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Abstract: This paper aims at identifying the adherences of the propositions of Autonomous Vehicles (AVs) over Traditional Vehicles (TradVs) by using the theoretical models of the blue ocean's strategy four-action framework and value curve (Kim & Mauborgne, 2005) and disruptive innovation (Christensen, 1997). Specifically, it aims at drawing new value curves for AVs over TradVs when considering AVs as a service and as a product. As for methodology, this study is classified as qualitative, empirical and descriptive with data collection via open questionnaires with AVs specialists in France, Belgium and Brazil and analyzed by content analysis (Bardin, 2010). The results point to the arrival of a "new" vehicle concept that includes: different ownership forms; free time for users (no driving required); "infotainment"; social integration of elder and handicapped people; in all, factors that will cause the extinction of some markets and creation of others. The AVs' value curves present different characteristics when compared to TradVs', in a sense that the main elements to be reduced are: human intervention; ownership; related services and accidents. The elements to be eliminated (in higher automation levels) are: car components like steering-wheel and pedals; rear-view mirrors; driver's license need; driver's liability as well as the fact that driving sensations and driver's control over the vehicle tend to disappear. It is also discussed about the vehicle's business environment and related services that might fade away, such as: car dealerships, driving schools and gas stations. On the other hand, aspects such as: comfort, relaxation, driving fluidity and timing efficiency will be raised as well as there will be seen the creation of a new use of the time, reconfiguration of the design and the mobility for other audiences.

Keywords: Autonomous Vehicles, Value Curve, Four-action Framework, Disruptive Innovation, Blue Ocean Strategy.

1. Introduction

Autonomous vehicles (AVs), also known as Automated Driving Systems (ADS), which are vehicles that don't require any sort of conductor or teleoperation control (SAE, 2016; Frazzoli, Dahleh & Feron, 2002), are a potentially disruptive change to the current transportation business model (Mutz et al., 2016; Attias, 2016; Schellekens, 2015; Schreurs & Steuwer, 2015). Although the reality of AVs seems distant, it is increasingly evident its advances and inevitable arrival in the near future. Given that the automotive industry is going through some radical changes, and it's been struggling to find the right positioning (Attias & Mira-Bonnardel, 2016), the traditional transportation model could suffer an exponential decline in the coming years (Enoch, 2015). In this sense, Schoitsch (2016) states that AVs are inserted in the most significant historical change for the society, economy, automobile and public transport industry.

AVs technology is of great interest and investment in the global automotive industry with numerous carmakers –Audi, BMW, Cadillac, Ford, GM, Mercedes-Benz, Nissan, Toyota, Volkswagen and Volvo – already testing driverless cars (Fagnant & Kockelman, 2015). Partnerships among companies have also been a common way to develop AVs technologies, not to mention that vehicles with semi-autonomous features are already being marketed – such as Tesla's cars (Fagnant & Kockelman, 2015). It is also worth mentioning that governments of several countries (U.S.A., France, Germany, Italy, England, among others) have also become interested in the AVs' benefits by introducing legislations allowing development and testing of technologies of AVs on their roads (Schoitsch, 2016).

Significant advances are also being made within the academia, research centers and universities world-wide are advancing many studies on technology mobility, vehicle-infrastructure interaction and management and business-related issues for AVs' consolidation (Lima, 2015; Guizzo 2011). Even though there has been an establishment of a theoretical field regarding AVs, it is not yet evident the main aspects that

permeate the thematic, as well as its conceptual base, tendencies and characteristics. In the scope of business and management this lack of studies is even more pronounced, little has been discussed about the real managerial implications regarding the AVs' arrival in the market (Gandia et al., 2017). Several authors (Attias, 2016; Attias & Mira-Bonnardel 2016; Mutz et al., 2016; Fagnant & Kockelman, 2015; Enoch, 2015; Schellekens, 2015; Schreurs & Steuwer, 2015; Poorsartep, 2014) consider the AVs' arrival as the greatest disruptive innovation in the automotive market.

In this context, one can raise several questions: What will be the main attributes present in AVs that differ from traditional vehicles (TradVs)? Which ones will be raised, created? What TradVs' attributes will not be present on AVs? Which attributes will be reduced and eliminated? From this, one can also question aspects related to AVs' value proposition, as well as marketing implications: what is the value proposition offered by AVs? What markets/services will be involved with the arrival of AVs? Will there be demand of a new public from the insertion of these vehicles? Will these vehicles face competition? Of what kind?

Based on such questions, this study aims at identifying the adherences of the propositions of Autonomous Vehicles (AVs) over traditional vehicles (TradVs) by using the theoretical models of the blue ocean's strategy four-action framework and value curve and disruptive innovation (Kim & Mauborgne, 2005; Christensen, 1997). Specifically, aims at drawing new value curves for AVs over TradVs when considering AVs as a service and as a product.

Considering that AVs are embedded in the most significant historical change to automobile industry and transportation (Attias, 2016; Enoch, 2015), this paper aims at contributing to broaden the understating of AVs' insertion in the market for both the academia and practitioners, in a sense that governments, universities and car-manufacturers worldwide identify AVs as key-research factor, therefore, such imminent arrival includes impacts on several spheres, being important to consider the impacts of such disruptive innovation not only on cities and society, but on structure and functioning of companies as well.

2. Theoretical background

Here we present the theories and concepts that guided this study, starting with the four-action framework, followed by the disruptive innovation concept and finishing with Autonomous Vehicles as Services and as Products conceptual review.

2.1 The blue ocean's strategy four-action framework and value curve

Proposed by Kim and Mauborgne (2005), the blue ocean's strategy questions why organizations continue a fierce dispute within saturated markets (red oceans) where large investments are made in pursuit of sustainable and profitable growth when results often are only small market-share gains (Kaplan, 2012). Therefore, for a company to be in a "blue ocean", the premise is to make competitors irrelevant, avoiding such fierce competitive battles and offering customers with something unique and yet untapped in a given business segment, thereby producing the so-called value innovation (Kim & Mauborgne, 2005; Osterwalder & Pigneur, 2010).

To answer the questions: how to make competition irrelevant? how to unveil unexplored markets and create blue oceans? Kim and Mauborgne (2005) developed a four-action framework that allows one to systematically explore ways of rearranging attributes that generate value for clients in order to offer entirely new experiences. This is achieved by reducing and/or eliminating less valued competitive attributes for a specific segment of consumers, and by raising or creating new attributes that generate differentiated value for such consumers' segment. The generated matrix from these four actions (eliminate, reduce, create and raise) leads companies to act based on the answers to build a new value curve.

In blue oceans demand is created rather than contested, resulting is ample opportunity for growth that is both profitable and rapid (Kim & Mauborgne, 2005; Osterwalder & Pigneur, 2010), therefore, competition is irrelevant because the "rules of the game" are waiting to be defined (Kim & Mauborgne, 2005), thereby, the authors conclude that blue oceans are created when a company achieves an innovation that simultaneously creates value for both consumers and company.

2.2 Disruptive innovation

Innovation represents a means by which a competitive advantage can be obtained by increasing the participation of a company in an existing market or even by creating completely new markets that may become explored (Feldens, Maccari & Garcez, 2012). As Christensen and Raynor (2003) states, innovations come in two general types: 1) sustaining and 2) disruptive innovations. In the former, products are made better over time to meet costumers' demands who are willing to pay more for better products; on the latter, the introduced products offer other benefits which will appeal to new customers.

New technologies (such as AVs) can create new markets or radically change (disrupt), the *status-quo* in existing markets (Nagy, Schuessler & Dubinsky, 2016). In this sense, Christensen (1997) states that disruptive technologies bring to market a very different value proposition than those previously available; which generally by being technologically straightforward, offer different packages of attributes that are not often considered important to mainstream customers. Therefore, disruptive innovation represents a solution to an unmet need, since it offers different solutions and alternatives to the market by changing social practices and ways of living, working, and interacting (Christensen, 2001).

In this sense, traditional car manufacturers and new industry players (e.g.: Google, Tesla, Otto & Uber) – desiring to extend their influence to new clienteles – are preparing for the future by investing heavily on AVs (Attias, 2016). Thus, AVs are stepping out the science fiction realm and are now becoming a reality (Schreurs & Steuwer, 2015).

Attias (2016) emphasizes that "not only does the self-driving car seem to be the city car of the future, it is also at the origin of the greatest revolution that the automobile industry has ever known" (p.100) – being considered as a true paradigm shift (Attias, 2016; Enoch, 2015). Thus, this disruptive innovation is upon us and is a matter of *when*, not *if;* therefore, we should strive to embrace it (Poorsartep, 2014). The author also highlights that this new technology has the potential to scar many industries while almost simultaneously creating others, fundamentally revolutionizing the way in which we live our lives.

2.3. Autonomous Vehicles as Services (AVs-S) and as Products (AVs-P)

As pointed out by Attias and Mira-Bonnardel (2016), the automotive industry is going through some radical changes, and it's been struggling to find the right positioning, in a sense that "while cooperation with traditional players is necessary, carmakers find themselves obliged to form alliances with new entrants, often far removed from their core business" (p.69) such as Google, Uber, Apple among other tech-companies.

Considering that, the traditional business model of selling cars as products is losing ground to alternative forms of trading such as Product-Service System – (PSS) (Attias & Mira-Bonnardel, 2016) which are models that combine on their structures characteristics of both a product and a service, hence the consumer will buy the service (transportation) offered by the product (AVs) and not the product itself.
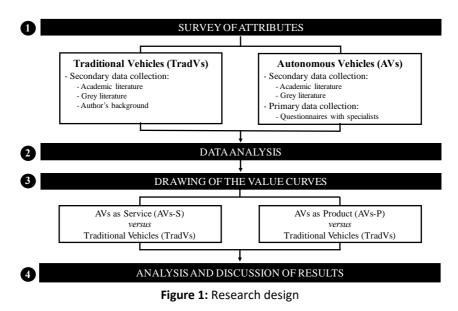
Thereby, a business model in which cars are offered as services is gaining strength and it is being tackled by many companies and scholars. As GM's former vice-presient stated:

> "(…) using a shared, self-driving, and purpose built fleet of vehicles could reduce the total cost of ownership from US$1.60 per mile down to US$0.50 per mile, this is more than a 10-fold improvement compared to personally owned vehicles" (Burns, Jordan & Scarborough, 2013:p.101).

"As a result, traditional players in the industry find themselves obliged to form new alliances with companies in emerging sectors (e.g. performance economy, circular economy, digital economy, etc.)" (Attias & Mira-Bonnardel, 2016:p.72), therefore an important part of the opportunities offered by PSS lies on the correlation between product and service activities (Mahut et al. 2015).

3. Methodology

This study was characterized by a qualitative approach of exploratory-descriptive nature. Exploratory in a sense that AVs' field of study is still little addressed in the business literature and thus, there is a lack of business-like academic knowledge on the topic; it is also descriptive because it aims at describing and analyzing phenomena (Malhotra, 2001; Gil, 2008). Figure 1, highlights the research design.

Figure 1: Research design

On stage 1 we proceeded with the survey of the attributes for creating the value curves. For TradVs, data collection was based on the analysis of secondary data - similarly to what Enoch (2015) adopted in his work and also on the authors' previous knowledge on the subject. For the AVs [considering SAE's (2016) level 4 of automation] we used secondary data collection as well as primary data collection with open-ended questionnaires with 12 specialists in the subject of AVs in France, Belgium and Brazil, in order to list the main components to be considered as the basis of the AVs value curves. As for data analysis (stage 2), Bardin's (2010) content analysis was adopted aiming at creating a grid of analytical categories by which we could better filter and understand the attributes used on the value curves' creation.

After filtering the attributes that would be part of the value curves, on stage 3 we asked the respondents to rank the attributes from 0 to 10 for each car model (AVs-S; AVs-P and TradVs) and by calculating the answers' arithmetic mean we drew the value curves which were analyzed and discussed (step 4) and are presented as follows.

4. Results and discussion

We present here the value curves for AVs-S and AVs-P compared to TradVs. For a better results' understanding we considered the TradVs' value curve as a standard (grey lines). Therefore, based on Kim and Mauborgne's (2005) four-action framework, Figure 2 displays the attributes that must be eliminated, reduced, created and raised.

By analyzing the charts of Figure 2 (1: AVs-S *versus* TradVs; and 2: Avs-P *versus* TradVs) one can see in both cases a "mirror-like" behavior. That is, indispensable TradVs' attributes appear on the AVs curves as eliminated and/or reduced; and after crossing the inflection point, the trend remains, since attributes considered as non-essential and/or non-existent for TradVs are raised and/or created in the AVs' curves. However, it is worth noting that, when comparing both charts, it is noticed that the AVs-P curve is not as linear as the AVs-S displaying peaks in several attributes.
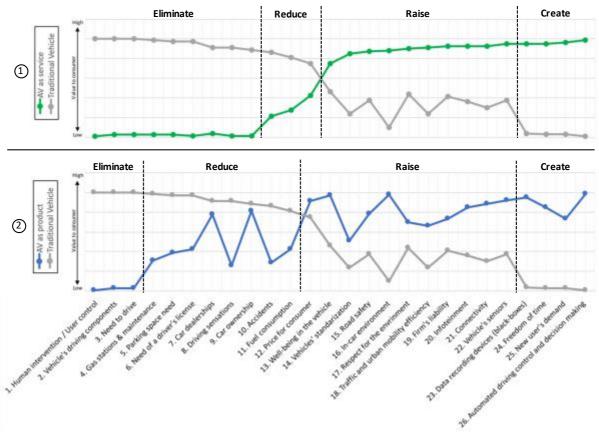
Figure 2: AVs-S and AVs-P versus TradVs value curves.
Source: research data, inspired by Orsato (2009, p.184), Bottacin, Madureira and Pedroso (2014, p.13).

4.1 Chart 1: Avs-S

We here present the value curve for AVs as a service when compared to Traditional Vehicles.

4.1.1 Eliminated attributes

Of the 26 attributes raked in this study, the results showed that for AVs-S the first 9 will be eliminated. It is interesting to note that 7 of these 9 attributes deal with essential and often inseparable elements for TradVs, such as: (1) "human intervention and user control"; (2) "driving components" [steering wheels, mirrors and pedals]; (3) "need to drive"; 4) "gas stations and maintenance"; (5) "parking space need"; (6) "driver's license need" and (8) "driving sensations". We also highlight attributes (7) and (9) – "car dealerships" and "car ownership" – that when considering AVs-S will no longer be necessary.

4.1.2 Reduced attributes

In this category, we have the attributes that will be reduced on AVs-S. Attribute (10) deals with the occurrence of accidents and deaths on the road, since, taking into account the reliability of the automated algorithms, security systems tend to be increased on AVs. The stakes on security promises are already impacting the market, for instance, the insurance company Root after an official NHTSA statement informed an expected reduction of 40% in accidents involving AVs, therefore deciding on reducing the insure price of Tesla's vehicles (Muoio, 2017).

Another aspect that will be reduced is "fuel consumption" (11), since, once a AVs-S business is in place, fuel consumption (regardless of its source) might certainly be optimized. The last attribute (12) to be reduced deals with "price for consumer", which, when comparing AVs-S and AVs-P curves, it is clear that shared vehicles offer a much more viable price to consumers, a 2016 Boston Consulting Group global study identified that 37% of consumers said that they are likely to share a ride in a self-driving taxi with strangers (BCG and WEF, 2016), this way, it is observed that there is users' predisposition to share AVs-S.

4.1.3 Raised attributes

We highlight here 10 attributes that will be raised on AVs-S; these attributes are somehow present on TradVs, however will gain greater representativeness on AVs-S, as well as might be able to incorporate new technologies and concepts.

Attribute (13) "well-being in the vehicle" relates to an increased sense of well-being within the car once comfort, relaxation; satisfaction; socializing moments and health care tend to rise in AVs-S. As for "vehicles' standardization" (14), considering the car-sharing business model and economies of scale the trend is that AVs-S will have higher degrees of standardization. Next, attribute (15) "road safety", reflects the inverse effect of attribute (10) "accidents"; and an increase in the "in-car environment" attribute (16) will also be noted, once AVs-S user will have greater moments to socialize and even to deal with professional matters.

Attribute 17 addresses the "respect for the environment" issue, often related to projections that AVs will generally be cars powered by clean and renewable sources of energy, thereby reducing fuel consumption, not to mention that AVs-S due to car-sharing characteristics, the harmful effects to the environment will be even smaller. Next, we have attribute (18) – "traffic and urban mobility efficiency", some expressions used by the respondents to characterize the rise of this attribute compared to TradVs were: "increase in traffic and timing efficiency and better urban mobility". Attribute (19) "Firm's liability" relates to the increase in legal implications that will involve both the car-manufacturer and the service-provider company (in cases they are two separate entities).

The "infoteiment" attribute (20) refers to the availability of information and entertainment services offered by AVs-S, which can be linked to the attribute "connectivity" (21) which deals with the communication forms and interfaces that will be developed in this new vehicle (vehicle-structure, vehicle-vehicle); these two attributes together represent an important part of the AVs-S' concept, since the central proposal for this type of vehicle is to offer of a series of possibilities to the user, radically changing the in-car experience. Also in this line, we can notice an increase on "vehicle's sensors" (22), necessary for the efficient navigation of such vehicles.

4.1.4 Created attributes

In this category, we have the attributes that will be created with the AVs' arrival. The first (23) refers to "data recording devices (black-boxes)", so that it will be possible to register all data and navigation inputs important in cases of accidents. The attribute (24) translates one of the main forms of AVs' value aggregation: "freedom of time" acquired by the user. Next, we have the emergence of "new user's demand" (25), because considering that AVs do not require a driver's license or any sort of specific motor skills, AVs open the way to new user's demand, so that children, disabled people, elders, could have greater independence by using this product/service. At last, if on the one hand "human intervention and user control" (1) will be eliminated, there is a need to develop mechanisms that allow "automated driving control and decision making" (26); some respondents' expressions used to describe this attribute were: "autonomous control and autonomous decision making".

4.2 Chart 2: AVs-P

After comparing the AVs-S with the TradVs, we present here the value curve for AVs as a product compared to Traditional Vehicles.

4.2.1 Eliminated attributes

For the AVs-P value curve, from the 26 attributes only 3 refer to aspects that will be eliminated with the arrival of AVs-P in the market. These are: (1) "human intervention and user control"; (2) driving components (e.g.: steering wheels, mirrors and pedals); (3) "need to drive". Important to highlight here that all these attributes correspond to essential characteristics on TradVs.

4.2.2 Reduced attributes

The rank of reduced attributes for AVs-P is larger than the one for AVs-S. This is because, it is expected that in the AVs-P market context, most attributes present on TradVs will be here reduced and not eliminated (as it happens for AVs-S). This can be explained because although AVs-P is a new concept result of a disruptive innovation, its business model would continue to occur in a similar way as TradVs. Therefore, 8 attributes belong to this category: (4) "gas stations and maintenance"; (5) "parking space need"; (6) need of a driver's license; (7) car dealerships; (8) driving sensations; (9) "ownership"; (10) accidents and; (11) "fuel consumption".

4.2.3 Raised attributes

Containing 11 of the 26 attributes, this category has the highest representativeness in the AVs-P value curve. We highlight here attribute (12) "price for consumer" that for AVs-P tends to be very high, since the expected sale-price of AVs-P is greater than what we have today with TradVs. However, BCG and WEF (2016) identified that a substantial parcel of consumers are willing to pay a premium of $5,000 or more for AVs given the benefits promised by such vehicles. We also highlight attribute (14) "vehicles standardization", although

presenting a rising trend it is less than on the AVs-S, since different vehicle options must be produced to meet the demands of the final consumer for AVs-P.

As for the other 9 attributes, they are the same as in AVs-S chart: (13) well-being in the vehicle; (15) road safety; (16) in-car environment; (17) respect for the environment; (18) traffic and urban mobility efficiency; (19) firm's liability; (20) infotainment; (21) connectivity and; (22) vehicle's sensors.

4.2.4 Created attributes

As in the AVs-S curve the attributes to be created for the AVs-P are the same: (23) "data recording devices"; (24) "freedom of time"; (25) "new user's demand" and; (26) "automated driving control and decision making".

4.3 Other considerations

AVs' value propositions indeed differ significantly from the ones on TradVs, emphasizing the disruptive characteristic of these vehicles. When questioned about such differences on the value propositions, respondents emphasized that in many respects AVs will add more value to what is already established on TradVs:

> "The main value proposition offered by TradVs is that they are door-to-door transportation mode. The same proposition will also be present on AVs but with more value coming from human factors (satisfaction)" – respondent 11.

It is also emphasized that, given the unprecedented benefits brought by this disruptive innovation, new elements, not yet considered, are added to AVs' value proposition, such as: greater time freedom, and leisure and entertainment options provided by creating an environment within the car. Although current public transport options may offer a certain degree freedom in time, often, the environment is not ideal for activities such as work or leisure, besides they are not as convenient as AVs.

For most respondents, the AVs concept is composed by the presence/absence of attributes displayed on the value curves, it can be noted aspects such as: the vehicle's ownership issue, widely discussed on AVs-S; again, creation of a "time freedom" for the user who once "dismissed" of driving can find other uses for time, which leads us to the proposition of the term "infotainment" and also; the creation of new demands/publics that will benefit from this new vehicle format, Other highlighted attributes by the respondents were: no need for car ownership (in case of AVs-S); greater safety and greater efficiency on traffic an urban mobility.

Regarding markets and businesses that would possibly be involved with the AVs' arrival, many examples were cited, such as: car-sharing; system services; communication services (connected vehicles); security services and; maintenance services. In addition to "shaking" existing markets and opening doors for the development of new ones, AVs will also allow new demands creation, by including new publics that do not have the possibility to own/drive a vehicle:

> "Once proven safer than conventional vehicles, AVs demand will grow dramatically as it reduces the costs of drivers for many situations. Driverless nights shuttles (if cities are safe enough); automated taxi for grandmas and grandpas for medical check; dads ordering safe shuttles to send kids to party and back home; shuttle for the dog for its monthly shampoo (...) In addition to people that basically need to stay home because they cannot drive themselves, or because public transports are difficult to use (even just to walk to the bus station) or because taxis are too expensive" – respondent 03.

It is worth mentioning that such benefit of inclusion will be even greater if we consider the AVs-S model, since AVs may be available for a significantly larger portion of the population.

At last, regarding the business competitors issue, although the respondents cited the usual forms of transportation - especially public transport – as the major competition, there seems to be a consensus that the entire transport sector will be significantly transformed by the AVs arrival, which will require from all involved actors (manufacturers, governments, service providers, etc.) various adaptations and changes on their respective businesses models so that they can remain competitive.

5. Concluding remarks

By the four-action framework and value curve and disruptive innovation models, the results point to the arrival of a "new" vehicle concept that includes: different ownership forms; free time for users (no driving required); "infotainment"; social integration of elder and handicapped people; in all, factors that will cause the extinction of some markets and creation of others.

The AVs' value curves display different characteristics when compared to TradVs, being the main elements to be reduced: human intervention; ownership; related services and accidents. The elements to be eliminated are: car components like steering-wheel and pedals; rear-view mirrors; driver's license need; driver's liability as well as the fact that driving sensations and driver's control over the vehicle tend to disappear. It is also discussed about the vehicle's business environment and related services that might fade away, such as: car dealerships, driving schools and gas stations. On the other hand, aspects such as: comfort, relaxation, driving fluidity and timing efficiency will be raised as well as there will be seen the creation of a new use of the time, reconfiguration of the design and the mobility for other audiences.

When analyzing the new value proposition of the autonomous vehicles we realize that, in fact, these vehicles have in their business model several attributes that fit them into a new market perspective, a 'blue ocean' compared to the current picture of TradVs. It is worth mentioning that for AVs-S, the value curve is even more distinct from the TradVs' curve, since besides having all the attributes related to the technological issues of the vehicle, it is necessary to consider all the attributes related to the implementation of this vehicle in the market as a service and not a product.

Acknowledgments

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