual Showroom, Size Advisors and Try On platforms, can be a feasible starting point for companies to be ahead of its competitors providing a unique experience. However, companies need to ensure that the investment will be assured and sustain by evidence of correlation between the consumers, and its levels of satisfaction and the technologies.

2.12. Potential Areas for Future Development

The potential for additional innovation and advancement in the fashion industry's use of these technologies is substantial. As augmented reality (AR) technology advances, it is expected to become more easily accessible, providing increasingly immersive and tailored retail experiences (Hilken et al., 2017). The progress in machine learning and artificial intelligence is anticipated to improve the functionalities of augmented reality (AR) apps, allowing for more precise and lifelike virtual try-on experiences. Some technologies may depend on others to improve themselves.

In addition, the combination of augmented reality (AR) with other developing technologies, such as virtual reality (VR) and the Internet of Things (IoT), offers promising prospects for the fashion sector (Scholz & Duffy, 2018). By combining these technologies, it is possible to build retail experiences that are more engaging and dynamic, hence increasing consumer pleasure and loyalty (Bonetti et al., 2018). For instance, smart mirrors empowered with IoT technology and virtual showrooms improved with virtual reality might provide consumers a completely holistic and interconnected buying experience (Pantano et al., 2017).

3. Methodology

3.1. Context

Drawing upon the study objectives and the literature review discussed earlier, this chapter intends to delineate the methodologies employed in the research process. This paper will provide a sequential explanation of the survey, the tests, data collecting methodology, and analysis techniques used in the research process. These elements will give the necessary support to evaluate the research hypotheses that form the basis of the analytical chapter in this dissertation.

H0: Integrating Metaverse driven Products based on AI, VR and AR in offline and online channels does not significantly enhances overall customer satisfaction in the fashion industry.

H1: Integrating Metaverse driven Products based on AI, VR and AR in offline and online channels significantly enhances overall customer satisfaction in the fashion industry.

3.2. Research Design

To validate the previously proposed hypothesis, the research was carried out as a quantitative empirical study. The data analysis was conducted using data obtained from an online survey.

3.3. Data Collection

3.3.1. Consumer Survey

This consumer survey (Annex A) comprises 43 questions aimed at evaluating various aspects of respondents' experiences, preferences, and interactions with the average fashion experience, with a particular focus on Metaverse-driven Products.

The target population were customers in the fashion sector. The sample was chosen by voluntary participation in the survey, which collected demographic information, educational attainment, employment position, and shopping habits concerning fast fashion and virtual shopping technologies. The poll was distributed online, via platforms such as Survey Swap.

Regarding the data collection, it was conducted via survey, completed online by participants, enabling researchers to obtain quantitative data on consumer demographics, preferences, habits and behaviors. The data's representativeness is moderate; despite a relatively small sample size of 105 respondents, it encompasses a balanced mix of gender, education, and income levels, particularly emphasizing younger, educated consumers who engage in online shopping.
The questions are divided into several key groups to address demographic characteristics, shopping patterns and behaviors, virtual shopping experiences, and technological adoption.

1. Sociodemographic Information and Shopping Patterns:

- This section includes 9 questions related to respondent demographics, such as:
    - **Age**.
    - **Gender**.
    - **Education Level**.
    - **Employment Status and Income**.
    - **Shopping Patterns**.

2. Virtual Showrooms, Virtual Size Advisor, and Virtual Try-On Questions:

This part of the survey captures the respondents' attitudes toward the use of Metaverse-driven Products, focusing on **Virtual Showrooms**, **Virtual Size Advisors**, and **Virtual Try-Ons**. The questions are grouped into three strategies, as follows:

Virtual Showrooms:

- **Expectations and Performance**: Respondents were asked about their initial expectations of virtual showrooms, and their experiences in terms of how the performance of these technologies compared to their expectations.
- **Use and Features**: Key questions assess respondents' likelihood to use virtual showrooms, their most valued features (such as 360-degree product views), and any concerns that they have regarding accessibility or the lack of personal interaction.

Virtual Try-On:

- **Consumer Interest**: Questions in this group assess the appeal and practicality of virtual try-on technologies, asking respondents to rate how likely they are to use such technologies.
- **Benefits and Challenges**: The benefits of virtual try-ons, such as increased accuracy in fit and reduced returns, are explored, alongside challenges such as accuracy concerns or privacy issues.

Virtual Size Advisor:

- **Appeal and Likelihood of Use**: Respondents rate how appealing the concept of a Virtual Size Advisor is and how likely they are to use it when shopping for fashion items.
- **Feature Preferences**: Key features, such as accurate size recommendations, personalized fit suggestions, and ease of inputting measurements, are addressed.
- **Potential Concerns**: The questions identify limitations that respondents foresee, such as the accuracy of the technology or concerns about data privacy.

3. Customer Experience and Satisfaction (SERVQUAL and EDM)

- The survey also incorporates questions aligned with the SERVQUAL and EDM model, which measures the quality of service experienced by customers.

4. Comparative Questions and Ranking of Preferences:

- These questions assess the overall impact of different Metaverse-driven technologies. Respondents are asked to rank the products (Virtual Showrooms, Virtual Try On, and Virtual Size Advisors) in terms of which would most enhance their shopping experience.
- The survey also captures respondents' optimism about the potential of Metaverse technologies to transform the fashion shopping experience, offering insights into the future direction of consumer preferences.

4. Analysis and Findings

This chapter provides an examination, and results obtained from the data gathered through a market investigation to comprehend the influence of incorporating Metaverse-powered products, such as AI, VR, and AR technologies, into online channels on the overall satisfaction of customers in the fashion industry.

Here is a breakdown of the analysis:

- Demographic analysis
- Consumer behavior analysis
- Statistical testing
- Product Analysis
- EDM and SERVQUAL Applications

4.1 Demographic Analysis

The survey data provides significant new information on the respondents' socioeconomic and demographic traits. The age distribution reveals a notable concentration in the younger age groups, especially the largest group of 40 respondents, who are in the 25–34 age range. There are 29 responders in the 18–24 age group and 21 in the 35–44 age group. There are fewer respondents (15) in the 45–54 age group, and interestingly, none of the respondents are in the 55–64, 65 and above, or under 18 age groups.

The survey's gender distribution is equal, with 50 male and 55 female respondents.

Regarding the level of education, 70 of the respondents, or the majority, have a bachelor's degree; the next three most common degrees are master's and doctoral. Just 4 respondents said their greatest level of education was a high school diploma or its equivalent, while 8 respondents said they had attended some college but not finished a degree. Not a single respondent had education below a high school diploma. Given the high degree of education among participants, it is likely that the survey drew a knowledgeable audience, which may have an impact on the

kinds of responses provided, especially when it comes to subjects like technology, even though the questions do not require any type of base knowledge besides the definitions provided.

With 93 responses, full-time employment accounts for most respondents' employment status. 12 respondents identified as students, while no respondents claimed being unemployed, self-employed, or working part-time.

According to the income statistics, 69 respondents, or most of the sample, have yearly household incomes between 20.000 and 39.999 euros. Ten respondents claim incomes between 40.000€ and 59.999€, while twenty-six respondents earn less than 20.000€.

4.2 Consumer Behavior Analysis

4.2.1. Purchasing Frequency

When asked how often they bought fashion items (Question 6), 55 respondents, or most of them, said they went shopping once a month. This shows a regular interaction with fashion retailers. Furthermore, 23 respondents purchase at least once a week, indicating a subset of frequent buyers who may be especially receptive to frequent releases and discounts, or even dynamic customer experiences. Smaller groups shop less frequently (2 respondents), once or twice a year. These responses show differing levels of participation, which may be impacted by variables including income, need, and interest in current fashion trends.

4.2.2. Preferred Shopping Channels

In accordance with Question 7, 64 respondents prefer to purchase online, making digital platforms their primary method of purchasing fashion garments. The results on this question reveals how crucial it is for fashion merchants to have a strong online presence and offer user-friendly e-commerce solutions. A major proportion (35 respondents) also prefer a mix of both channels. Merely six participants expressed a preference for in-store shopping entirely, suggesting a reduced but continued need for traditional retail experiences that can be improved with individualized services and engaging store designs.

4.2.3. Satisfaction with Fast Fashion Quality

Most respondents were satisfied with the quality of fast fashion brands like Zara and H&M (Question 8). In particular, 69 respondents had positive opinions, of whom 57 are satisfied and 12 are extremely satisfied. This implies that fast fashion companies are generally living up to consumer expectations about quality in relation to cost which is crucial in this industry. There is still opportunity for development in quality consistency, as evidenced by the 27 respondents who are neutral and the minority who are unsatisfied (5 respondents) or very dissatisfied (4 respondents).

4.2.4. Importance of Ethical Labor Practices

The vast majority of the respondents think that ethical labor practices are important, indicating that this topic has been growing concerns into the customers and that might influence the purchasing decision.

There are just 24 responses who are indifferent, a meager 1 responder who believes it is not very significant, and 0 respondents who believe it is unimportant. These results imply that ethical behavior and openness can play a significant role in a brand's reputation and customer loyalty, mainly in the fast fashion industry where incidents happened mentioned in the Literature Review.

4.2.5 Online and In-Store Shopping Experiences

The experiences in online and in store channels are perceived in different ways. The majority of respondents (43) describe their experience as ordinary when it comes to online merchants. On the other hand, respondents gave in-store encounters a higher percentage of favorable ratings—37 called them excellent, and 46 called them good. This discrepancy shows that, despite the ease and popularity of online shopping, there is room to improve the digital customer experience to the point where it can rival or even surpass the levels of satisfaction observed in physical locations.

4.2.6. Importance of Personalized Shopping Experiences

Personalization is key to the respondents as. 57 said that individualized shopping experiences are extremely important, and 26 said that they are important. According to the majority, personalized offers and recommendations can greatly increase client happiness and engagement.

4.2.7. Experiencing Stock-Outs

When it comes to stock availability, 40 respondents said they rarely or never experienced stockouts when shopping for fashion items, while 7 said they never did. But 36 respondents report stockouts once in a while, whereas a lower percentage (19 respondents) or very frequently (3 respondents) report this problem.

4.2.8. Satisfaction with Customer Service

The majority of fast fashion shops report neutral to positive customer service satisfaction. 34 respondents are satisfied, 12 are very satisfied, and 54 are neutral about the service. There are only a few who are unhappy (4 respondents) or really unhappy (1 reply). These findings show that although customer service satisfies fundamental requirements, it still has room for improvement to turn unfavorable impressions into favorable experiences. Once due to the industry branch of fast fashion, this is likely to demonstrate the overall experience. However the gap that exists between the market is real and companies can work on their customer experience.

4.2.9. Importance of Omnichannel Experience

A seamless online and physical shopping experience is highly valued; according to 57 respondents, it is extremely important, and for 31 respondents, it is important. The agreement highlights the imperative for retailers to proficiently integrate their diverse platforms to guarantee uniformity in terms of service, product accessibility, and consumer satisfaction, irrespective of the buying channel.

4.3. Statistical Testing

4.3.1. Chi-Squared Test Analysis

For the statistical testing, hypothesis was created and mentioned in the beginning of this paper:

H0: Integrating Metaverse driven Products based on AI, VR and AR in offline and online channels does not significantly enhances overall customer satisfaction in the fashion industry.

H1: Integrating Metaverse driven Products based on AI, VR and AR in offline and online channels significantly enhances overall customer satisfaction in the fashion industry.

In order to verify the correlation between the customer satisfaction and the usage of AI, VR and AR, the Chi-Squared Test is the most suitable test.
Two categories were created from Question 18:

- Those who consider AI, AR and VR as "Very Important" and "Important".
- Those who consider them to be "Neutral", "Not Much Important" and "Not Important at All".

The Chi-Square test findings showed a **6.80 Chi-Square statistic** with a 0.0091 p-value. The significance of the relationship between customer happiness and the relevance of AI, VR, and AR technologies is statistically significant, as evidenced by the p-value, which is significantly lower than the traditional threshold of 0.05. According to this research, consumers who value these technologies are more likely to express satisfaction with the way online and offline retail channels are integrated.

As the results showed, the chi-squared test suggest a p-value within the threshold of the level of confidence of 95%, and so we can **reject the null hypothesis**.

This is consistent with the retail industry's increased focus on digital and immersive experiences, as consumers anticipate technologies to improve their shopping experiences.

4.3.2. T-Test Analysis

For the T-Test analysis, in order to verify if there is a significance between the means of two groups:

- Those who consider AI, AR and VR as “Very Important” and “Important”.
- Those who consider them to be “Neutral”, “Not Much Important” and “Not Important at All”.

The T-test a p-value of 0.068 and a T-statistic of 2.22. There is no statistically significant difference in the mean satisfaction levels between the two groups, as indicated by the p-value exceeding the 0.05 threshold. This finding implies that although AI, VR, and AR technologies are acknowledged to be important, there may not be a significant change in satisfaction levels when assessing the state of technological integration as it stands right now.

It can signal that other factors are having a greater impact on customer happiness or that the current implementation of these technologies is not sophisticated enough to have a substantial impact on satisfaction.

4.3.3. Discussions and Interpretation

By the statistical testing, important information is provided by the differences in the tests. A strong Chi-Square test identifies a correlation between the customer satisfaction and the value customer makes of AI, VR and AR as part of the customer experience. However the T-Test reported the absence of significant difference, which could not reject the null hypothesis.
There could be multiple reasons, such as the effectiveness of the technologies that are currently integrated might not be differentiator enough.

These results suggest that while investing in AI, VR, and AR technologies is important, fashion companies must execute them carefully and skillfully to increase customer happiness. Retailers ought to concentrate not just on the existence of these technologies but also on how well they integrate with one another and the real advantages they provide to consumers. Higher satisfaction levels can only be attained by making sure that new technologies are more than just novelties; they must actually improve the customer journey and produce customer satisfaction.

4.4 Product Analysis

4.4.1. Virtual Showrooms

There was a lot of interest in the idea of virtual showrooms, where customers could view fashion collections in a virtual setting. The notion was either "Very appealing" (32.4%, n = 34) or "Somewhat appealing" (47.6%, n = 50) by a total of 80% of respondents.

The chance of employing such technology also reflects this great interest, with 73.3% of respondents saying they are "Very likely" (14.3%, n = 15) or "Somewhat likely" (59%, n = 62) to use a Virtual Showroom.

Respondents gave top priority to functional aspects that they saw or would like to see in the product like 360-degree product views (72.4%, n=76) and an engaging customer experience (92.4%, n=97). These characteristics were thought to be essential for improving the online buying experience. But worries still exist, especially with regard to technology accessibility (61%, n=64), which turned out to be the major obstacle/challenge. This can also solidify what has been analyzed before. The problem can arise by the actual implementation of the products or the technology that is not ready to be disruptive for the customer.

4.4.2. Virtual Try-On

Virtual Try-On technology was widely welcomed since it enables customers to virtually try on clothing before making a purchase. This was appealing to an impressive 96.2% of respondents, 81.9% (n=86) of whom said it was "very appealing." This implies that the fashion industry could very well embrace the product and its technology.

Though there is a lot of attractiveness, there are more various chances of use. 45.7% of participants said they were "Very likely" to use a virtual try on, compared to 23.8% (n=25) who said they were "Somewhat unlikely." Better fit accuracy (37.1%, n=39) and improved shopping experiences (66.7%, n=70) are the main advantages that have been noted. However, serious concerns were raised regarding privacy (30.5%, n=32) and fitting technology accuracy (57.1%, n=60), highlighting issues that need to be addressed before adoption becomes more widespread.

4.4.3. Virtual Size Advisor

There was also a lot of interest in the Virtual Size Advisor, which makes size recommendations based on personal measurements. The idea was appealing to 91.4% of respondents in total, with a sizable percentage (24.8%, n=26) believing it to be "Very appealing." This implies that tools that provide individualized shopping experiences will be well received.

A Virtual Size Advisor is also very likely to be used; 93.3% of respondents said they are "Very likely" or "Somewhat likely" to utilize it. Features like accurate size recommendations (41%, n=43) and integration with virtual fitting tools (52.4%) were highly valued by respondents. However, issues with recommendation accuracy (25.7%, n=27) and ease of use (32.4%, n=34) were raised, pointing to areas where user experience and technological dependability should be strengthened.

4.4.4. Equivalency of Preferences and Hope for Metaverse Technologies

Respondents were asked to compare the three Metaverse-driven products said they preferred the Virtual Size Advisor (42.9%, n = 45) above the Virtual Fitting (31.4%, n = 33) and Virtual Showrooms (25.7%, n = 27) as the most useful for improving their shopping experience. Furthermore, when respondents ranked these items in order of significance, Virtual Fitting came out on top 39% (n=41), closely followed by the Virtual Size Advisor (35.2%, n=37).

A total of 74.3% of respondents expressed optimism about the possibilities of Metaverse technology, with 41% (n=43) indicating that they were "Very optimistic." This optimistic view suggests that consumers are generally willing to adopt these developments, indicating that the fashion sector is about to undergo a substantial transition.

4.4.5. Conclusions

Virtual Try-On and the Virtual Size Advisor are two examples of the Metaverse-driven products that have generated significant interest, according to survey data. The high degrees of usability and attraction indicate that users are keen to interact with these technologies. By including these technologies in their offerings, fashion shops may be able to draw in and keep customers who are looking for more unique and customized buying experiences.

However, this does not mean that one product can be better than the others. The sample cannot conclude that due to its small size. The focus should be on the readiness of the consumers

and the market to utilize for the first time, or even to spread these products to multiple stores, if already available by early adopter brands.

A consumer base that is receptive to and enthusiastic about digital purchasing experiences is shown by the overall optimism around Metaverse technologies. But in order for these advances to live up to the hype, they must address the raised issues, especially those related to accuracy, technology development and privacy.

The adoption of Virtual Showrooms, Virtual Try-Ons, and Virtual Size Advisors will depend on how well these technologies solve concerns relating to accuracy, privacy, and user experience, despite the fact that consumers are very interested in and optimistic about these advances. Fashion businesses should expect to experience an improvement in customer satisfaction and loyalty if they can successfully integrate these technologies while maintaining accessibility and dependability. The results of this poll offer the industry an opportunity to seek to take the lead as the industry shifts towards a more digital and customized purchasing experience.

4.5. Models Applications

In order for this paper to be more robust in theoretical terms, it should also have in mind the models previously presented as another proof that the introduction or appliance of Metaverse Driven Products can be crucial for companies as a critical success factor. The survey contained questions in order to measure how successful each criteria of the model is and provide some interesting insights.

4.5.1. Expectancy-Disconfirmation Model (EDM) Analysis

Customer Expectations

The survey asked respondents (Question 21) to indicate their initial anticipations on the use of technology driven by the Metaverse. Out of the total of 105 participants, a significant majority of 65 individuals reported high expectations, while 19 participants showed very high expectations. Only 9 participants, representing a minority, indicated modest expectations, and none of them held very low expectations. Perhaps because to the innovative and immersive nature of these platforms, consumers generally embrace Metaverse technology with optimistic anticipations.

Perceived Performance

Upon being asked to evaluate the actual performance of Metaverse technologies (Question 22) in comparison to their initial expectations, the results indicated a diverse range of experiences. Only one person stated that the technology surpassed expectations, in contrast to 17 respondents who considered the performance to be as expected. Yet, 21 participants said that the technologies did not provide the expected performance, and a significant number (67 participants) had never used the technologies, indicating a potential lack of market penetration or user adoption.

Disconfirmation

The analysis (Question 23) reveals that none of the participants characterized the technologies as being much superior to or even exceeding their expectations. In contrast, 23 people expressed that the technologies did not match their expectations, whereas 11 participants affirmed that their expectations were indeed met. The remaining participants had not made use of the provided technologies. Evidence of this adverse disconfirmation suggests that Metaverse technologies in the fashion industry are now failing to meet client expectations, which could impact overall satisfaction and adoption rates.

Implications

Through the EDM Framework, we can analyze the results having in mind the model:

Disconfirmation = Performance Score – Expectation Score

Expectation Score =409

- The weighted sum of the expected responses is 409. The calculation involved multiplying the number of responders in each category (Very High, High, Neutral, Low) by their corresponding numerical values (e.g., Very High = 5, High = 4, etc.).

Then it is necessary to calculate the Average expectation, dividing the total weighted expectation by the number of total respondents.

$$\textbf{Average Expectation Score.} = \frac{409}{105} = 3.9$$

Same process is applied for the Average Performance Score:

$$\textbf{Average Performance Score.} = \frac{97}{39} = 2.49$$

And so,

$$\textbf{Disconfirmation} = 2.49 - 3.90 =. - 1.41$$

A negative disconfirmation score signifies that the perceived performance of the technologies fell markedly short of expectations, underscoring respondent discontent.

The results of the EDM research indicate that while customers first show excitement for the potential of Metaverse-driven technology, the specific performance often fails to meet their expectations. This discrepancy can lead to dissatisfaction (Positive Disconfirmation) and indeed hinder the widespread approval.

To address this problem, and being these tools still in their early developments, probably it is a matter of time until technology is enough to create an immersive sense as it supposed. The possibility of this discrepancy can also be the lack in hearing on what features would the customers like. In both terms there is still room for improvement.

Another crucial topic that can influence, is the fact that the majority of the people that answered the question have not tried these Metaverse Driven Products.

4.5.2. SERVQUAL Model Analysis

Tangibles

Among the users of these technologies, just one responder (Question 24) described the tangibles as outstanding, while 14 considered them acceptable, and 18 classified them as ordinary. A smaller subgroup, comprising 5 participants, evaluated the tangibles as below average. Hence, it can be deduced that while the visual and navigational aspects are generally acceptable, there exists significant opportunity to improve the overall user experience. Such replies may suggest a lack of preparedness and technological progress.

Reliability

Thirteen respondents (Question 37) reported that the virtual size recommendations and fitting results were occasionally accurate, while three respondents deemed them consistently accurate. The survey results indicated that 15 respondents assessed them as occasionally correct, while 6 respondents ranked them as rarely accurate. One participant highlighted that the equipment consistently exhibited a deficiency in accuracy.

Responsiveness

The ability of AI-driven customer service solutions to address user queries (Question 43) , was evaluated subjectively by 13 participants, with only 5 respondents expressing pleasure. A significantly large proportion of participants (87 answers) had never utilized these services, suggesting a possible lack of understanding or engagement with these features. The lack of satisfaction among users of the service suggests a need for more effective and timely customer assistance interventions within the platform.

Assurance

The survey (Question 41) results indicate that 16 participants reported a high level of confidence in the platforms protecting data privacy and security, 17 participants reported confidence, 45 participants reported a moderate level of confidence, and 4 participants reported no confidence at all. The results indicate a slight absence of trust that could deter customers from fully embracing. This may be a problem due to

Empathy

The platform obtained comparatively poor ratings in empathy (Question 42), a measure of its capacity to satisfy individual requirements and preferences. A small number of participants, specifically 9, reported being satisfied with the platforms' capacity to cater to their unique fashion preferences. Equally, 23 respondents expressed the belief that the platform offered just a limited degree of adaptability. A considerable number of participants in the survey (70 respondents) had no previous experience with the technologies.

Implications

Now in order to apply the SERVQUAL model, it requires the Likert Scale on the questions assigned for the following topics of the model, and it is also necessary to have the Expectation Score calculated in the previous model.

Expectation Score = 3.9

Now it is necessary to calculate the Average performance in each topic, using the Likert Scale, each question is adapted, but the most positive answer takes the highest value (5).

Tangibles = 3.29
Reliability =3.29
Assurance =2.96
Empathy =3.17
Responsiveness =3.28

Now, after calculating our Perceived Performance in each dimension, lets proceed with the gap calculation.

Tangibles = 3.29 – 3.9 = - 0.71
Reliability = - 0.71
Assurance = - 0.94

Empathy = - 0.73

Responsiveness = - 0.62

All parameters show negative gaps, indicating that consumers universally perceive the performance of Metaverse-driven fashion technology as inadequate relative to their expectations.

The most significant disparity is in Assurance (-0.94), meaning that privacy and security are the foremost issues that need to be resolved to enhance consumer satisfaction.

An analysis of SERVQUAL model reveals several areas where tech Metaverse Driven Products fail to fully satisfy customer expectations.

The reliability is a significant issue, since many consumers have experienced inconsistencies, which may lead to dissatisfaction. Continual improvement of the responsiveness of AI tools is essential, as customers expect immediate and accurate support while using this advanced technology. Undoubtedly, it is essential to tackle the critical elements of confidence and understandability. Consumers need to have a reasonable level of assurance in the data protection and that the platforms understand and provide to their particular needs. Nevertheless these were all problems regarding with the technological infrastructure already mentioned in the paper as expected.

4.5.3. Conclusions

The integration of the **Expectancy-Disconfirmation Model** and **SERVQUAL Model** reveals that although Metaverse-driven technologies in the fashion sector show considerable potential, there are obstacles that must be resolved in order to enhance customer satisfaction. Frequently, the technologies fall short of the lofty expectations established by consumers, resulting in unfavorable confirmation.

In order to increase satisfaction and promote wider acceptance, fashion companies should prioritize the provision of consistent and dependable services, strengthen the responsiveness and efficiency of AI-powered customer care, and establish more trust through refined data security measures. By focusing on these aspects, companies can enhance the congruence between their Metaverse initiatives and consumer expectations, resulting in increased customer satisfaction and loyalty in this burgeoning digital environment.

5. Final Insights

This chapter outlines the primary findings of this study, derived from the results mentioned in the preceding chapter. At the outset, the research questions will be addressed. At last, the chapter will delineate certain constraints of the study and propose recommendations for future investigation.

The main contribution of this thesis, even though it is a very speculative area, and still in development, is to make aware the companies in the fashion sector that, even though Metaverse is still not available, there is an opportunity gap to explore these technologies and improve customer satisfaction.

1. **Can Metaverse-driven technologies, such as Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI), enhance customer satisfaction in the fashion industry?**

A: As seen and proved by the statistical testing, the answer of the rejection of the null hypothesis, can signify that exists a correlation between the technologies and the customer satisfaction.

The research findings also provide compelling evidence that technologies driven by the metaverse have the capacity to greatly improve customer satisfaction in the fashion sector. Virtual showrooms, Virtual Size Advisors (VSA), and Virtual Try-On tools exemplify how digital advancements may connect the realms of online shopping. A significant majority of respondents in the poll, more than 80%, indicated a strong interest in these technologies and a favorable attitude towards virtual shopping experiences. These technologies provide a fully engaging and participatory method to online purchasing, which conventional e-commerce platforms are unable to replicate.

One key factor that significantly influences customer happiness in these virtual settings is the extent of personalization provided. Technological solutions like Virtual Size Advisors, which offer tailored sizing suggestions derived on user input, effectively tackle a significant challenge in online shopping—inaccurate sizing and fit. Responses from survey respondents revealed that a higher degree of precision in matching results in a reduced number of product returns and increased satisfaction with their purchases.

Furthermore, the study indicates that AI-powered customization is absolutely essential in enhancing the whole consumer experience. Advanced artificial intelligence (AI) technology enables fashion companies to customize shopping experiences according to

consumer preferences, purchase history, and behavior. This results in a purchasing environment that is more seamlessly integrated, captivating, and focused on the customer, therefore meeting the increasing consumer need for customized services.

2. **To what extent does the integration of Metaverse-driven products influence consumer behavior and purchasing decisions in the fashion industry?**

A: The integration of Metaverse Driven Technologies in the fast fashion industry has a **significant influence** on the consumer behavior, satisfaction and purchasing decisions. These companies are used to standardize in order to reduce the costs because they gather lots of consumers, however and according to the market, represented by the survey population, the respondents are highly receptive of engaging with the technologies and products associated which can be differentiator from its other competitors that only try to reduce the costs and have fast lead times. The Metaverse Driven Products allow consumers to interact with products in ways that replicate the in-store experience, making them more likely to convert interest into purchases.

However, there are also challenges that the industry must overcome to fully leverage these innovations. Privacy concerns, technical limitations, and the costs of implementing such technologies are significant hurdles that need to be addressed. The accuracy of virtual tools such as Virtual Size Advisors is still developing, and some respondents expressed concerns about data privacy when using such tools.

Even though metaverse-driven technologies present substantial opportunities, brands must focus on building trust and ensuring that these technologies are accessible, reliable, and secure.

Limitations

Although the study provides encouraging analysis of the potential of metaverse-driven technologies in the fashion sector, it also highlights several constraints that obstruct the broad acceptance and complete achievement of these advances. These constraints relate to both technical obstacles and end-user preparedness, as well as wider social and ethical considerations. Overcoming these constraints is essential to guarantee the successful

incorporation of Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) technologies in improving customer happiness and influencing consumer behavior.

Technological Readiness and Infrastructure

An inherent constraint in the implementation of metaverse-driven technologies is the present level of technological preparedness. Despite ongoing advancements, virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) technologies remain incomplete and out of reach for a wide spectrum of users. Virtual Try-On platforms and Virtual Size Advisors, although conceptually appealing, frequently lack the necessary level of accuracy to ensure precise sizing or realistic simulations of garments. Insufficient precision in these technologies can result in customer dissatisfaction, therefore compromising the anticipated advantages they seek to offer.

Moreover, the necessary technological infrastructure to facilitate extensive, immersive metaverse experiences, including high-speed internet, sophisticated gear (e.g., VR headsets), and robust computing systems, is not yet universally accessible.

Cost and Implementation

Deploying metaverse-based technology might incur significant expenses, especially for smaller fashion companies lacking the means to invest in state-of-the-art virtual environments or AI-powered personalization platforms. Developing and maintaining virtual showrooms necessitate significant investment in technology, infrastructure, and industry-specific knowledge. The exorbitant cost of entry may discourage many firms, particularly those in the fast fashion industry where profit margins are already narrow, from widely adopting these technologies.

Even for bigger companies, in the fast fashion industry, that have the means to embrace these advancements, the immediate impact on their return on investment (ROI) may not be evident. Although Nike and Gucci, leading early adopters of metaverse technology, have garnered media coverage and consumer curiosity, the overall effect on sales and long-term customer loyalty is still uncertain. Without additional empirical evidence on the impact of these technologies on consumer behavior and profitability, several companies may be reluctant to wholeheartedly embrace the incorporation of metaverse-driven mechanisms into their business strategies.

Suggestions for Future Research

Studies on Consumer Behavior and Technology Adoption

An area of primary need for future study is comprehending the temporal evolution of consumer behavior and technology adoption in reaction to developments driving the metaverse. This study, along with others, offers a momentary glimpse into how consumers perceive and feel about virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) in the fashion retail industry. Nevertheless, adopting a longitudinal methodology could provide more profound understanding of the evolving customer preferences and behaviors as these technologies advance and achieve greater integration into daily purchasing experiences

A study could investigate the temporal evolution of consumer satisfaction with metaverse-driven technologies such as Virtual Size Advisors and Virtual Try-On systems, as well as the influence of repeated usage on loyalty and buying behavior.

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Appendix A: Inquiry to the Market

1. **What is your age group?**
    - Under 18 (0 respondents)
    - 18-24 (29 respondents)
    - 25-34 (40 respondents)
    - 35-44 (21 respondents)
    - 45-54 (15 respondents)
    - 55-64 (0 respondents)

2. **What is your gender?**
    - Male (50 respondents)
    - Female (55 respondents)
    - Non-binary (0 respondents)
    - Prefer not to say (0 respondents)

3. **What is your highest level of education?**
    - Less than high school (0 respondents)
    - High school diploma or equivalent (4 respondents)
    - Some college, no degree (8 respondents)
    - Bachelor's degree (70 respondents)
    - Master's degree (21 respondents)
    - Doctoral degree (2 respondents)

4. **What is your employment status?**
    - Employed full-time (93 respondents)
    - Employed part-time (0 respondents)
    - Self-employed (0 respondents)
    - Unemployed (0 respondents)
    - Student (12 respondents)

- Retired (0 respondents)

5. **What is your annual household income?**
    - Less than 20,000€ (26 respondents)
    - 20,000€ - 39,999€ (69 respondents)
    - 40,000€ - 59,999€ (10 respondents)

6. **How often do you purchase fashion items (clothing, shoes, accessories)?**
    - Once a week or more (23 respondents)
    - Once a month (55 respondents)
    - Every few months (12 respondents)
    - Once or twice a year (13 respondents)
    - Less than once a year (2 respondents)

7. **Where do you primarily shop for fashion items?**
    - In-store (6 respondents)
    - Online (64 respondents)
    - Both equally (35 respondents)

8. **How satisfied are you with the quality of the fashion items you purchase in fast fashion brands (i.e Zara, H&M)?**
    - Very satisfied (12 respondents)
    - Satisfied (57 respondents)
    - Neutral (27 respondents)
    - Dissatisfied (5 respondents)
    - Very dissatisfied (4 respondent)

9. **How important is it for fashion brands to have ethical labor practices?**
    - Very important (21 respondents)
    - Important (59 respondents)
    - Neutral (24 respondents)
    - Not very important (1 respondent)
    - Not important at all (0 respondent)

10. **How would you rate your overall shopping experience with online fashion retailers?**
    - Excellent (27 respondents)
    - Good (31 respondents)
    - Average (43 respondents)
    - Poor (4 respondents)
    - Very poor (0 respondents)

11. **How would you rate your overall shopping experience with in-store fashion retailers?**
    - Excellent (37 respondents)
    - Good (46 respondents)
    - Average (16 respondents)
    - Poor (2 respondents)
    - Very poor (4 respondents)

12. **How important is personalized shopping experience (recommendations, personalized offers) to you?**
    - Very importante (57 respondents)
    - Important (26 respondents)
    - Neutral (14 respondents)
    - Not very importante (7 respondents)
    - Not important at all (1 respondents)

13. **How often do you encounter stockouts (items being out of stock) when shopping for fashion items?**
    - Very often (3 respondents)
    - Often (19 respondents)
    - Occasionally (36 respondents)
    - Rarely (40 respondents)
    - Never (7 respondents)

14. **How satisfied are you with the customer service provided by fast fashion retailers?**
    - Very satisfied (12 respondents)
    - Satisfied (34 respondents)
    - Neutral (54 respondents)
    - Dissatisfied (4 respondents)
    - Very dissatisfied (1 respondents)

15. **How important is it for you to have a seamless shopping experience across both online and offline channels?**
    - Very important (57 respondents)
    - Important (31 respondents)
    - Neutral (17 respondents)
    - Not very important (0 respondents)
    - Not important at all (0 respondents)

16. **How important is it for you to have your online and in-store purchase history unified for better personalized offers and recommendations?**
    - Very important (20 respondents)
    - Important (27 respondents)
    - Neutral (39 respondents)
    - Not important (11 respondents)
    - Not important at all (8 respondents)

17. **How satisfied are you with the current level of technological integration between online and offline shopping experiences provided by your fashion retailers?**
    - Very satisfied (13 respondents)
    - Satisfied (27 respondents)
    - Neutral (42 respondents)
    - Dissatisfied (15 respondents)
    - Very dissatisfied (8 respondents)

18. **Do you think brands that provide experience through AI, AR or VR can improve your customer satisfaction?**
    - Very Important (49 respondents)
    - Important (34 respondents)
    - Neutral (14 respondents)
    - Not Much Important (6 respondents)
    - Not Important at all (2 respondents)

19. **Do you confirm you have understood the three topics mentioned? (Virtual Showrooms, Virtual Size Advisor, and Virtual Try-On)?**
    - Yes (105 respondents)
    - No (0 respondents)

20. **Have you ever used one of these products before (Virtual Showroom, Virtual Size Advisor and Virtual Try-On)?**
    - Yes (37 respondents)
    - No (68 respondents)

21. Before using Metaverse-driven technologies (virtual showrooms, virtual try-ons, virtual size advisors), what are your expectations regarding their performance?

- Very High (19 respondents)
- High (65 respondents)
- Neutral (12 respondents)
- Low (9 respondents)
- Very Low (0 respondents)

22. How did the actual performance of the Metaverse technologies compare to your expectations?

- Much better than expected (0 respondents)
- Better than expected (1 respondent)
- As expected (17 respondents)
- Worse than Expected (20 respondents)
- Much Worse than Expected
- Never used any (67 respondents)

23. Did the Metaverse-driven technologies exceed, meet, or fall short of your expectations?

- Far Exceeded Expectations (0 respondents)
- Exceeded Expectations (0 respondents)
- Met Expectations (11 respondents)
- Below Expectations (23 respondents)
- Far Below Expectations (0 respondents)
- Never used any (71 respondents)

24. If ever used one of these products, how would you rate the visual appeal and ease of navigation in the virtual showrooms or virtual fitting rooms you have used?

- Excelent (1 respondent)
- Good (14 respondents)
- Average (18 respondents)
- Poor (5 respondents)
- Very Poor (0 respondents)
- Never used it (67 respondents)

Product 1: Virtual Showroom

25. How appealing do you find the idea of exploring fashion collections in a virtual showroom?

- Very appealing (34 respondents)
- Somewhat appealing (50 respondents)
- Neutral (12 respondents)
- Somewhat unappealing (4 respondents)
- Very unappealing (5 respondents)

26. How likely are you to use a virtual showroom to explore fashion collections?

- Very likely (15 respondents)
- Somewhat likely (62 respondents)
- Neutral (25 respondents)
- Somewhat unlikely (3 respondents)
- Very unlikely (0 respondents)

27. What features would you find most valuable in a virtual showroom? (Select all that apply)

- 360-degree product views (76 respondents)
- Product customization options (2 respondents)
- Interactive Customer Experience (97 respondents)
- Virtual stylist assistance (23 respondents)
- Ability to share on social media (0 respondents)

28. What concerns, if any, do you have about potentially using virtual showrooms?

- Technology accessibility issues (64 respondents)
- Overwhelming experience (5 respondents)
- Lack of personal touch (17 respondents)
- I don’t have any concerns (19 respondents)

Product 2: Virtual Try-On

29. How appealing do you find the concept of trying on clothes virtually before purchasing?

- Very appealing (86 respondents)
- Somewhat appealing (15 respondents)
- Neutral (4 respondents)
- Somewhat unappealing (0 respondents)
- Very unappealing (0 respondents)

30. How likely are you to use a virtual Try On for trying on fashion items?

- Very likely (48 respondents)
- Somewhat likely (15 respondents)
- Neutral (17 respondents)
- Somewhat unlikely (25 respondents)
- Very unlikely (0 respondents)

31. What benefits do you see in using virtual Try-On technology? (Select all that apply)

- Better fit accuracy (39 respondents)
- Reduced need for returns (27 respondents)
- Time-saving convenience (0 respondents)
- Access to a wider range of styles and sizes (5 respondents)
- Enhanced shopping experience (70 respondents)

32. What potential challenges or issues do you foresee with virtual Try-On?

- Accuracy of the fitting technology (60 respondents)
- Privacy concerns (32 respondents)
- Complexity of use (3 respondents)
- I do not have any issues with Virtual Fitting (10 respondents)

Product 3: Virtual Size Advisor

33. How appealing do you find the concept of a Virtual Size Advisor that recommends sizes based on your measurements?

- Very appealing (28 respondents)
- Somewhat appealing (70 respondents)
- Neutral (2 respondents)
- Somewhat unappealing (3 respondents)

- Very unappealing (2 respondents)

34. How likely are you to use a Virtual Size Advisor when shopping for fashion items?

- Very likely (37 respondents)
- Somewhat likely (61 respondents)
- Neutral (3 respondents)
- Somewhat unlikely (2 respondents)
- Very unlikely (2 respondents)

35. What features would you find most valuable in a Virtual Size Advisor? (Select all that apply)

- Easy measurement input (19 respondents)
- Accurate size recommendations (43 respondents)
- Personalized fit suggestions (12 respondents)
- Integration with virtual fitting tools (55 respondents)
- Ability to save and update measurements (21 respondents)

36. What concerns or limitations do you foresee with using a Virtual Size Advisor?

- Accuracy of recommendations (27 respondents)
- Ease of inputting measurements (34 respondents)
- Privacy of personal data (24 respondents)
- There are no limitations with the Virtual Size Advisor (20 respondents)

Comparative Questions

37. How consistent and accurate do you find Metaverse Driven Product results?

- Always accurate (3 respondents)
- Often accurate (13 respondents)
- Sometimes accurate (15 respondents)
- Rarely Accurate (6 respondents)
- Never Accurate (1 respondent)
- Never used it (67 respondents)

38. Which of the following products do you believe would most enhance your fashion shopping experience?

- Virtual Showrooms (27 respondents)
- Virtual Try-On (33 respondents)
- Virtual Size Advisor (45 respondents)

39. Rank the products in order of importance to you (1 = most important, 3 = least important):

- 1st: Virtual Fitting (41 respondents)
- 2nd: Virtual Size Advisor (37 respondents)
- 3rd: Virtual Showrooms (27 respondents)

40. How do you feel about the potential of metaverse technologies to transform your shopping experience in the fashion industry?

- Very optimistic (43 respondents)
- Somewhat optimistic (35 respondents)
- Neutral (17 respondents)
- Somewhat pessimistic (10 respondents)
- Very pessimistic (0 respondents)

41. How confident are you in the security and privacy of your transactions and personal data when using Metaverse-driven fashion platforms?

- Very Confident (16 respondents)
- Confident (17 respondents)
- Neutral (23 respondents)
- Slightly Confident (45 respondents)
- Not Confident at all (4 respondents)

42. How well do you feel the virtual platform understands and caters to your personal fashion preferences and needs?

- Extremely Well (0 respondents)
- Well (9 respondents)
- Moderately (23 respondents)
- Slightly (3 respondents)
- Not at All (0 respondents)
- Never used it (70 respondents)

43. How satisfied are you with the responsiveness of customer service (AI bots, virtual assistants) in addressing your queries or issues within the Metaverse environment?

- Very Satisified (0 respondents)
- Satisfied (5 respondents)
- Neutral (13 respondents)
- Dissastified (0 respondents)
- Very Dissatisfied (0 respondents)
- Never used it (87 respondents)