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THE IMPACT OF TECHNOLOGY IN DISTRIBUTION

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"The first step is to establish that something is possible; then probability will occur."

Elon Musk

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Abstract

Nowadays we are facing a digital era submerse in technology. Information technology is embracing every industry, causing significant impacts and leading to considerable adaptations. The distribution industry is no exception. This study aims to collect evidence supporting that distribution channels are still not benefiting from information technologies full potential. Furthermore, this investigation proposed to understand and analyse the factors that can influence customer mind-set towards technology, either positively or negatively, helping to predict technology acceptance and use more accurately.

Moreover, in order to contextualize the impact of technology in distribution, this investigation approached a specific technological innovation, the autonomous vehicles, who promise to revolutionise distribution, particularly in terms of mobility. This dissertation intends to analyse autonomous vehicles growth and predict their impact in a global perspective and objectively in the distribution industry.

In this regard, an online survey was conducted, allowing the collection of most up-to-date information about distribution channels, in terms of efficiency and potentialities, in addition to collecting updated data regarding autonomous vehicles beneficial value, as well as, the drawbacks and concerns influencing the acceptance and use of this innovative technology.

Thus, it is conclusive that there is clearly a room for improving the current distribution channels, concretely in terms of technological improvements. Autonomous vehicles promise to be a key disruptive technology, however, they will take time to be implemented, as this technology is still being developed. Although, as soon as it reaches its full potential, it is expected that autonomous vehicles face a sudden massive adoption.

Key words: Distribution Channels; Technology; Acceptance and Use; Autonomous Vehicles

JEL Classification:

L91 – Transportation General

O33 - Technological Change: Choices and Consequences; Diffusion Processes

Y40 - Dissertations

Resumo

Atualmente, estamos a enfrentar uma era digital submersa em tecnologia. A tecnologia da informação está inserida em várias indústrias, causando impactos significativos e levando a adaptações consideráveis. O setor da distribuição não é exceção. Este estudo tem como objetivo recolher evidências que sustentem que os canais de distribuição ainda não estão a beneficiar o potencial das tecnologias da informação. Esta investigação pretende analisar os fatores que podem influenciar a mentalidade do cliente em relação à tecnologia, positiva ou negativamente, ajudando a prever a aceitação e utilização da tecnologia com mais precisão.

De forma a contextualizar o impacto da tecnologia na distribuição, esta investigação abordou uma inovação tecnológica específica, os veículos autónomos, que prometem revolucionar a distribuição, principalmente em termos de mobilidade. Esta dissertação pretende analisar o crescimento dos veículos autónomos e prever o impacto dos mesmos, numa perspetiva global e especificamente no setor da distribuição.

Nesse sentido, foi realizada um inquérito on-line, permitindo recolher informações atualizadas sobre os atuais canais de distribuição, em termos de eficiência e potencialidades, recolhendo ainda dados sobre os benefícios trazidos pelos veículos autónomos, bem como as desvantagens e preocupações que influenciam a aceitação e o uso desta tecnologia inovadora.

Assim, é conclusivo que existe um espaço para melhorar os atuais canais de distribuição, concretamente em termos de melhorias tecnológicas. Os veículos autónomos prometem ser uma tecnologia disruptiva, no entanto necessitam de tempo para serem implementados, uma vez que a tecnologia ainda está em desenvolvimento. Assim que atinjam todo o seu potencial, é esperado que os veículos autónomos enfrentem uma adoção repentina e massificada.

Palavras-Chave: Canais de Distribuição; Tecnologia; Aceitação e Uso; Veículos Autónomos

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List of Abbreviations

ADS – Advanced Driver System

AV – Autonomous Vehicle

B2B – Business-to-Business

B2C – Business-to-Consumer

IT – Information Technology

OSAT - Open-Source Appropriate Technology

R&D – Research and Development

RQ – Research Question

SAE – Society of Automotive Engineers

SCM – Supply Chain Management

SGV – Self-Guided Vehicles

SME – Small and Medium Sized Company

UTAUT – Unified Theory of Acceptance and Use of Technology

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Chapter I - Introduction

1.1 Contextualization

Over the last two decades, technology has been causing a relevant impact in many industries, in the up-rise and self-improvement of many industries, or in the development of new revolutionary industries, this digital age where we live in has revolutionized many industries and the distribution industry is no exception.

Technology has always been valued for its potential of increasing economies competitiveness on the international market. Consequently, economies are changing dramatically, largely as a result of emerging markets threat and competition, the exponential development of new technologies, sustainability policies and consumer preferences about the acquisition of goods and services. Hence, information technology (IT) and, furthermore, innovation can be seen as the driving force in order to introduce new developments and improvements, companies constantly need to adapt their vision and strategic focus, in order to keep up and benefit from the potentialities of technology. Although, investing in IT, despite the numerous advantages, also brings new challenges.

Technology is changing people in many ways, from relationships, to attitudes, tastes and routines (Huang & Benyoucef, 2013). Human preferences and expectations will keep shifting proportionally to the technological advances, especially among the millennials generation, indicating that companies will need to be continuously aware of the technological improvements and the potential impact caused, even before the implementation of those technologies occur, in order to assure competitive advantage, by delivering customers what they want and keeping up their expectations.

Due to the high technological development across industries, new technologies can only be considered and implemented, when fully accepted by the final consumer. Therefore, their acceptance is a key factor for the success of new technologies, implying a deep knowledge of the consumer in order to meet their expectations and to ensure greater reliability regarding the social acceptance of these technologies.

Mobility is at the core of our society. Better and faster solutions allow for a greater potential market, a faster alignment of supply and demand, more specialization and higher productivity. Changing from muscle to steam to fuel powered transport was one of the major enablers of the industrialization and the explosion of global economic growth in the last two centuries, improving the life of billions of people.

Automation promises to overcome one of the last obstacles to nearly unlimited growth of mobility, which is the human driver. Even though humans are excellent drivers, they have to rest, make errors, and their time is expensive. Autonomous vehicles (AVs), or self-guided vehicles (SGVs), can drive without a human driver. The looming revolution is comparable to the industrial revolution from workshops, where each product required the full attention and effort of an artisan during the whole production process, to automated mass production, where one engineer oversees the production process creating thousands of units per day.

AVs promises to make mobility cheaper than ever, significantly reducing distribution costs to a minimum, and minimize externalities per distance traveled, making mobility faster and safer. However, AV technology is still not globally consensual, as many concerns are still challenging AVs massive adoption, principally regarding to the assured safety of these vehicles.

Customer acceptance of AVs analysis is crucial, as most studies based on AV technology, focuses on technology development, revealing a gap in consumer acceptance of this potentially disruptive technology. Therefore, further research is required, in order to understand the acceptance and use of this technology, and integrate consumer insight into a field that has been guided, most exclusively, by technological insight. To incorporate AVs in planning and policy strategies, extensive knowledge is required about this innovative technology, in order to reliably predict AVs potential impacts on mobility and, consequently, on the distribution industry (Rosenzweig & Bartl, 2015).

1.2 General Objective

The main objective of this dissertation is to collect data that contributes for the incentive of technological improvements in distribution, with a specific approach towards AVs as a disruptive technology, while additionally alerting future studies, for the psychological constraints influencing AVs acceptance and adoption, particularly in the distribution industry.

1.3 Specific Objectives and Research Questions

In order to fulfil the main goal of this dissertation, specific insights were considered, which, aligned together, will seek to answer the three research questions (RQs) of this dissertation, formed under the purpose of contributing to the achievement of the general objective. In Table 1, exposed underneath, are presented the specific objectives and the RQs, with a contextualization of the literature review, introduced further up in chapter II: Table 1.

Table 1 – Specific Goals and Research Questions

Specific Objectives	Research Questions	Literature Review
Acquire a global outlook of the current distribution channels and collect data in whether or not there is room for improvement	RQ 1 - Are the current distributions channels efficient?	Galkin, 2015; Andrejić & Kilibarda, 2016; Fayaz & Azizinia, 2016
Understand and analyse the conditioners that can influence customers mind-set towards technology	RQ 2 - How can Information Technology acceptance and use, be predicted and assured?	Venkatesh *et al.*, 2003; Im *et al.*, 2011; Huijts *et al.*, 2012; Venkatesh *et al.*, 2012; Venkatesh *et al.*, 2016; Clark *et al.*, 2016; Litman, 2017; Lavasani *et al.*, 2017; Leicht *et al.*, 2018; Adnan *et al.*, 2018; Ketron & Naletelich, 2019
Analyse AVs growth and predict their impact in a global perspective and objectively in the distribution industry	RQ 3 - Can Autonomous Vehicles be a dynamic answer and assume a disruptive technology role?	Rathod, 2013; Shanker *et al.*, 2013; Pillath, 2016; Schoettle & Sivak, 2014; Litman, 2017; Adnan *et al.*, 2018; Mirzaeian *et al.*, 2018; Bansal *et al.*, 2016; Slowik & Sharpe, 2018; Fagnant & Kockelman, 2015; Clark *et al.*, 2016; Endsley, 2017; Chen *et al.*, 2016; Haboucha *et al.*, 2017; Oliver *et al.*, 2017;
Collect empirical data regarding AVs beneficial value, as well as, the drawbacks and concerns influencing the acceptance and use of this innovative technology		

1.4 Dissertation Structure

In line with the proposed general and specific objectives described above, along with the RQs, this dissertation was developed under the following structure:

- Chapter I – Introduction: Contextualization of the investigation, giving an insight regarding the general objective of this dissertation, along with the specific objectives and the RQs formulated, in line with the purpose of this thesis.

- Chapter II – Literature Review: Presentation of the secondary data collection. A critical analysis of a segment of a published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles, allowing the development of the research through the exposure of realistic scenarios and concepts, contributing to the identification of appropriate research methodologies and, forwardly, to the analysis of the results and findings.

- Chapter III – Methodology: Research strategy that frameworks the way in which the investigation is going to be undertaken, this is, the identification of the methods and processes utilized, in order to follow the objectives of this study. Definition and validation of the primary data collection, more precisely, characterization of the sample defined and pre-test validation of the online survey.

- Chapter IV - Data Analysis: Analyzation of the data collected from the online survey, using statistical methods and tools, in order to achieve a better and more diversified comprehension of the results, which will forwardly, be discussed and compared with the bibliographic information collected in the literature review.

- Chapter V – Conclusions: Presentation of the findings and results, validating the achievement of the proposed objectives, while answering the RQs. Description of the limitations concerning the research, in terms of barriers towards the topic of the study and in terms of inefficiencies regarding the data collection methods. Contributions of this study to services and technology management. Individual recommendations and guidelines for future investigations regarding the topic of this dissertation.

Chapter II - Literature Review

2.1 Distribution Channels

A distribution channel is a chain of businesses or intermediaries through which a good or service passes until it reaches the final buyer or the end consumer, in other words, the main goal of a distribution channel is to bridge the gap between producers and consumers by adding value to products or services (Kim & Frazier, 1996). Distribution is the definition of moving a good or service from one place to another, either in terms of Business-to-Consumer (B2C) relation, Business-to-Business (B2B) relation, or even exclusively for geographic purposes. Distribution channels can include wholesalers, retailers, distributors, and even the internet (Pitt *et al.*, 1999), which means distribution channels are rather diverse, varying from short or long, or even a combination of both, depending on the amount of intermediaries required to deliver or make, a final product or service (Coughlan *et al.*, 2006).

Distribution channels may be split into two different forms: direct and indirect. Direct channels allow the consumer to make purchases from the manufacturer, while indirect channels allow the consumer to buy the good from a wholesaler or retailer. Indirect channels are typical for goods that are sold in traditional stores, for example, small family businesses. Generally, if there are more intermediaries involved in the distribution channel, the price for a good may increase. Conversely, a direct or short channel may mean lower costs for consumers because they are buying directly from the manufacturer, however, this insight may not necessarily be so linear (Fayaz & Azizinia, 2016).

Forwardly, it is possible to identify three main types of distribution channels, beneath a combination of a producer, wholesaler, retailer and the final consumer.

The first channel is the longest as it includes each of the four parts mentioned above. Starting in the producer, who first sells its product to a wholesaler who then sells to a retailer, who afterwards sells the product to the end consumer. Some examples of this type of channel are the paper industry and the wine industry.

The second channel cuts out the wholesaler, which means that the producer sells directly to a retailer who sells the product to the end consumer, comprehending only one intermediary. Franchised based businesses are a good example of this type of distribution channel.

The third and final channel is a direct-to-consumer based model where the producer sells its product directly to the end consumer, which is a commonly used model in e-commerce. Amazon and Apple are some examples, while many firms practice this type of distribution combined in addition to re-selling it to wholesalers and retailers, like Heineken.

Distribution channels have become the "underground" strategy in the B2B marketing portfolio, several times forgotten and almost seen as dispensable for numerous authors, mostly marketers, who inclusively do not give much thought to distribution strategy. This contempt towards distribution can be justified from the conceptualization of the term and how it is interpreted, being commonly reduced to the movement of a physical product from one place to another. Furthermore, in small and medium sized companies, the distribution strategies are exclusively assumed and discussed by the top of the hierarchy, consequently generating a knowledge gap in this matter, which makes rare to find new case studies and findings about innovative channel design and management.

Although, as many studies and researches prove, a well-planned, implemented and executed, distribution strategy can significantly boost the top line of a business, on the other hand, the opposite, can also be verified, as a poor management of a company distribution channels, can lead to considerable losses. For many B2B service firms, distribution channels are partially intangible and take creativity to apply (Galkin, 2015). For example, it is possible to create a private-label version of a service and offer it to large partners to offer to their customers, or instead create a packaged offering, joining forces with other companies, in order to offer a larger suite of services (Andrejić & Kilibarda, 2016).

Following the previous reasoning, it is always possible to improve distribution channels performance. Specifically in the Portuguese market, distribution channels are quite inefficient in terms of technological advances and mechanisms. In order to develop the current distribution channels, several changes must occur, while some involve avid investments, others can demand a cultural change or adaption. Companies must assure distribution strategies as a priority, devoting resources to channel management, building programs and relationships to drive revenue through the different channels, avoiding pricing conflicts and addressing conflicts swiftly. Developing measurements and track performance, keeping

aware of the best sales performers and better understanding the efficiency and profitability of each channel (Galkin, 2015; Andrejić & Kilibarda, 2016).

2.2 Technology Growth and Adoption

Technology is an ambiguous and wide term, which leads to several different interpretations and, consequently, leads to countless definitions from different authors. Throughout the years, technology has been evolving, therefore, the definition of technology has also been suffering adjustments over the years. Emmanuel Mesthene defined technology in the 70's as "The organization of knowledge for the achievement of practical purposes" (Mesthene, 1970). Furthermore, in 1993, Ian Barbour defined technology as "The application of organized knowledge to practical tasks by ordered systems of people and machines" (Barbour, 1993). By "organized knowledge", Barbour intended to include both technologies based on practical experience and based on scientific theories, whereas the definition encompassed the production of goods and delivery of services, based on social institutions, as well as the hardware of technology.

Technology involves mechanisms used as means to practical ends, manifested in the material world as expressions of intelligence. Forwardly, in the 21st century, William Brian Arthur conceptualized technology in a 3-way definition, firstly as "a mean to fulfil human purposes", being a method, a process, or a device. Secondly, "Technology is an assemblage of practices and components" and lastly "The entire collection of devices and engineering practices available to a culture" (Arthur, 2009).

While some authors have been desperately looking for defining and conceptualizing technology, others have been constantly searching for new applications and new methods for exploring technology. Industrial innovation is becoming more open, requiring changes in how firms manage innovation. External sources of knowledge become more prominent, while external channels to market also offer greater promise. This complicates the evaluation of early-stage technology projects, which often involve significant technical and market uncertainty.

Due to the constant requirements for innovating in some markets, creativity and change were a demand, or else, there would be a huge stagnation risk, which, in such a digital era, could

traduce in losing the track towards the competitors, leading to understandable failure. Therefore new sources for innovating started to emerge, being open innovation and Research and Development (R&D), one of the most knowledgeable and revolutionary of all (Enkel *et al.*, 2009).

2.2.1 Open Innovation

Some companies started to understand that, new metrics could help a firm focus more upon external sources of innovation to enhance its business model, instead of exclusively focusing in internal sources. Just like crowdfunding, open innovation had similar insights, the only difference between them is that in crowdfunding the aim is to obtain financial assets, while in open innovation the purpose is centred in getting the new ideas, opinions, and skills, different from what would be expected to get from inside the company sources.

The reason for this externalities to succeed, are mostly justified by the lack of inside knowledge, contradicting conformism and behaviourist stagnation, while, on the other hand, stimulating out of the box thinking and differing from the standardized thoughts and patterns. Companies started to realize that not all good ideas come from inside their organization, besides that not all ideas from inside the companies turn out into innovating and successful ideas (Chesbrough & Crowther, 2006).

Many companies reduced the massive investment in their own R&D departments, but instead started to balance the inside and outside gather of knowledge and innovation sources. As a reward for adopting this strategy, these companies saw vast growth, as this modern approach revealed to bring more benefits than risks. Samsung, General Eletric, Proctor and Gamble, Apple and Lego are just a few examples, of companies that deeply benefited from open innovation strategies, either as a sudden outgrowth, like Apple, or as a "survival" strategy, like Lego, who even created a market niche due to external sources of innovation. On the other hand, companies like Nokia and Kodak completely went down, for being afraid of taking risks and obtaining external sources of knowledge, but instead adopted a conservative strategy, which resulted in stagnation and furthermore, in the failure of these companies, that were, at some point, market leaders in their respective industries.

2.2.2 Appropriate Technology

In 1973, Dr. Ernst Friedrich Schumacher came up with the concept of "Intermediate Technology" in is work *Small is Beautiful.* Initially this concept was focused on the idea that technologies are specific to particular combinations of inputs. Schumacher insisted that technology need and application should be flexible and appropriate to the context of its use. He was undoubtedly against large capital-intensive measures and projects, as he defended that less developed countries, with less financial capacities, do not require the same inputs and do not face the same barriers compared to rich and developed countries, with other financial capacities, educated people and infrastructures. This movement tended to create new technologies and transfer existing ones for small-scale, with less financial capital demands, aiming towards decentralization and energy-efficiency. Nevertheless, it would be unpractical to avoid completely that countries use technologies that do not match their level of development (Basu. & Weil., 1998).

Thus, the concept developed to "Appropriate Technology". The term often appears in regard of economic development, representing an alternative of transferring high technologies, evolving high investments, from developed countries and societies, to developing and less developed nations. Naturally, there are different types of "appropriateness" depending on the type of society, financially and culturally. While less-developed countries attempted to improve efficiency and performance, in developed countries environmental issues and sustainability were already a consideration since the late 1970's (Basu. & Weil., 1998).

Nowadays appropriate technology is both seen as a mean to achieve a determined result with low investments and simple technological implementations, and, on the other hand, a technological measurement privileging environmental and social issues, which is a growing tendency worldwide, and not exclusively in developed countries. Open source principles have emerged, leading to the concept of Open-Source Appropriate Technology (OSAT), as a new model of enabling innovation and sustainable development.

As mentioned before, there are several constraints concerning open innovation methods, which have been significantly reducing over the years, mostly due to the positive results achieved in industries and companies, where open source policies were adopted.

It's vital to identify the biggest obstacles that can delay OSAT's scaling, either economic, cultural, ethical or political, as the urgency of reaching sustainable development goals keeps

rising, alongside with climate destabilization, energy resources (way to) extinction, such as oil and coal. Developed countries and developing countries observe and analyse OSAT, in entirely different ways, due to the priorities established and issues faced in these types of societies. In developed countries appropriate technology can be seen as inferior technology, due to the investment costs, as in these societies it is common to associate low prices to low quality, which is a stereotype that should demandingly be overcome. Furthermore, funding issues, institutional support and logistics limitations are the main constraints in view of appropriate technology adoption. The key answers to these barriers are open source measurements (Zelenika. & Pearce, 2011).

Open source, alongside with internet, instigated the appearance of new concepts that absolutely revolutionised entire industries, from Crowdsourcing to Crowdfunding. Online collaboration and external sources of knowledge and financial capital increased exponentially since the beginning of the 21st century, enabling start-ups, small and medium sized companies (SME's) and even industries to face a significant growth. These sourcing models deeply contributed to the purpose of reaching sustainable development, besides contributing to reduce the gap between developed countries and developing countries (more than reducing the gap, it influenced the development of poorer countries, with less resources and know-how), as it incentives knowledge sharing, as well as allowing financial and infrastructural transfer and gathering (Mitra, 2012).

2.3 Impact of Technology on Distribution, Benefits and Drawbacks

Since the last 40 years, the concept of Technology has been interconnected with progression, change and development. It is relatively easy to identify the disruptive power of technology, either in terms of productivity or in terms of efficiency, and, consequently, in terms of results. Nowadays, more than ever, technology has been making necessary for companies to be constantly aware of innovations, changes, or trends, than can be shaped every day.

The ongoing globalization, alongside with the progresses in communication and marketing strategies, implied adaptations concerning distribution and Supply Chain Management (SCM). While this change was initially demanded in physical terms, now there is also a need to adapt to the information flows, as a better relation and response to the emerging technologic necessities, can make a difference in terms of standing out from the competition.

In order to guarantee a better business performance, it is necessary to assure that distribution is supported by ITs.

Hence, distribution and its channels can entirely influence the whole business performance and the connection with information systems, can be a vital differentiator in the success of an enterprise. IT within distribution and SCM can raise the efficiency of a company by making information flow more effective in and out of the business, improving competitive priorities like quality, price, time, flexibility and responsiveness of production (Şteţ, 2014; Güles *et al.*, 2012).

One of the most significant characteristics in today's business world is the recurrent change in internal and external environment of organizations. In such an environment, the success of a business depends more on obtaining information and using it in line with the aims of the business, rather than on aspects like capital and labour force. In this context, the basic dynamics that entail businesses use of IT are technological, economic, political, cultural and environmental factors, which grants a significant contribution to companies dealing with increasing global competition.

IT is progressively becoming important in the collection, procession, preservation and transmission of data. Thus, IT is also an effective mean for businesses, as it offers innovative ways to perform more efficiently than their competitors and gain competitive edge. IT has a strong influence on the business cost structure and provides opportunities for differentiation, affecting competition primarily in three ways: by changing the structure of the industry; by creating competitive edge; and allowing new job positions to be created. IT can be used as a strategic mean of obtaining competitive advantage, improving efficiency and performance (Porter & Millar, 1985).

IT applications, therefore, have positive impacts on the business performance by itself. Most of the companies are not able to sustain their business without the support of IT. Gathering, storing and processing data helps companies to increase their efficiency and effectiveness. Besides operational efficiency, companies also utilize IT for supplier, sales channel and customer collaboration in order to meet customer requirements in the most effective and fastest way. IT also enables companies to monitor operational and organizational performances and manage the complex processes like product development. Information plays a critical role in the success of an enterprise in the recent dynamically changing

business environment. Accessing and processing information enables companies to sustain their competitiveness in this challenging atmosphere.

ITs matured in business life in time and based on more realistic bases and needs, can bring in significant incomes and enable them to reach to promised efficiency levels. The Internet with its structure open to general use, low cost compared to value-added networks, its use without special rules and worldwide access feature, plays a strategic role in the spread of electronic processes among enterprises. At this point, it is almost certain that there are two main reasons for businesses to use the Internet. One of them is the low establishment and application cost of the Internet thanks to its characteristics by its nature. The other is that due to its high influential power on the environment, the Internet improves opportunities resulting from new cooperative relations more effectively (Folinas *et al.*, 2004).

In recent years, with the development of computer systems and communication technologies, IT supported distribution applications, while starting to be used more commonly considering the huge potential regarding SCM and distribution. Considering these two powerful solutions together, distribution models and processes that are supported by IT applications have presumably higher significant impacts on the business performance.

The implementation and development of IT represents a cutting edge in data collection, procession and distribution, making it easier to integrate independent components, contributing globally to distribution and supply chain performance, by cutting in costs, time and improving quality. Especially, developments in network technology lead to radical changes in commercial affairs, offering new methods to businesses for growing their markets, presenting their products and services, increasing their efficiency, while earning customers and preserving those (Papazoglou *et al.*, 2000).

One major problem concerning distribution in B2C relationship, is the lack of capacity from the customer side to monitor on time the process of a certain ongoing distribution. In other words, there should be a single block chain public ledger that could allow both ends, from suppliers to customers, to track, at any moment, record of a certain order, from the moment that it is placed, encompassing the shipment phase and the final delivery. The stagnation of IT development in the goods distribution sector is noticeable, particularly when compared to other markets that can relate to the obstacles faced in the goods distribution process (Wu *et al.*, 2017). For example, the Uber application or other replaceable applications with the same

outcomes, enable a constant tracking of location, movement and time-lapse, from both the driver and customer.

Despite the huge positive contributions that ITs can bring to distribution, there is also a downside, or, in other words, a barrier that needs to be overcame. Every industry that required the introduction of technology in order to improve, had to face the problem of inertia and denial to change, not just from employees and other participants, but also from the protocols and working papers. Technology requires a deep change, not only in physical terms, but also in terms of environment, mind-set and, as said, willing to change. The better the general reaction to the intervention of technology and innovation, higher the probability of the company to be successful, regarding those applications.

Therefore, embracing technology and its implied changes in distribution, can reveal immensely positive for various reasons, but mostly because it strengthens the transparency regarding the process of distribution, building a trustworthy feeling beneath the client. Although, it is impossible to deny that these adjustments imply a significant investment, which can hinder and delay the acceptance from SME's (Wu *et al.*, 2017).

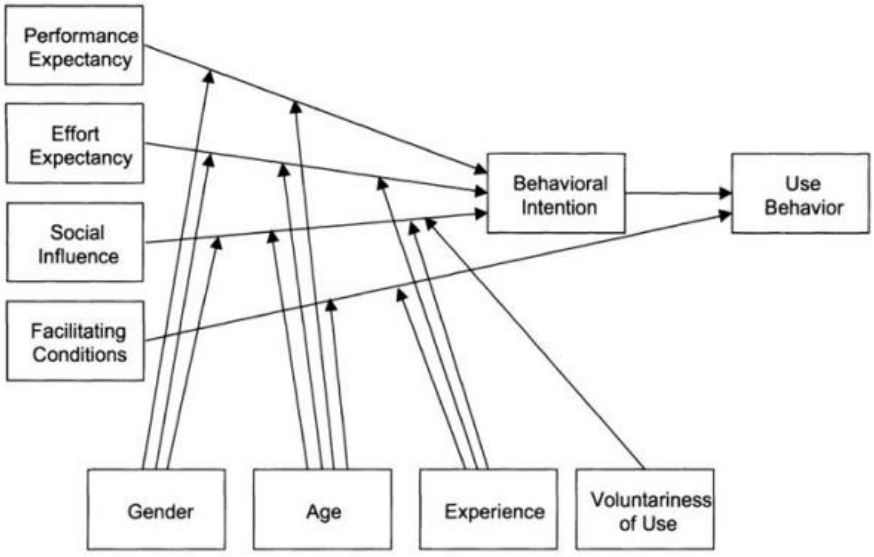
2.4 Acceptance and Use of Information Technology

The usage of technology has been a popular topic during the last decades. While numerous authors discussed how far technology could go, others debated how far society wanted technology to go. Although both discussions may seem similar, they are completely different. Technology visibly brought new insights to worldwide industries, although, technology adoption varies significantly from country to country, mainly due to consumer acceptance, deeply influenced by cultural patterns and tendencies, regarding perceived ease of use, perceived risk and perceived usefulness.

In order to benefit from IT full potential, it was a certainty that adaptations needed to occur. Culturally, the human being was not ready for such an impact as the one lived in the beginning of the 21st century. In the lights of the Unified Theory of Acceptance and Use of Technology (UTAUT), it's perceptible that technology acceptance dramatically varies from continent to continent, country to country and even city to city (Venkatesh *et al.*, 2003).

UTAUT was conceptualized by mixing different models regarding the adoption of technology and innovation. Initially, this theory consists in analysing different variables, emotional and psychological factors, namely, performance expectancy, effort expectancy, social influence and facilitating conditions, while taking in account moderating variables such as gender, age and experience – Figure 1.

Figure 1 – Unified Theory of Acceptance and Use of Technology



Source: Venkatesh *et al.* (2003)

UTAUT aimed to work around the traditional limitations of previous models concerning this topic, integrating and taking into account different studies, with special care towards the gaps and limitations of those exact theories. Furthermore, this theory intended to reduce subjectivity regarding technology acceptance, by trying to establish patterns and profiles. Nevertheless, this topic will always be subject to a certain level of subjectivity, in fact, technology adoption is as much a cultural issue as a rational decision-making process (Im *et al.*, 2011).

UTAUT has been serving as a base-line model, aiding in the comprehension of technology adoption and expanding the theoretical boundaries of this theory, while emphasizing the supplementary utility of a certain technology. Understanding the acceptance and adoption of technology requires different approaches, while a practical approach can be more incisive, it

is indispensable to keep aware of the intrinsic influencing variables. Many studies focused on a limited set of factors that can influence public acceptance, instead of aiming towards a comprehensive framework involving psychological theories and empirical approaches, including key aspects influencing technology acceptance. A modern methodology is required and a wide range of psychological factors must be taken into account. Characteristics such as personality, social norms, behavioural reactions and attitude are too subjective to be standardized in short measurements. It is important to keep aware of the impact that a designated technology can have, in a process, in a company, market or in society in general, nevertheless, it's vital to analyse and study people's perceived reaction towards the introduction of that same technology. Assuring public acceptance of technology is crucial and a huge step to guarantee a successful implementation of technology into society (Huijts *et al.*, 2012).

Furthermore, with the objective of reducing even more the limitations of UTAUT, three new constructs were integrated in the theory. Hedonic Motivation can be defined as the pleasure felt by using a certain technology, which is now seen as a major conditioning factor in analysing technology acceptance and use directly.

Price Value is the second new construct, although it was already seen as relevant characteristic to keep in mind, only was individualized as a key aspect, years after the original UTAUT was conceived. Nowadays, price is usually the first aspect that influences both, costumer perceived quality of a product or service, and costumer intention and importance to acquire that product or service. In fact, price/quality is the relationship that mostly influences someone's opinion and decision, together with the authentic need of that product/service (Venkatesh *et al.*, 2012).

The last construct added was Habit, which is interconnected with experience, although, the two concepts are distinct. Experience identifies and standardize the usage of a technology, emotionally and physically, deeply depending on the designated time period. Habit, on the other hand, relates much more with conformity and comfortability, being defined as the tendency of people to perform behaviours automatically, following a determined behavioural pattern, depending on contingencies such as, willingness to change, fear of making mistakes and, as said before, conformity.

In order to create habit, experience is required, though experience alone does not implies nor forms habit. Besides, experience can result in the formation of different stages of habit

towards a certain target technology, depending on the familiarity and interaction level regarding that technology (Venkatesh *et al.*, 2016).

Over the last decade, the consciousness regarding the concept of sustainability has been continuously emerging. People in general started to give higher importance to the impact of a certain product in the environment, rather than the individual benefit of the product. Late 90's generation and the *Millennials* are the main reason to this "behaviorist revolution", as these are also the generations that will most benefit and experience the consequences of these modifications. In addition, this generations are embedded in progression and change, which, when comparing to the previous generations, shows a huge difference, as routines and conformism are put aside (Ketron & Naletelich, 2019).

2.5 Autonomous Vehicles as a Disruptive Technology

2.5.1 Autonomous Vehicles

The evolution of transports and the evolution of the consumer profile has led to a diversification of suppliers offer. By proposing differentiated products in a high value-added market, enables companies to reach huge amounts of profit, later invested in new processes and R&D of new products. Thus, and with the need to increase mobility, convenience and safety on world roads, the concept of AVs was born. AVs are vehicles capable of moving and acting intelligently with little human intervention or even without requiring a guide or remote controller. These kind of vehicles are being studied for use in the most diversified industries and for countless purposes, from exploratory missions, planetary reconnaissance (either aerial, maritime or terrestrial), remote repairs, or even products and materials mobility within factories and offices, internally or externally (Wilfong, 1990).

AVs are vehicles that make decisions for themselves, based not only on the information they gather about their route, but also on the routes and decisions that other vehicles connected to the same network make, allowing them to carry passengers or goods from one point to another, without any intervention or even physical presence of a human being (Rathod, 2013; Shanker *et al.*, 2013). They are interconnected with a network of vehicles, infrastructures, car brands and other stakeholders, collecting data and communicating with each other so that

they know in real time all the information needed for decision making, instantly and autonomously.

2.5.2 Autonomous Vehicles Evolution

On 2013, Morgan and Stanley defined the adoption and emergence of AVs in four phases (Shanker *et al.*, 2013), excluding the entrance of this technology in the market (see Figure 2):

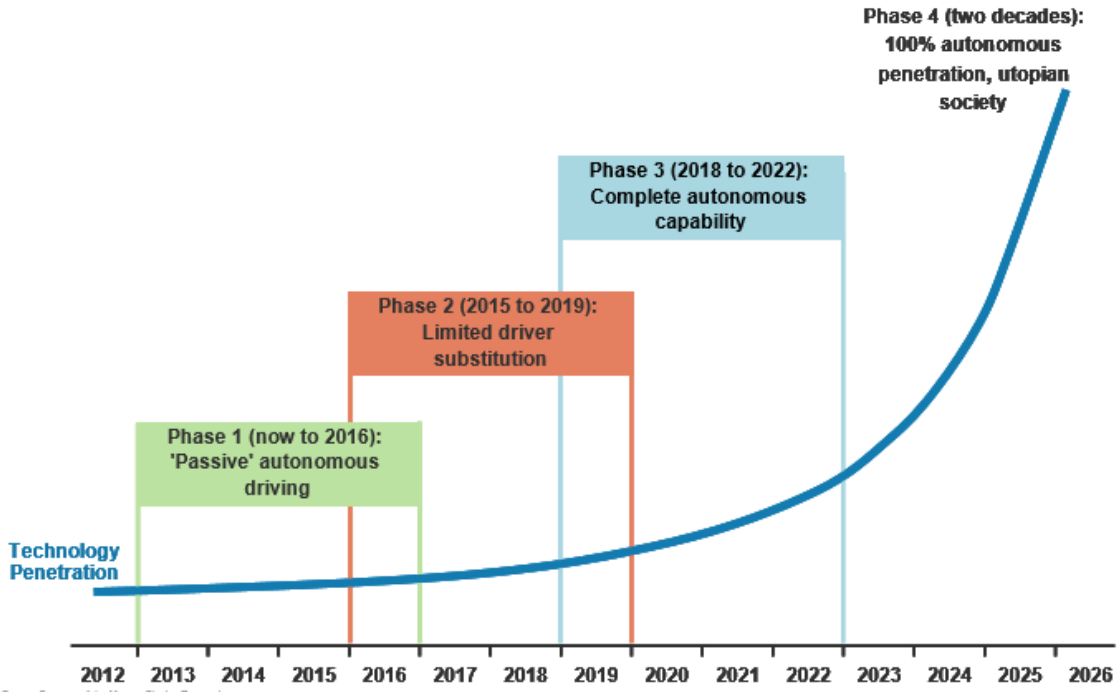
- Phase 1 (2013-2016) – Passive autonomous driving. The driver is entirely responsible for driving. Autonomous features only come into play when the vehicle feels that an accident is imminent.

- Phase 2 (2015-2019) – Limited driver substitution. The driver is still responsible for driving the vehicle, but has the chance, depending on the situations, to grant the driving task to the vehicle itself, in a controlled environment. However, human intervention may be required, to take care of tasks such as parking the vehicle.

- Phase 3 (2018-2022) – Complete autonomous capability. Vehicles drive autonomously, although human intervention can be required, in determined situations, such as emergencies.

- Phase 4 (2022-2042) – Utopian Society. All vehicles on the road are completely autonomous. Human intervention will no longer be necessary, as the vehicle will be driving autonomously and responding autonomously to any situation, including emergencies. This phase is rather unpredictable, as it can take up to two decades, although, it can be realized earlier than expected.

Figure 2 - The four phases of AVs adoption



Source: Morgan Stanley Research (2013)

Nowadays there are already AVs in the market than can perform several basic driving tasks, although there is not yet a fully AV (100% autonomous). According to Susanne Pillath of the European Parliament research service and the Society of Automotive Engineers (SAE) International, there are six levels of driving automation (Pillath, 2016): Table 2.

Table 2 – Levels of driving automation

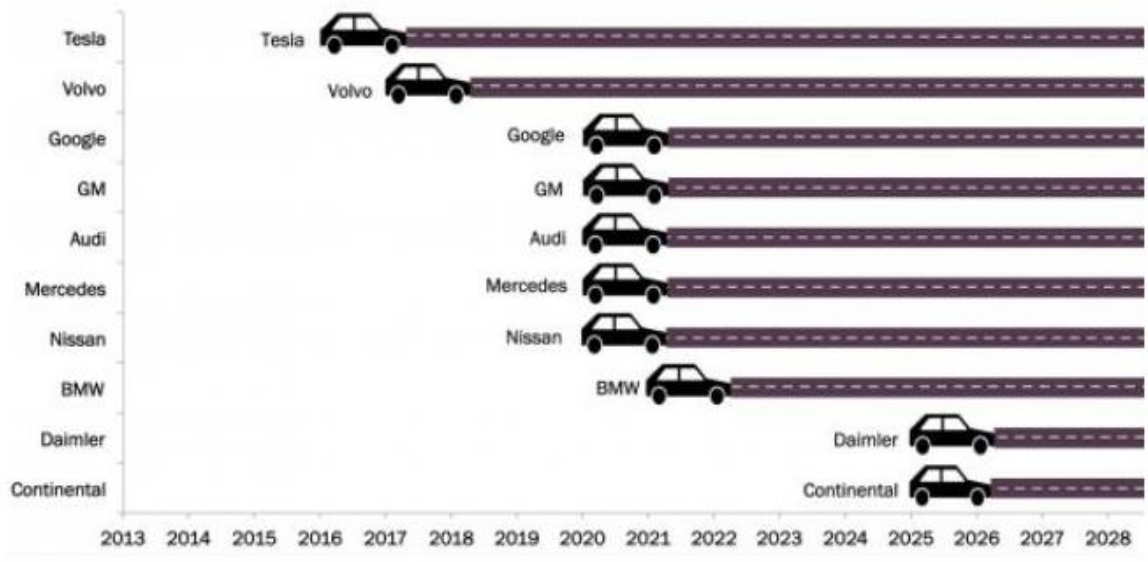
<table>
<tr><th colspan="2">Human Monitors Environment</th><th colspan="2">Vehicle Monitors Environment</th></tr>
<tr><th>Manual</th><th>Partly Automated</th><th>Higly Automated</th><th>Fully Automated</th></tr>
<tr><td rowspan="2">Level 0 - There is no autonomy and the human driver does all the driving</td><td>Level 1 - The vehicle is controlled by the driver, but some assist features may be included. The advanced driver system (ADS) on the vehicle can “sometimes assist”</td><td>Level 3 - The ADS on the vehicle can perform aspects of the driving task simultaneously under some circumstances. The human driver must be ready to take control at</td><td rowspan="2">Level 5 - No human intervention is necessary. At this level, human occupants are passengers. An ADS on the vehicle is capable of doing all driving tasks in all circumstances</td></tr>
<tr><td>Level 2 - The vehicle has combined automated functions, but the human driver must remain engaged with the driving task and monitor the driving environment at all times</td><td>Level 4 - The ADS on the vehicle can perform all driving tasks in certain circumstances or only in limited spatial areas. During those circumstances the human driver does not need to pay attention</td></tr>
</table>

Source: Adapted from Society of Automotive Engineers (2018)

2.5.3 Autonomous Vehicles Pioneers

While expectations around AVs are rising, many companies are pursuing their own initiatives, competing to produce the best available technologies in the market. This growing interest came majorly from the biggest car manufactures, but not exclusively, as several hi-tech companies took the first steps towards AVs technology. Some companies have been making serious investments, expecting to reach a leadership position and stand out from competition, such as manufacturers BMW AG (Poschenrieder & von Frankenberg, 2017), Volvo (Volvo Cars Company, 2017), worldwide software developers Apple (Wakabayashi, 2016), vehicles components supplier Bösch, partnering with Daimler (Ritcher, 2017), Google, with their independent project Waymo, working alongside with Jaguar Land Rover, amongst many others (CB Insights Research, 2016) – Figure 3.

Figure 3 – Expected release of AVs



Source: Sulaiman (2018)

Innovative automotive company Tesla, has already proven to be an autonomous technology pioneer. The company aims to improve transport safety and ensure a rapid transition to a sustainable global future by making its vehicles safer than human driving, lowering ownership costs and promoting sustainable transport options for those without a vehicle of their own. Tesla already released car models with software that enables autonomous driving in many everyday situations, which will be remotely updated, recurrently, so that all their models come together and communicate in the same way (Tesla Europe, 2017). However, on the 7th of May of 2016, a first fatal crash for an autonomous Tesla Model S owner in Williston, Florida, USA, raised questions about the safety of such technology, as the vehicle crashed with an 18-wheel tractor-trailer, while in autopilot mode (Yadron & Tynan, 2016).

2.5.4 Autonomous Vehicles – Benefits and Barriers

Following the previous reasoning, fully AVs promise a complete revolution in mobility, as they are expected to make travelling more efficient in every term, from security, flexibility, comfortability, sustainability, to time and cost for both ends of the service, either in the costumer perspective or the business perspective. Based on its feature, AVs are expected to improve traffic flow, reduce accidents, reduce social exclusion, improve the utility of time on

travel and reduce drivers stress and tedium (Schoettle & Sivak, 2014; Litman, 2017). It is increasingly accepted that the next step to the evolution of mobility and transportation is the replacement of human as the driver by the Artificial-intelligence-capable machine. Taking into account a long-term scenario, the possibility of reducing operational costs, could be a game changing factor in the adoption of AVs in innumerable markets (Adnan *et al.*, 2018).

Numerous authors have been arguing and identifying new advantages by increasing the usage of AVs. This improvements and benefits could vary from either traffic flow gains to capacity gains, fundamentally due to the fact that a machine can perform the same task, at the same rhythm, with the same quality, during a whole time process, which is significantly longer than a human being capacity. In a scenario where AVs travel together with human-controlled vehicles in all lanes, a moderate number of AVs can lead to a 30% improvement on the traffic conditions in highly congested highways (Mirzaeian *et al.*, 2018).

Nevertheless, there are studies indicating that when confronted with the potential benefits of AVs, the most valued benefit for people is the reduction of road accidents and, on the other hand, the less valuable benefit is road traffic reduction (Bansal *et al.*, 2016). Motor vehicle collisions cause more than 1.2 million deaths worldwide and an even greater number of non-fatal injuries each year (World Health Organization, 2015). In this perspective, countless authors defend that AV's massive adoption could majorly reduce the amount of road accidents, as the likelihood of a machine committing a mistake is considerably lower comparing to a human being (Slowik & Sharpe, 2018; Fagnant & Kockelman, 2015). However, these arguments are mostly based under the assumption that every vehicle on the road would be autonomous, which is an ambitious conceptualization, as the adoption of AVs is more likely to succeed considering a gradual growth rather than an instant massive adoption, drastically occurring from a moment to another (Bösch *et al.*, 2016; Clark *et al.*, 2016).

With the growing interest and awareness towards sustainability, the distribution sector, just like many other industries, have been facing some eco-friendly measurements, mostly with the appearance of hybrid cars, and furthermore the electric cars. (Høyer, 2008) Both innovative vehicles had the benefit of reducing the emission of polluting gases, although in a long term perspective, the results are still not the same as the normal gasoline and diesel vehicles, due to the autonomy issue, this is, the length of kilometres that the deposit lasts. Keeping this in mind, the last electric vehicles have been always battling the autonomy issue

and it is getting better results every year, especially concerning Tesla vehicles (Endsley, 2017; Chen *et al.*, 2016).

On a not so broad and remote view, it is a matter of time for distributors to adopt connected and AVs, as they have the potential to reduce emissions, increase earnings and reduce costs (Litman, 2017). Fully AVs have the potential to transform distribution chains. Nonetheless, the sustainable focus as two sides, on one hand the process and the technology require a proper implementation, in order to achieve the performance levels desired, on the other hand, this could create a significant cut of expendable costs, which could potentially imply the raise of the unemployment rate in many markets (Todorovic *et al.*, 2018; Stefansdottir & Grunow, 2018).

Regardless of the imminent benefits identified and predicted, various authors highlight the social dilemma about adopting the concept of AVs, as it creates barriers in the minds of potential consumers. Computer system failures, privacy issues, hacking vulnerability and the difficulty of the vehicle to answer appropriately in unexpected situations, are some of the issues used to understand the perceived barriers in consumer's minds. (Schoettle & Sivak, 2014; Bansal *et al.*, 2016; Fagnant & Kockelman, 2015). The loss of human control is another barrier to overcome, not only relating to driving safety, but also in terms of driving pleasure, as further investigations report that individuals who enjoy their driving moments, are less receptive to the concept of fully AVs (Power, 2012; Haboucha *et al.*, 2017).

Several authors point that, as AVs are an innovative technology, the overall initial investments are expected to be extremely high and hardly affordable for everyone (Oliver *et al.*, 2017; Fagnant & Kockelman, 2015). However, this inability to purchase AVs, could create massive opportunities by adopting these vehicles in the distribution sector, in view of service performance, instead of an individual use. This technology, directly connected to transportation vehicles (Taxis, Uber and other equivalent applications), distributes operating costs over a large number of consumers making mobility services more affordable, which, consequently, could produce considerable savings for consumers (Nunes & Hernandez, 2019). However, the costs in the future, once economies of scale kick in, are expected to drop and be able to be scaled down readily, as the technology enters in mass production phases (Oliver *et al.*, 2017; Fagnant & Kockelman, 2015) – Table 3.

Table 3 – Benefits and Barriers regarding AVs

Benefits	Authors	Barriers	Authors
Road Safety	Schoettle & Sivak, 2014; Mirzaeian *et al.*, 2018; Adnan *et al.*, 2018; Fagnant & Kockelman, 2015	Hacking Vulnerability	Schoettle & Sivak, 2014; Bansal *et al.*, 2016; Fagnant & Kockelman, 2015
Road Traffic	Schoettle & Sivak, 2014; Mirzaeian *et al.*, 2018; Litman, 2017; Adnan *et al.*, 2018; Fagnant & Kockelman, 2015	Driving Safety	Schoettle & Sivak, 2014; Bansal *et al.*, 2016; Fagnant & Kockelman, 2015
CO2 Emissions	Schoettle & Sivak, 2014; Litman, 2017; Adnan *et al.*, 2018	Initial Costs	Oliver *et al.*, 2017; Fagnant & Kockelman, 2015
Long Term Costs	Oliver *et al.*, 2017; Adnan *et al.*, 2018; Litman, 2017; Fagnant & Kockelman, 2015	Autonomy Insufficiency	Chen *et al.*, 2016
Time on Travel Utility	Schoettle & Sivak, 2014; Litman, 2017	Less Human Control	Power, 2012; Haboucha *et al.*, 2017
Stress Levels	Schoettle & Sivak, 2014; Litman, 2017	Unemployment	Litman, 2017; Todorovic *et al.*, 2018; Stefansdottir & Grunow, 2018

2.5.4 Autonomous Vehicles – Acceptance and Use

In the lights of unified theory of acceptance and use of technology (Venkatesh *et al.*, 2003), mentioned in the previous chapter (2.4), it is clear that people have different interpretations and perceptions of the effect, either positive or negative, a determined innovation, even in

terms of applicability, as different people have different conceptualizations and idealizations for a certain technology.

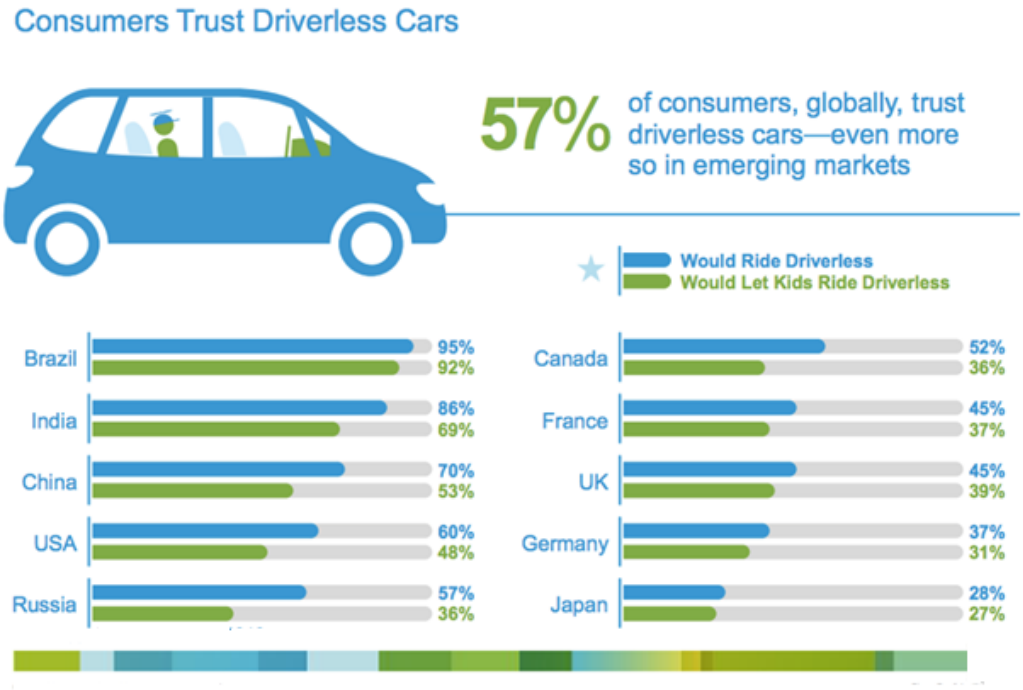
Specifically concerning to AVs, there are different barriers and constraints that influence their adoption, which, just like many disruptive technologies throughout history, need time to be implemented, as AVs implicate adaptations in diverse aspects, physically and psychologically. In this regard, effort expectancy and performance expectancy most be correctly analyzed, as well the consumers profile, as the initial adoption of these vehicles, is deeply conditioned by the consumer mentality, even more than in terms of financial capacities, as the most probable causes for retarding AVs adoption, are imminently psychological (Leicht *et al.*, 2018).

Following the previous reasoning, some of the biggest challenges standing against AVs adoption remain especially in convincing the consumers to switch to AVs despite the apparent benefits. In the past, with the perspective of encouraging the acceptance of AVs, papers highlighted that trust and reliability towards this technology, needed to be assure, individually. Nowadays, ethical implications of the autonomous technology must be considered, in order to better analyze the acceptance of this technology. Hence, there is a need to embed ethical implications as a construct, in order to guide the users trust and reliability, relating to AV's acceptance model. There are other sociodemographic factors influencing the acceptance of this technology, either cultural or emotional, which require a certain period of time to overcome (Adnan *et al.*, 2018; Clark *et al.*, 2016; Litman, 2017; Lavasani *et al.*, 2017).

Many authors have been conducting researches and interviews, in view of obtaining empirical data supporting customer acceptance and use of AVs, to better understand not only their benefits and concerns, but also the perceived value and use of this innovative technology. In 2013, Cisco Systems, a multinational networking hardware company, developed a global survey, in which gathered the opinion of 1,514 consumers, from 10 different countries, 18 years or older. The answers to this survey highlighted customers intention and interest regarding the concept of AVs, as 57% of the respondents would put their trust in a driverless vehicle. Although, as expected, the answers varied wildly depending on the country of origin. In emerging markets such as Brazil and India, acceptance and trust towards AVs was over 90% and 80%, respectively. On the other hand, in Japan and Germany scepticism and distrust is notably still present, as only 28% and 37% of the respondents

would be willing to give up direct control of their vehicles and trust an AV. The same trend was latent when respondents were asked whether or not to let their children drive their own AVs, gathering 47% of affirmative answers, again, with higher acceptance rates in emerging countries (Cisco, 2013) – Figure 4.

Figure 4 – Consumers Trustworthiness towards Driverless Cars



Source: Cisco Systems (2013)

This survey contained significant relevant information in terms of customer adoption and use of AVs. For instance, 74% of the respondents would be willing to allow remote monitoring of their driving habits if it generated tangible benefits, primarily by produced savings on their insurance premiums or auto repair bills. Furthermore, 64% would be willing to share even more personal information, with the purpose of creating unique driver profiles, inclusively, 60% would even provide health condition information, genetic and biometric data, processed solely to identify a human being, if it could aid in improving the vehicle safety.

AVs adoption, will most likely occur slowly, although, as financial incentives, nowadays, are rather easily obtained, customers trust towards AVs could be a key accelerator in the adoption phase, either considering AVs as a product or as a service. Having this in mind, highlighting AVs potential benefits and by reducing and eliminating the concerns about this

technological innovation, strengthening customers reliability and trust, could be decisive in the success of AVs as a disruptive technology (Leicht *et al.*, 2018; Daziano *et al.*, 2017; Litman, 2017; Lavasani *et al.*, 2017; Fagnant & Kockelman, 2015).

Chapter III - Methodology

3.1 Research Approach

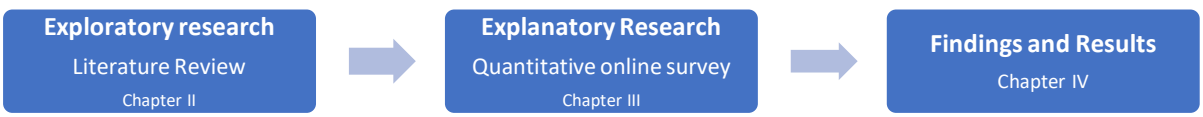
This dissertation combines two types of research methodologies, exploratory and explanatory research strategies. Those research strategies are not mutually exclusive and a combination of these two strategies aids in the analysis and definition of benefits and drawbacks, concerning to the desired goal. By combining an explanatory and exploratory approach, I was considerably more capable of entirely investigate the aim of the study.

Additionally, both primary and secondary data acquisition were conducted. Primary data was gathered over explanatory research, which was based on qualitative data collection through the elaboration of an online survey with 16 questions, 11 questions with the objective of helping me to answer my 3 RQs and 5 sociodemographic questions (see Appendix 1). The online survey was designed under the guidance and approval of supervisor professor Renato Costa and was exclusively prepared taking into account the matter of this study.

Furthermore, the analysis of this survey answers, implied quantitative data collection, as it was conducted through the application of statistic's methodology, with the support of SPSS program. Secondary data was collected through an exploratory research approach, which was reflected by obtaining data from previous research and studies, highlighted in the Literature Review chapter. The conclusions for the initial research problem consolidate all types of data attained.

Thus, the research design, which consists in the methods that I applied to investigate the problem statement, is demonstrated graphically in figure 5.

Figure 5 – Research Design Framework



There are several primary data collection techniques, from experiments to interviews, depending on the type of approach undertaken, either quantitative or qualitative, which can contribute to the collection of solicited or spontaneous data. The online survey has the advantage of allowing information to be collected from a large number of respondents at the same time, contributing to obtain precise results, easier data processing and analysis. The use of the survey is justified whenever there is a need to obtain behavioural data, such as attitudes, feelings, opinions, preferences and experiences, which aids in providing information about subjective and objective characteristics of a population, regarding a specific subject (Hox & Boeije, 2005; Wright, 2005).

3.2 Quantitative Research – Online Survey

3.2.1 Online Survey Conceptualization

In order to meet the proposed research objectives, an online survey was elaborated, using the Google Forms platform shared between 18 of July of 2019 and 21 of August of 2019, in order to get the largest and most diverse sample possible. Prior to the official release, a pre-test was conducted and none of the four pre-test subjects identified any difficulty or failure in completing the survey. This survey was divided into 4 parts, in order to facilitate a connection and a better analysis between the purposes of the study and the answers obtained in Table 4. The survey can be found in appendix 1.

Table 4 – Online Survey Structure

1st	2nd	3rd	4th
Distribution Channels Efficiency	Autonomous Vehicles Awareness	Autonomous Vehicles Adoption and Use	Sociodemographic Description

The first part introduced the topic of this dissertation, alongside with the purpose of this survey, collecting respondents judgement about the current state of the distribution channels, providing information about the most and less valuable characteristics in a distribution process, on a scale of 1 to 6, being 1 the "Most Valuable Characteristic" and 6 the "Less Valuable Characteristic". In addition, this part assembled each respondent opinion, regarding the efficiency of the current distribution channels, which, consequently, helped in the analysis and discussion of the first RQ of this dissertation.

The second and third parts of this survey, focused on the acceptance and use of AVs. The second part intended to analyse respondent's familiarity towards the concept of AVs and understanding their perceived concerns and benefits about this emerging concept, on a scale of 1 to 6, being 1 the "Biggest Concern" / "Most Important Benefit" and 6 the "Smallest Concern" / "Less Important Benefit". The third part on the other hand, had the objective of providing quantitative information regarding the adoption and usage of AVs, giving concrete data of respondents willingness to use AVs, either in terms of a product for individual and own use, or as technological mean in view of optimizing processes and improving services, specifically concerning to the distribution sector. Both the second and third part of the survey, were directly driven towards the discussion of the second and third RQs, constituting fundamental methodology in the assist of answering these RQs.

The fourth and final part of the online survey was entirely conceptualized in view of obtaining sociodemographic information of the respondents, aiding in the identification of individual characteristics, such as age, gender and education level. This sociodemographic data mainly anticipated to differentiate respondents, which was extremely important in the establishment of statistical correlations between a respondent profile and their behaviourist opinion, regarding the matters of the survey.

After reaching a reasonable and adequate number of answers, the survey was closed. Afterwards a database was downloaded directly from the Google Forms platform and stored in Microsoft Excel format. The processing of the data collected was performed using version 25 of SPSS (Statistical Package for Social Sciences) program, whose annual license was available free of charge, thanks to the IT services of ISCTE-IUL Business School.

In order to precisely analyse and conclude about the relationship between respondent's sociodemographic characteristics and their specific answers regarding the first three parts of the survey, correlation tests between ordinal variables were performed by using Spearman's

rank correlation coefficient (Spearman's RHO). This correlation coefficient is not sensitive to distribution asymmetries or the presence of outliers.

3.2.2 Sample Characterization

The sample was defined aiming a target population of individuals over 18 years old, male and female, resident and non-resident in the Portuguese territory, with different education levels and backgrounds. Overall, the sample was fixed at 187 individuals, in which of those, 62% were male respondents (n = 116) and 38% were female respondents (n = 71) – Figure 6.

Figure 6 – Gender Distribution

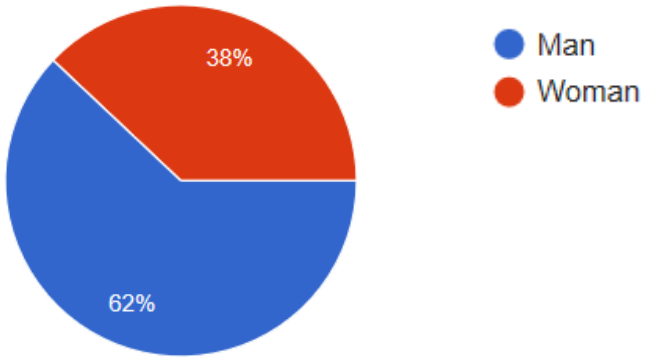


Table 5 shows the age distribution of the individuals by age group, demonstrating that predominantly the sample consists in individuals between [18-24] - 40% and [25-34] - 36%.

Table 5 – Age Group Distribution

Age Group	Frequency	Percentage (%)
[18-24]	75	40%
[25-34]	67	36%
[35-44]	25	13%
[45-54]	13	7%
[55-65]	4	2%
More than 65	3	2%
Total	**187**	**100%**

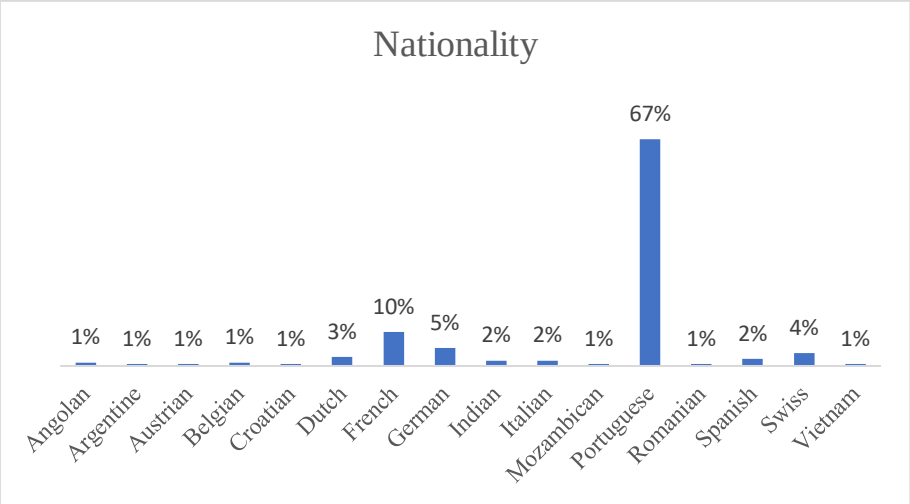
Regarding to the education levels, it can be inferred that most of the individuals surveyed have either a master's degree or a bachelor's degree, representing 39% of the sample (n = 72) and 33% (n = 61), respectively. It should also be noted that 14% (n = 26) have a postgraduate degree and 4% with a doctorate (n = 7), meaning that only 12% (n = 21) of the respondents did not took any higher education courses and did not attend an university – Table 6.

Table 6 – Education Levels Distribution

Education Level	Frequency	Percentage (%)
Elementary School	5	3%
High School Graduate	16	9%
Bachelor's Degree	61	33%
Postgraduate	26	14%
Mater's Degree	72	39%
Doctorate Degree	7	4%
Total	**187**	**100%**

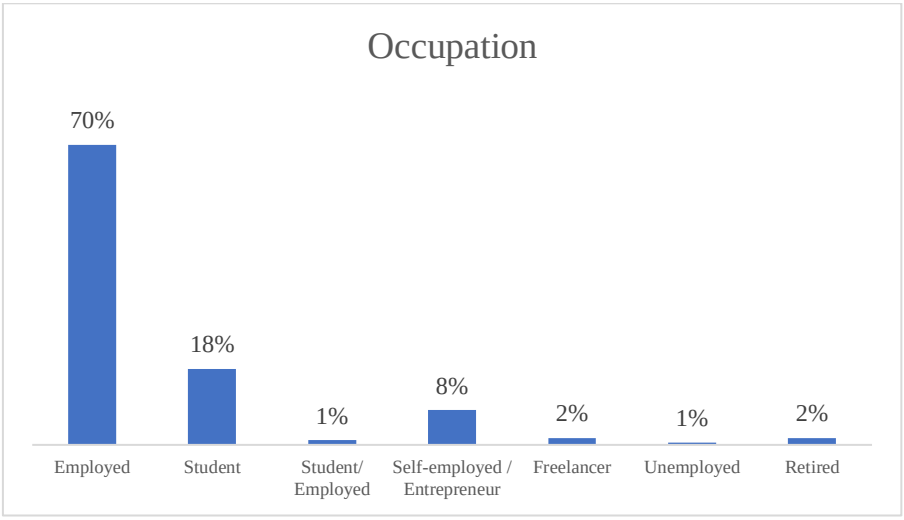
In terms of nationalities, this survey gathered answers from 16 different nationalities, mostly from European countries, 96% (n = 179). From the analysis of figure 7, it is noticeable that the predominant nationalities are Portuguese, with 67% (n = 126), French 10% (n = 19), German 5% (n = 10) and Swiss 4% (n = 7). In addition to these, Dutch, Spanish, Italian, Indian, Angolan, Argentine, Austrian, Belgian, Croatian, Mozambican, Romanian and Vietnamese nationalities were mentioned, albeit in a small number (n = 25) – Figure 7.

Figure 7 – Nationalities distribution



Regarding the occupational status, it is found that majorly the respondents are employed, as of the 187 individuals, 130 are employed. Approximately 18% are students (n = 33) and 8% (n = 15) are self-employed or consider themselves entrepreneurs. The employed population involve various industry, but mainly it is distributed into three industries: Management (including finance, strategy and industrial management); Pharmaceutical; IT Engineering – Figure 8.

Figure 8 – Occupational Status



Chapter IV - Analysis and Discussion of Results

4.1 Descriptive Analysis

4.1.1 Distribution Channels Efficiency

As mentioned in the previous chapter, the on-line survey structure follows a reasoning in conformity with the three RQs of this dissertation. The analysis of the online survey answers identified many results in accordance with the analysis of the literature review, as well as, some discordant outcomes, making it possible to collect different insights and strengthen certain points of view regarding the aims of this dissertation. Furthermore, the combined analysis of these two sources of data collection, enabled gathering findings to support the answer of the three RQs of this dissertation.

The first question of the survey was to inquire respondent's acquaintance and knowledge about distribution channels. Of the 187 individuals in the sample, 78% (n = 146) were familiar with the term of distribution channels, while 21% (n = 39) admitted they were not familiar with the concept. Meanwhile 1% (n = 2), observed that they knew the term but were not totally comfortable about its meaning, nonetheless, the awareness of respondents regarding the concept of distribution channels was considerably elevated.

Forwardly, six features of a distribution process were defined and the population had to classify them, from the most valuable characteristic, to the less valuable. Three characteristics were clearly preferential for respondents, being those the "speed of the delivery", the "cost of the service" and the "condition of the product", this is, the comparison between the expectations of what was ordered, against what was actually received. The "condition of the product" was considered the most valuable characteristic for 36% (n = 68) of the population and at least moderately valuable for 83% (n = 156). The "speed of the delivery" was distinguished as the most valuable characteristic for 33% (n = 62) and identified as at least moderately valuable for 89% (n = 166) of the population, highlighting the relevance of this feature in a distribution process. The "cost of the service" did not get the same appreciation as the two already mentioned characteristics for the most important characteristic, as only

13% (n = 25) of the respondents classified this feature as the most important characteristic of a distribution process. However, 37% (n = 69) considered it highly valuable, and 90% (n = 171) of the population identified, at least, moderate value regarding this feature.

Furthermore, the "tracking of the service" was neither considered the most valuable characteristic nor the less valuable, being identified as valuable for 25% (n = 46) of the respondents and as moderately valuable for 36% (n = 68). Moreover, "how it was delivered", this is, what type of the vehicle performed the delivery, and the "relationship with the distributor" were notably the less valuable characteristics. In fact, 66% (n = 123) of the population considered the type of the vehicle rather irrelevant, identifying low value in this characteristic within a distribution process. Moreover 70% (n = 131) of the respondents had the same appreciation for the "relationship with the distributor", inclusively 37% (n = 70) considered it the less valuable characteristic in a distribution process – Table 7.

Table 7 – Distribution Channels Characteristics Appreciation

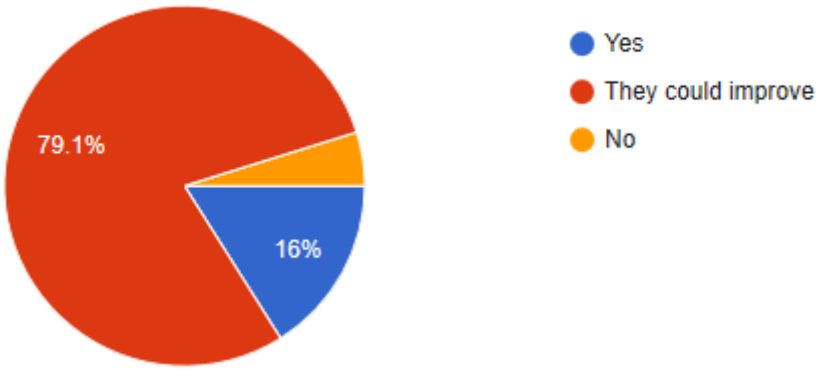
	1	**2**	**3**	**4**	**5**	**6**
Speed of the Delivery	33% (n = 62)	23% (n = 42)	18% (n = 34)	15% (n = 28)	6% (n = 11)	5% (n = 10)
Tracking of the Delivery	2% (n = 4)	10% (n = 19)	25% (n = 46)	36% (n = 68)	19% (n = 35)	8% (n = 15)
How it was Delivered	10% (n = 19)	5% (n = 9)	8% (n = 14)	12% (n = 22)	29% (n = 55)	36% (n = 68)
Cost of the Service	13% (n = 25)	37% (n = 69)	21% (n = 39)	19% (n = 35)	5% (n = 10)	5% (n = 9)
Condition of the Product	36% (n = 68)	13% (n = 25)	24% (n = 45)	10% (n = 18)	8% (n = 15)	9% (n = 16)
Relationship with the Distributor	5% (n = 9)	11% (n = 21)	5% (n = 9)	9% (n = 17)	33% (n = 61)	37% (n = 70)

n = 187

1. The Most Valuable
2. High Value
3. Valuable
4. Moderately Valuable
5. Low Value
6. The Less Valuable

When asked to give their opinion about the adequacy of the current distribution channels to the modern days, in terms of technological developments, the answers were rather assertive, as only 16% (n = 30) of the respondents consider that the current distribution channels are adequate to the recent technological advancements. Of the 84% individuals that think otherwise, 79% (n = 148) believe that the actual distribution channels could improve and 5% (n = 9) consider that these channels are inadequate to the modern technological outlooks – Figure 9.

Figure 9 – Are distribution channels adequate to the modern technology?



This analysis follows the reasoning of Galkin (2015) and Andrejić & Kilibarda (2016), even considering that these results are not a precise indicator, regarding the level of technological investment required, since the answers are rather standardized. Nonetheless, it is deeply consensual that distribution channels are overdue in terms of technological developments, which means that these channels are not as efficient and optimized as they could be.

Improving distribution channels efficiency does not only indicates a need in terms of tangible assets, but also in terms of optimizing these channels, mostly in terms of speed and price, as technology can even shorten the length of a distribution channel. In this regard, these results also support Fayaz & Azizinia, 2016, as assuring more efficient distribution channels, can influence the successfulness of a product, products can have a determining role in conveyance of thoughts, social norms and carrying cultural values.

Additionally, several recommendations can be made, aiming to improve the current distribution channels, thus, it's possible to withdraw a general conclusion in this regard, which is the importance of technological improvements in distribution, as mostly all of these

recommendations implicate technological advancements, in order to boost distribution channels efficiency.

4.1.2 Autonomous Vehicles Awareness

After the initial approach towards distribution channels awareness, it was necessary to inquire individuals opinion concerning to AVs, whether in terms of familiarity with the concept, perceived impact, both positive and negative, and in terms of conditioning factors affecting the successful adoption of this innovative technology.

Following the sample results, it is visible that AVs are not an unknown concept, as 86% (n = 161) of the respondents had already heard about this technology, supporting the idea that, despite being a completely innovative technology and relatively recent, AVs are already on top of the spotlights and are one of the most discussed topics nowadays.

In terms of potential benefits that AVs could bring, the answers were quite disperse and not unanimous, making it difficult in withdrawing conclusions. Nevertheless, 45% (n = 85) of the respondents chose “road safety”, as the most important benefit potentially brought by AVs, and 74% (n = 138) identified “road safety” as an important potential benefit of AVs, supporting the impression from numerous authors such as Schoettle & Sivak (2014), Adnan *et al.* (2018) and Fagnant & Kockelman (2015). Another benefit highlight by the sample population is carbon dioxide emissions reduction, as 62% (n = 115) considered this potential reduction as an important factor of AVs and of these, 37% (n = 69), considered the “reduced C02 emissions” a highly important potential benefit. This statistic follows the growing awareness surrounding sustainability and green initiatives issues, supporting Schoettle & Sivak (2014) and Adnan *et al.* (2018).

“Long term costs reduction” and “reduced traffic congestion” were quite similar in terms of beneficial added value perception, as 50% (n = 93) and 45% (n = 85) of the respondents, identified considerable importance regarding these features brought by AVs. The less important benefits for the population, that AVs could carry, were “stress levels reduction” and “free time while driving”. In fact, 63% (n = 119) and 67% (n = 127), respectively, do not identify much importance within these potential benefits, inclusively, 36% (n = 68) of the individuals elected increased free time while driving as the less important benefit, contradicting the arguments of various authors – Table 8.

Table 8 – Autonomous Vehicles Potential Benefits

	1	2	3	4	5	6
Road Safety	45% (n = 85)	16% (n = 29)	13% (n = 25)	9% (n = 17)	5% (n = 9)	12% (n = 22)
Reduced Traffic Congestion	10% (n = 18)	17% (n = 31)	19% (n = 36)	24% (n = 45)	18% (n = 34)	12% (n = 23)
Reduced CO2 Emissions	16% (n = 29)	21% (n = 40)	25% (n = 46)	17% (n = 32)	12% (n = 23)	9% (n = 17)
Reduced Long Term Costs	13% (n = 24)	14% (n = 26)	23% (n = 43)	18% (n = 34)	22% (n = 41)	10% (n = 19)
Free Time While Driving	5% (n = 9)	17% (n = 32)	10% (n = 19)	13% (n = 24)	19% (n = 35)	36% (n = 68)
Stress Levels Reduction	11% (n = 21)	13% (n = 24)	12% (n = 23)	19% (n = 36)	24% (n = 45)	20% (n = 38)

n = 187

1. The Most Important
2. High Importance
3. Important
4. Moderately Important
5. Low Importance
6. The Less Important

The analysis of the main drawbacks concerning to AVs, identified, just like the potential benefits analysis, disperse answers, with the individuals of the sample having different appreciations and valuations regarding this matter. In consonance with the most important benefit, the biggest concern towards AVs for 44% (n = 83) of the sample population is "driving safety", showing that road safety is a fundamental characteristic to assure, as people are rather sceptic regarding to some AVs features. Thus, assuring that these vehicles are, indeed safe and flawless, is essential, for significantly reducing individuals concerns and, forwardly, contributing for the general receptivity of AVs, following the arguments of Schoettle & Sivak (2014), Bansal *et al.* (2016) and Fagnant & Kockelman (2015).

Another concern highlighted by the sample population is the vulnerability of AVs to hacking experts, as AVs systems are entirely developed in the light of IT, within IT systems databases. 54% (n = 101) of the respondents identified "hacking vulnerability" as highly worrying. The "initial costs / short term costs" and the "reduced human control" also collected an important appreciation, as 49% (n = 91) and 50% (n = 94), respectively, indicated these potential impacts as at least relevant concerns regarding to AVs. Although, only 8% (n = 15) of the population considered the initial costs as the biggest concern

influencing the success of AVs and, simultaneously, only 7% (n = 14) considered the reduction of human control as their biggest concern towards AVs. The smallest concern to the population was undoubtedly the "unemployment rate", which, due to the automatic functions of AVs, is expected to grow, especially in the transportation sector, where costs with drivers, would no longer be necessary in a fully autonomous service perspective. This said, 33% (n = 62) chose the "unemployment rate" imminent increase as their smallest concern and 71% (n = 133) of the respondents did not identified relevant concerning levels regarding this potential impact – Table 9.

Table 9 – Autonomous Vehicles Concerns

	1	**2**	**3**	**4**	**5**	**6**
Hacking Vulnerability	30% (n = 56)	24% (n = 45)	12% (n = 23)	6% (n = 11)	10% (n = 19)	18% (n = 33)
Driving Safety	44% (n = 83)	19% (n = 36)	11% (n = 21)	6% (n = 11)	5% (n = 9)	14% (n = 27)
Initial Costs / Short Term Costs	8% (n = 15)	16% (n = 30)	25% (n = 46)	16% (n = 29)	20% (n = 37)	16% (n = 30)
Incremental Autonomy	2% (n = 4)	10% (n = 18)	19% (n = 36)	34% (n = 64)	23% (n = 43)	12% (n = 22)
Less Human Control	8% (n = 14)	21% (n = 40)	21% (n = 40)	19% (n = 35)	24% (n = 45)	7% (n = 13)
Unemployment Ratio	8% (n = 15)	9% (n = 17)	12% (n = 22)	20% (n = 38)	18% (n = 33)	33% (n = 62)

n = 187

1. Biggest Concern
2. High Concern
3. Relevant Concern
4. Moderate Concern
5. Low Concern
6. Smallest Concern

4.1.3 Autonomous Vehicles Adoption and Use

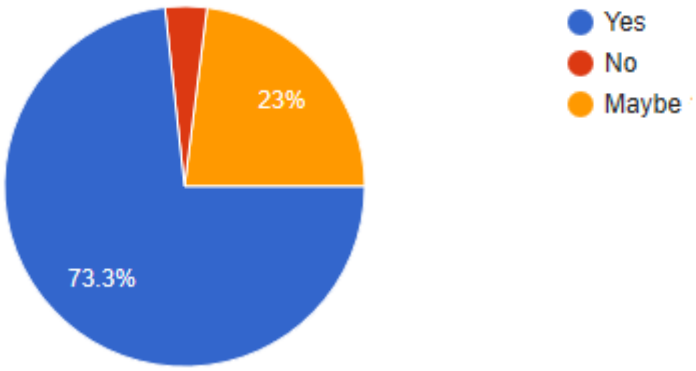
The third part of this survey was conceptualized in a logical structure, in view of collecting information and results regarding AVs adoption and use.

The first analysis of this part, showed that, the population of this sample is deeply unexperienced in terms of AVs utilization, as 91% (n = 170) of the population have never

tried an AV, while 7% (n = 13) have experienced it only once and merely 2% (n = 4) have tried it more than once.

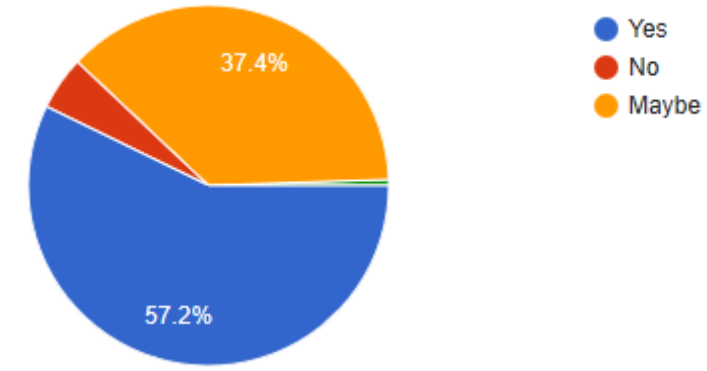
Even though the sample population was considerably unexperienced in terms of AVs usage, which is rather normal due to how innovative and recent this technology is, the willingness to try AVs was imminent. 73% of the population (n = 137) answered affirmatively in their interest of trying AVs, while 23% (n = 43) were more reluctant but did not eliminated the hypothesis of trying AVs answering "maybe". Only 4% (n = 7) showed no interest in experiencing this type of vehicles, answering negatively to their willingness to try AVs – Figure 10.

Figure 10 – Would you be willing to try an Autonomous Vehicle?



Furthermore, when respondents were confronted about their willingness to let their relatives try AVs, the answers were more conservative comparing to their willingness to try themselves, with 37% (n = 70) answering "maybe". Nonetheless, 57% (n = 107) answered affirmatively, and only 5% (n = 9) responded negatively, which, although it shows a more sceptical and conservative approach, traduces an imminent desire of the population to experience AVs, not just for curiosity, but also to test this innovative technology features – Figure 11.

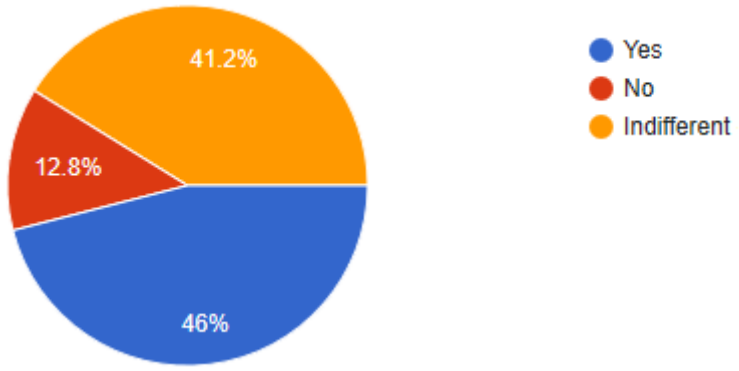
Figure 11 - Would you let your family try an Autonomous Vehicle?



These results are relatively superior from the ones conducted by Cisco Systems survey in 2013, presented on figure 4, although that study did not contemplated the Portuguese population, but comparing, for example, with the results from the French population, it is visible a relevant increase in terms of AVs acceptance. A possible reason for this increase is the fact that Cisco Systems survey was developed in 2013 and after six years, in 2019, the mind-set in regard of AVs, suffered some changes, motivated from cultural reasons in consequence of the visible developments of AVs technology supporting Adnan *et al.* (2018), Leicht *et al.* (2018), and Fagnant & Kockelman (2015). Additionally, these technological developments support Pillath (2016) and Shanker *et al.* (2013) theories, indicating that AVs are, step-by-step, getting closer from level 5 of automation (see Table 2) and from the end of the third phase of AVs adoption, looking towards the fourth phase of AVs adoption (see Figure 2).

Moreover, in order to collect data regarding customers perceived value of AVs in distribution, individuals were asked, firstly, if they would opt for a distribution service based on an AV, over a regular distribution service, if both had the same time and cost. 46% (n = 86) of the respondents showed an interest in this feature, answering affirmatively, while 41% (n = 77) admitted that it was indifferent weather the service was based on AVs or regular vehicles, considering that both had the same time and cost. On the other hand, 13% (n = 24) of the population showed no interest in a distribution service performed by AVs, answering negatively – Figure 12.

Figure 12 - Would you choose a service based on Autonomous Vehicles, over a regular distribution service, if both had the same time and cost?



Afterwards, individuals were asked the same question, but considering that a distribution service based on AVs would be more expensive. The answers to these questions indicated that it is significantly important for companies to assure that the price and time of a distribution service performed with AVs are similar or lower than a distribution service based on a regular vehicle. Principally considering the price of the service, as 70% (n = 131) of the respondents would not be willing to pay more for a distribution service based on AVs. However, 24% (n = 45) of the population would opt for a distribution service based on AVs even if it would be more expensive, while 6% (n = 11) indicated that their decision would be dependent on the assurance that the service would be more efficient, either in terms of time, safety, or sustainability. These results follow along Daziano *et al.* (2017) and Lavasani *et al.* (2017), indicating individuals reluctance in facing higher costs throughout AVs adoption, which, can massively diminish, as AVs benefits are gradually validated and while AVs concerns are overcome.

4.2 Statistical Correlation Analysis

In the analysis of the correlation between the variables of the statistical model, the Spearman correlation coefficient is used. Results range from -1 to 1 and the closer the results to these values, the greater the relationship between the variables.

Considering the correlation matrix presented in table 10, it is conclusive that there are only weak and moderate correlations between the variables under study. Nonetheless, by analysing the correlations considered significant, in isolation, it is possible to withdraw several conclusions.

Table 10 – Spearman Correlation Board

Variables	Age	Gender	Education	Distribution Channel	Distribution Channel Adequate	Heard about AV	Tried a Self Guided Vehicle	Willing to try a Self Guided Vehicle	Let family try a Self Guided Vehicle	Service made by an AV	Willing to pay more for a AV service	Characteristic 1 - Speed of the Delivery	Characteristic 2 - Tracking	Characteristic 3 - TypeVehicle	Characteristic 4 - Cost
Age	1,000	-0,132	0,110	-.253**	-0,020	0,051	0,090	-.192**	-0,045	0,007	-0,039	-.173*	-0,020	-0,031	0,036
Gender	-0,132	1,000	0,055	0,011	-0,103	-.259**	-0,135	-0,091	-0,134	-0,047	0,013	-0,017	-0,023	-0,005	0,049
Education	0,110	0,055	1,000	0,025	0,062	-0,060	-0,023	0,102	-0,037	0,003	-0,018	-0,055	0,047	-0,005	-0,050
Distribution Channel	-.253**	0,011	0,025	1,000	-0,109	0,127	0,030	.185*	0,072	0,087	0,042	-0,087	0,009	0,071	-0,040
Distribution Channel Adequate	-0,020	-0,103	0,062	-0,109	1,000	-0,074	0,101	-0,042	0,094	-.174*	-0,111	0,056	-0,112	-0,023	0,048
Heard about AV	0,051	-.259**	-0,060	0,127	-0,074	1,000	-0,031	0,136	.153*	.204**	0,123	-0,018	0,135	-0,034	-0,065
Tried a Self Guided Vehicle	0,090	-0,135	-0,023	0,030	0,101	-0,031	1,000	0,085	.166*	0,041	-0,004	0,047	-0,043	-0,033	0,037
Willing to try a Self Guided Vehicle	-.192**	-0,091	0,102	.185*	-0,042	0,136	0,085	1,000	.483**	.250**	0,139	0,058	0,036	-0,070	-0,098
Let family try a Self Guided Vehicle	-0,045	-0,134	-0,037	0,072	0,094	.153*	.166*	.483**	1,000	.241**	.163*	-.161*	-0,036	0,008	0,057
Service made by an AV	0,007	-0,047	0,003	0,087	-.174*	.204**	0,041	.250**	.241**	1,000	.443**	-0,065	0,119	-0,101	-0,012
Willing to pay more for a AV service	-0,039	0,013	-0,018	0,042	-0,111	0,123	-0,004	0,139	.163*	.443**	1,000	-0,018	0,131	-.178*	0,013
Characteristic 1 - Speed of the Delivery	-.173*	-0,017	-0,055	-0,087	0,056	-0,018	0,047	0,058	-.161*	-0,065	-0,018	1,000	-0,142	-.321**	0,082
Characteristic 2 - Tracking	-0,020	-0,023	0,047	0,009	-0,112	0,135	-0,043	0,036	-0,036	0,119	0,131	-0,142	1,000	-0,057	-.431**
Characteristic 3 - TypeVehicle	-0,031	-0,005	-0,005	0,071	-0,023	-0,034	-0,033	-0,070	0,008	-0,101	-.178*	-.321**	-0,057	1,000	-.267**
Characteristic 4 - Cost	0,036	0,049	-0,050	-0,040	0,048	-0,065	0,037	-0,098	0,057	-0,012	0,013	0,082	-.431**	-.267**	1,000
Characteristic 5 - ProductCondition	-0,022	0,023	-0,085	0,050	-0,023	-0,004	0,016	0,057	0,129	0,008	0,049	-0,119	-.241**	-.492**	0,123
Characteristic 6 - Distributor Relation	.208**	0,004	0,128	0,058	0,022	0,010	-0,008	-0,006	-0,007	0,071	0,006	-.427**	-0,009	0,068	-.373**
Benefit 1 - Road Safety	-0,136	-0,034	-.163*	-0,053	-0,043	-0,096	0,038	-0,047	-0,028	-0,063	-.172*	.197**	-.213**	-0,037	.150*
Benefit 2 - Reduced Trafic Congestion	-0,042	0,087	0,070	0,032	-0,097	0,129	-0,098	0,056	0,120	0,095	0,066	-0,049	-0,102	0,009	0,034
Benefit 3 - Reduced CO2 Emissions	0,093	-0,093	0,041	-.173*	-0,032	-0,036	-.146*	-0,031	-0,053	-0,115	0,015	0,110	-0,054	-0,057	0,103
Benefit 4 - Reduced Long Term Costs	0,002	-.147*	-0,019	-0,082	-0,008	0,041	-0,028	-0,105	-0,101	-0,057	0,033	0,142	0,051	0,024	0,120
Benefit 5 - Improved Free Time	0,020	0,089	0,002	0,074	0,015	-0,073	0,050	0,048	0,015	.170*	0,110	-.186*	.211**	-0,039	-.153*
Benefit 6 - Less Stress	0,087	0,030	0,089	.208**	.162*	0,066	.198**	0,093	0,026	-0,021	-0,073	-.192**	0,089	0,120	-.212**
Concern 1 - Hacking vulnerability	-0,043	0,068	-0,026	-0,001	-0,031	0,019	-.196**	0,013	0,049	0,083	.148*	-0,050	0,113	-.243**	-0,020
Concern 2 - Driving Safety	-0,031	-.168*	-0,080	-0,134	0,075	-0,079	.174*	-0,024	0,121	-0,033	-0,065	.146*	-.174*	-0,099	.193**
Concern 3 - Initial Costs / Short Term Costs	-0,078	0,099	0,023	0,023	-0,090	-0,098	-0,050	-.144*	-0,104	-.153*	-0,046	0,104	0,020	.238**	0,060
Concern 4 - Incremental Autonomy	0,056	0,119	0,109	0,102	-0,056	-0,071	0,080	-.169*	-.171*	-0,141	-0,081	-0,048	0,042	0,140	-0,034
Corcern 5 - Less Human Control	0,033	-0,105	-0,025	0,055	0,110	0,058	0,032	.235**	0,061	0,126	0,038	-0,045	-0,014	-0,041	-0,058
Concern 6 - Unemployment Ratio	.147*	-0,002	0,053	0,030	-0,051	0,139	0,059	0,079	-0,047	0,127	-0,048	-0,138	-0,046	0,125	-0,126

Variables	Characteristic 5 - Product Condition	Characteristic 6 - Distributor Relation	Benefit 1 - Road Safety	Benefit 2 - Reduced Trafic Congestion	Benefit 3 - Reduced CO2 Emissions	Benefit 4 - Reduced Long Term Costs	Benefit 5 - Improved Free Time	Benefit 6 - Less Stress	Concern 1 - Hacking vulnerability	Concern 2 - Driving Safety	Concern 3 - Initial Costs / Short Term	Concern 4 - Incremental Autonomy	Corcern 5 - Less Human Control	Concern 6 - Unemployment Ratio
Age	-0,022	.208**	-0,136	-0,042	0,093	0,002	0,020	0,087	-0,043	-0,031	-0,078	0,056	0,033	.147*
Gender	0,023	0,004	-0,034	0,087	-0,093	-.147*	0,089	0,030	0,068	-.168*	0,099	0,119	-0,105	-0,002
Education	-0,085	0,128	-.163*	0,070	0,041	-0,019	0,002	0,089	-0,026	-0,080	0,023	0,109	-0,025	0,053
Distribution Channel	0,050	0,058	-0,053	0,032	-.173*	-0,082	0,074	.208**	-0,001	-0,134	0,023	0,102	0,055	0,030
Distribution Channel Adequate	-0,023	0,022	-0,043	-0,097	-0,032	-0,008	0,015	.162*	-0,031	0,075	-0,090	-0,056	0,110	-0,051
Heard about AV	-0,004	0,010	-0,096	0,129	-0,036	0,041	-0,073	0,066	0,019	-0,079	-0,098	-0,071	0,058	0,139
Tried a Self Guided Vehicle	0,016	-0,008	0,038	-0,098	-.146*	-0,028	0,050	.198**	-.196**	.174*	-0,050	0,080	0,032	0,059
Willing to try a Self Guided Vehicle	0,057	-0,006	-0,047	0,056	-0,031	-0,105	0,048	0,093	0,013	-0,024	-.144*	-.169*	.235**	0,079
Let family try a Self Guided Vehicle	0,129	-0,007	-0,028	0,120	-0,053	-0,101	0,015	0,026	0,049	0,121	-0,104	-.171*	0,061	-0,047
Service made by an AV	0,008	0,071	-0,063	0,095	-0,115	-0,057	.170*	-0,021	0,083	-0,033	-.153*	-0,141	0,126	0,127*
Willing to pay more for a AV service	0,049	0,006	-.172*	0,066	0,015	0,033	0,110	-0,073	.148*	-0,065	-0,046	-0,081	0,038	-0,048
Characteristic 1 - Speed of the Delivery	-0,119	-.427**	.197**	-0,049	0,110	0,142	-.186*	-.192**	-0,050	.146*	0,104	-0,048	-0,045	-0,138
Characteristic 2 - Tracking	-.241**	-0,009	-.213**	-0,102	-0,054	0,051	.211**	0,089	0,113	-.174*	0,020	0,042	-0,014	-0,046
Characteristic 3 - TypeVehicle	-.492**	0,068	-0,037	0,009	-0,057	0,024	-0,039	0,120	-.243**	-0,099	.238**	0,140	-0,041	0,125
Characteristic 4 - Cost	0,123	-.373**	.150*	0,034	0,103	0,120	-.153*	-.212**	-0,020	.193**	0,060	-0,034	-0,058	-0,126
Characteristic 5 - ProductCondition	1,000	-.303**	.146*	.145*	0,083	-.230**	-0,068	-0,102	.281**	.164*	-.258**	-.204**	-0,006	-0,133
Characteristic 6 - Distributor Relation	-.303**	1,000	-.252**	-0,060	-.191**	-0,059	.241**	.277**	-0,050	-.234**	-0,101	0,097	0,131	.265**
Benefit 1 - Road Safety	.146*	-.252**	1,000	-0,073	-0,056	-0,125	-.262**	-.453**	-0,045	.301**	0,080	-.170*	-0,035	-.156*
Benefit 2 - Reduced Trafic Congestion	.145*	-0,060	-0,073	1,000	-0,019	-.379**	-.220**	-.323**	0,111	-0,098	0,045	-0,031	0,019	-0,092
Benefit 3 - Reduced CO2 Emissions	0,083	-.191**	-0,056	-0,019	1,000	-0,076	-.526**	-.216**	0,028	0,081	-0,009	-.162*	0,032	-0,028
Benefit 4 - Reduced Long Term Costs	-.230**	-0,059	-0,125	-.379**	-0,076	1,000	-.148*	-.179*	-.248**	0,074	.161*	.149*	-0,079	0,058
Benefit 5 - Improved Free Time	-0,068	.241**	-.262**	-.220**	-.526**	-.148*	1,000	0,135	0,142	-.200**	-0,050	0,092	0,030	-0,051
Benefit 6 - Less Stress	-0,102	.277**	-.453**	-.323**	-.216**	-.179*	0,135	1,000	-0,019	-.150*	-.255**	0,110	0,075	.288**
Concern 1 - Hacking vulnerability	.281**	-0,050	-0,045	0,111	0,028	-.248**	0,142	-0,019	1,000	-.350**	-.303**	-.332**	-.182*	-.180*
Concern 2 - Driving Safety	.164*	-.234**	.301**	-0,098	0,081	0,074	-.200**	-.150*	-.350**	1,000	-0,074	-.167*	-0,077	-.380**
Concern 3 - Initial Costs / Short Term Costs	-.258**	-0,101	0,080	0,045	-0,009	.161*	-0,050	-.255**	-.303**	-0,074	1,000	.144*	-.447**	-.192**
Concern 4 - Incremental Autonomy	-.204**	0,097	-.170*	-0,031	-.162*	.149*	0,092	0,110	-.332**	-.167*	.144*	1,000	-.187*	-0,074
Corcern 5 - Less Human Control	-0,006	0,131	-0,035	0,019	0,032	-0,079	0,030	0,075	-.182*	-0,077	-.447**	-.187*	1,000	0,038
Concern 6 - Unemployment Ratio	-0,133	.265**	-.156*	-0,092	-0,028	0,058	-0,051	.288**	-.180*	-.380**	-.192**	-0,074	0,038	1,000

Legend

Correlation is significant at the 0.05 level (2-tailed).

Correlation is significant at the 0.01 level (2-tailed).

Firstly, this analysis indicates that there is a tendency between the age of the population and the knowledge of the concept of distribution channels, in fact, the older the respondent, higher is the likelihood of that same individual not being familiar with the concept of distribution channels. Regarding to AVs, man are more likely to be acquainted with the concept of AVs, rather than woman. Additionally, younger individuals are more willing to try AVs, indicating that older people are more sceptic of using AVs. Another significant correlation is the perceived appreciation of the beneficial impact brought by AVs in terms of safety, which is progressively more important, for people with higher education levels.

The individuals who were already acknowledged with the term of AVs and who are willing to try AVs, would be more receptive to let a family member try an AV and would more likely opt for a distribution service performed with AVs over a regular vehicle, in a scenario were both type of vehicles would imply the same time and cost of the service. Moreover, the respondents who would decisively opt for a distribution service with this features, would also

be likewise willing to choose a distribution service based on AVs, even if it implied higher costs. People who would be willing to pay more a distribution service performed by AVs, consider the type of vehicle seemingly more important in a distribution process and highlight the importance of road safety as potential benefit brought by AVs.

The respondents who already tried AVs are withal willing to allow family members to experience AVs, valuing carbon dioxide emissions reduction as an imminent benefit brought by AVs and, inversely, give lower significance to the potential stress levels reduction implied by this innovative technology. In terms of concerns, the population who already experienced AVs, are progressively more concerned with the hacking vulnerability of the systems and, on the other hand, are less preoccupied with the driving safety risks of these vehicles, expressly for respondents who tried AVs more than once, indicating that higher AV usage is inversely proportional to the perceived driving safety concerns towards these vehicles.

The importance given to the potential road safety gains associated to AVs adoption directly converges with the concern levels regarding AVs driving safety. On the other hand, reduced stress levels, improved free time while driving, unemployment ratio increase and insufficient autonomy, vary in opposite directions, this is, greater the perceived importance of road safety gains, smaller is the significance of these factors for respondents.

Chapter V - Conclusion

This chapter aims to present and summarize the findings and results based on the data collected and analysed in the previous chapters, validating the achievement of the proposed objectives and goals, starting by answering the three RQs. Furthermore, the limitations concerning this research and topic will be introduced and synthesized, providing, moreover, individual recommendations and guidelines for future investigations.

5.1 Are the Current Distribution Channels Efficient?

This first RQ intended to acquire a global outlook of the current distribution channels and collect data in whether or not there is room for improvement in the distribution industry. In this regard, both the literature review and the online survey highlighted that there is clearly a room for improving the current distribution channels, essentially regarding to technological improvements.

Both data collection methods identified this technological gap, acknowledging the need to improve distribution channels performance, as a well-planned and efficient distribution strategy can be directly connected to the success of a product or a service and, consequently, to the success or failure of a business. The way people interpret and perceive the quality of a product or a service, starts directly from the instant when it is ordered, because that is the moment where expectations start to be created.

This said, improving distribution channels efficiency does not only indicates a need in terms of tangible assets, but also in terms of optimizing these channels in all of its features, particularly focusing on the characteristics that are the most relevant for people in general, which could significantly improve with the development of IT. This efficiency enhancement could occur either in terms of cost, time, tracking, or even in terms of sustainability. IT can inclusively shorten the length of a distribution channel, while producing optimized costs and assure a better customer knowledge. Gathering, storing and processing data helps companies to increase their efficiency and effectiveness to meet customer requirements in the most effective and fastest way.

In conclusion, distribution channels can indeed be more efficient. Subsequently, assuring more efficient distribution channels can influence the successfulness of a product or service and, likewise, the success of a company. A single product can be decisive in the conveyance of thoughts, social norms and carrying cultural values. In this regard, further developments of IT can positively contribute to this psychological impact, by facilitating distribution to meet customer expectations more efficiently.

5.2 How can Information Technology Acceptance and Use, be Predicted and Assured?

Following the answer to the first RQ, it is notorious that in order to improve business performance it is fundamental to guarantee that distribution is supported by IT, as IT, within distribution, can result in more effective information flows in and out of the business, improving competitive priorities like, cost, time, flexibility and responsiveness of production. Although, technology requires a deep change, not only in physical terms, but also in terms of mind-set and willing to change.

Measuring and predicting IT acceptance and use is a considerable challenge, due to the inherent subjectivity involved. Although, a wide approach based on a comprehensive framework comprising not only sociodemographic characteristics, but also taking in consideration psychological factors, significantly contribute to the understanding and analysis of the conditioners influencing customer mind-set towards technology. In this sense, sociodemographic characteristics, such as gender, age and education level must be analyzed, alongside with psychological factors such as, performance expectancy, effort expectancy and social influence. Furthermore, the experience and habit regarding a certain technology are a key influencing factor for the acceptance and use of that exact technology.

In order to predict more accurately the acceptance of a determined technology by an individual, it is important to have a considerable knowledge regarding that technology and regarding the individual, in terms of motivations, opinions and expectations. A disruptive technology is more likely to substantially change an entire market, breaking routines, which

involves switching costs that sometimes and for some individuals, can be more relevant, than the actual beneficial added value of that technology.

In this regard, assuring the acceptance and use of IT reliably, it is significantly challenging, due to the high psychological contingencies and emotional charge related to this subject. Although human beings can be categorized and standardized, each individual has specific and own psychological characteristics, formulating different opinions, making this analysis rather complex.

Nevertheless, the acceptance and use of IT can be predicted more accurately, with the confrontation and further analysation of the perceived benefits and concerns, making it important to evaluate the individual awareness and knowledge in relation to a specific technology. An individual highly informed with a determined technology, is more likely to have a well-structured opinion and position towards the acceptance and use of that technology, making it less unpredictable.

5.3 Can Autonomous Vehicles be a dynamic answer and assume a disruptive technology role?

The last RQ of this dissertation intended to, initially, analyse AVs growth and predict their impact in a global perspective and objectively in the distribution industry. Additionally, another objective of this RQ is collecting empirical data regarding AVs beneficial value, as well as, the drawbacks and concerns influencing the acceptance and use of this innovative technology.

AVs are visibly growing and improving, although, currently this technology still requires human intervention in determined situations, namely emergencies, nonetheless, AVs are stepping each day closer to the fifth and last level of automation (SAE, 2018). When the fully automation level is reached, AVs will then start to truly demonstrate their complete potential, as, at that point, no human intervention will be necessary, which will completely revolutionise many industries.

Specifically regarding to the distribution industry, AVs promise an entire revolution in mobility, significantly improving distribution channels efficiency, by optimizing costs and

time, which could be a fundamental factor regarding the introduction of these vehicles in the distribution industry. Additionally, AVs promise to make travelling safer, more comfortable, more sustainable and less stressing, benefiting both consumers and companies.

However, convincing consumers to switch to AVs, still remains a challenge, even though the individual willingness to try AVs is considerably growing, there are steps that must be assured and demonstrated, in order to overcome the psychological barriers inherent. There is still a lot of concerns regarding to the reliability of these vehicles, which, on the other hand, is one of the most appreciated potential benefits of AVs, as the entrance in an Utopian Society (Shanker *et al.*, 2013) promises to significantly improve road safety. In this regard, assuring that AVs are infallible, is demanding, as it would allow to overcome trust issues and simultaneously closer to improve road safety.

The adoption of AVs will implicate serious adaptions, physically and psychologically, furthermore, there many factors influencing the acceptance and use of this technology, either cultural, emotional or even technological, which require a certain period of time to overcome. Nonetheless, AV technology will continuously keep developing, diminishing the barriers and the imminent concerning factors delaying its acceptance and use. Concurrently, the benefits of AVs will become increasingly more evident and assured, making it expected that AVs acceptance and further adoption and use, significantly grows during the next two decades.

5.4 Limitations

A cross-sectional feature of all studies is the existence of limitations during the elaboration of the research. The first major limitation is that the concept of autonomous vehicles is still a developing and emerging concept, and there is still no autonomous vehicle market on the market, which means that only 2% of the sample of the online survey sample have tried autonomous vehicles more than once.

Another limitation regarding the online survey, is related to the channel used to disseminate the survey, which was the internet, as it offered a wider scope, more capable of reaching ra higher number of respondents more effectively and rapidly, considering the time established for this part of the process. In consequence of resorting to internet, the sample turned out to

be little diversified in terms of age group and education level, as 89% of the sample is fixed between 18 years old and 44 years old, and 88% of the respondents have at least a bachelor's degree. Although, these limitations are not completely negative, especially regarding to age, as those age groups are precisely the ones than will most likely deal with the impact of AVs.

In addition to the limitations already mentioned, the diversity of the concept of AVs was also a limitation, as the concept is considerably broad, leading to many different interpretations. The objectivity and ability of synthesize information was rather challenging and, in order to circumvent this limitation, it was necessary to complement and correlate different points of view, in order to solidify opinions, particularly regarding the benefits and barriers of AVs. Furthermore, since it is an innovative technology still in a development phase, it was difficult to encounter proper and precise numeric information, based on factual data, especially regarding to the impact of AVs in the distribution sector.

5.5 Contribution to Services and Technology Management

This study and the respective results obtained are a good resource for services and technology management, as well as, for the automotive industry. This research reinforces the importance of taking into consideration the costumer point of view, when analysing the impact of introducing a determined technology in the market, which in the case of this study, is AV technology. As a concept still poorly explored by the academic community, it is imperative to define a course of development of the theme and to divide the consumer issue into demographic and psychographic variables.

Automotive manufacturers and technology firms also find here a guide to consumer knowledge in a disruptive market. Changing business practices and marketing strategies will inevitably take place in the short term and companies have to adapt to the new paradigm in the automotive industry, needing to know the consumer to make targeted efforts in the most urgent areas.

Psychological factors, such as the perception of benefits and concerns regarding the adoption of new technologies, are significant to the evolution of consumer behaviour. Thus, meeting the perceived benefits and minimizing the adoption concerns perceived, timely, while

assuring that consumers are accurately informed and aware, will overcome adoption barriers and concerns, facilitating the introduction of new technologies in the market, more efficiently.

Therefore, there should be a balance between the knowledge regarding the impact that a technology can have on an industry, as well as, the impact of that same technology in the consumer perspective. The expectations towards the industry must be considered, in addition to the individual customer expectations and needs, in order to reduce the potential risks of technology, and to better predict the success of a determined technology.

5.6 Recommendations for Future Investigations

The main recommendations for future researches and investigation focus on the scope of the study and the methodology. Since the obtained results obtained and the conclusions drawn, are conditioned by the sample characteristics, mainly in terms of size and diversity. In this regard, future investigations should evaluate and search for different channels, in order to increase the reliability and even the quality of the primary data collection.

Conducting interviews to people who are directly responsible to make decisions regarding distribution management, as well as, people who are already users or former users of AVs, could be significantly relevant in terms of data collection. Additionally, monitoring the development of AV technology with potential users could also bring important insights to future studies.

Another suggestion would be to analyze and evaluate the socio-economic implications and contingencies of AVs adoption in the distribution industry, regarding a particular region or country. Deeper and factual investigations could potentially accelerate the development of AV technology, particularly if comprising a well-structured and reliably detailed project, as it could be a significantly relevant indicator for future investigations.

References

Adnan, N., Nordin, S. M., bin Bahruddin, M. A., & Ali, M. (2018). How trust can drive forward the user acceptance to the technology? In-vehicle technology for autonomous vehicle. *Transportation research part A: policy and practice*, *118*, 819-836.

Andrejić, M., & Kilibarda, M. (2016). A framework for measuring and improving efficiency in distribution channels. *International Journal for Traffic and Transport Engineering*, *6*(2), 137-148.

Arthur, W. B. (2009). *The nature of technology: What it is and how it evolves*. Simon and Schuster.

Bansal, P., Kockelman, K. M., & Singh, A. (2016). Assessing public opinions of and interest in new vehicle technologies: An Austin perspective. *Transportation Research Part C: Emerging Technologies*, *67*, 1-14.

Barbour, I. G. (1993). *Ethics in an Age of Technology* (No. 2, 1989-1991).

Basu, S., & Weil, D. N. (1998). Appropriate technology and growth. *The Quarterly Journal of Economics*, *113*(4), 1025-1054.

Bösch, P. M., Becker, F., Becker, H., & Axhausen, K. W. (2018). Cost-based analysis of autonomous mobility services. *Transport Policy*, 64, 76-91.

Bösch, P. M., Ciari, F., & Axhausen, K. W. (2016). Autonomous vehicle fleet sizes required to serve different levels of demand. *Transportation Research Record*, *2542*(1), 111-119.

CB Insights Research. (2016). *33 Corporations Working On Autonomous Vehicles.*

Chen, T. D., Kockelman, K. M., & Hanna, J. P. (2016). Operations of a shared, autonomous, electric vehicle fleet: Implications of vehicle & charging infrastructure decisions. *Transportation Research Part A: Policy and Practice*, *94*, 243-254.

Chesbrough, H., & Crowther, A. K. (2006). Beyond high tech: early adopters of open innovation in other industries. *R&d Management*, *36*(3), 229-236.

Cisco. (2013). Cisco Customer Experience Research Automotive Industry Global Data.

Clark, B., Parkhurst, G., & Ricci, M. (2016). Understanding the socioeconomic adoption scenarios for autonomous vehicles: A literature review.

Coughlan, A. T., Anderson, E., Stern, L. W., & El-Ansary, A. (2006). Marketing channels.

Daziano, R. A., Sarrias, M., & Leard, B. (2017). Are consumers willing to pay to let cars drive for them? Analyzing response to autonomous vehicles. *Transportation Research Part C: Emerging Technologies*, *78*, 150-164.

Endsley, M. R. (2017). Autonomous driving systems: A preliminary naturalistic study of the Tesla Model S. *Journal of Cognitive Engineering and Decision Making*, *11*(3), 225-238.

Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: exploring the phenomenon. *R&d Management*, *39*(4), 311-316.

Fagnant, D. J., & Kockelman, K. (2015). Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations. *Transportation Research Part A: Policy and Practice*, *77*, 167-181.

Fayaz, R., & Azizinia, M. (2016). Current challenges in distribution channels of cultural goods and services. *Marketing and Branding Research*, *3*, 75-85.

Folinas, D., Manthou, V., Sigala, M., & Vlachopoulou, M. (2004). E-volution of a supply chain: cases and best practices. *Internet research*, *14*(4), 274-283.

Galkin, A. (2015). Distribution Channels Management in Different Regions. *Management*, *1*(2), 92-96.

Ghobakhloo, M., Arias-Aranda, D., & Benitez-Amado, J. (2011). Adoption of e-commerce applications in SMEs. *Industrial Management & Data Systems*, *111*(8), 1238-1269.

Grandón, E. E., Nasco, S. A., & Mykytyn Jr, P. P. (2011). Comparing theories to explain e-commerce adoption. *Journal of Business Research*, *64*(3), 292-298.

Güles, H. K., Çagliyan, V., & Bedük, M. (2012). The Strategic Impact of Information Technologies on Supply Chain and Business Performance. *Journal of Business Research–Türk*.

Haboucha, C. J., Ishaq, R., & Shiftan, Y. (2017). User preferences regarding autonomous vehicles. *Transportation Research Part C: Emerging Technologies*, *78*, 37-49.

Heard, B. R., Taiebat, M., Xu, M., & Miller, S. A. (2018). Sustainability implications of connected and autonomous vehicles for the food supply chain. *Resources, conservation and recycling*, 128, 22-24.

Hox, J. J., & Boeije, H. R. (2005). Data collection, primary versus secondary.

Høyer, K. G. (2008). The history of alternative fuels in transportation: The case of electric and hybrid cars. *Utilities Policy*, *16*(2), 63-71.

Huang, Z., & Benyoucef, M. (2013). From e-commerce to social commerce: A close look at design features. *Electronic Commerce Research and Applications*, *12*(4), 246-259.

Huijts, N. M., Molin, E. J., & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. *Renewable and sustainable energy reviews*, *16*(1), 525-531.

Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information & management*, *48*(1), 1-8.

Ketron, S., & Naletelich, K. (2019). Victim or beggar? Anthropomorphic messengers and the savior effect in consumer sustainability behavior. *Journal of Business Research*, *96*, 73-84.

Kim, K., & Frazier, G. L. (1996). A typology of distribution channel systems: a contextual approach. *International Marketing Review*, *13*(1), 19-32.

Lavasani, M., Jin, X., & Du, Y. (2016). Market penetration model for autonomous vehicles on the basis of earlier technology adoption experience. *Transportation Research Record*, *2597*(1), 67-74.

Lavasani, M., Asgari, H., Jin, X., & Pinjari, A. (2017). *Investigating the Willingness to Pay for Autonomous Vehicles and the Likelihood of Residential Relocation* (No. 17-00849).

Leicht, T., Chtourou, A., & Youssef, K. B. (2018). Consumer innovativeness and intentioned autonomous car adoption. *The Journal of High Technology Management Research*, *29*(1), 1-11.

Litman, T. (2017). *Autonomous vehicle implementation predictions*. Victoria, Canada: Victoria Transport Policy Institute.

Mesthene, E. G. (1970). Technological change: Its impact on man and society.

Mirzaeian, N., Cho, S. H., & Scheller-Wolf, A. A. (2018). A Queueing Model and Analysis for Autonomous Vehicles on Highways.

Mitra, D. (2012). The role of crowdfunding in entrepreneurial finance. *Delhi Business Review*, *13*(2), 67.

Morgan Stanley. (2013). *Autonomous Cars: Self-Driving the New Auto Industry Paradigm*. Morgan Stanley Blue Papers.

Nunes, A. & Hernandez, K. (2019). The Cost of Self-Driving Cars Will Be the Biggest Barrier to Their Adoption. *Harvard Business Review.*

Oliver, N., Calvard, T. & Potočnik, K. (2017). The tragic crash of Flight AF447 shows the unlikely but catastrophic consequences of automation. *Harvard Business Review.*

Papazoglou, M. P., Ribbers, P., & Tsalgatidou, A. (2000). Integrated value chains and their implications from a business and technology standpoint. *Decision Support Systems*, *29*(4), 323-342.

Papazoglou, M. P., Yang, J., & Tsalgatidou, A. (2002). The Role of eServices and Transactions for Integrated Value Chains. *Business to Business Electronic Commerce: Challenges and Solutions*, 207-241.

Pillath, S. (2016). Automated vehicles in the EU. *European Parliament Think Tank*, *sty*.

Pitt, L., Berthon, P., & Berthon, J. P. (1999). Changing channels: the impact of the Internet on distribution strategy. *Business Horizons*, *42*(2), 19-28.

Porter, M. E., & Millar, V. E. (1985). How information gives you competitive advantage.

Poschenrieder, M. & von Frankenberg, C. (2017). *Automated driving at the BMW Group*.

Power, J. D. (2012). Vehicle owners show willingness to spend on automotive infotainment features. *Retrieved July*, *24*, 2017.

Ramanathan, R. (2010). The moderating roles of risk and efficiency on the relationship between logistics performance and customer loyalty in e-commerce. *Transportation Research Part E: Logistics and Transportation Review*, *46*(6), 950-962.

Rao, S. S., Metts, G., & Monge, C. A. M. (2003). Electronic commerce development in small and medium sized enterprises: A stage model and its implications. *Business Process Management Journal*, *9*(1), 11-32.

Rathod, S. D. (2013). An autonomous driverless car: an idea to overcome the urban road challenges. *Journal of Information Engineering and Applications*, *3*(13), 34-38.

Ritcher, F. (2017). *Who Leads the Autonomous Driving Patent Race? | Statista, Statista.*

Rosenzweig, J., & Bartl, M. (2015). A review and analysis of literature on autonomous driving. *E-Journal Making-of Innovation*.

SAE. (2018). SAE International Releases Updated Visual Chart for Its "Levels of Driving Automation" Standard for Self-Driving Vehicles.

Schoettle, B., & Sivak, M. (2014). *A survey of public opinion about autonomous and self-driving vehicles in the US, the UK, and Australia*. University of Michigan, Ann Arbor, Transportation Research Institute.

ShabbirHusain, R. V., & Varshney, S. (2019). Is Current Way of Promoting Sustainability, Sustainable?. *Journal of Nonprofit & Public Sector Marketing*, *31*(1), 84-113.

Shanker, R., Jonas, A., Devitt, S., Huberty, K., Flannery, S., Greene, W., Swinburne, B., Locraft, G., Wood, A., Weiss, K., Moore, J., Schenker, A., Jain, P., Ying, Y., Kakiuchi, S., Hoshino, R. & Humphrey, A. (2013). Autonomous Cars: Self-Driving the New Auto Industry Paradigm. *Blue Paper, Morgan Stanley*.

Slowik, P., & Sharpe, B. (2018). Automation in the long haul: Challenges and opportunities of autonomous heavy-duty trucking in the United States. *The International Council of Clean Transportation*.

Stefansdottir, B., & Grunow, M. (2018). Selecting new product designs and processing technologies under uncertainty: Two-stage stochastic model and application to a food supply chain. *International Journal of Production Economics*, *201*, 89-101.

Șteț, M. (2014). Benefits and Drawbacks of Technology in Supply Chain Management. *SEA–Practical Application of Science*, *2*(05), 617-621.

Sulaiman, B. R. (2018). Artificial Intelligence Based Autonomous Car.

Tesla Europe. (2017). *Service | Tesla Europe.*

Todorovic, V., Maslaric, M., Bojic, S., Jokic, M., Mircetic, D., & Nikolicic, S. (2018). Solutions for More Sustainable Distribution in the Short Food Supply Chains. *Sustainability*, *10*(10), 3481.

Van Kerrebroeck, H., Brengman, M., & Willems, K. (2017). When brands come to life: experimental research on the vividness effect of Virtual Reality in transformational marketing communications. *Virtual Reality*, *21*(4), 177-191.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS quarterly*, *36*(1), 157-178.

Venkatesh, V., Thong, J. Y., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems*, *17*(5), 328-376.

Volvo Cars Company. (2017). *Drive Me – the self-driving car in action, Volvo Cars Company.*

Wakabayashi, D. (2016). *Apple Is Said to Be Rethinking Strategy on Self-Driving Cars - The New York Times, New York Times.*

Wilfong, I. J. (1990). Autonomous Robot Vehicles. Springer Science & Business Media.

World Health Organization. (2015). *Global status report on road safety 2015*. World Health Organization.

Wright, K. B. (2005). Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of computer-mediated communication*, *10*(3), JCMC1034.

Wu, H., Li, Z., King, B., Miled, B. Z., Wassick, J., & Tazelaar, J. (2017). A distributed ledger for supply chain physical distribution visibility. *Information*, *8*(4), 137.

Yadron, D., & Tynan, D. (2016). Tesla driver dies in first fatal crash while using autopilot mode. *the Guardian*, *1*.

Zelenika, I., & Pearce, J. (2011). Barriers to appropriate technology growth in sustainable development.

Appendix

Appendix 1 – Online Survey

Autonomous Vehicles: Solution or a Threat? For everyone or just for some? What role can they play in Distribution.

This survey is developed under my Dissertation Project within the Master in Management in Services and Technology at ISCTE-IUL Business School. All the information obtained in this form is confidential and it will be used, exclusively, for research purposes. The survey takes no longer than 5 minutes. Thank you! (Este inquérito é desenvolvido no âmbito do meu Projeto de Dissertação no Mestrado em Gestão de Serviços e Tecnologia no ISCTE-IUL Business School. Todas as informações obtidas neste formulário são confidenciais e serão usadas exclusivamente para fins de pesquisa. O inquérito não leva mais que 5 minutos. Obrigado!)

1. Are you familiar with the concept of Distribution Channel? (Está familiarizado com o conceito de Canal de Distribuição?)

- ○ Yes (Sim)
- ○ No (Não)
- ○ Other...

2. In short, a Distribution Channel provides a link between Production and Consumption. What would you value most in a distribution process, (being column 1, the most valuable characteristic and column 6, the less valuable)? (Um Canal de Distribuição estabelece uma ligação entre a Produção e o Consumo. Que características mais valoriza num processo de distribuição, sendo a coluna 1, a característica que considera mais valiosa e a coluna 6, a menos valiosa?)

	1	2	3	4	5	6
Speed of the D...	○	○	○	○	○	○
Tracking of the...	○	○	○	○	○	○
How it was del...	○	○	○	○	○	○
Cost of the ser...	○	○	○	○	○	○
Condition of th...	○	○	○	○	○	○
Relationship w...	○	○	○	○	○	○

3. In your opinion, are the current distribution channels adequate to the modern times (In terms of technological development)? (Considera os atuais canais de distribuição adequados aos tempos modernos (em termos de desenvolvimento tecnológico)? *

- ○ Yes (Sim)
- ○ They could improve (Podiam melhorar)
- ○ No (Não)

4. Have you ever heard about Autonomous Vehicles? (Já alguma vez ouviu falar sobre Veículos Autónomos) *

- ○ Yes (Sim)
- ○ No (Não)
- ○ Other...

5. In short, an Autonomous Vehicle is a vehicle that can guide itself with no (or few) human intervention. What benefits do you believe that this type of vehicle could bring? Choose 1 option per column, being column 1, the most important benefit and column 6, the less important benefit. (Resumidamente, um Veículo Autónomo é um veículo que se pode guiar com nenhuma (ou pouca) intervenção humana. Na sua opinião, quais os benefícios que este tipo de veículo poderia trazer? Escolha 1 opção por coluna, sendo a coluna 1, o benefício mais importante, e a coluna 6, o benefício de menor importância) *

	1	2	3	4	5	6
Safety (Segura...	○	○	○	○	○	○
Reduced Trafic...	○	○	○	○	○	○
Reduced CO2 ...	○	○	○	○	○	○
Reduced Long ...	○	○	○	○	○	○
Improved Free ...	○	○	○	○	○	○
Less Stress (R...	○	○	○	○	○	○

6. Which are your biggest concerns regarding Autonomous Vehicles? Choose 1 option per column, being column 1, the biggest concern and column 6, the smallest concern. (Quais as suas maiores preocupações em torno dos Veículos Autónomos? Escolha 1 opção por coluna, sendo a coluna 1, a maior preocupação, e a coluna 6, a menor preocupação) *

	1	2	3	4	5	6
Hacking vulner...	○	○	○	○	○	○
Driving Safety ...	○	○	○	○	○	○
Initial Costs / ...	○	○	○	○	○	○
Incremental A...	○	○	○	○	○	○
Less Human C...	○	○	○	○	○	○
Unemploymen...	○	○	○	○	○	○

Approximately 1.2 million people die in traffic accidents every year. The widespread adoption of autonomous vehicles could reduce the number of auto incidents. Autonomous Vehicles can communicate with each other and identify the most optimal route, which could reduce congestion and make ground transportation more seamless. (Aproximadamente 1,2 milhão de pessoas morrem em acidentes de trânsito todos os anos. A adoção generalizada de Veículos Autónomos poderia reduzir o número de incidentes com automóveis. Os Veículos Autónomos podem comunicar entre si e identificar a rota mais ideal que poderia reduzir o congestionamento e tornar o transporte terrestre mais fluído).

7. Have you ever tried a self-guided vehicle? (Já alguma vez exprimentou um Veículo Autoguiado?)

- ○ Yes, 1 time (Sim, uma vez)
- ○ Yes, more than once (Sim, mais do que uma vez)
- ○ Never (Nunca)

8. Would you be willing to try a Self-Guided Vehicle? (Gostaria de exprimentar um Veículo Autoguiado?)

- ○ Yes (Sim)
- ○ No (Não)
- ○ Maybe (Talvez)
- ○ Other...

9. Would you let your kids or family try a Self Guided Vehicle? (Deixaria os seus filhos ou algum familiar exprimentar um Veículo Autoguiado?)

- ○ Yes (Sim)
- ○ No (Não)
- ○ Maybe (Talvez)
- ○ Other...

10. Would you choose a service based on Autonomous Vehicles, over a regular distribution service, if both had the same time and cost? (Optaria por um serviço baseado em Veículos Autónomos, em detrimento de um serviço de distribuição normal, se ambos tivessem o mesmo tempo e custo?) *

- ○ Yes (Sim)
- ○ No (Não)
- ○ Indifferent (Indiferente)

11. Would you be willing to pay more for a service made by an Autonomous Vehicle? (Estaria disposto(a) a pagar mais por um serviço feito por um Veículo Autónomo?) *

- ○ Yes (Sim)
- ○ No (Não)
- ○ Other...

12. Gender (Género) *

- ○ Man (Homem)
- ○ Woman (Mulher)
- ○ I prefer not to answer (Prefiro não responder)

13. Age (Idade) *

- ○ Less than 18 (Menos de 18)
- ○ 18 - 24
- ○ 25 - 34
- ○ 35 - 44
- ○ 45 - 54
- ○ 55 - 65
- ○ More than 65 (Mais de 65)

14. Nacionality (Nacionalidade) *

- Portuguese (Portuguesa)
- Spanish (Espanhola)
- French (Francesa)
- Swiss (Suiça)
- German (Alemã)
- Dutch (Holandesa)
- English (Inglesa)
- Angolan (Angolana)
- Mozambican (Moçambicana)
- Other...

15. Education Level (Grau de Educação) *

- Elementary School (9º ano)
- High School Gratuate (12º ano)
- Bachelor's Degree (Licenciatura)
- Postgraduate (Pós-Graduação)
- Master's Degree (Mestrado)
- Doctorate Degree (Doutorado)
- Other...

16. Occupation (Ocupação) *

- ○ Student (Estudante)
- ○ Employed (Empregado)
- ○ Self-employed / Entrepreneur (Trabalhador por conta própria / Empreendedor)
- ○ Freelancer
- ○ Unemployed (Desempregado)
- ○ Retired (Reformado)
- ○ Other...