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Consumers Acceptance Of Artificial Intelligence Virtual Try-On systems when shopping apparel online

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BUSINESS
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Department of Marketing, Strategy and Operations

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This investigation was the result of a personal effort to achieve one of my most important academic objectives, to obtain a Master's degree in an area that, despite being totally different from my initial background, I believe is the basis for an optimal functioning of any other sector. I confess that this was a particularly difficult year, not only because of the pandemic, but also because I had to reconcile work with the thesis, which allowed me not only to explore and learn more about my interests but also to grow as a human and professional. Nevertheless, none of this would be possible without the great support of the people who accompanied me in the most diverse phases without ever letting me give up, and to whom I owe a deep thanks.

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Resumo

A Inteligência Artificial está cada vez mais presente na maior parte da vida de cada um de nós. Frequentemente, as interações ocorrem inconscientemente entre os indivíduos e a tecnologia. Por ser uma tecnologia cada vez mais presente no quotidiano, é frequente encontrá-la e aplicá-la em diversas áreas de negócios, uma das quais é sem dúvida o mundo do retalho virtual. É assim que a Inteligência Artificial se torna relevante para as empresas que desejam ganhar através de vantagem competitiva. Uma das formas que as empresas podem utilizar e aplicar a Inteligência Artificial é, sem dúvida, através do melhor entendimento dos seus consumidores, estabelecendo uma relação de empatia e diferenciando-se dos seus concorrentes oferecendo experiências únicas e personalizadas, baseadas nas necessidades individuais. Uma das formas de proporcionar essa experiência virtual aos seus consumidores é por meio de Virtual Try-On.

Esta Investigação procura compreender o estado atual de aceitação do consumidor em relação aos sistemas Virtual Try-On na indústria de vestuário online através da análise de 5 parâmetros que pretendem avaliar primeiro a aceitação dos consumidores e depois as suas intenções comportamentais. Para isso, foram escolhidas 5 variáveis independentes, *Perceived Usefulness, Perceived Ease of Use, Perceived Time Consumption, Perceived Accuracy and Ethical Concerns.*

O estudo dessas variáveis foi desenvolvido por meio de um questionário online. Após a análise dos resultados, concluiu-se que, em geral, os consumidores têm uma atitude positiva em relação ao uso do Virtual Try-On e, consequentemente, a sua intenção comportamental também é positiva, podendo-se afirmar que os consumidores tendem a aceitar essa tecnologia.

Palavras-chave: Inteligência Artificial; Virtual Try-On; Technology Acceptance Model; Comportamento do Consumidor.

Classificação JEL:
D71 - Social Choice
M31 – Marketing

Abstract

Artificial Intelligence is a technology that is present in most of each of us today daily lives. Often, interactions occur unconsciously between individuals and technology. Since it is a technology that is increasingly present in people's daily lives, it is frequent to find and apply it in many business areas, one of which being the virtual retail world. It is in this way that Artificial Intelligence becomes relevant for companies that want to gain by competitive advantage. One of the ways that companies can use and apply Artificial Intelligence is undoubtedly through better understanding of their consumers, establishing a relationship of empathy and understanding out from that of their competitors offering unique and personalized experiences, based on individual needs. One of the ways to provide this virtual experience to consumers is through Virtual Try-On.

This investigation seeks to understand the current state of consumer acceptance in relation to Virtual Try-On systems in the online clothing industry through the analysis of 5 parameters that intend to evaluate first the consumers' acceptation and then their behavioral intentions. For this, 5 independent variables were chosen, *Perceived Usefulness, Perceived Ease of Use, Perceived Time Consumption, Perceived Accuracy and Ethical Concerns*.

The study of these variables was further developed through an online questionnaire. After analyzing the results, it was concluded that, in general, consumers have a positive attitude towards the use of Virtual Try-On, and consequently, their behavioral intention is also positive, thus being able to affirm that consumers tend to accept this technology.

Key concepts: Artificial Intelligence; Virtual Try-On; Technology Acceptance Model; Consumer Behavior.

Classificação JEL:
D71 - Social Choice
M31 - Marketing

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Abbreviations List

AI	Artificial Intelligence
AVE	Average Variance
ATU	Attitude Towards Usage
BI	Behavioral Intention
CA	Cronbach Alpha
CR	Composite Reliability
EC	Ethical Concerns
PA	Perceived Accuracy
PEU	Perceived Ease of Use
PTC	Perceived Time Consumption
PU	Perceived Usefulness
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
VTO	Virtual Try-On

Introduction

Contextualization

The technological development followed by the clear expansion in the online shopping business regarding clothes has prompted analysts to consider imperative for the business world to use tools that can be helpful in attracting new consumers, while maintaining others. Artificial Intelligence (AI) has the ability to materialize this, through a multiplicity of formats (Team EA, 2017; Vasic et al., 2019).

Technology can be used as a matrix platform for updating correspondence among buyers of fashion products, such as the launch of collections and even the availability of articles. On the other hand, it has increasingly provided interaction platforms where unique digital proofs are possible with the help of algorithms endowed with creativity, together with the strengthening of the electronic business, investigating the preferences of the beneficiaries, leading to a particularized acquisition experiment (Asling, n.d.).

Furthermore, there is an adversity with the online fashion industry today, which is its insufficiency in taking the best advantage of the way of using AI. Certain companies launched a variety of services that, in some cases, proved to be dominated by technology itself rather than by creativity. One of the most obvious examples of this was the chatbot. As an intelligent alternative, these types of mechanisms serve to create engagement among customers, but also to get to know them through the platforms of choice that they prefer, ranging from a simple social network to a retail shopping website (Quintino, 2019).

In contemporary days, fashion brands present themselves as competitors for resorting to the use of AI as a harnessing mechanism in order to capitalize on the most modern tools and with a greater range of attracting new consumers and maintaining the usual ones. In view of this, this is an industry that should avoid falling into some deceptions, because as just as customers can be captured through AI, they can also very easily sever relationships when they feel cheated by it (Vasic et al., 2019).

AI tends to be used on a recurring basis by the fashion production and consumption sector. However, this cannot be the expression of an entire industry, having in these tools the preferred stage for the dissemination of exclusive images of new collections or products, even before the debut to the general public, being able to share information related to the product, and opening pre-sale channels (Pupillo, 2019).

In this sense, companies have devoted time and efforts to develop and incorporate AI systems that are able to respond to customers' needs holistically, providing them with the most real experience possible. One of those systems that is under development and already adopted by some companies, such as Amazon, is the Virtual Try-On (VTO) (Zhang et al., 2019).

According to Fiore, Kim, and Lee (2005, p.39), VTO "*consist of Web site features that enable creation and manipulation of product or environment images to simulate (or surpass) actual experience*

with the product or environment". So, is the way a customer can try a product, through the use of devices that can support and operate on online platforms that are able to create or manipulate the image in order to simulate a real experience between the customer and the product. However, it is not only necessary to create and improve these systems, but also to understand their acceptance by consumers. Why would a company invest in such a system if consumers will not accept it?

It was following this line of thought that the theme "*Consumers Acceptance of Artificial Intelligence Virtual Try-On systems when shopping online apparel*" came up. Therefore, this investigation intendeds to study the acceptance by consumers of the VTO AI systems when buying apparel online according to specific variables previously defined.

Problem Discussion

The popularity of online shopping for retail clothing items has increased substantially in recent years worldwide (Roy et al., 2020). A study launched by Amazon Lab126[1] in 2020, states that: "the *share of online apparel sales as a proportion of total apparel and accessories sales is increasing at a faster pace than any other E-commerce sector*" (Neuberger et al., 2020; p.1). Furthermore, online apparel sales in the US are expected to reach 123 billion in 2022 from 72 billion in 2016. Despite the convenience online fashion shopping provides, consumers are concerned about how a particular fashion item in a product image would look on them when buying apparel online (Han et al., 2018). Thus, allowing consumers to virtually try on clothes will not only enhance their shopping experience, transforming the way people shop for clothes, but also save cost for retailers, for instance, reducing cart abandonment and product returns (Han et al., 2018). In addition, online apparel shopping offers the convenience to shop from anywhere, any product at any time (Neuberger et al., 2020; Mohanty & Nanda, 2020). It even allows for the customer to have access to products that have already left the stores or are not yet available (Neuberger et al., 2020).

That said, do consumers accept Virtual Try-On systems? And do consumers intend to use Virtual Try-On systems? To answer these questions, we first need to understand that a behavior is determined by the intention to perform that same behavior (Ajzen and Fishbein, 1977). And what is intention? Intention is a function of the attitudes (Ajzen and Fishbein, 1977). Therefore, we can say that attitudes precede behavior, having the ability to predict it. In this regard, Schepman and Rodway (2020) state that people's attitudes towards AI play a fundamental role in the acceptance and intention to use this technology. Previous studies demonstrate that customers seem to accept and adopt AI systems when they perceive them to bring advantages to them (Rogers, 1995).

[1] Founded by Gregg Zehr in 2004, is an American research and development computer hardware subsidiary company owned by Amazon based in California.

The literature points out several factors that explain the acceptance and use of AI systems, namely the VTO systems. Among these factors the following is highlight: 1) the fact that the customer perceives that the VTO system is useful for him (Perceived Usefulness) (Sun et al., 2009); 2) the fact that the client perceives that the platform is easy to use (Perceived Ease of Use) (Davis, 1989; Pantano & Di Pietro, 2012; Bauerová & Klepek, 2018); 3) the fact that the customer considers that he can save time when using a given online platform (Perceived Time Consumption) (Vasic et al., 2019); 4) the fact that the item purchased online corresponds to what is expected when it arrives (Perceived Accuracy) (Vasic et al., 2019), and 5) the fact that there are Ethical Concerns (Vasic et al., 2019; Du & Xie, 2020).

There are many aspects that can influence the adoption of a technology or not; however, for the present study, these are the 5 fundamental aspects to be analyzed. It is also important to emphasize that even selecting 5 aspects, the perception and influence among consumers can vary from consumer to consumer.

Purpose and Delimitations

The purpose of this investigation is to identify and investigate some factors that may influence consumers' acceptance of VTO AI system, as well as the relationship between the attitude and behavioral intention towards using it.

Based on the subject of this investigation and in order to achieve its purpose several theoretical and empirical objectives were established. Concerning the theoretical objectives, this investigation aims to contribute to the development of literature both in the field of AI and the aspects that influence consumers acceptance of new technologies, identify and understand some of those aspects and establish and understand relationships between those same aspects and concepts. Regarding the empirical objectives, through a web survey it is intended to analyze the results obtained, verify and understand to what extend the concepts are related between them and fill the gap in literature concerning the relationship between some concepts such as Perceived Time Consumption (PTC), Perceived Accuracy (PA) and Ethical Concerns (EC) towards the usage of VTO.

The main delimitations of the study are mainly related to the methodological decisions taken, which have implications in terms of approach, data collection, results and conclusions reached.

Investigation Structure

To achieve what is being proposed, this thesis is structured into seven chapters. The first identifies the research topic by given context, describing the problem and its relevance, the research purpose and delimitations, and the thesis structure. Then, a Literature Review will be developed to get a deeper understanding of the principal concepts and factors related to consumers' acceptance of Virtual Try-On systems (both Attitude Towards Usage and Behavioral Intention). It is also in this chapter that the

research questions will be placed. The third chapter is the Conceptual Framework, and in this chapter the hypotheses formulated to support this study will be presented. The fourth chapter covers the research Methodology, which includes the research approach and design, data analysis method, survey content and sample characterization. In the fifth and sixth chapters, the study's results will be shown, followed by a discussion of the obtained data and then the assessment of the validity of the research hypotheses. Lastly, chapter seven will be about the study's main conclusions and implications, ending with the research's potential limitations and recommendations for future research.

Chapter 1 - Literature Review

1.1. The importance of Artificial Intelligence Virtual Try-On apparel systems

To frame the subject of this investigation, *Consumers Acceptance of Artificial Intelligence Virtual Try-On systems when shopping online apparel*, it is important to understand the AI and VTO apparel systems concepts. These two concepts are extremely important to the present study, given the fact that they refer to the conceptual basis of the conducted investigation, hence being crucial to fully apprehend their scope, both in general and applied to online shopping apparel context. In this subchapter both concepts will be explored and defined according to several authors.

1.1.1. Artificial Intelligence

It is difficult to get an accurate understanding about AI definition because, according to John McCarthy (1970), who was considered the father of AI, the problem is that we still cannot idealize, generically, which typologies of computational mechanisms are to be called intelligent. It is understood, therefore, that some are mechanisms endowed with intelligence, unlike others.

Within the literature there are several definitions of AI, with no single universally agreed definition being presented. For instance, the European Commission (2019) suggests that AI basis refers "*to systems that display intelligent behavior by analyzing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in virtual world such as voice assistants, image analysis software, search engines, speech and face recognition systems or AI can be embedded in hardware devices such as advanced robots, autonomous cars and drones*".

On the other hand, Tran (2019) claims that AI consists in an area of computer science that is mainly focused on machine creation in order to work and respond with human intelligence, including several processes such as learning, planning, and problem-solving. Others suggest that AI is based on two specific goals, namely: to create expert systems that conduct, learn, illustrate and clarify several tasks; and to implement human intelligence on those expert systems for them to comprehend, learn, think and respond like human beings (Aws Amazon, 2018). As a matter of fact, AI's main tool is machine learning, which comprehends a set of specific techniques that allows machines to learn in an automated manner and without any explicit instructions by individuals (Pupillo, 2019).

However, for clarity and objectivity's sake, limitations to the AI's conceptions sustained by what Shubhendu & Vijay (2013) advocate have been considered in this investigation. The authors refer to AI as machines that react to impulses concordant with humans' conventional reactions, given our human observation, judgment and intentional intentions. Each of these machines must engage in critical evaluation and divergent opinions selection within itself. Manufactured by humans and using human skills, these machines must conduct themselves in accordance with life, spirit and gracefulness

despite being, indeed, an imitation of human behavior. Also, in line with this definition and according to West (2018), AI software systems are considered to make expert decisions that deal and anticipate problems based on three qualities: intentionality, intelligence and adaptability.

Furthermore, according to the European Parliament (2020), AI holds a great social, economic, security, medical and environmental promise with great benefits. Some of the pointed benefits are providing real-time environmental monitoring for air pollution and quality, enhancing cybersecurity defenses, reducing healthcare inefficiencies, designing and delivering faster production times and quicker iteration cycles, improving real-time translation services to connect people across globe, among others.

In addition to these benefits, in a narrow context, AI is also greatly beneficial when shopping online apparel, especially because it provides and allows customer experience enhancement through chatbots or AI smart assistants (increasing experience customization), image search (allowing customers to find specific images through a specific text input), subscription services and recommendation engines (enabling high level of experience customization), personal AI stylist (which consists in a virtual personal stylist helping customers to choose outfits) (Pupillo, 2019). Also, with AI systems it is possible to forecast trends and demands providing recommendations based on information given regarding their height, weight, age, and fit preferences (Pupillo, 2019).

In sum, based on the ideas presented by the authors mentioned above, it is possible to conclude that AI is especially important in any business or industry, since it provides several benefits that ultimately increase business' growth and profit, while allowing more personalized and unique experiences to customers when shopping for specific products.

1.1.2. Virtual Try-On Apparel System

VTO is a system in which a customer can try a product or service using a device with a built-in camera, such as tablets or smartphones (Kwiecień, 2019). According to Fiore, Kim, and Lee (2005, p.39), it also "*consist of Web site features that enable creation and manipulation of product or environment images to simulate (or surpass) actual experience with the product or environment*".

Authors such as Kim and Forsythe (2007) define this innovative technology as one that allows customers to zoom in, rotate and view products from different angles, sizes and colors on a virtual model designed to copy customer's appearance. In this sense, VTO can deliver product information identical to the one gathered from examining the product physically, synthetizing garments for the target body in 2D and 3D domains (Hu et al., 2020).

Thus, considering the approaches presented above, VTO is the way a customer can try a product, through a device that can support and operate on online platforms that allow image creation and editing in order to provide a real experience simulation between customer and product.

Adopting VTO technologies is quite trendy, being likely to represent online future of cloth retail, as well as other online retailers that sell different products such as glasses and cosmetics, as it is pointed out by Greene (2011). Online retailers have been introducing VTO technologies in their businesses whose main goal is to enable clothes selection on their online shops, trying several matches freely and seeing existing outfits on screen, thus assisting customers with their evaluation of clothes (Fiore, Jin & Kim, 2005).

Within the literature, some authors claim that VTO technology has a utilitarian value, while others suggest that it has a hedonic value. Regarding utilitarian value, VTO technology helps consumers to address the suit, fit and match dilemma. For instance, this type of technology can provide consumers with helpful information about apparel's attributes, such as color and size, during online shopping, which justifies why consumers are extremely interested in such technology to evaluate apparel fit, as well as their usefulness and ease of use (Baytar, Chung & Shin, 2016; Faust & Carrier, 2011).

In turn, the hedonic value is associated to enjoyable shopping experience that is provided by VTO to customers, given the fact that this technology allows online consumers to enlarge or rotate an outfit, to customize a virtual model according to their body information and to upload a picture of their own face to make models look like themselves (Merle, Senecal & St-Onge, 2012; Pachoulakis & Kapetanakis, 2012).

In addition, interactivity and customer involvement promoted by VTO systems usage can enhance the entertainment value of the online shopping experience itself. By becoming extensively more available in online shopping apparel environment, this dynamic interactive product and service is decreasing the existing gap between the online and physical shopping experiences (Wagner, 2007). It is particularly important that this type of innovative interactive technologies is accepted by consumers because it allows companies to increase their conversion through online revenue maximizing (Wagner, 2007).

It is noteworthy to mention that, in addition to social networking features VTO can also allow customers to send photos and quickly receive feedback, which also contributes to great success of these new and innovative technologies within the retail businesses, while simultaneously boosting their sales and decreasing returns (Pachoulakis & Kapetanakis, 2012). Kang and Johnson (2013) also mention social value, since VTO technologies allow consumers to seek for their friends' opinions about a specific apparel or a customized model.

However, despite these systems' advantages, some customers may decide not to purchase apparel from online retailers using VTO system once it requires too much effort (Merle et al., 2012). Besides the utilitarian and hedonic views, and in order to achieve a holistic view, a risk perspective should be taking in consideration to better understand the effect of VTO systems on online customers' decision when purchasing online (Zhang et al., 2017).

According to Hwangbo et al, (2020), several departments stores in the United States applied new virtual fitting room technology in the early 2010s, aiming to improve their customers' retail experiences. Overall, VTO technologies have been slowly introduced, and have been adopted due to their advantages in both conventional and online retail channels, essentially solving some of the existing problems. In conventional retailers, for example, some consumers felt reluctant to talk about their body shape and size with the salesperson, while in online retailers, consumers were unable to physically wear the apparel. Therefore, VTO technologies end up providing an opportunity for consumers to establish an impersonal interaction with a virtual model of their own bodies, replacing the actual try-on, and simultaneously providing them a size and fit guide. Furthermore, VTO technologies are also beneficial for retailers in terms of sales prediction, given the fact that these technologies provide important information regarding consumers' preferences when buying clothes, and improve/increase consumers' loyalty, since this is a technology dedicated to increase consumers' satisfaction (Pantano & Di Pietro, 2012).

In retail businesses, VTO technologies have clearly begun to transform businesses' core, mainly through multiple-sensor 3D scanners implementation, augmented reality and simulations. However, this virtual fitting room must rely on two specific factors in order to be beneficial, namely on the method of detecting consumers' body size, movement and position and on the method of displaying virtual apparel superimposed in consumers' body (Kaewrat & Boonbrahm, 2017). Lastly, Yen et al. (2017) claim that VTO technologies have a very substantial business potential since they already brought millions of above average returns to garment and clothing industry.

In sum, VTO technologies are quite popular since businesses in general, and clothing/retail businesses in particular, have seen their actual advantages for both business and customers. Essentially, the implementation of these technologies within businesses is highly associated to a constant evolution of technology worldwide, which has been revolutionizing every aspect of our daily lives, from our daily basis tasks to an entire business management.

1.2. Consumer behavior when shopping online apparel

In this second subchapter, the main concepts that are going to be discussed and defined are shopping online apparel and the influence of consumer behavior towards online shopping. Similarly, to previous concepts, these two terms are crucial to the present study, considering that they aim to assess the relationship between consumer behavior and online shopping, as well as the influence of such behavior in the online shopping business.

1.2.1. **Shopping online apparel**

Online shopping is defined as the act of purchasing products from the Internet, with the main benefit referring to offering a superior convenience (e.g., shopping from the comfort of one's home), as well as a wider variety of merchandise from around the world (Kim, Park & Pookulangara, 2006; Yen et al., 2017; Neuberger et al., 2020). According to Subramanian and Jayalakshmi (2020), online shopping is considered to be a process whereby customers can buy certain goods and services directly from a seller without an intermediary. In this way, consumers can visit online stores, from anywhere, at any time.

Online stores offer a 24/7 accessibility, without opening hours restrictions (as physical stores do) and allow a larger number of items and assortments to be displayed lacking a significant increase in terms of costs providing a convenient way of purchasing (Kim, Park & Pookulangara, 2006; Subramanian & Jayalakshmi, 2020).

Nevertheless, online shopping has some disadvantages, mainly associated to the fact that consumers cannot gain the exact same experience as when shopping in traditional stores. Hence, consumers lack some specific elements, such as salesperson interaction, touching, testing or trying on clothes and feeling the shop atmosphere (Monsuwé, Dellaert & Ruyter, 2014).

Within online shopping literature, it is very frequent to find mentions to perceived risks and to uncertainty. The main referred risks are related to psychological or social ones, directly associated to concerns about conforming or acceptance with a specific group; economic risks associated to concerns about eventual financial losses; performance risks related to durability of a specific garment/item; and physical risks associated to concerns about bodily comfort and appearance. On the other hand, and regarding uncertainty, consumers may be uncertain about an unfamiliar or unpopular brand, which is why they frequently tend to gather some information before purchasing products from that same brand (Park & Stoel, 2002).

When shopping online apparel, product presentation is considered to be the most important evaluative factor for consumers. As a matter of fact, it has been demonstrated that product image zooming and 3D are essential, as well as expected, as a minimum requirement in apparel websites since they help consumers to visualize and imagine products, which further influence in their purchase decision (Kawaf, 2012).

Park and Stoel (2002) indicate that consumers that purchase online apparel heavily rely on available information about the product, expecting specific information to be available in online apparel description, such as style, color, price, garment care, fiber content, brand, fit, and store name.

More recently, Mahalaxmi and Nagamanikandan (2016, p. 194) stated that "*online goods have become an important part of company business scope, regardless of their nature of conducting business as online companies or conventional companies that are yet to develop online services*". Furthermore,

these authors demonstrated that, for many consumers that purchase online apparel, the main benefits are related to convenience, security, ease of use, usefulness and value.

According to this authors' research (Mahalaxmi & Nagamanikandan, 2016), there are several advantages with online shopping, such as easiness of product finding since consumers can search any product quite easily by using an online shopping website research engine feature; sometimes products can be cheaper, especially when their origin is a foreign country; customers can save time and energy since they do not have to physically go to the store; eventual risks can be minimized and prevented by consumer protection when shopping online.

Also, these authors report a sense of freedom is associated to online shopping in terms of choice, based in product selection from a wide range of products and freedom regarding price flexibility, considering that consumers can look at the same type of item in several online stores at the same time until they find a cheaper price (Mahalaxmi and Nagamanikandan, 2016). When privacy is in concern, online shopping is a more reliable way to buy certain articles. Rare products are also more easily found in online than in physical stores (Mahalaxmi and Nagamanikandan, 2016).

Finally, it is important to mention some studies results obtained, especially those that emphasize shopping online apparel evolution. For instance, a survey conducted by Global Lifestyle Monitor Survey (2003, cit. in Nawi, 2012) highlighted that 38% of Japanese and Chinese consumers used Internet to buy apparel in 2003, while 25% of American consumers bought clothes online. Ergin and Akbay (2008) demonstrated that in the UK there was an increase in apparel purchased online from 25% in 2004 to 34% in 2008. Shields (2010), in turn, proved that in the UK online shoppers spent 4.3 billion pounds buying apparel in 2010. Therefore, it is possible to conclude that shopping online apparel has been evolving and increasing throughout years, with consumers purchase raising mainly due to an ease of use and wide variety of cheap products that are available in such online platforms.

1.2.2. **The influence of consumer behavior towards online shopping**

Consumer behavior is the study of how individual customer, groups or organizations make decisions about acquiring a product or a service that they want or need and the way they act regarding that situation (Chand, 2014; Schofield & Scalia, 2016). Kuester (2012), also defined consumers' behavior concept as a behavior that can be described through the study of individuals, groups, or organizations and processes used to select, secure and dispose of products, services, experiences, or ideas to satisfy needs and impacts that these processes have on consumer and society.

Regarding consumer behavior in terms of online shopping, it is important to emphasize that it includes several processes, such as browsing, comparing, evaluating and decision-making. In more detail, before consumers purchase any online product, they search for information about the apparel on several websites, namely about its price, color, size, texture and any other characteristic that might

be relevant to them. After gathering all information, consumers decide whether to buy or not the apparel (Ha & Stoel, 2004).

Overall, people have different personalities that influence their own perception and behavior when shopping online, leading to distinct shopping behaviors according to their personality's traits, utilitarian or hedonic values and perceptions. For instance, utilitarian consumers purchase products online based on a rational necessity, being causally related to a specific goal. Therefore, they generally look for a task-oriented, rational, and efficient online shopping, rather than an entertaining experience. Also, these consumers are more satisfied when stores' websites are more convenient, easily accessible, present a wider range of products, freedom and control (Kim & Shim, 2002).

In turn, hedonic consumers usually gather information when shopping online while simultaneously intent to have fun, enjoy the shopping journey experience by itself. In other words, these consumers want to be fully immersed in a shopping experience, not aiming to merely achieve a specific goal. Hence, hedonic consumers are more satisfied when stores' websites are more unique, playful, and surprising (Wolfinbarger & Gilly, 2001). In this sense, retailers are investing into advanced product visualization technologies that can provide both motives.

The following table summarizes the main differences between utilitarian and hedonic consumers for a clearer and easier perception of their main aspects and values.

Table 1.1. – Main differences between utilitarian consumers and hedonic consumers (Sanchez-Franco & Roldan, 2005)

Utilitarian Consumer	Hedonic Consumer
Instrumental orientation	Ritualized orientation
Utilitarian benefits/value	Hedonic benefits/value
Work	Fun
Extrinsic motivation	Intrinsic motivation
Cognitive	Affective
Directed search	Nondirected search (browsing)
Planned purchases	Compulsive/impulsive shopping
Situational involvement	Enduring involvement
Goal-oriented choice	Navigational choice

Wolfinbarger and Gilly (2001) established that about 71% of consumers were goal-oriented, having planed their purchases in advance, while the remaining 29% of consumers were hedonic, valuing the entire experience online, from browsing to product purchase. It is possible to conclude that the vast majority of consumers seem to be goal-oriented, purchasing their online products due to necessity. Still, the experimental browsing behavior is desirable in consumers since it is associated to increased impulse purchases and to more frequent visits to the website.

In a distinct study, Goldsmith and Flynn (2004) showed that consumers who are more innovative when they use Internet are more likely to purchase online apparel, especially when compared to consumers who are less innovative. Moreover, the study conducted by these authors has also proved that consumer innovativeness while shopping online apparel and past online experiences might actually influence their future purchasing intentions and decisions.

Lastly, consumers might also have different goals when shopping online apparel. Therefore, some consumers may have the goal of purchasing online apparel (the purchasers), while others may not (the browsers and searchers). In more detail, searchers are consumers who only want to search for online information about a specific product, browsers are consumers who want to find an entertaining experience rather than information about the product and the purchasers are consumers who only want to fulfill their goal of purchasing a product online (Ha & Stoel, 2004). Hereupon, it is possible to conclude that consumer behavior deeply influences online shopping decision, and it is related to individual personality, characteristics and traits.

1.3. Consumer's acceptance and intention towards Virtual Try-On apparel systems

Ajzen and Fishbein (1977) defend the idea that a behavior is determined by the intention of carrying out that behavior. Intent corresponds to a function of the attitude of a given subject, which, in turn, is related to the behavior that the individual will perform. Thus, in order to better understand the relationship between attitudes and behavior, the Theory of Reasoned Action (TRA) by Ajzen and Fishbein (1975) will be revied.

Ajzen and Fishbein (1975) define attitudes as the assessment that an individual makes about an object, person, behavior or policy. Behavior, on the other hand, can be seen as one or more observable actions that are performed by an individual and recorded by an investigator (Ajzen & Fishbein, 1975). It is expected that a negative attitude towards an object determines unfavorable behaviors towards that object, as well as positive attitudes towards an object determines favorable behaviors towards that same object. However, the authors argue that this view is too simplistic and lacks theoretical support. Rather, the authors defend the idea that behavior is dependent on 4 aspects: action, target in relation to which the action is directed, context in which the action is carried out and, finally, time in which the action takes place. The attitude would also be directed towards one of these aspects or a combination of two or more aspects.

An attitude will correspond to a certain behavior, to the extent that the aspects that define the attitude correspond to the aspects defined in the behavior. That is, if, when evaluating the attitude, the researcher defines the target, the context, the time and the action intended (i.e. to appear or not at mass, in church, next Sunday at 10 am where Action = to appear or not; Target = mass; Context =

church; Time = next Sunday at 10 am), it will be possible to analyze the evaluation that the person makes of this intention in the form of observable behavior (Ajzen and Fishbein, 1977). Most of the time, only the target or action needs to be defined. When only the target is defined, there is a multiplicity of actions in relation to the target, whereas when the action is defined, there is a multiplicity of targets to which the individual can direct his action. Thus, Ajzen and Fishbein (1977) state that to effectively measure the correspondence between attitudes and behaviors, both aspects (target and action) need to be defined. The authors also point out that the measures used to assess attitudes play an important role, since measures that are unreliable or with problems of validity may attenuate the ability to predict attitudes towards the behavior that the individual will perform.

In light of this theory, the acceptance and use of AI systems is dependent on consumer attitudes towards it. In this regard, Schepman and Rodway (2020) states that people's attitudes towards AI play a fundamental role in the acceptance and adoption of this technology. This idea is reinforced in the literature by a large number of studies, in which participants are able to identify positive and negative aspects regarding AI (Cave, Coughlan and Dihan, 2019; Fast and Horvitz, 2017; Carrasco et al, 2019; Edelman, 2019), and these aspects influence the adoption or not of the technology.

A study by Zhang and Dafoe (2019), in a sample of 2000 Americans, demonstrated the existence of divergent opinions in relation to the development of AI. 9% of Americans "Strongly oppose", 13% "Somewhat oppose", 28% referred to a neutral position "Neither support nor oppose", 28% replied "Somewhat support" and 13% said "Strongly support". In general, 22% of Americans said they opposed the development of AI, while 28% remained neutral and 41% revealed a positive attitude towards the development of AI. Other studies revealed high percentages with regard to the positive impact of AI on people's work or lives in the coming years, while 23% considered that AI would have a negative impact (Northeastern University and Gallup, 2018). A study by Morning Consult (2017) also revealed that 51% Americans supported research in the field of AI, with 31% opposing the continuation of research in this area.

The study carried out by Cave, Coughlan and Dihan (2019), which analyzed speeches about AI in a representative sample of the population of the United Kingdom, verified the existence of hopes (AI facilitating the daily lives of humans) and also fears (AI replacing humanity in the workplace). Fast and Horvitz (2017) noted an increase in optimism and concerns over the years about AI.

Hwang and Good (2014) found that having a positive attitude towards technology at a general level had a positive impact on the individual's intention to buy a particular product online, while a negative attitude towards technology had a negative impact on the purchase intention consumer. Also, Lichtenthaler (2019) reinforces this idea by stating that when the individual presents a positive attitude of interaction with AI, promotes a greater openness of these people with other types of AI, at the same

time that it promotes a neutral position in relation to interaction with other human beings. Thus, by decreasing empathy and promoting rational decisions, individuals are more open to testing and interacting with new technologies that are still under development.

Lichtenthaler (2019) defends the idea that individuals, despite being aware of the advantages and disadvantages of the use of AI, are not frightened by the possible negative effects that it can bring, betting on a pragmatic approach regarding issues of privacy and data protection, especially if the individual believes that the use of this AI adds value to itself or brings advantages. From these ideas we can conclude, like Rogers (1995), that people adopt an innovative technology when they perceive that it has advantages (e.g., perceived usefulness, ease of use or enjoyment) compared to those that they are currently using.

Specifically, in the case of VTO, literature demonstrates that several aspects must be considered in relation to the intention of consumers to use the technology for making online purchases. At this level, some authors point out that there is a greater focus on aspects related to technology, contrary to individual differences when it comes to studying the intention of consumers to adopt a certain technology. For example, a study carried out by Kim and Forsythe (2008), which analyzed the consumer acceptance of VTO systems in online stores, concluded that several aspects seem to influence the acceptance of the technology, namely individual aspects (e.g., anxiety) and aspects related to technology (e.g., ease of use). In this study, the authors found that consumer characteristics had a moderating effect on the relationship between attitude and intention to use VTO.

Personality traits can also condition this intention, being that Qasem, (2021) points to technological readiness as an aspect that can change the consumer's perception, intention and behavior when adopting a new technology. At this level, Jackson, Parboteeah, and Metcalfe-Poulton (2014), found that the level of pleasure that the participants experienced when using the VTO had an impact on the use of “self-checkout machines” in online stores. Also, technology aspects related to security and privacy in past experiences affect consumer's intention to accept and use of a new technology such as AI (Margulis, Boeck, & Laroche, 2019). Yim et al., (2017) concluded that the use of VTO systems positively influenced the purchase intention, since the use of AI created a sense of novelty, pleasure and usefulness. Beck and Crié (2018) also found that consumers' purchase intention increased with the use of VTO, and Huang and Qin (2011) concluded that aspects such as “performance expectancy”, “effort expectancy”, “social influence”, and “perceived risk” conditioned the intention to make purchases through the VTO.

In conclusion, individuals tend to have a positive attitude towards the acceptance and use of new technologies, especially if they perceive advantages for themselves in their use. These advantages can be related to both individual aspects (e.g., acquisition of pleasure) and characteristics of the technology itself (e.g., ease of use).

In this study we will focus mainly on aspects related to the use of technology, which is why we will address in more detail the advantages perceived by individuals who are related to the use of the VTO systems, namely: Perceived Usefulness (PU), Perceived Ease of Use (PEU), Perceived Time Consumption (PTC), Perceived Accuracy (PA). One individual aspect is also going to be studied regarding this technology, namely: Ethical Concerns (EC).

From this review the most varied questions could arise, however, this investigation will focus on two, presented below in table 1.2.

Table 1.2. – Relation between Literature Revision and Research Questions.

Objectives	Research Questions	Literature Review
Objective 1: Assess consumers' acceptance of Artificial Intelligence Virtual Try-On systems when shopping online apparel.	**(Q1)** Do consumers accept Virtual Try-On systems?	(Lichtenthaler, 2019) (Margulis, Boeck, and Laroche, 2019) (Huang and Qin, 2011)
Objective 2: Analyse and understand how the independent variables can influence consumers acceptance of Virtual Try-On systems.	**(Q2)** Do consumers intend to use Virtual Try-On systems?	(Kim and Forsythe, 2008) (Qasem, 2021) (Margulis, Boeck, and Laroche, 2019) (Yim et al., 2017) (Beck and Crié, 2018) (Zhang et al., 2019)

Chapter 2 - Conceptual Framework

In this chapter more key concept behind this study's purpose are going to be presented, as well as the research model and the variables to be applied and tested.

2.1. Technology Acceptance Model

Among the relevant literature, several research models of technology adoption have been extensively used in studies that focus on online consumer acceptance behavior. As it is pointed out by Cheung, Chan and Limayem (2005), most of the existing studies focus on the TRA, including the technology Acceptance Model (TAM). The TRA was developed by Fishbein and Ajzen (1975) and aimed to describe a person's behavior by their intentions (Rauniar et al., 2014). While the TRA describes human behavior in general, the TAM focus on the factors that influence a person's computer technology acceptance (Rauniar et al., 2014).

The TAM was firstly introduced and developed by Davis (1989) with the intention of providing a theory of user's computer technology behavior (Rauniar et al., 2014). It consists in one of the most used and accepted models that researchers use in order to explain information technology and systems' acceptance and usage. This specific model has been widely used in several studies to assess the relationship between consumer acceptance behavior and VTO systems. It is frequently considered as the backbone of the research models, while other theories are often integrated with several adaptations (O'Cass & Fenech, 2003; Ahn, Ryu & Han, 2004).

When analyzing what causes people to accept or reject technology for the first time, Davis (1989), concluded that among many variables that may influence the attitude and intention of technology usage, two determinants are especially decisive, namely the PU and the PEU. However, this model only gives a general view on a person's technology acceptance (Liu et al., 2010). Hence, other authors, such as, Venkatesh and Davis (2000), extended the original TAM including additional factors, creating the TAM2 and TAM3. Both studies revealed that adapted models could offer more profound information than the original TAM.

The purpose of this Investigation is to analyze certain aspects that influence consumers' acceptance and intention towards the usage of AI VTO systems when shopping online apparel by applying an adaptation of the TAM like previous researchers. Since the TAM is a broad model, the following variables are going to be added to PU and to PEU and applied to the present study: Perceived Time Consumption, Perceived Accuracy, Ethical Concerns, Attitude Towards Usage (ATU) and Behavioral Intention (BI).

2.2. Perceived Usefulness

Rogers (1995) presents relative advantage as one of five aspects that influence customers to adopt new technologies. PU is an aspect that is considered to translate relative advantage because it considers that a person decision to use or not a certain technology depends on the benefits that that same technology has to offers to perform a determined task (Davis, 1989). It is defined by Sun et al. (2009, p.52) as "*the extent to which a person believes that using a particular system will enhance his or her job performance*", in this specific case, enhance a customer's online shopping activity and experience.

Zhang et al.(2019), Yen et al.(2017) and Kim and Forsythe (2007) concluded that PU was a strong predictor of consumers attitude towards using VTO and consequently influencing their behavior towards using VTO systems. As AI acceptance is an emerging research field, this led to the question to which extent a person adopts new technological systems, in this case VTO. In this sense, the following hypothesis was created:

H1: *Perceived Usefulness influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*

2.3. Perceived Ease of Use

Rogers (1995) also presents complexity as one of five aspects that influence customers to adopt new technologies. PEU is an aspect that is considered to translate complexity because it considers that a person decision to use or not a certain technology depends on the degree of complexity associated to the usage of that technology to perform a determined task (Davis, 1989).

PEU points that although a person believes that a certain technology is going to be useful, this person may simultaneously consider it to be complicated to use, and then the performance benefits of usage are outweighed by the effort of using it (Davis, 1989; Bauerová & Klepek, 2018; Pantano & Di Pietro, 2012). It was also defined by Sun et al. (2009, p.52) as "t*he extent to which a person believes that using a particular system will be free of effort*".

Although some studies concluded that when a person thinks or wants to use a new technology its ease of use will positively influence their decision (Liu et al., 2010), others suggest that it is not a significant predictor of consumer's intention and ATU a VTO system (Yen et al., 2017; Kim and Forsythe, 2007). This result can indicate that consumers do not believe that the technology is easy to use possibly because it is still new, not easily to find and unknown. This inconsistency of results led to the formulation of the following hypothesis:

H2: *Perceived Ease of Use influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*

2.4. Perceived Time Consumption

Nowadays, most people live their lives in a rush, and this same rush can add perceived value to time consumption. People are genuinely concern with time consumption, where to spend their time and specially where to save it (Lobaugh et al., 2019).

Vasic et al., (2019), present the idea that since online shopping, allows to purchase apparel from anywhere, at any time by anyone, consumers can save time on activities such as traffic, parking, public transportation, queues, among others. Also, reducing consumers' sacrifice though diminishing time consumption can enhance their perception of value. If consumers can easily find and comprehend the available information, they can save their time and effort, leading to a higher perceived value (Zeithaml, 1988). In this sense, saving time becomes a crucial consumer concern increasing consumers' perceived value. When consumers' perceived value is substantial, consumers will maintain the same purchase method (Zeithaml, 1988; Chang & Wang, 2011).

Thus, consumers' PTC is likely to affect positively consumers' attitude and intention towards VTO. Therefore, it is important to study the relation between PTC and ATU of VTO systems since no relevant studies analyzing it were found. Based on the previous information, the following hypothesis was created:

H3: *Perceived Time Consumption influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*

2.5. Perceived Accuracy

According to the dictionary.com, Accuracy is "*the condition or quality of being true, correct, or exact; freedom from error or defect; precision or exactness; correctness*".

The authors Zhang et al, (2019) explain that despite the VTO has its utilitarian and hedonic values, it is not risk free. Dennis (2017) reported that the return rates for apparel bought online are between 25% and 40%, suggesting that the risk of inconsistently fit between the virtual and actual results is probable. Furthermore, Vasic et al., (2019), claimed that online consumers expect online retailers to provide relevant and accurate information about the products available. By providing the right information, a large number of potential problems (for both the customer and retailer), can be avoided.

Making online shopping less risky and easier on decision making for both parties can lead to more satisfied customers. The level of accuracy of the information available by the retailer allows potential consumers to feel more secure, making the accuracy of the information a factor to take into consideration when shopping online apparel through the use of platforms and technologies that include VTO systems. Not only information accuracy is required by the consumer, but also price and

time accuracy. According to Limbu et al., (2011), the price showed is not always the actual price billed and also the time of delivery is not always the time expected or promised by the company.

So, in this sense, a risk of accuracy associated to VTO systems, and the actual products exist. Furthermore, it is important to study this relation since no relevant studies analyzing PA were found. Based on the previous information, the following hypothesis was created:

H4: *Perceived Accuracy influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*

2.6. Ethical Concerns

Consumers EC can be defined as the extent to which the moral principles that govern consumers behavior and their activities influence their attitude towards an activity (Bird et al., 2020), in this case, the usage of VTO.

Despite increasing enthusiasm regarding AI systems there are divergent perspectives on the subject (Tegmark, 2017). According to Du & Xie (2020), AI embodies paradoxes that can deliver from one perspective scientific miracles and human obsolescence from another perspective. This view was also shared by Stephen Hawkins, who believed that AI systems could be both miraculous and catastrophic (Time, 2018).

Several EC associated with value creation are at the center of these paradoxes. Due to the exponential growth and global impact of AI systems, such as VTO systems, these EC, such as privacy, reliability and safety, have gained even more significance among consumers, which consequently interferes with AI systems acceptance and development (Du & Xie, 2020).

The following hypothesis arose from the increasing EC towards AI systems, in this case, consumers' EC towards VTO usage:

H5: *Consumer's Ethical Concerns influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*

2.7. Attitude Towards Usage

According to Fishbein and Ajzen (1975), attitude is a general term to define and describe a specific behavior, this is, it influences BI. Attitude defines the "attitude towards", in this case, consumers' ATU of VTO. In other words, attitude is not a behavior itself, but it is a tendency that influences a specific behavior of individuals (Fishbein and Ajzen, 1975). All the previous factors presented above, (PU, PEU, PTC, PA and EC), are going to impact (or not) the ATU.

Based on Ajzen and Fishbein's (1980) study, humans' actions are based on intentions, and these are consequently influenced by a person's attitude. Several empirical studies have exposed that the intention and the actual use of a technological system is impacted by a person's attitude towards

it (Hassanein and Head, 2007). In accordance with the previous information, and align with several TAMs applied studies, the following hypothesis was integrated:

H6: *Attitude Towards Usage of Virtual Try-On system for apparel influences consumers' Behavioral Intention.*

2.8. Behavioral Intention

The BI is the vital factor of TRA by Fishbein and Ajzen's (1975). BI is considered the preliminary steps before a person presents a determined behavior according to the TRA. Thus, assuming that the relationship between the final outcome and a person's behavior exists, BI influence a person's direct actions (Liu et al., 2005). Since most of the studies that examine consumers' technology acceptance are based on the TAM, and this one usually incorporates the evaluation of BI (Kim & Forsythe, 2007) this study will also incorporate this dimension to evaluate consumers' acceptance of the AI system: VTO.

2.9. Conceptual Model

Based on the previous theoretical concepts and hypotheses presented in the present chapter and in order to be researched and analyzed in more details, the following Conceptual Framework was created for this study:

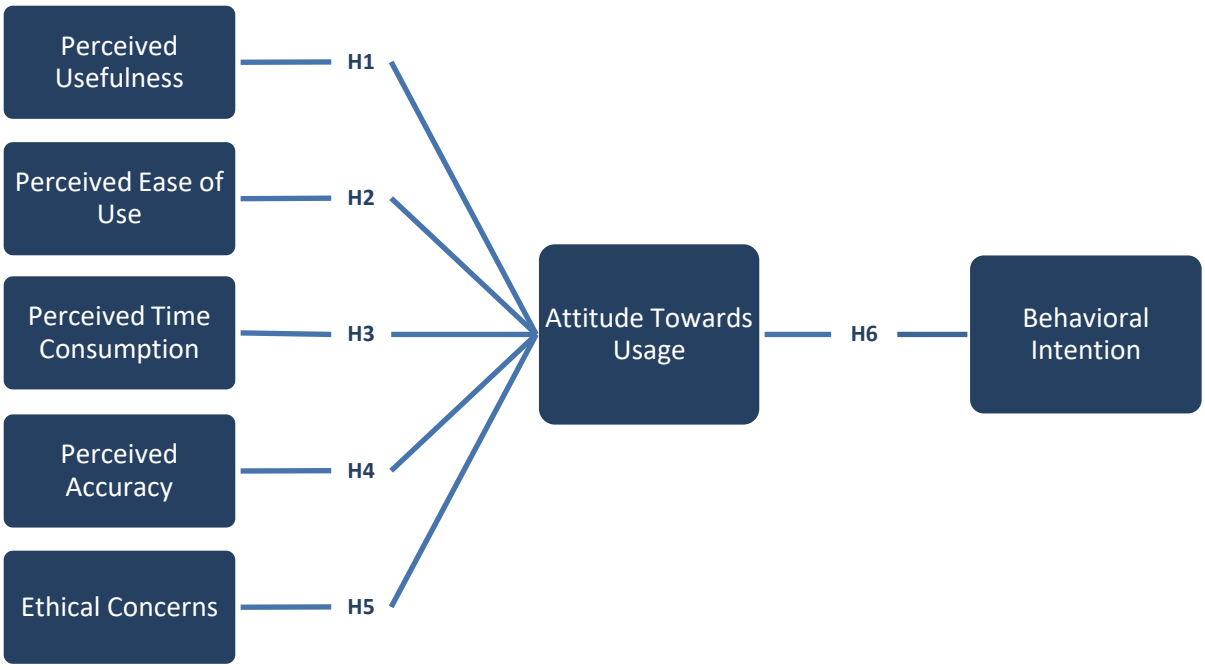

Figure 2.1. – Conceptual Framework.

The proposed model of acceptance extends the original TAM and allows us to examine if there exists a direct influence of the variables PU, PEU, PTC, PA and EC on consumers' ATU of VTO and their consequential BI.

Table 2.1. – Relation between the hypotheses and literature revision.

Variable	Hypotheses	Literature Review
PU	**H1:** *Perceived Usefulness influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*	(Zhang et al., 2019) (Yen et al., 2017) (Kim and Forsythe, 2007)
PEU	**H2:** *Perceived Ease of Use influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*	(Liu et al., 2010) (Yen et al., 2017) (Kim and Forsythe, 2007)
(PTC)	**H3:** *Perceived Time Consumption influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*	(Vasic et al., 2019) (Chang & Wang, 2011) (Zeithaml, 1988)
(PA)	**H4:** *Perceived Accuracy influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*	(Dennis, 2017) (Vasic et al., 2019) (Limbu et al., 2011)
(EC)	**H5:** *Consumer's Ethical Concerns influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*	(Du & Xie, 2020)
(ATU)	**H6:** *Attitude Towards Usage of Virtual Try-On system for apparel influences consumers' Behavioral Intention.*	(Fishbein and Ajzen, 1975) (Ajzen and Fishbein, 1980) (Hassanein and Head, 2007)
(BI)	-	(Fishbein and Ajzen's, 1975) (Liu et al., 2005)

Chapter 3 - Methodology

This chapter seeks to clarify and explain the methodology used in the present study. In this way, the methodological choices made will be substantiated, as well as the procedures carried out for the conduct of the present study will be described.

3.1. Research Approach and Design

According to Sampieri (2014) a scientific research is a set of systematic, critical and empirical processes applied when studying a phenomenon or a problem defined by an investigator. In the present study, an investigation model will be used, which will have as main objective to study the research questions and test the hypotheses listed a priori in the Conceptual Framework chapter.

According to Prodanov and Freitas (2013), scientific research is essentially based on two main research methods: the inductive method and the deductive method. The deductive method can be defined as one that uses reasoning to draw a particular conclusion from the general information (Prodanov & Freitas, 2013). The inductive method can be defined as a process in which, starting from a set of particular data, an investigator infers a general or universal truth, that is, first the investigator conducts the study and later develops the theory (Prodanov & Freitas, 2013). We can conclude that these processes are opposite in the conduct of investigations (Prodanov & Freitas, 2013). The present study will use the *deductive* approach since the construction of the hypotheses was based on theories, models and information that already exists.

In a scientific research, there are two main types of information collection: 1) primary data; 2) secondary data. Sileyew (2019) claims that primary data refer to data that is specifically collected from the original source of information (participants) for the study outlined. At the same time as primary data is collected, this data is available for use and reuse within a scientific community, thus becoming secondary data. In this way, secondary data are those that come from other documents/studies that are considered for the literature review (Sileyew, 2019). The present study was based on primary data, since questionnaires were applied to participants. Additionally, secondary sources were also used, which consisted of the bibliographic research carried out and the treatment of this research, which had its origin in scientific databases, books, magazines and scientific articles.

Regarding data classification there are two different ways according to Singh (2007): 1) qualitative and 2) quantitative. Quantitative data is an approach that uses measurements in order to explore, present, describe and examine the possible relationship between two or more elements (Saunders et al., 2009). By using this approach, reliable and valid data can be re-used in other studies since quantitative data can be generalized more easily (Bryman, 2012). Qualitative data approach main focus is collecting in-depth information to explore a certain topic (Bryman, 2012). Different viewpoints

can emerge from a qualitative analysis (Bryman, 2012).The present study is based on the quantitative approach since it seeks to conduct a study that aims to explain relationships between different items towards consumers attitude thought the adaptation of the TAM.

Regarding the type of investigation, the present study, is a predictive/explanatory investigation since several elements will be tested in order to verify whether they contribute to the explanation of the consumers acceptance regarding the use of the VTO systems. Another reason that justifies the choice of this method is due to the fact that the present investigation is based on a pre-established theory, as well as trying to test hypotheses previously described in the previous chapter (Sampieri, 2014).

Any type of investigation, regardless of the strategy adopted, can be defined in temporal terms, mainly in two ways: cross-sectional and longitudinal. Cross-sectional research is defined as one whose data collection takes place at a specific point in time (Coutinho, 2014). Longitudinal studies, on the other hand, allow data collection to occur at different times in time, allowing for a continuous assessment of the same subject, as well as establishing a relationship between the data collected at different times. So, it is possible to verify the evolution of the subjects over time (Coutinho, 2014). In the present study, it was decided to carry out a cross-sectional study, since the time required to carry out a longitudinal study proved to be unworkable. Also, the objective of the present study was to evaluate the acceptance of consumers towards the use of the VTO systems instead of measuring the changes in consumer ATU of VTO over time, so the option of a study cross-sectional approach proved to be adequate to the objectives of the present study (Coutinho, 2014).

Regarding the sample technique, these can be divided into probabilistic or non-probabilistic. According to Sampieri (2014), a probabilistic sample is one and that all elements of a population have an equal chance of being selected. In a non-probabilistic sample, on the other hand, it is oriented towards a subgroup of the population in which the selection of elements is not dependent on the probability, but on the characteristics of the investigation itself (Sampieri, 2014). In the case of the present study, we can conclude that a non-probabilistic sample was used, since the selection of the sample of the present investigation was concerned only with electing people who met the inclusion and exclusion criteria previously defined.

Among the possible non-probabilistic samples, we can have: 1) snowball sampling; 2) quota sampling, or 3) convenience sampling. A sample selected by snowball concerns an individual or group that is of interest to the study and, for this reason, is selected by the investigator to participate in the study. Subsequently, the participant is asked who of his acquaintances could be of interest for the present study and so on (Coutinho, 2014; Sampieri, 2014). In the quota sample, an investigator seeks to collect data from people according to certain categories predetermined by the investigator (e.g., 50% women, 50% men) (Sampieri, 2014). Convenience samples, on the other hand, refer to samples

made up of subjects that are available, and that the researcher has easy access to for data collection (Sampieri, 2014). In this study, a convenience sample was used for reasons of ease of access to participants (Sampieri, 2014). This same author states that this type of sample has disadvantages, namely the difficulties in generalizing the results (Sampieri, 2014).

The technique of obtaining data from a sample group is called a data collection method. Considering answering the study purpose and that this study will conduct a quantitative research, there are mainly three ways of data collection: 1) experiments; 2) observations and 3) surveys (Bryman, 2012). The first one purpose is to falsify or validate one or more hypotheses under controlled conditions known to the researcher, and it is possible to manipulate the independent variables in order to verify effects on the dependent variables (Bryman, 2012). The second one, observations, is most frequently used to analyze people behavior, with the disadvantage of being highly time consuming and difficult to apply in large samples (Bryman, 2012). The last one, surveys, consists of a data collection technique that involves asking the participants directly about the behaviors, attitudes or other aspects that the researcher wishes to investigate. (Prodanov & Freitas, 2013).

For data collection, a web-survey (Appendix A) was created and distributed between March 6 and 30, 2021, which was posted online through “Google Forms” platform. This questionnaire was released online on social networks (Facebook, Instagram, WhatsApp). According to a study carried out by Marktest, in 2020, these are the most used platforms in Portugal, which is why they were selected for conducting data collection. Regarding the use of surveys, this was the most appropriate data collection technique for this investigation, since the questionnaire allows to save time and travel while allowing a high number of responses (Andrade, 2009; Nayak & Narayan, 2019).

One of the main advantages of the questionnaire is that it can reach a large number of people simultaneously, as well as saving the necessary human resources, both in terms of necessary training for the application of the surveys, as well as in terms of travel and respective data collection in person (Andrade , 2009; Nayak & Narayan, 2019). Another fundamental aspect of the surveys is that it allows for some freedom of response, since they are anonymous and also allows less influence on the part of the researcher since he/she is not present when filling out the survey (Andrade, 2009; Nayak & Narayan, 2019). There is more flexibility to answer the questionnaires since it is the participant who decides when and where to complete the survey; however, this can be a disadvantage since it impossible to control certain “parasitic” variables that may influence the investigation (Andrade, 2009). Also, other disadvantage it is impossible to clarify doubts to the participant during the moment of answering the questionnaire (Andrade, 2009). Finally, it is impossible to know whether the individual selected for the study, or another member of the household, friend or colleague answered the questionnaire (Andrade, 2009; Nayak & Narayan, 2019).

3.2. Survey Content

To collect data for the present study, a set of questions was developed based on questionnaires from other authors. Thus, some changes were made due to several aspects such as: some statements in the original questionnaire were too long; some statements in the original questionnaire needed to be properly translated into Portuguese to apply to the Portuguese population; the sample selected was different from the studies carried out by the other authors; some questions had to be adapted and restructured in order to enhance statements that differ from the original questionnaire (Bourque & Fielder, 1995).

To guarantee the reliability of the questionnaire, it was decided to follow 4 steps according to Bourque and Fielder (1995). First, a literature review was carried out regarding the factors to be studied and analyzed in the present study. Then, some questions were adapted from questionnaires previously applied by other authors. In this way, it is possible to obtain some confidence in the quality of the data collected and a possible comparison with other international studies. Subsequently, the questions were adapted for the population in question, considering linguistic and cultural aspects. Finally, some additional questions were created, which were not part of any original questionnaire, as they were questions that had not been raised before, adding value to the present investigation.

In this sense, for the present study, the questions to test *PU*, *PEU, ATU* and *BI* were adapted from previous authors and studies (Zhang et al., 2019; Yen et al., 2017; Liu et al., 2010; Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980; Hassanein and Head, 2007). Since *PTC*, *PA* and *EC* are variables never tested before new questions were created with some authors ideas and concepts (Vasic et al., 2019; Chang & Wang, 2011; Zeithaml, 1988; Dennis, 2017; Du & Xie, 2020; Limbu et al., 2011) These authors are present by variable on Appendix B.

According to Sampieri (2014), a number of aspects for the effective construction of questionnaires must be taken into account, namely: the questions must be clear, precise, concise and understandable; ambiguous or confusing terms should be avoided; the questions must not disturb the participant, provoke feelings of injustice or be perceived as threatening; each question must answer a single aspect to be evaluated; the questions should not include the answers or be biased in that sense and, finally, questions in the negative should be avoided. These aspects were considered, mainly to facilitate the self-completion of the questionnaire by the participants.

It is also emphasized that in a questionnaire there are closed and open answers. Sampieri (2014) refers that closed questions present a priori response categories, which facilitates their coding and analysis. These questions can be dichotomous or present several categories of answers. In the open questions, there are no answer categories a priori, with an infinite number of answers, which may even vary from sample to sample or from population to population. In these types of questions, the coding of responses seems difficult and may even be unenforceable (Sampieri, 2014).

For the present study, closed questions were chosen since these allow easy coding and also responses comparison. For the introductory questions (demographic data and actual use), a mix of dichotomous and several categories was present. The questions applied to the variables were measured on a five-point Likert-type scale where 1 = “do not agree”, and 5 = “completely agree”. Appendix B shows the connection between the concepts to be studied, the questions applied, the base theory and the type of measurement applied.

It should be also noted that this investigation considered all the ethical principles inherent to scientific research, and to increase the confidence of the participants, confidentiality and anonymity were assured in all applied questionnaires. All participants were informed about their participation being voluntary, and it is possible to give up participating in the study at any time and without any consequences for themselves.

3.3. Sample Characterization

By population, we mean all subjects that are part of the group that we intend to study. A sample, on the other hand, would be a subgroup of the population to be studied (Sampieri, 2014). The need to collect samples stems from the fact that it is often impossible to question all elements of the population (Sampieri, 2014).

The inclusion/exclusion criteria of the present sample were: 1) individuals of Portuguese nationality and 2) individuals above 18 years old. Only these criteria were defined due to the fact that anyone can be a potential user of the VTO systems in the future, so it will be in the interest of the present study to evaluate the attitudes of not only of current users, but also non-users to understand the factors that contribute or not to the adoption of this technology by consumers.

As previously mentioned, the questionnaire was distributed between March 6 and 30, 2021, through social networks (Facebook, Instagram and WhatsApp). The total number of responses was 324. However, 53 responses were removed, since they were not complete, so in the present study only 271 responses were considered valid. The questionnaires distributed online correspond to a response rate of 84%. To characterize this sample, it was decided to analyze the sociodemographic variables: sex, age, education and marital status. Subsequently, the sample was characterized in relation to online shopping and the use of VTO.

Of the 271 responses obtained in the questionnaires, we can say that 47% (n = 128) corresponded to male individuals and 53% (n = 143) corresponded to female individuals.

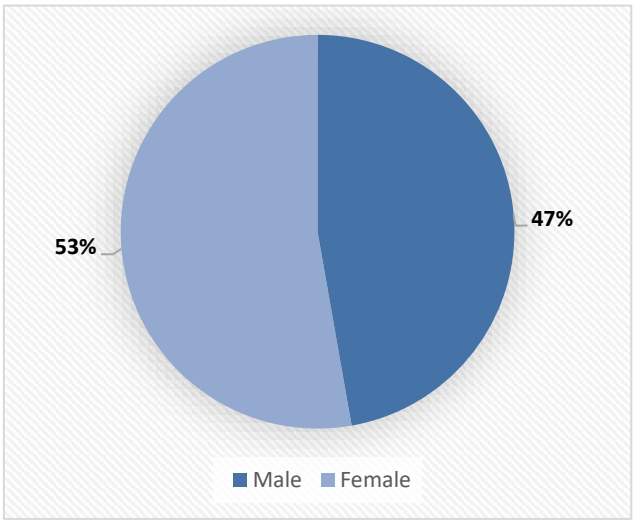

Figure 3.1. - Distribution of respondents by gender.

In relation to age, the respondents had, for the most part, ages between 26 and 35 years old, which presents a percentage of 65% (n = 176) of respondents, category, in which the mode and median were also found (50% of the accumulated frequencies).

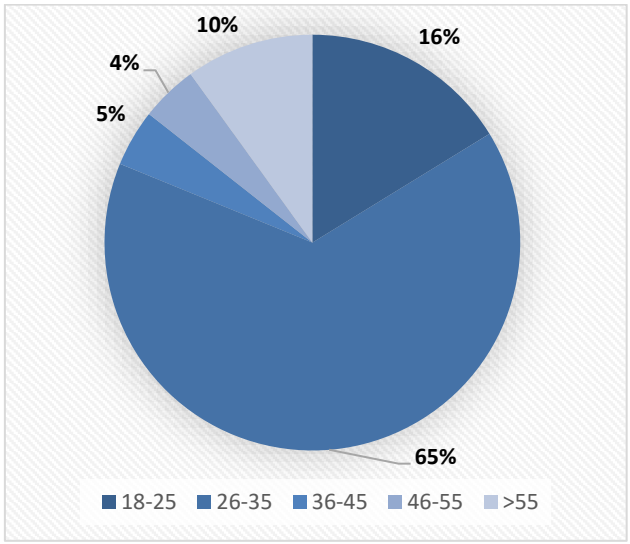

Figure 3.2. - Distribution of respondents by age group.

With regard to schooling, it was found that 2% (n = 6) had Elementary School education, 16% (n = 43) High School education, 41% (n = 111) a Bachelor's degree, 36% (n = 98) a Master's degree and 5% (n = 13) the Doctorate.

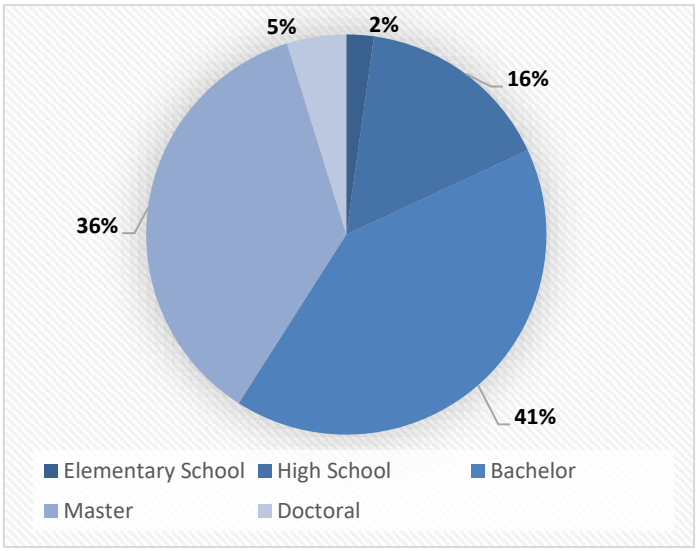

Figure 3.3. - Distribution of respondents by academic qualifications.

Regarding marital status, most participants were in the Single category 52.4% (n = 142), followed by the Married category with 29.2% (n = 79). The Divorced category presented a percentage of only 4% (n = 10), and 15% of respondents preferred not to indicate their marital status (n = 40).

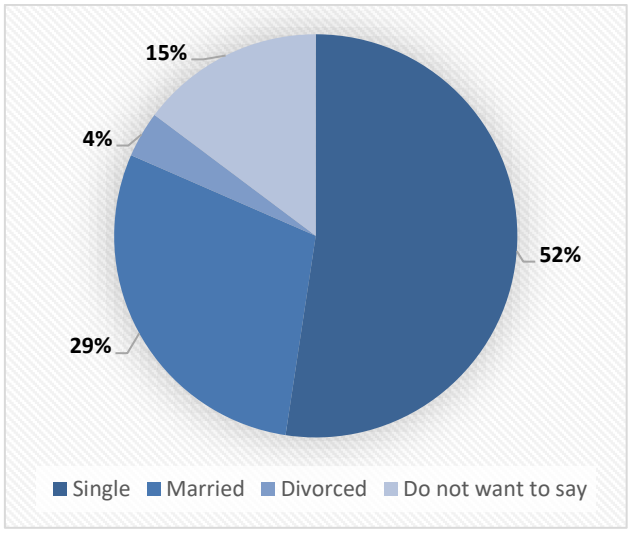

Figure 3.4. - Distribution of respondents by marital status.

As for the question “Do you buy clothes online?”, it was found that 74% (n = 200) of the respondents made purchases online, while 26% (n = 71) respondents did not make purchases online.

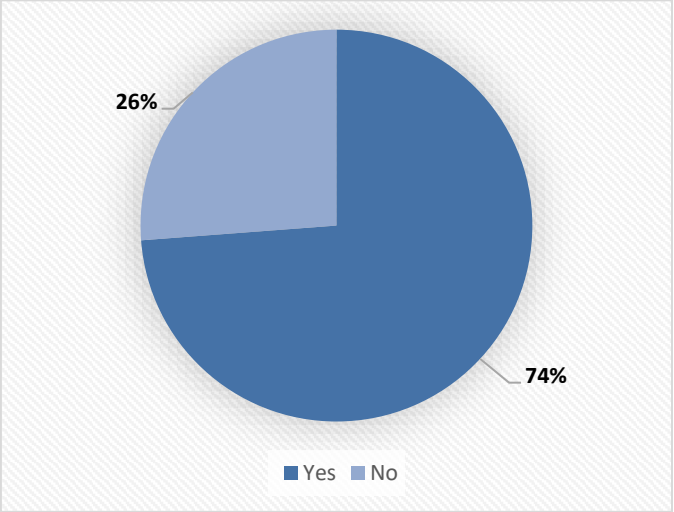

Figure 3.5. - Distribution of respondents by online purchases.

As for the question “If yes, how frequently?” 23% (n = 62) of the participants revealed to make purchases with the frequency of 1 month, 21% (n = 56) revealed to make purchases online with the frequency of “3 to 4 times per quarter”, 13% (n = 36) made online purchases 1 time every 2 weeks and 11% (n = 29) only once every 3 months.

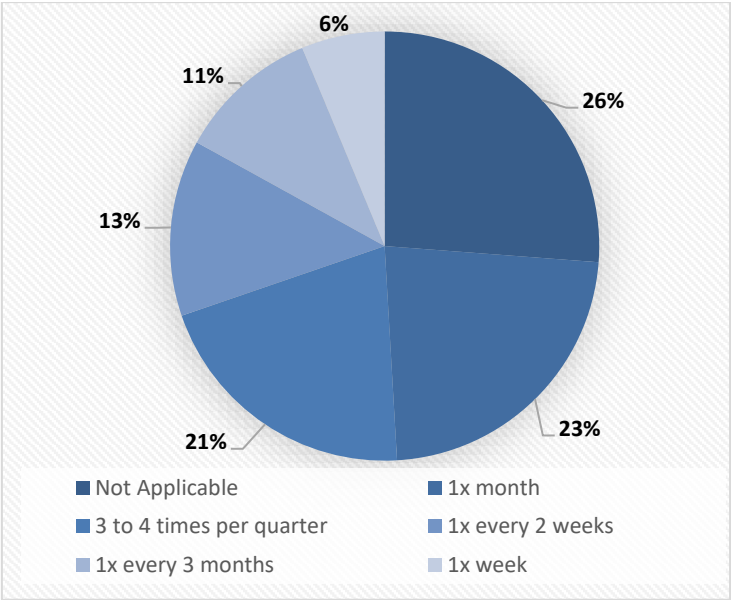

Figure 3.6. - Distribution of respondents by frequency of online shopping.

"Have you ever used Virtual Try-On systems?" only 7% (n = 20) of the respondents reveal that they have already used this system, and 93% (n = 252) had never used this technology.

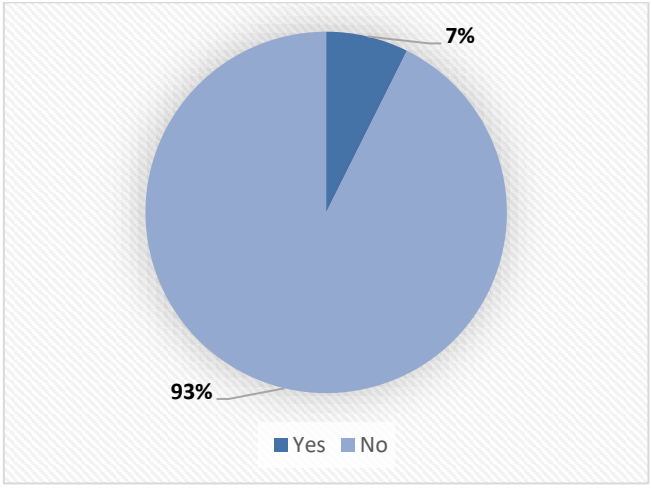

Figure 3.7.- Distribution of respondents by whether they use the Try-On Virtual System.

When asked about the reason for not using the VTO, 44% (n = 119) revealed that they preferred to make purchases in person, 27% (n = 72) revealed that they do not know the technology, 13% (n = 36) did not consider this technology to be reliable, 7% (n = 20) considered that the use of technology has no advantages, 3% (n = 8) considered the technology to be difficult to use and 2% (n = 4) considered that the technology is not useful.

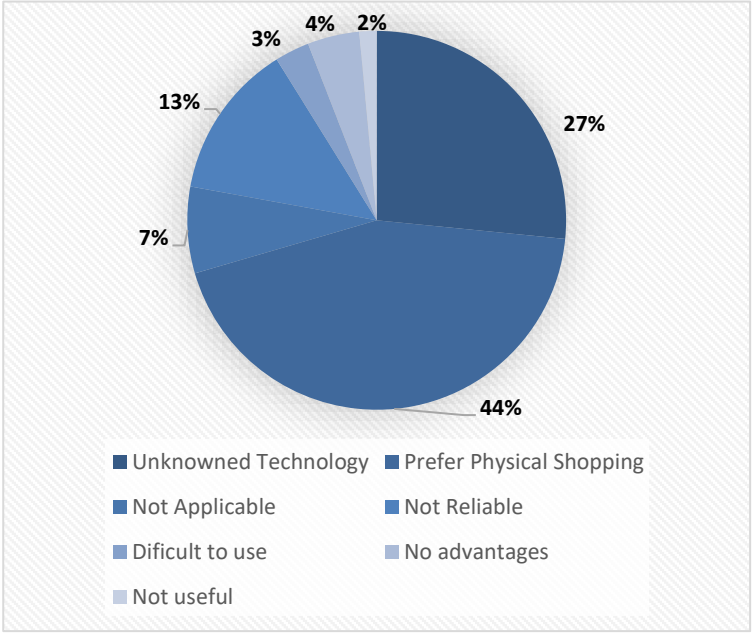

Figure 3.8. - Distribution of participants' reasons of not using the Virtual Try-On.

3.4. Data Analysis Method

Since the present study presents a quantitative approach, it was decided to perform a statistical analysis using the PLS Smart Program (Ringle et al., 2015). Regarding the scaling techniques presented in the outputs, non-comparative evaluation scales (Likert) were used, which allowed evaluating statements according to an ordered scale of 5 categories (Sampieri, 2014). The response scale used in the questionnaire under study was based on a 5-point Likert scale where 1 = “do not agree”, and 5 = “completely agree”. This method has the advantage of allowing the answers obtained to be easily understood, using a set of reference points for all the participants' answers while reducing the transition effect from one judgment to another. As disadvantages of this method, it can be highlighted the ordinal nature of the data, which groups information and reduces the generalization of scaled objects (Sampieri, 2014).

In the present study, the following data analysis methods were used: Cronbach alpha’s reliability test, Composite Reliability test, Average Variance Extracted, R-Squared, Fornell & Larcker criterion, Heterotrait-Monotrait Ratio, Structural path coefficients, Collinearity statistics. They will be covered in more detail in the *Results and Discussion* chapter.

3.4.1. Quality Criteria

According to Sampieri (2014), the measures used in a scientific study must essentially obey two quality criteria: reliability and validity.

Reliability means the ability of a given instrument to be able to produce consistent and coherent results, that is, if the same instrument is applied to the same subject, it is expected that it will be able to reproduce equal results (Sampieri, 2014). Reliability can be assessed using 3 methods: 1) stability, 2) internal reliability and 3) interobserver consistency.

Stability is assessed by applying the same instrument at two different time points, to the same subjects. Internal reliability, on the other hand, is assessed by calculating the Cronbach's Alpha, which seeks to analyze whether the items of a given instrument effectively measure the underlying construct. The same is to say, it seeks to verify whether the items developed to measure ease of use actually evaluate the “ease of use” or another construct (Sampieri, 2014). Finally, the interobserver consistency allows two or more independent observers to rate or rate a subject's response, in a given period of time, in the same or similar way. The less variability in your quotes, the greater the Interobserver Consistency (Coutinho, 2014; Sampieri, 2014).

Validity concerns the ability of a given instrument to actually measure the variable that it is expected to measure, that is, a valid instrument for measuring memory, it must, in fact, evaluate memory and not intelligence. There are two types of essential validity to be analyzed: internal and external validity.

Internal validity can be understood as the degree of confidence that the results are properly interpreted and valid (Sampieri, 2014). For this, Sampieri (2014) states that it is necessary to control the conditions in which the studies are carried out in order to be sure that the effects that occur in an independent variable come from the manipulation of the dependent variables and not from other variables (parasites) that do not were controlled or included in the study. In terms of external validity, this refers to the possibility of generalizing the results of a study to other situations, to other subjects or cases (Sampieri, 2014).

The methodological aspects addressed and presented throughout this chapter are summarized in Table 3.1. Thus, the present study is characterized by being a study inserted in the deductive method, in a quantitative design, based on primary data collected in a single moment (cross -sectional), through Web-Surveys, applied to a sample for convenience.

Table 3.1. - Methodology overview.

Research Approach
Deductive
Research Design
Quantitative
Data Source
Primary
Strategy
Explanatory
Time Horizon
Cross-sectional
Data Collection Method
Web-Survey
Sampling Method
Non-probabilistic & Convenience
Data Analysis Method
Statistics
Quality Criteria
Reliability & Validity

Chapter 4 - Results

To test the conceptual model a Structural Equation Modeling (SEM) was used. The SEM refers to a statistical modeling technique that combines factor analysis with regression. The objective is to design paths and trajectories between latent variables and constructs in order to build or sustain theories (Neves, 2018). To be more precise, a variance-based on the SEM technique was used, the Partial Least Squares (PLS) technique by means of SmartPLS software (Ringle et al., 2015). A two-staged approach was followed regarding the analyzes and interpretation of the results: 1) reliability and validity analyzes of the measurement of the model created, 2) assess the structural model.

4.1. Validity and Reliability

To assess the quality of the measurement model the convergent validity, internal consistency reliability, and discriminant validity was analyzed (Hair et al., 2017).

Internal consistency reliability was confirmed because all the constructs' Cronbach Alphas (CA) and Composite Reliability (CR) values surpassed the cut-off of 0.7 (with a minimum value of 0.717 and 0.874 respectively), indicating an adequate internal consistency (Table 4.1.) (Hair et al., 2017). The convergent validity was also confirmed by observing CR values greater than 0.70 and Average Variance (AVE) greater than the limit of 0.50 (Bagozzi & Yi, 1988).

Table 4.1. - Cronbach Alpha, Composite Reliability, Average Variance, Correlations and Discriminant Validity.

	CA	CR	AVE	PU	PEU	PTC	PA	EC	ATU	BI
PU	0.945	0.957	0.786	**0.887**	0.662	0.803	0.834	0.277	0.841	0.787
PEU	0.863	0.907	0.709	0.662	**0.842**	0.649	0.686	0.166	0.708	0.569
PTC	0.909	0.936	0.785	0.803	0.649	**0.886**	0.835	0.393	0.843	0.633
PA	0.944	0.957	0.817	0.834	0.686	0.835	**0.904**	0.268	0.842	0.733
EC	0.717	0.874	0.777	0.277	0.166	0.393	0.268	**0.881**	0.262	0.125
ATU	0.951	0.961	0.804	0.843	0.708	0.849	0.995	0.262	**0.897**	0.739
BI	0.935	0.958	0.885	0.787	0.569	0.633	0.733	0.125	0.739	**0.941**

Note: CA – Cronbach Alpha, CR – Composite Reliability, AVE – Average Variance. Bold numbers in diagonal are the square roots of AVE. Below the diagonal elements are the correlations between the constructs. Above the diagonal elements are the Heterotrait-Monotrait ratios.

Discriminant validity was analyzed using the Fornell & Larcker and the Heterotrait-Monotrait ratio (HTMT) criterion (Hair et al., 2017; Henseler et al., 2015). The first criterion requires that the construct's square root (AVE) be greater than its greatest correlation with any construct (Fornell & Larcker, 1981). Table 4.1. shows that this criterion was achieved for all constructs, with the exception of the PA construct, in which there was a greater correlation with the ATU construct. By the second criterion, we can see through Table 4.1. that the HTMT are all below the conservative threshold value of 0.85, providing additional evidence of discriminant validity (Hair et al., 2017; Henseler et al., 2015).

4.2. Structural Model

Before evaluating the structural model, an analysis of collinearity was carried out, with values between 1.45 and 4.66, that is, lower than the criterion 5 proposed by Hair et al., (2017). Thus, it was concluded that the items did not present collinearity with each other.

The structural model was assessed using the sign, magnitude, and significance of the structural path coefficients; the magnitude of R2 value for each endogenous variable as a measure of the model's predictive accuracy; and the Stone Stone-Geisser's Q2 values as a measure of the model's predictive relevance (Hair et al., 2017). The coefficient of the determination R2 for the two endogenous variables of ATU and BI were 99.4% and 54.7%, respectively. These values surpassed the threshold value of 10% (Falk & Miller, 1992). The Q2 values for the endogenous variables, 0.793 and 0.475 respectively, were above zero that indicated the predictive relevance of the model. (Hair et al., 2017).

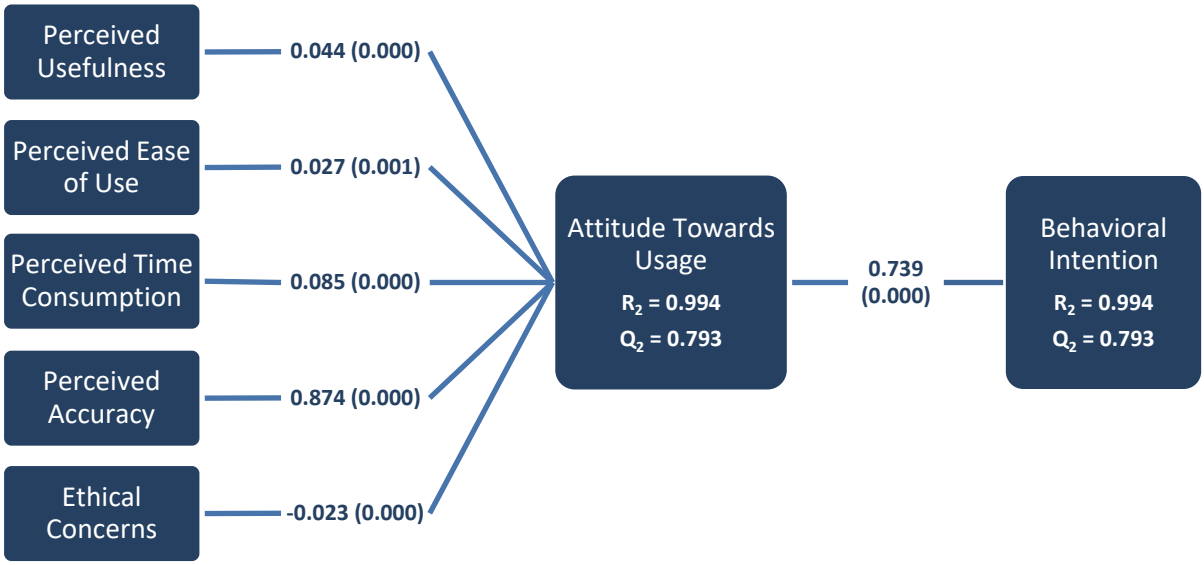

Figure 4.1. - Research Model with PLS-algorithm and bootstrapping results.
Note: Path coefficients out of parentheses. P-values in parentheses.

4.3. Quantitative Results

Table 4.2. shows that ATU suffered a positive effect from the variables PU (β = 0.044, p <0.000), PEU (β = 0.027, p <0.001), PTC (β = 0.085, p < 0.000) and PA (β = 0.874, p <0.000). Regarding EC variable, we can see that it has a negative effect on ATU (β = -0.023, p <0.000). These results support hypotheses H1, H2, H3, H4 and H5. Finally, ATU revealed a positive effect on BI (β = 0.739, p <0.0001), supporting hypothesis H6.

Table 4.3. shows the results of the mediated effects. Thus, we can conclude that the indirect effects of the variables PU, PEU, PTC, PA and EC on BI through the ATU mediator are statistically significant, since all p values <0.001 (see Table 4.3.).

Table 4.2. - Structural model assessment.

	Path Coefficient	Standard Deviation	T Statistics	P Values
PU -> ATUs	0.044	0.011	3.881	0.000
PEU -> ATU	0.027	0.008	3.382	0.001
PTC -> ATU	0.085	0.01	8.581	0.000
PA -> ATU	0.874	0.011	82.147	0.000
EC -> ATU	-0.023	0.006	3.726	0.000
ATU -> BI	0.739	0.025	29.161	0.000

Table 4.3. - Bootstrap results for indirect effects.

	Estimate	Standard Deviation	T Statistics	P Values
PU -> ATU -> BI	0.033	0.009	3.817	0.000
PEU -> ATU -> BI	0.02	0.006	3.453	0.001
PTC -> ATU -> BI	0.063	0.007	8.958	0.000
PA -> ATU -> BI	0.646	0.024	26.622	0.000
EC -> ATU -> BI	-0.017	0.004	3.804	0.000

4.4. Hypotheses Testing

After the results analysis one can verify which hypotheses can be accepted or rejected. Thus, the hypotheses of the study are presented in Table 4.4., as well as the value of β and its statistical significance in order to support the decision to reject or accept the hypotheses presented.

Table 4.4. - Hypotheses testing.

Hypotheses	β	P value	Accepted/Rejected
H1: Perceived Usefulness influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.	0.044	0.000	Accepted
H2: Perceived Ease of Use influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.	0.027	0.001	Accepted
H3: Perceived Time Consumption influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.	0.085	0.000	Accepted
H4: Perceived Accuracy influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.	0.874	0.000	Accepted
H5: Consumer's Ethical Concerns influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.	-0.023	0.000	Accepted
H6: Attitude Towards Usage of Virtual Try-On system for apparel influences consumers' Behavioral Intention.	0.739	0.000	Accepted

The aforementioned results have shown that there are linear relationships between the different items. In the hierarchical linear regression one dependent variable and one or more independent variables exist, which cause causal relationships. In this study, two hierarchical linear

regressions were conducted. The first model consists of the factors PU, PEU, PTC, PA and EC regarding ATU. The second model examines the influence of ATU on BI.

All the hypotheses presented were accepted through the analysis of hierarchical regressions, since all the values of statistical significance presented are less than $p < 0.001$. That is, the variables PU, PEU, PTC, PA, and EC influence VTO systems ATU. Similarly, VTO systems ATU influences consumers' BI variable. Also, the high β value, especially in the PA variable ($\beta = 0.874$, $p < 0.000$) demonstrates that this is the aspect with the greatest influence on ATU of VTO systems variable.

Chapter 5 - Discussion

This chapter intends to critically explore the results presented in the previous chapter, considering the literature review carried out and the research questions. It is intended to understand and evaluate through an adapted TAM if consumers accept the VTO AI systems when shopping for apparel online. The same will be to say that the present study wanted above all to verify whether the applied variables influence the adoption behavior of the VTO systems for making online purchases.

In the literature review was found that there is a large number of studies that explored the relationship between several variables and online shopping through VTO systems. In the present study different variables were combined, which presented theoretical support within the scientific community, in a single model of analysis

The results of the variables studied will be presented individually compared to the studies analyzed in the Literature Review and Conceptual Framework, as well as the research questions.

5.1. Hypotheses

5.1.1. H1: Perceived Usefulness influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel

The first hypothesis was based on the studies carried out by Rogers (1995), Davis (1989) and Sun et al., (2009), who believe that the adoption of a technology is linked to the perception of its advantages. Thus, it was defined as **H1:** *Perceived Usefulness influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.*

Regarding PU, the results of this study are in accordance with the definition proposed by the authors mentioned above, as well as the results of studies conducted by Zhang et al., (2019), Yen et al., (2017) and Kim and Forsythe (2007), that is, PU is considered a predictor of ATU, the latter being, consequently, a predictor of BI for the use of the VTO systems.

More specifically, Zhang et al., (2019) concluded that PU had a positive effect on online consumers' attitudes towards VTO systems. Yen et. al (2017) also came to the same conclusion, verifying that PU was a significant predictor of consumer attitudes towards a virtual system. Finally, the study by Kim and Forsythe (2008) revealed that PU is one of the strongest predictors of consumers' attitude towards the intention of VTO systems usage. One can draw this conclusion from the values of β and p-value (β = 0.044, p= 0.000), presented in the Results section.

In this way, it is possible to conclude that H1 was accepted. Our results are reinforced by the ideas present in the questionnaire in which PU exists when the individual considers that: 1) Using Virtual Try-On would enable to accomplish the task of trying clothes more quickly; 2) Virtual Try-On could improve the online shopping overall experience, and 3) The use of Virtual Try-On could increase the effectiveness of online purchase.

5.1.2. H2: Perceived Ease of Use influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel

The second hypothesis intended to analyze whether the *Perceived Ease of Use influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel.* In relation to this aspect Rogers (1995), Davis (1989), Bauerová and Klepek (2018) and Pantano and Di Pietro (2012), consider that the adoption of a certain technology is dependent on its degree of complexity or ease of use. Sun et al., (2009) also defined this aspect as a person's belief in how the use of a particular technology is considered effortless.

In this study, it can be concluded that the PEU was one of the factors influencing the attitude towards usage with a β of 0.027 and a p-value of 0.001, so H2 was accepted. Some studies go in this direction (Liu et al., 2010), while other studies (Yen et al., 2017; Kim and Forsythe, 2007) state that this factor is not predictive of attitudes towards users.

Liu et al. (2010) concluded that the PEU was a significant predictor of the intention to use an online system in such a way that the greater the ease of use of a system, the greater the user's intention to use it. The study conducted by Yen et al. (2017) points out that the PEU is not a predictor of consumers' intentions regarding the use of a virtual system. This result is supported by the study of Kim and Forsythe (2008) in which the PEU revealed not to be a predictor of ATU of the VTO systems in men and women.

However, the present study applied to the Portuguese population points to the acceptance of H2, as evidenced in the study by Liu et al., (2010) suggesting that particularly in the Portuguese case, there is an influence of this factor for the use of a system such as VTO. So, individuals PEU when: 1) Learning to operate Virtual Try-On systems would be easy; 2) Virtual Try-On systems would be easy to navigate, and 3) It would be easy to become skillful at using the Virtual Try-On system.

5.1.3. H3: Perceived Time Consumption influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel

Some authors believe that the use of AI systems such as the VTO systems can help people to save time in their daily lives (Zeithaml, 1988; Chang & Wang, 2011; Vasic et al., 2019). In this way, it was interesting to analyze whether the *Perceived Time Consumption influences online consumers 'Attitude Towards Usage of Virtual Try-On system for apparel*.

In the present study results, it is possible to verify by the value of β (0.085) and p-value (0.000) that there is a significant influence between PTC and the ATU of VTO systems, and in this sense, H3 is accepted. A possible explanation for this aspect is that individuals in Portugal see the use of the VTO systems as a technology that is available to save time (Zeithaml, 1988; Chang & Wang, 2011; Vasic et al., 2019). It is possible, for example, to make purchases on public transport on the way to work,

allowing after work time to be used for other activities. At this level Vasic et al., (2019) point out that time is one of the main predictors of customer satisfaction. Actually, not having to wait in line or avoiding trafficking are perceived as advantages for online consumers, especially if they feel they do not have time (time pressures).

In conclusion, PTC exists when: 1) Virtual Try-On for apparel shopping would allow to perform other tasks at the same time (e.g., cooking); 2) Virtual Try-On for apparel shopping is very time efficient; 3) Virtual Try-On for apparel shopping would help to better manage my time.

5.1.4. H4: Perceived Accuracy influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel

Different authors emphasize the importance of the product purchased online serving in terms of size to its users, as well as alerting to the quality of the product and the importance of the correspondence between the online price and the price actually paid by the customer (Vasic et al., 2019 , Zhang et al, 2019; Dennis 2017, Limbu et al., 2011). Thus, the following hypothesis was formulated: *Perceived Accuracy influences online consumers 'Attitude Towards Usage of Virtual Try-On system for apparel*.

According to this study, H4 was accepted since the β and p-value values (β = 0.874, p= 0.000), indicate that PA is a predictor of ATU. In this logic, users seem to adopt VTO systems as they believe in the correspondence between the product presented online and the product they will receive at home (Vasic et al., 2019, Zhang et al, 2019; Dennis 2017, Limbu et al., 2011).

According to Vasic et al. (2019) there are some factors capable of predicting customer satisfaction, namely price, shipping, and quality information. So, one can deduce that these factors will consequently have some influence on the use of the VTO systems, since satisfied customers tend to choose the same purchasing systems. Limbu et al. (2011) concluded that the correspondence between the product viewed online, and the physical product is important for the customer, and these authors point out that this fulfillment is one of the main factors responsible for customer satisfaction. Thus, one can conclude that the results obtained are corroborated by the studies previously presented.

PA exists when individuals perceive that: 1) Using Virtual Try-On could give access to more information about the product; 2) Using Virtual Try-On would give more confidence about a product information, and 3) Using Virtual Try-On would enable to have more accurate information.

5.1.5. H5: Consumer's Ethical Concerns influences online consumers' Attitude Towards Usage of Virtual Try-On system for apparel

With regard to Consumers EC and, considering the definition of Bird et al., (2020) these concern the moral principles that guide the subject's behavior and influence the subject's attitudes towards the use of technology. In this regard, we can mention concerns about privacy, reliability and safety (Due &

Xi, 2020). When considering these aspects, the following hypothesis was formulated: *Consumer's Ethical Concerns influences online consumers 'Attitude Towards Usage of Virtual Try-On system for apparel*.

The results allowed to conclude that EC is a negative predictor of ATU, that is, if the subjects are concerned with ethical issues (privacy, data security, etc.), the lower the probability of adopting AI systems such as the VTO. These results are in line with that advocated by Due and Xie (2020). Thus, one can conclude that H5 was accepted, and this variable showed to be statistically significant (β = -0.023, p = 0.000.

The idea of the presence of EC when shopping online exists when individuals realize that: 1) Ethical concerns would interfere with the usage of Virtual Try-On; 2) The risks of cybersecurity would interfere with usage of Virtual Try-On systems, and 3) The usage of Virtual Try-On is associated with unethical behavior.

5.1.6. H6: Attitude Towards Usage of Virtual Try-On system for apparel influences consumers' Behavioral Intention

To evaluate ATU, two models were tested: in the first model, the effects of PU, PEU, PTC, PA and EC factors on ATU were tested; in the second model, the effect of the ATU factor on BI was tested.

According to Fishbein and Ajzen (1975) an attitude concerns an intention to adopt a certain behavior. BI, on the other hand, refers to the last steps for the realization of a certain action. Considering the perspective of these authors, it was possible to test and understand that the ATU of VTO systems influences consumers' BI.

In the Results section it is possible to verify that PU, PEU, PTC, PA and EC influence ATU and that ATU influence BI with a β = 0.739 and a p <0.0001, accepting H6. These results are in line with the results found by Hassanein and Head (2007). In their study on the intention to use and the effective use of a technological system, it was found that a person's attitude influenced the intention and behavior of using AI systems, such as the VTO. Likewise, Liu et al. (2005) argued that BI influences a person's observable behavior, corroborating this study results.

The ATU of VTO is confirmed when the individual has ideas such as: 1) I think positively about using Virtual Try-On for online shopping; 2) I plan on using Virtual Try-On systems for online shopping purposes on a regular basis in the future, and 3) Using Virtual Try-On systems within the online shopping experience would be pleasant.

5.2. Research Questions

5.2.1. Q1 - Do consumers accept Virtual Try-On Systems?

Considering the answers to the reasons underlying the non-use of the VTO systems, one can consider that Portuguese offer some resistance to the adoption of this AI system, since the majority of the Portuguese in the sample (44%) prefer to purchase in physical stores. This aspect may be related to the conclusions of Lichtenthaler (2019). The author states that when interacting with technology, individuals develop an attitude of indifference towards contact with other human beings. It may be that the Portuguese have not yet developed this indifference and as such, prefer to buy in physical stores because they have contact with a human assistant, something that AI systems do not allow.

On the other hand, from the sample, those who have never used VTO do not consider this technology to have any advantages, be it reliable or useful. As advocated by Rogers (1995), people tend to accept a technology when they perceive advantages in its use. In our study, these people seem to be few, since only 20 individuals claimed to have already used VTO systems, that is, only 20 people had already accepted and used this technology. Also, the ethical aspects (security and privacy) in past experiences related to the use of technology, affect the acceptance of technology, as said in our study and according to the study by Margulis, Boeck, and Laroche (2019). Kim and Forsythe (2008) also found that the acceptance of the VTO was influenced by individual aspects (e.g.: anxiety). These individual aspects were not considered in our study, so they should be the focus of attention in future studies.

It should also be noted that a large number of Portuguese in our study (n = 72) are unaware of VTO systems, so we consider that aspects such as “not seeing advantages in using the Virtual Try-On System”, or “ not be useful ”should be interpreted with caution. These aspects raise the question of whether people are actually talking about VTO systems or whether they are messing with other technology.

Another important aspect concerns the general attitude of people towards technology, which was not evaluated in this study. In a study by Zhang and Dafoe (2019), 22% of Americans showed a negative attitude towards the development of AI. In the present study, we do not know what percentage of Portuguese people with a negative attitude towards the development of AI, so this aspect should be considered in future studies, as it can be an important factor to consider for the acceptance or not of technologies. like the VTO.

In sum, one can conclude that Portuguese consumers tend to accept VTO AI systems to conduct their purchases online.

5.2.2. Q2 – Do consumers intend to use Virtual Try-On System?

According to this investigation results, one can consider that Portuguese customers would use VTO systems, as long as this AI system guaranteed a series of advantages for its users. Namely: it appeared

to be useful, allowed to save time, was easy to use, did not raise ethical concerns (privacy and security) and showed high precision in terms of price, size and quality of the garment.

The study by Yim et al., (2017) is in in line with this perspective, as they concluded that a sense of novelty, pleasure and usefulness would contribute to the use of the VTO systems. Kim and Forsythe (2007), Yen et al., (2017) and Zhang et al., (2019) agreed with this last aspect (Usefulness), evidencing in their studies that PU is a predictor of ATU. Also, Jackson, Parboteeah, and Metcalfe-Poulton (2014), found that the pleasure experienced by the user when making online purchases may condition the use of this technology. However, in our study, we did not study the aspect of pleasure and entertainment, and future studies may take this aspect into account. Margulis, Boeck, and Laroche (2019), on the other hand, defended the importance of ethical aspects (security and privacy) as in our study, for the use of AI systems. Huang and Qin (2011) also addressed issues related to "performance expectancy", "effort expectancy", "social influence", and "perceived risk", arguing that these also condition the acceptance of using AI systems. However, these aspects were not addressed in our study. Regarding time, authors such as Zeithaml (1988), Chang and Wang (2011) and Vasic et al., (2019) argue that saving time is an important aspect for individuals.

On the other hand, PA is the factor with the greatest predictive power of ATU of VTO systems, with the remaining factors appearing to be less important for the Portuguese, especially when the subject in question is to buy clothes online. It seems that the fundamental aspect for customers is to ensure that the clothing found through the VTO corresponds to what was promised when it arrives at the customers' address. At this level, Zhang and colleagues (2019) state that, despite the advantages of VTO systems, it is not without risks. Dennis (2017), on the other hand, reported that the rate of return of clothes online is between 25% and 40%, with the risk that the item bought online does not correspond to the actual item.

In sum, although Portuguese consumers in the sample accept VTO, their intention to use it depends not only on its acceptance, but also on the perceived advantages seen. In other words, the intention to use goes beyond the acceptance of the system and is in accordance with the individual perception of each consumer according to his momentary needs, since these change over time.

Conclusion

In this chapter, the most important results of the present study will be reviewed, as well as the objectives of the study will be revisited. The contribution of this study to future research will also be presented and its limitations will be analyzed.

When carrying out the Literature Review of the present study, we came to two research questions and in order to search for conclusions on them we design a Research Model (based on the TAM) on which the formulation of the hypotheses of our study was also based. This model was adapted to our investigation. Thus, it was chosen to study the variables PU, PEU, which originally belonged to the model, and then it were introduced the variables PTC, PC and EC. The main objective was to explain the influence of these factors at the level of ATU and, consequently, latter on BI.

As such, 271 questionnaires (valid) were collected, and the variables mentioned above were evaluated regarding the adoption of the VTO systems. After analyzing the results, it was possible to conclude that all the independent variables had an influence on the dependent variables and as such all the formulated hypotheses were accepted.

The results of the study revealed that PA is the most important predictive factor for ATU. The remaining factors revealed to have a lesser impact on users' attitudes, and EC revealed to be a negative predictor of these attitudes, that is, the fact that users have concerns about privacy and security when using the VTO systems would lead to presenting a negative attitude in accepting this technology. Also, ATU factor was found to influence BI, as suggested by other studies analyzed in the Literature Review. These results answered the research questions raised, the objectives of the study, revealing some of the factors that influence the acceptance and use of the VTO systems within the Portuguese population.

In conclusion, we can consider that the present study is innovative in that it allowed the creation of a new model based on TAM by including new variables (PTC, PA, EC) adding value to the TAM. When creating a new model based on TAM, the present study revealed that the influence of predictive variables on the dependent variable (ATU) is not the same. Apparently, PA has a greater predictive power, in contrast to the variables initially studied by the model (PU and PEU). Additionally, the present study also contributed to suggest new variables to be studied, such as the involvement of the Portuguese with technology, their digital literacy, as well as their interest in AI, since these aspects also seem to influence the acceptance and use of systems of AI.

Another important aspect to analyze concerns the limitations of the study, among which one can mention: 1) the fact that it is a cross-sectional study, thus limiting our ability to be casual among the variables studied; 2) the fact that a non-probabilistic sample for convenience was used which may create representativeness problems for the population under study; 3) the fact that the sample is limited to Portuguese consumers and hence may not be generalizable to consumers in other countries.

Another aspect to note in the conclusion is undoubtedly the high number of responses (271 out of 324). Despite the high number of responses (84%), the results of the present study should be read with caution, since the sample was collected by convenience, having not been randomly obtained, nor being representative of the population in question and it is not possible to generalize its results (Sampieri, 2014).

Other disadvantage is the fact that it is not possible to know who actually answered the questionnaire, as mentioned in sub-chapter Data Collection (Andrade, 2009; Nayak & Narayan, 2019). Despite the impossibility of generalizing the results, the present study constitutes an added value since it allows access to the perceptions of the Portuguese regarding the use of an innovative system for online purchases, with few studies on the use of this technology in Portugal.

Since the study at hand followed a cross-sectional research design, only current consumers' attitudes have been examined. Hence, a suggestion for further research is carrying out a longitudinal study which observes the attitudes and perceptions of consumers over a longer time period. It would be interesting to witness if their attitude changes over time and to see which factors have an influence on this occurrence.

Others suggestions could include: 1) Perform the study with population from different countries and compare the results between countries; 2) Understand if people's lifestyle influences their needs and acceptance of these new technologies; 3) Recognize if the use of the application corresponds to peoples' expectations, by conducting a study in which expectations are evaluated before using VTO, after using and comparing with this AI system; and 4) In the next studies, other variables may be studied or cross the variables used in this study with those of other studies (e.g., digital literacy; anxiety, pleasure, entertainment).

To summarize, consumers ATU of VTO systems are an important and interesting area for further empirical studies regarding AI. With the substantial increase in the use of technologies with integrated AI, it becomes evident the importance of studies such as this one, in which the focus is on the analysis and understanding of the acceptance of its users. Thus, it is hoped that this research project will encourage further studies in the area of AI and consumers' behaviour.

References

Accuracy. (n.d.). Retrieved March 20, 2021, from https://www.dictionary.com/browse/accuracy

Ahn, T., Ryu, S., & Han, I. (2004). The impact of the online and offline features on the user acceptance of internet shopping malls. Electronic Commerce Research and Applications, 3(4), 405-420.

Ajzen, I. and Fishbein, M., 1980. Understanding attitudes and predicting social behavior. Englewood Cliffs, NJ: Prentice-Hall

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. Psychological bulletin, 84(5), 888. http://dx.doi.org/10.1037/0033-2909.84.5.888

Andrade, M. M. D. (2009). Introdução à metodologia do trabalho científico. Atlas: São Paulo. ISBN: 9788522458561.

Asling, D. (n.d.). 19 powerful ways to use artificial intelligence in ecommerce. Retrieved January 12, 2021, from https://www.linnworks.com/blog/artificial-intelligence-in-ecommerce

Aws Amazon (2018). What is Artificial Intelligence? AWS. Available at https://aws.amazon.com/vi/machine-learning/what-is-ai/. Consulted on 19 January 2021.

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. Journal of the Academy of Marketing Science, 16(1), 74–94. https://doi.org/10.1007/BF02723327

Bauerová, R., & Klepek, M. (2018). Technology acceptance as a determinant of online grocery shopping adoption. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 66(3), 737–746. https://doi.org/10.11118/actaun201866030737

Baytar, F., Chung, T.-l. D., & Shin, E. (2016). Can augmented reality help e-shoppers make informed purchases on apparel fit, size, and product performance. International Textile and Apparel Association Annual Conference Proceedings, Vancouver, and Knoxville, TN, pp. 1-2.

Beck, M., & Crié, D. (2018). I virtually try it… I want it! Virtual Fitting Room: A tool to increase on-line and off-line exploratory behavior, patronage and purchase intentions. Journal of Retailing and Consumer Services, 40(1), 279-286. http://dx.doi.org/10.1016/j.jretconser.

Bird, E., Fox-Skelly, J., Jenner, N., Larbey, R., Weitkamp, E., & Winfield, A. (2020). The ethics of artificial intelligence: Issues and initiatives. In The Legal Studies Institute of Chosun University (Vol. 27, Issue 1). https://doi.org/10.18189/isicu.2020.27.1.73

Bourque, L., & Fielder, E. P. (2003). How to conduct self-administered and mail surveys. Sage: California. ISBN: 0-7619-2510-4.

Bryman, A., 2012. Social Research Methods. 4th ed. New York: Oxford University Press.

Carrasco, M., Mills, S., Whybrew, A., & Jura, A. (2019). The citizen's perspective on the use of AI in government. BCG digital government benchmarking. Boston consulting Group. https://www.bcg.com/publications/2019/citizen-perspective-use-artificial-intelligenc e-government-digital-benchmarking.aspx

Cave, S., Coughlan, K., & Dihal, K. (2019). Scary robots': examining public responses to AI. In Proceedings of the Second AAAI / ACM Annual Conference on AI, Ethics, and Society. https://doi.org/10.17863/CAM.35741 https://www.repository.cam.ac.uk/handle/1810/288453

Chand, S. (2014, April 02). Consumer Behaviour: Meaning/Definition and Nature of Consumer Behaviour. Retrieved October 21, 2020, from https://www.yourarticlelibrary.com/marketing/market-segmentation/consumer-behaviour-meaningdefinition-and-nature-of-consumer-behaviour/32301

Chang, H. H., & Wang, H. W. (2011). The moderating effect of customer perceived value on online shopping behaviour. Online Information Review, 35(3), 333–359. https://doi.org/10.1108/14684521111151414

Cheung, C. M. K., Chan, G. W. W., & Limayem, M. (2005). A critical review of online consumer behavior: Empirical research. Journal of Electronic Commerce in Organizations, 3(4), 1-19.

Coutinho, C. P. (2014). Metodologia de investigação em ciências sociais e humanas. Leya: Lisboa. ISBN: 9789724051376.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS quarterly, 13(3), 319-340.

Dennis, S. (2017), "Many unhappy returns: E-commerce's Achilles heel", available at: https://www.forbes.com/sites/stevendennis/2017/08/09/many-unhappy-returns-e-commerces-achilles-heel/?sh=6eec32f84bf2 (accessed 31 January 2021).

Du, S., & Xie, C. (2020). Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities. Journal of Business Research, August, 0–1. https://doi.org/10.1016/j.jbusres.2020.08.024

Edelman. (2019). Artificial intelligence (AI) survey. https://www.edelman.com/sites/g/files/aatuss191/files/2019-03/2019_Edelman_AI_Survey_Whitepaper.pdf

Ergin, E. A., & Akbay, H. O. (2008). An empirical investigation of Turkish consumers' online shopping patterns. Journal of Global Business and Technology, 4(2), 54-59.

European Commission (2019). Trustworthy AI – Brochure. European Commission. Available at https://ec.europa.eu/digital-single-market/en/news/trustworthy-ai-brochure. Consulted on 19 January 2021.

European Parliament (2020). The ethics of artificial intelligence: Issues and initiatives. Brussels: European Parliamentary Research Service.

Fast, E., & Horvitz, E. (2017, February). Long-term trends in the public perception of artificial intelligence. In Proceedings of the AAAI Conference on Artificial Intelligence (Vol. 31, No. 1), 963-969. file:///E:/8%20de%20junho/Projetos/TURISMO/pesquisa/10635-Article%20Text-14163-1-2-20201228.pdf.

Faust, M. E., & Carrier, S. (2011). How computer technologies may change the way women buy apparel. Proceedings of the 2011 International Conference on Computer and Management, Wuhan, pp. 1-4.

Fiore, A. M., Jin, H. J., & Kim, J. (2005). For fun and profit: Hedonic value from image interactivity and responses toward an online store. Psychology & Marketing, 22(8), 669-694.

Fiore, A. M., Kim, J., & Lee, H. H. (2005). Effect of image interactivity technology on consumer responses toward the online retailer. Journal of Interactive Marketing, 19(3), 38–53. https://doi.org/10.1002/dir.20042

Fishbein, M. and Ajzen, I., 1975. Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. Reading, MA: Addison-Wesley.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(3), 382–350. https://doi.org/10.2307/3151312

Goldsmith, R. E., & Flynn, L. R. (2004). Psychological and behavioral drivers of online clothing purchase. Journal of Fashion Marketing and Management, 8(1), 84-95.

Greene, L. (2011). Next big trend: virtual fitting rooms. Financial Times. Available at www.ft.com/cms/s/2/57b1fea6-1f55-11e0-8c1c-00144feab49a.html#axzz26RCYH5Zm. Consulted on 20 January 2021.

Ha, Y., & Stoel, L. (2004). Internet apparel shopping behaviors: The influence of general innovativeness. International Journal of Retail & Distribution Management, 32(8), 377-385.

Hair, J. F., Hult, G. M., Ringle, C., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling. Sage Publications.

Han, X., Wu, Z., Wu, Z., Yu, R., & Davis, L. S. (2018). VITON: An Image-Based Virtual Try-on Network. Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, May 2018, 7543–7552. https://doi.org/10.1109/CVPR.2018.00787

Hassanein, K. and Head, M., 2007. Manipulating perceived social presence through the web interface and its impact on attitude towards online shopping. Int. J. Human-Computer Studies, 65(8), pp.689-708.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115–135. https://doi.org/10. 1007/s11747-014-0403-8

Hu, P., Nourbakhsh, N., Tian, J., Sturges, S., Dadarlat, V., & Munteanu, A. (2020). A generic method of wearable items virtual try-on. Textile Research Journal, 90(19–20), 2161–2174. https://doi.org/10.1177/0040517520909995

Huang, N., & Qin, G. (2011). A study of online virtual fitting room adoption based on UTAUT. 2011 International Conference on E-Business and E-Government (ICEE), 1-4.

Hwang, J., & Good, L. (2014). Intelligent sensor-based services success: the role of consumer characteristics and information. European Journal of Marketing, 48(3/4), 406–431. https://doi.org/10.1108/EJM-11-2011-0689

Hwangbo, H., Kim, E. H., Lee, S.-H., & Jang, Y. J. (2020). Effects of 3D virtual "try-on" on online sales and customers' purchasing experiences. IEEE Access, 8, 189479-189489.

Jackson, T. W., Parboteeah, P., & Metcalfe-Poulton, S. (2014). The Effects of Consumer Personality Types on the Attitudes and Usage of Self-Checkout Technology in the Retail Sector among 18-22 Years Old. International Journal of Marketing Studies, 6(2), 15. https://doi.org/10.5539/JMS.V

Kaewrat, C., & Boonbrahm, P. (2017). A survey for a virtual fitting room by a mixed reality technology. Walailak Journal of Science and Technology, 14(10), 759-767.

Kang, J.-Y. M., & Johnson, K. K. P. (2013). How does social commerce work for apparel shopping? Apparel social e-shopping with social network storefronts. Journal of Customer Behavior, 12(1), 53-72.

Kawaf, F. (2012). The role of web atmospherics and consumers emotions in online fashion shopping experiences. Available at https://core.ac.uk/download/pdf/154425372.pdf. Consulted on 21 January 2021.

Kim, J., & Forsythe, S. (2007). Adoption of virtual try-on technology for online apparel shopping. Journal of Interactive Marketing, 21(3), 2–20. https://doi.org/10.1002/dir

Kim, J., & Forsythe, S. (2008). Adoption of virtual try-on technology for online apparel shopping. Journal of Interactive Marketing, 22(2), 45-59. https://doi.org/10.1002/dir.20113
Kim, Y., Park, S., & Pookulangara, S. (2006). Effects of multi-channel consumers' perceived retail attributes on purchase intentions of clothing products. Journal of Marketing Channels, 12(4), 23-43.
Kim, Y.-M., & Shim, K.-Y. (2002). The influence of Internet shopping mall characteristics and user traits on purchase intent. Irish Marketing Review, 15(2), 25-34.
Kuester, S. (2012). MKT 301: Strategic marketing and marketing in specific industry contexts. The University of Mannheim.
Kwiecień, A. (2020, June 25). Examples of AR-powered virtual try ons in the fashion industry. Retrieved October 19, 2020, from https://divante.com/blog/examples-of-ar-powered-virtual-try-ons-in-the-fashion-industry/
Lichtenthaler, U. (2019), "Extremes of acceptance: employee attitudes toward artificial intelligence", Journal of Business Strategy, Vol. 41 No. 5, pp. 39-45. https://doi.org/10.1108/JBS-12-2018-0204
Limbu, Y. B., Wolf, M., & Lunsford, D. L. (2011). Consumers' perceptions of online ethics and its effects on satisfaction and loyalty. Journal of Research in Interactive Marketing, 5(1), 71–89. https://doi.org/10.1108/17505931111121534
Liu, C., Marchewkab, J. T., Luc, J. and Yud, C.-S., 2005. Beyond concern—a privacy-trustbehavioral intention model of electronic commerce. Information & Management, 42(1), pp.289- 304.
Liu, I., Chen, M., Sun, Y., Wible, D. and Kuo, C., 2010. Extending the TAM Model to Explore the Factors that Affect Intention to Use an Online Learning Community. Computers & Education, 54(2), pp.600-610.
Lobaugh, K., Stephens, B., & Simpson, J. (2019). The consumer is changing , but perhaps not how you think. Deloitte Insights. https://www2.deloitte.com/insights/us/en/industry/retail-distribution/the-consumer-is-changing.html
Mahalaxmi, K. R., & Nagamanikandan, P. (2016). A study on online shopping behavior for apparel: Literature review. International Journal of Innovative Research in Technology, 2(11), 194-199.
Margulis, A., Boeck, H., & Laroche, M. (2019). Connecting with consumers using ubiquitous technology: A new model to forecast consumer reaction. Journal of Business Research, 121, 448-460. https://doi.org/10.1016/j.jbusres.2019.04.019
Marktest (2020). Os portugueses e as redes sociais. Grupo Marktest: Lisboa. https://www.marktest.com/wap/a/grp/p~96.aspx
McCarthy, J. (1970, January 01). What is AI? Basic Questions. Retrieved October 05, 2020, from http://jmc.stanford.edu/artificial-intelligence/what-is-ai/index.html
Merle, A., Senecal, S., & St-Onge, A. (2012). Whether and how virtual try-on influences consumer responses to an apparel web site. International Journal of Electronic Commerce, 16(3), 41-64.
Mohanty, S., & Nanda, B. (2020). E-COMMERCE: EVOLUTION, PRESENT STATUS AND FUTURE PROSPECTS. Aut Aut Research Journal, XI(IV), 284–293.
Monsuwé, T. P., Dellaert, B. G., & Ruyter, K. (2004). What drives consumers to shop online? A literature review. International Journal of Service Industry Management, 15(1), 102-121.
Morning Consult. (2017). "National Tracking Poll 170401." Survey report. Morning Consult. https://perma.cc/TBJ9-CB5K.
Nawi, N. C. (2012). Small online apparel businesses in Malaysia: A framework for customer framework. Doctorate thesis presented at the Faculty of Business & Law of the Victoria University, Melbourne.
Nayak, M. S. D. P., & Narayan, K. A. (2019). Strengths and weakness of online surveys. Journal of Humanities and Social Science, 24(5), 31-38 https://doi.org/10.9790/0837-2405053138.
Neuberger, A., Borenstein, E., Hilleli, B., Oks, E., & Alpert, S. (2020). Image Based Virtual Try-On Network From Unpaired Data. 5183–5192. https://doi.org/10.1109/cvpr42600.2020.00523
Neves, J. A. B. (2018). Modelo de equações estruturais: uma introdução aplicada. http://repositorio.enap.gov.br/bitstream/1/3334/1/Livro_Modelo de equações estruturais.pdf
Northeastern University and Gallup. (2018). Optimism and Anxiety: Views on the Impact of Artificial Intelligence and Higher Education's Response. Survey report. Northeastern University: Gallup. https://perma.cc/57NW-XCQN.
O'Cass, A., & Fenech, T. (2003). Web retailing adoption: Exploring the nature of internet users web retailing behavior. Journal of Retailing and Consumer Services, 10(2), 81-94.
Pachoulakis, I., & Kapetanakis, K. (2012). Augmented reality platforms for virtual fitting rooms. International Journal of Multimedia & Its Applications, 4(4), 35-46.
Pantano, E., & Di Pietro, L. (2012). Understanding consumer's acceptance of technology-based innovations in retailing. Journal of Technology Management and Innovation, 7(4), 1–19. https://doi.org/10.4067/S0718-27242012000400001

Park, J. H., & Stoel, L. (2002). Information availability on US apparel merchant web sites. Journal of Fashion Marketing and Management, 6(2), 158-176.
Prodanov, C. C., & de Freitas, E. C. (2013). Metodologia do trabalho científico: métodos e técnicas da pesquisa e do trabalho acadêmico. Feevale: Rio Grande do Sul. ISBN 978-85-7717-158-3.
Pupillo, M. (2019). Artificial Intelligence and the fashion industry. Thesis presented at the Luiss Guido Carli University, Italy.
Qasem, Z. (2021). The effect of positive TRI traits on centennials adoption of try-on technology in the context of E-fashion retailing. International Journal of Information Management, 56(102254), 1-11. https://doi.org/10.1016/j.ijinfomgt.2020.102254
Quintino, A. (2019). Title: The impact of chatbot technology attributes on customer experience: an example in telecom. June. https://repositorio.ucp.pt/handle/10400.14/29277
Rauniar, R., Rawski, G., Yang, J. and Johnson, B., 2014. Technology acceptance model (TAM) and social media usage: an empirical study on Facebook. Journal of Enterprise Information Management, 27(1), pp.6-30.
Ringle, C., Da Silva, D., & Bido, D. (2015). Structural equation modeling with the SmartPLS. Brazilian Journal Of Marketing, 13(2) https://doi.org/10.5585/remark.v13i2.2717.
Rogers, E. (1995). Diffusion of innovations. 4th ed. New York: The Free Press.
Roy, D., Santra, S., & Chanda, B. (2020). LGVTON: A Landmark Guided Approach to Virtual Try-On. 1–10. http://arxiv.org/abs/2004.00562
Sampieri, R. (2014). Metodología de la Pesquisa. McGRAW-HILL: Mexico: Santa Fé. ISBN: 978-1-4562-2396-0.
Sanchez-Franco, M. J., & Roldan, J. L. (2005). Web acceptance and usage model: A comparison between goal-directed and experiential web users. Internet Research, 15(1), 21-48.
Saunders, M., Lewis, P. and Thornhill, A. (2009) Research Methods for Business Students. Pearson, New York.
Schepman, A., & Rodway, P. (2020). Initial validation of the general attitudes towards artificial intelligence scale. Computers in Human Behavior Reports, 1(100014), 1-13. https://doi.org/10.1016/j.chbr.2020.100014
Schofield, T., & Scalia, S. (2016, January 19). What Is Consumer Behavior in Marketing? - Factors, Model & Definition. Retrieved October 21, 2020, from https://study.com/academy/lesson/what-is-consumer-behavior-in-marketing-factors-model-definition.html
Shields, A. (2010). Fashion leads online sales growth. Drapers. Available at https://www.drapersonline.com/topics/digital-and-tech/fashion-leads-online-sales-growth. Consulted on 21 January 2021.
Shubhendu, S., & Vijay, J. (2013). Applicability of Artificial Intelligence in Different Fields of Life. International Journal of Scientific Engineering and Research (IJSER), 1(1), 28–35. www.ijser.in
Sileyew, K. J. (2019). Research Design and Methodology. IntechOpen: London DOI: 10.5772/intechopen.85731.
Singh, K. (2007). Quantitative social research methods. SAGE Publications India Pvt Ltd https://www.doi.org/10.4135/9789351507741
Subramanian, C., & Jayalakshmi, M. (2020). Online Shopping : A Study On Consumers Preference For Various Products. 11(3), 2734–2738.
Sun, Q., Wang, C. and Cao, H., 2009. An extended TAM for analyzing adoption behavior of mobile commerce. In: Publisher: Mobile Business, 2009. ICMB 2009. Eighth International Conference on. Dalian, China. USA: IEEE.
Team EA. (2017, May 18). Artificial intelligence: Artificial intelligence is changing the face of online shopping. Retrieved January 12, 2021, from https://expressanalytics.com/blog/artificial-intelligence-is-changing-the-face-of-online-shopping/
Tegmark, M. (2017). Life 3.: Being human in the age of artificial intelligence. Knopf.
Time (2018). What seven of the world's smartest people think about artificial intelligence. Available at http://time.com/4278790/smart-people-ai/.
Tran, A. (2019). Artificial Intelligence in e-commerce: Case Amazon. Thesis presented at the Centria University of Applied Sciences, Finland.
Vasic, N., Kilibarda, M., & Kaurin, T. (2019). The Influence of Online Shopping Determinants on Customer Satisfaction in the Serbian Market. Journal of Theoretical and Applied Electronic Commerce Research, 14(2), 0–0. https://doi.org/10.4067/s0718-18762019000200107
Venkatesh, V. and Davis, F. D., 2000. A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science, 46(2), pp.186-204.
Wagner, M. (2007). Dynamic product imagery shrinks the gap between the online and offline shopping experience. Internet Retailer, April 8, www.internetretailer.com/ article.asp?id21900.
West, D. (2018, October 4). What is artificial intelligence? Retrieved December 02, 2020, from https://www.brookings.edu/research/what-is-artificial-intelligence/

Wolfinbarger, M., & Gilly, M. C. (2001). Shopping online for freedom, control, and fun. California Management Review, 43(2), 34-55.

Yen, Y. Y., Narayanasamy, K., Lin, C. Y., Rasiah, D., & Ramasamy, S. (2017). Consumer's perception towards real-time virtual fitting system in Zulikha. Proceedins of the 6th International Conference of Computing & Informatics, 311-316.

Yim, M. Y. C., Chu, S. C., & Sauer, P. L. (2017). Is augmented reality technology an effective tool for e-commerce? An interactivity and vividness perspective. Journal of Interactive Markets, 39, 89-103. doi: 10.1016/j.intmar.2017.04.001.

Zeithaml, V. A. (1988). Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence. Journal of Marketing, 52(3), 2–22.

Zhang, B., & Dafoe, A. (2019). Artificial Intelligence: American Attitudes and Trends. Center for the Governance of AI Future of Humanity Institute, University of Oxford, 3-109. https://doi.org(Mohanty & Nanda, 2020)/10.2139/ssrn.3312874

Zhang, T., Cao, L., & Wang, W. Y. C. (2017). The impact of virtual try-on image interaction technology on online shoppers' purchase decision. ACM International Conference Proceeding Series, 6–10. https://doi.org/10.1145/3026480.3026484

Zhang, T., Wang, W. Y. C., Cao, L., & Wang, Y. (2019). The role of virtual try-on technology in online purchase decision from consumers' aspect. Internet Research, 29(3), 529–551. https://doi.org/10.1108/IntR-12-2017-0540

Appendixes

Appendix A – Survey

Aceitação por parte do consumidor de sistemas de Virtual Try-On para a compra de roupa online

O presente questionário é realizado no âmbito de uma tese de Mestrado em Gestão de Empresas no ISCTE-IUL, tendo como objectivo analisar e medir a aceitação dos consumidores de sistemas de Virtual Try-On (sistemas de Inteligência Artificial).

A participação neste estudo é voluntária e, todas as respostas são confidenciais e anónimas. Os dados recolhidos serão utilizados única e exclusivamente para fins académicos.

Agradeço desde já a sua disponibilidade e colaboração!

O Virtual Try-On, consiste numa ferramenta de Machine Learning que utiliza visão 3D de modo a permitir que o consumidor possa experimentar através de um dispositivo que pode suportar e operar em plataformas online que permitem a criação e edição de imagens de forma a proporcionar uma simulação de experiência real entre cliente e produto.

1. Por favor indique o seu género.
    - ○ Masculino
    - ○ Feminino

2. Por favor indique a sua idade.
    - ○ 18 – 25
    - ○ 26 – 35
    - ○ 36 – 45
    - ○ 46 – 55
    - ○ > 55

3. Por favor indique o seu nível de escolariedade.
    - ○ Ensino Básico
    - ○ Ensino Secundário

- ○ Licenciatura
- ○ Mestrado
- ○ Doutoramento

4. Por favor indique o seu estado civil.
    - ○ Solteiro
    - ○ Casado/União de Facto
    - ○ Divorcidado
    - ○ Viúvo
    - ○ Prefiro não indicar

5. Costuma comprar roupa online?
    - ○ Sim
    - ○ Não

6. Se sim, com que frequência?
    - ○ 1 vez por semana
    - ○ 1 vez por mês
    - ○ 1 vez de duas em duas semanas
    - ○ 3 a 4 vezes por trimestre
    - ○ 1 vez a cada 3 meses
    - ○ Não aplicável

7. Alguma vez usou sistemas de Virtual Try-On?
    - ○ Sim
    - ○ Não

8. Se não, porquê?
    - ○ Tecnologia desconhecida
    - ○ Prefiro compras físicas
    - ○ Não é confiável

- ○ É dificil de utilizar
- ○ Não apresenta vantagens
- ○ Não é útil
- ○ Não aplicável

Por favor selecione a resposta que mais se adequa à sua percepção desta tecnologia, considerando 1 como "Não concordo" e 5 como "Concordo plenamente".

	1 (Não concordo)	2	3	4	5 (Concordo plenamente)
Usar Virtual Try-On iria permitir-me concretizar a tarefa de experimentar roupa mais rapidamente					
Os sistemas de Virtual Try-On poderias melhor a minha qualidade de vida na tarefa de experimentar roupa.					
O Virtual Try-On poderia melhorar a minha experiência de compras online.					
O Virtual Try-On poderia permitir mais controlo sobre a experiência online.					
O uso do Virtual Try-On pode aumentar a eficácia das compra online.					
As vantagens do Virtual Try-On em processos de utilidade superam as desvantagens.					
O Virtual Try-On atenderia às minhas necessidades pessoais de maneira mais adequada do que as compras online convencionais.					

	1 (Não concordo)	2	3	4	5 (Concordo plenamente)
Aprender a operar sistemas de Virtual Try-On seria fácil para mim.					
Eu acharia fácil fazer com que os sistemas de Virtual Try-On fizessem o que eu quero.					
Seria fácil para mim tornar-me hábil no uso do sistema Virtual Try-On.					
Os sistemas de Virtual Try-On seriam fáceis de navegar para mim.					
Os sistemas de Virtual Try-On não seriam confusos para mim.					

	1 (Não concordo)	2	3	4	5 (Concordo plenamente)
O Virtual Try-On para comprar roupas é muito eficiente em termos de tempo.					
O Virtual Try-On para comprar roupas permitiria-me realizar outras tarefas ao mesmo tempo (por exemplo, cozinhar).					
O Virtual Try-On para compras de roupas ajudaria-me a gerir melhor o meu tempo.					
O uso do Virtual Try-On diminuiria o tempo gasto em compras online.					
O Virtual Try-On consome menos tempo do que a prova física.					

	1 (Não concordo)	2	3	4	5 (Concordo plenamente)
Usar o Virtual Try-On pode dar-me acesso a mais informações sobre o produto.					
Usar o Virtual Try-On permitir-me-ia ter informações mais precisas sobre o produto.					
O Virtual Try-On para compras de roupas apresentaria informações adequadas e verdadeiras.					
Usar o Virtual Try-On daria-me mais confiança sobre as informações do produto.					
O Virtual Try-On forneceria informações que normalmente procuro e geralmente não estão disponíveis.					

	1 (Não concordo)	2	3	4	5 (Concordo plenamente)
Informações justas e transparentes sobre as políticas de privacidade afetariam o compromisso uso de sistemas Virtual Try-On.					
O Virtual Try-On contribui para o aumento da taxa de desemprego.					
Os riscos da cibersegurança interfeririam no uso de sistemas Virtual Try-On.					
Considero o uso do Virtual Try-On um meio de provar minhas preocupações éticas.					
O uso de Virtual Try-On está associado a comportamentos antiético.					
As minhas preocupações éticas interfeririam no uso do Virtual Try-On.					

	1 (Não concordo)	2	3	4	5 (Concordo plenamente)
Tenho uma opinião positiva sobre o uso do Virtual Try-On para compras online.					
Os sistemas de Virtual Try-On são uma ferramenta positiva para compras online.					
O uso de sistemas de Virtual Try-On para compras online é uma ideia inteligente.					
Os sistemas de Virtual Try-On valem a pena usar no processo de compra online.					
Eu planeio usar sistemas de Virtual Try-On para fins de compras online regularmente no futuro.					
O uso de sistemas de Virtual Try-On na experiência de compra online seria agradável.					

	1 (Não concordo)	2	3	4	5 (Concordo plenamente)
Pretendo começar a usar sistemas Virtual Try-On para fazer compras online.					
Pretendo usar com frequência os sistemas Virtual Try-On para realizar compras online.					
Supondo que eu tenha acesso a sistemas Virtual Try-On para processos de compras online, pretendo adotá-lo.					

Appendix B – Concept, Question, Theory and Measurement

Table B - Relation between the variables, respective questions, theory, and measurement applied.

Concept	Question	Theory	Measurement
Demographic Data			
Demo1	Please state your gender.	To establish a link between the research area and the respondent	Closed-ended question.
Demo2	Please state your age.		
Demo3	Please indicate your level of education.		
Demo4	Marital status.		
Actual Use			
AU1	Do you usually buy clothes online?	To establish a link between the research area and the respondent	Closed-ended question.
AU2	If yes, how frequently?		
AU3	Have you ever used Virtual Try-On systems?		
AU4	If not, why?		
Perceived Usefulness			
PU1	Using Virtual Try-On would enable me to accomplish the task of trying clothes more quickly.	(Zhang et al., 2019) (Yen et al., 2017)	5-point Likert scale
PU2	Virtual Try-On systems could improve my quality of life within clothes try-on task.		
PU3	Virtual Try-On could improve the online shopping overall experience.		
PU4	Virtual Try-On could give more control on the online clothes experience.		
PU5	The use of Virtual Try-On could increase the effectiveness of online purchase.		
PU6	The advantages of Virtual Try-On on usefulness processes outweigh the disadvantages.		
PU7	Virtual Try-On would address my personal needs more properly than conventional online shopping.		
Perceived Ease of Use			
PEU1	Learning to operate Virtual Try-On systems would be easy for me.	(Liu et al., 2010) (Yen et al., 2017)	5-point Likert scale
PEU2	I would find it easy to get the Virtual Try-On systems to do what I want it to do.		
PEU3	It would be easy for me to become skillful at using the Virtual Try-On system.		
PEU4	Virtual Try-On systems would be easy to navigate.		
PEU5	Virtual Try-On systems would not be confusing for me to use.		
Perceived Time Consumption			

PTC1	Virtual Try-On for apparel shopping is very time efficient.	(Vasic et al., 2019) (Chang & Wang, 2011) (Zeithaml, 1988)	5-point Likert scale
PTC2	Virtual Try-On for apparel shopping would allow me to perform other tasks at the same time (e.g., cooking).		
PTC3	Virtual Try-On for apparel shopping would help me to better manage my time.		
PTC4	Virtual Try-On usage would decrease time spent on online shopping.		
PTC5	Virtual Try-On is less time consuming than physical try-on.		
Perceived Accuracy			
PA1	Using Virtual Try-On could give me access to more information about the product.	(Dennis, 2017) (Vasic et al., 2019) (Limbu et al., 2011)	5-point Likert scale
PA2	Using Virtual Try-On would enable me to have more accurate information.		
PA3	Virtual Try-On for apparel shopping would present adequate and truthful information about clothes.		
PA4	Using Virtual Try-On would give me more confidence about a product information.		
PA5	Virtual Try-On would give information that I usually search for and usually is not available.		
Ethical Concerns			
EC1	Fair and transparent information regarding privacy policies would affect engagement towards Virtual Try-On systems usage.	(Du & Xie, 2020)	5-point Likert scale
EC2	Virtual Try-On contributes for an increasing unemployment rate.		
EC3	The risks of cybersecurity would interfere with my usage of Virtual Try-On systems.		
EC4	I consider the usage of Virtual Try-On a mean to prove my ethical concerns.		
EC5	The usage of Virtual Try-On is associated with unethical behavior.		
EC6	My Ethical concerns would interfere with the usage of Virtual Try-On.		
Attitude Towards Usage			
ATU1	I think positively about using Virtual Try-On for online shopping.	(Fishbein and Ajzen, 1975) (Ajzen and Fishbein, 1980) (Hassanein and Head, 2007)	5-point Likert scale
ATU2	Virtual Try-On systems are a positive tool for online shopping.		
ATU3	Using Virtual Try-On systems for online shopping is a wise idea.		

ATU4	Virtual Try-On systems are worth to use within the online shopping process.		
ATU5	I plan on using Virtual Try-On systems for online shopping purposes on a regular basis in the future.		
ATU6	Using Virtual Try-On systems within the online shopping experience would be pleasant.		
Behavioral Intention			
BI1	I intend to start using Virtual Try-On systems to perform online shopping.	(Fishbein and Ajzen's, 1975) (Liu et al., 2005)	5-point Likert scale
BI2	I intend to frequently use Virtual Try-On systems to perform online shopping.		
BI3	Assuming I have access to Virtual Try-On systems for online shopping processes, I intend to adopt it.		