Exploring Marketing Strategies and the Market Perceptions of Autonomous Vehicles

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Declaration

I declare that this Dissertation that I have submitted to Dublin Business School for the award of M.sc Digital Marketing is the result of my investigations, except where otherwise stated, where it is clearly acknowledged by references. Furthermore, this work has not been submitted for any other degree.

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Abstract

The self-driving cars are said to be the future of the automotive industry. The automotive industry was one earliest to adopt the artificial intelligence for the deployment in its products since the 1980's. A 7 set questionnaire was prepared to understand the market perception regarding the autonomous vehicles. Similarly, a pre-prepared interview consisting of 11 questions was used in this research to gather insights on the marketing plans and strategies for the same, for 5 experts from an OEM (Original Equipment Manufacturer) 'KPIT ltd'. The analysis showed that social media platform and digital influencers are the key pillars to market autonomous vehicles. Along with that the analysis showed, that under the current market scenario, feature rich videos in the online platforms like YouTube could help create the initial interest for autonomous vehicles. On a closing note, the researcher has told that automotive brands must embrace digital platforms and creative advertising.

1. Introduction

Ever since the inception of the first automobile by Ford Incorporated in the year 1908, the automobile industry has been constantly and rapidly changing.

The world's fascination with self-driving vehicles began nearly 100 years ago, in 1926, when the "Phantom Auto" drove through the streets of Milwaukee with the help of remote control. The article about this vehicle which required no driver was published in the Milwaukee Sentinel in December 1926 by Loses Husband. Husband described how the car was controlled by a radio set, called the "mastermind" which guided the vehicle as it moved through the city (Husband, 1926). The "Phantom Auto" was the world's first introduction to the idea of a vehicle that could operate without a driver.

The world has come a long way since then and now many giant automotive manufacturers like Toyota, Mercedes- Benz, Tesla and Nissan are testing their versions of autonomous vehicles. Many technology companies like Google and Apple are also developing and testing prototypes (Mathews, 2018).

Autonomous vehicles or self-driving cars or driver-less vehicles are a category of vehicles that can drive by themselves with little or no human control and intervention. The concept of autonomous vehicles has become a reality because of Artificial Intelligence (A.I.) in the automotive industry.

Artificial Intelligence (A.I.) refers to the ability of computers to read, develop and replicate the intelligence and behaviour of human beings (Oxford Learner's Dictionaries , 2020).

These autonomous vehicles can detect, sense and analyse their surroundings with the help of advanced techniques such as RADAR (Radio Detection and Ranging), LIDAR (Light Detection and Ranging), and computer vision to navigate successfully from origin to destination. These systems are collectively called 'Advanced Driver Assistance Systems' (ADAS). ADAS is responsible for a self-

driving vehicle's human-like abilities like; steering the vehicle, changing between lanes, braking the vehicle, detecting objects and so on.

Vehicle brands are moving more and more toward technology. Now, more than ever, companies need to not just be top quality manufacturers of the product but, they also need to provide great technology to be successful. For instance, Tesla has started developing its own LIDAR system for deployment in its electric autonomous vehicles. Tesla is one of the first companies to release a fully functioning autonomous car (Hörl, Ciari and Axhausen, 2016).

All these automated systems are created to improve safety and efficiency as told by Olivier Bockenbach of KPIT Technologies. Some other benefits according to Bockenbach are that these A.I. systems will aid in improving the driving experience (like a better use of in-vehicle travel time to relax or work), will make roads safer (according to the Highway Traffic Safety Administration (NHTSA), 90% of all traffic crashes are due to human error) and will aid in making better traffic decisions (this will result in fuel efficiency and lesser congestions).

According to the SAE (Society of Automotive Engineers), there are six stages of autonomy levels in vehicles ranging from Level 0 which is 'No Automation' to Level 5 which is 'Full Automation'. At present, many vehicles include various computer-operated functions (Level 2 or 3) which operate independently of the driver and these have been accepted by consumers with time (Thierer and Hagemann, 2014).

From a technical stance, according to Bockenback, the current barriers to achieve Level 5 'Full Autonomation', can be eliminated through data collection, Machine Learning (ML) and Deep Learning (DL). Some other barriers include initial huge costs, lack of privacy standards, insurance coverage debates, legal implications, and consumer acceptance (Fagnant et al., 2015).

There are barriers to consumer psychology. Not all emerging technologies, especially disruptive ones, are immediately embraced by consumers. Most technology advancements are

initially viewed as intrusive but with time they become essential, not just accepted (Thierer & Hagemann, 2014). The same pattern will likely occur with respect to accepting self-driving vehicles.

There are many benefits of autonomous vehicles and the monetary estimations are staggering. Some benefits (caused by 100% penetration of autonomous vehicles) include a reduction in traffic congestion by potentially $71 billion per year, a fall in the number of accidents leading to benefits of $118 to $500 billion per year, a fall in diesel consumption leading to cost savings of $2.7 to $4 billion and a fall in oil consumption leading to of $13 to $58 billion per year (Montgomery, 2017).

The above estimations are solely in monetary terms, another way to view these benefits relates to its positive impact on the environment, improvement of air quality and so on. Thus, this technology could lead to huge monetary savings along with great impacts on the planet.

A.I. in vehicles has grown gradually and consistently to reach the current level of automation (Level 2 or 3). However, full automation (Level 5) will be a transformational change for vehicle owners and society.

Back in 1926, the "Phantom Auto" was introduced as a novelty driverless vehicle on the streets of Milwaukee, at present we stand on the verge of seeing autonomous vehicles become a reality.

2. Literature Review

This section comprises of a discussion of some of the previous studies that have been done to understand the importance of marketing and how consumers feel about self-driving vehicles.

2.1 Marketing Autonomous Vehicles

Though self-driving vehicles have been promoted as being safer, among other benefits like fuel efficiency, less pollution, less traffic and so on, many people are reluctant and don't trust the technology (Shariff, Bonnefon and Rahwan, 2017). There are barriers to consumer psychology, consumer readiness and consumer perception with respect to accepting autonomous vehicles.

The feelings of commitment and trust for a vehicle brand can be built through marketing efforts (Olson, 2017). According to another recent paper focusing on the acceptance of autonomous vehicles, companies must develop informative creative marketing campaigns to impart knowledge that would encourage consumers to embrace self-driving vehicles, (Sciaccaluga and Delponte, 2020).

For example, BMW released a video of a BMW 7 series self-driving prototype to promote the safety of driverless cars. This video is an illustration of how creative marketing can aid in creating awareness and improve consumer perception about technology (Capgemini, 2019). In the video, the prototype driverless car is navigating through a dark jungle and stops automatically when a ghost appears in front of it. The ghost proceeds to peek inside the car but is terrified that the car has no driver and then runs away. The video ends with the lines "The future of driving is nothing to be afraid of".

According to a research published in the International Journal of Technology Marketing, brands which were successful due to their differentiation may lose out on their competitive advantage due to the sharing of technology (Olson, 2017).

Thus, the importance of marketing has been discussed in previous literature. The advent of autonomous vehicles could mean that brands will have to market their products better to create awareness, to promote the benefits, to differentiate themselves and to ultimately succeed.

2.2 Public Opinion Surveys

Understanding consumers' perceptions about autonomous vehicles are one way of understanding how difficult the penetration of this technology will be. These factors also provide a base for effective planning and implementation of marketing strategies. A discussion of some of the previous studies that have been done to understand consumers' perceptions is discussed subsequently.

World Economic Forum (2015) conducted a survey of 5,500 city residents from 10 countries. One objective of the study was to examine consumers' attitude toward autonomous vehicles through a consumer survey. More than half of the participants agreed that the key impediments to the realisation of autonomous vehicles are 'Consumer Acceptance', followed by 'Technology Readiness'. When ranking the benefits of autonomous vehicles, improved road safety was ranked no. 1 in the benefits perceived at a societal and individual level by the participants, while less traffic congestion was no.2.

Ernst and Young's (2015) survey of 1,000 drivers in Germany revealed that 88% of the participants were willing to ride in an autonomous vehicle. Most respondents believed autonomous vehicles would aid in reducing traffic congestion (54%), 40% agreed that autonomous vehicles would aid in the reduction of emissions, however, there were safety concerns with 44% of the respondents having a negative perception about the safety of these vehicles.

Capgemini (2019) conducted a comprehensive survey of 5,500 consumers from around the world and 280 company executives. They found that most respondents (59%) were awaiting the arrival of self-driving cars in "anticipation". It was shown that 71% believed that these vehicles

would aid in reducing pollution, 73% of the respondents considered fuel-efficiency to be a compelling factor to own a self-driving vehicle and 50% of the respondents believed autonomous vehicles would save time. Overall, this survey received positive responses and revealed a positive perception of the technology. They also found that millennials (participants under the age of 35) had fewer trust issues and had more positive responses to the technology.

Forbes (2019) surveyed with 5,000 participants and found that most participants (68%) had little or no knowledge about self-driving vehicles while 71% participants expressed that their primary concern was a lack of safety. This survey revealed a more negative perception of the technology with more than half of the respondents not trusting the technology.

Deloitte (2019) conducted a web survey which had more than 25,000 participants across 20 countries. This survey revealed that the media had an immense effect on consumers' perception of the technology (like reports of accidents). Many of the perceived benefits were strongly accepted by the respondents with 64% believing that these vehicles would provide updated vehicle maintenance updates and 67% strongly believing that vehicle collisions can be prevented. Over two-thirds of the participants believed that autonomous vehicles would aid in the reduction in traffic congestion and most participants ranked 'minimum travel time' as the most important aspect of mobility. This survey shed light on consumers' acceptance of the perceived benefits of autonomous vehicles.

Deloitte (2020) surveyed with more than 35,000 consumers from 20 countries. This survey revealed that most consumers were concerned with data handling as most respondents said that they would trust 'no one' with their data. Beside data privacy issues, 55% had a positive perception of the technology overall and 19% of the respondents believed autonomous vehicles would be better for the environment.

Thus, public opinions about autonomous vehicles have been varied. An emerging trend in the literature is that traffic reduction and fuel efficiency are perceived as benefits of self-driving vehicles

by most participants always (as in World Economic Forum, 2015; Ernst and Young, 2015; Capgemini, 2019; and Deloitte, 2019). Pollution reduction received mixed responses with some studies showing acceptance (as in Ernst and Young, 2015; Capgemini, 2019) and in others, consumers did not agree as much (as in World Economic Forum, 2015; and Deloitte, 2020). Another overall theme was that, in most studies, many participants feared the technology and lacked trust in the same (as in World Economic Forum, 2015; Ernst and Young, 2015; and Forbes, 2019).

2.3 Gaps in the Current Literature and Rationale

Previous research has highlighted the crucial role of marketing (as in Olson, 2017; and Sciaccaluga and Delponte, 2020) to enhance consumer awareness and perception of autonomous vehicles. However, there are some existing knowledge gaps in the literature with respect to understanding the kinds of marketing strategies required to enhance consumers perception and to promote autonomous vehicles. Marketing strategies need to be further studied in an in-depth manner.

Other previous literature (such as Goldsmith, 1999; Dou et al., 2010; Todor, 2016; Maden, 2017; and Sahatcija et al., 2019), highlight the importance of various marketing strategies to successfully promote products. A summary of the findings from some previous literature is shown in *Table 1*. These studies were conducted about brands and products on a generic basis. Many other studies have been conducted regarding the importance of marketing and the kinds of marketing strategies which companies use. However, no specific study has been conducted relating to the kinds of marketing strategies needed to improve consumers' perceptions, increase their awareness and promote self-driving vehicles.

Table 1:Previous Literature about the Importance of various Marketing Strategies in Product Promotion

Findings	References
This paper highlighted the importance of going beyond the traditional marketing mix (i.e. Product, Price, Place and Promotion) to include customisation and personalisation	Goldsmith, 1999
This study revealed that companies spend money at a faster rate on search engine marketing than other other online advertising medium	Dou et al., 2010

This literature concluded that the key to succeed in product promotion is through a combination of traditional and digital marketing strategies	Todor, 2016
This research emphasiesed on the role of digital influencers in persuading consumers to purchase products	Maden, 2017
This study highlighted the importance of digital marketing in the promotion of products	Sahatcija et al., 2019

The use of effective, creative, and impactful marketing strategies could especially be the key to success for automotive brands at this stage when autonomous vehicles are not readily available to consumers. At present, consumers cannot see, touch, test drive or experience autonomous vehicles and so their perception/opinion of this technology is mostly from what they read and hear.

The primary aim of this research is to fill this gap by conducting interviews with experts to gain insights into the current scenario of autonomous vehicles. This aim can be summarised as:

> The primary aim of this research is to understand from experts, the current scenario of autonomous vehicles and, the kinds of marketing strategies that companies would use to improve consumers' perception and promote autonomous vehicles i.e. exploring the marketing strategies of autonomous vehicles.

While many studies have been conducted regarding consumers' perceptions about self-driving vehicles, this topic is far from being exhausted as a research area. Previous research concerning consumers' perception of this technology has highlighted many mixed trends. Much of the existing literature is descriptive and univariate, the secondary aim of this research focuses on understanding marketing perception and subsequently conducting a multivariate analysis of different factors. This aim can be summarised as follows:

> The secondary aim of this research is to understand the markets perception/ awareness of this technology and to study emerging patterns. i.e. exploring the markets perceptions of autonomous vehicles

Understanding the relationship between the factors (or variables) will aid in understanding the dependencies of each factor. These patterns of perception can also help in devising marketing campaigns aimed at a group or groups of the target audience.

From the survey, patterns can be analysed like; whether there is a relationship between the age of the participants and their trust of the technology, whether there is a relationship between awareness of the term A.I. and believing that self-driving vehicles are the future, whether there is a correlation between those who are comfortable sharing their real-time data and those who trust the technology, and whether all benefits of autonomous vehicles are perceived in the same manner.

The public opinion survey is meant to shed some light on the market's perceptions about this technology and the emerging patterns of the variables. The survey answers will also be used as a source of information when conducting the interviews with experts (as part of the primary aim).

The reason why research about autonomous vehicles is important is that it is a disruptive change that will not only change the entire automotive industry but will also change the way in which consumers interact with their vehicles. It has been estimated that by 2040 the entire autonomous cars market cap will emerge and become $2.5 trillion markets (Jiao, Ghaffarzadeh and Jiang, 2019).

2.4 Research Questions

This research aims to fill some gaps in current literature by obtaining information on the marketing strategies and techniques which would be effectful and impactful to consumers. This will be achieved by obtaining expert opinions about the subject.

The secondary focus is about market perception and emerging patterns. This will be achieved through public opinion surveys sent out to the general public.

> The primary research question of this research:

What are the marketing strategies that companies would use to improve consumers' perception and promote autonomous vehicles?

> The secondary research question of this research:

What are the perceptions of the market in relation to autonomous vehicles?

Though the world currently seems comfortable with level 2 or 3 in automation, fully autonomous vehicles (level 5) are regarded as disruptive force and at this point, it is not clear whether people are ready to 'switch' to self-driving vehicles. What is clear is that, there is a strong dependence on suppliers for all the single components of the technology such as LIDAR, RADAR and cameras, meaning that the competition is going to be fierce (Hörl, Ciari and Axhausen, 2016b).

3. Methodology

This section explains how the research was conducted. A *mixed-methods approach* was used combining quantitative and qualitative forms of data collection. An overall framework/ summary of this research is shown in *Figure 1*.
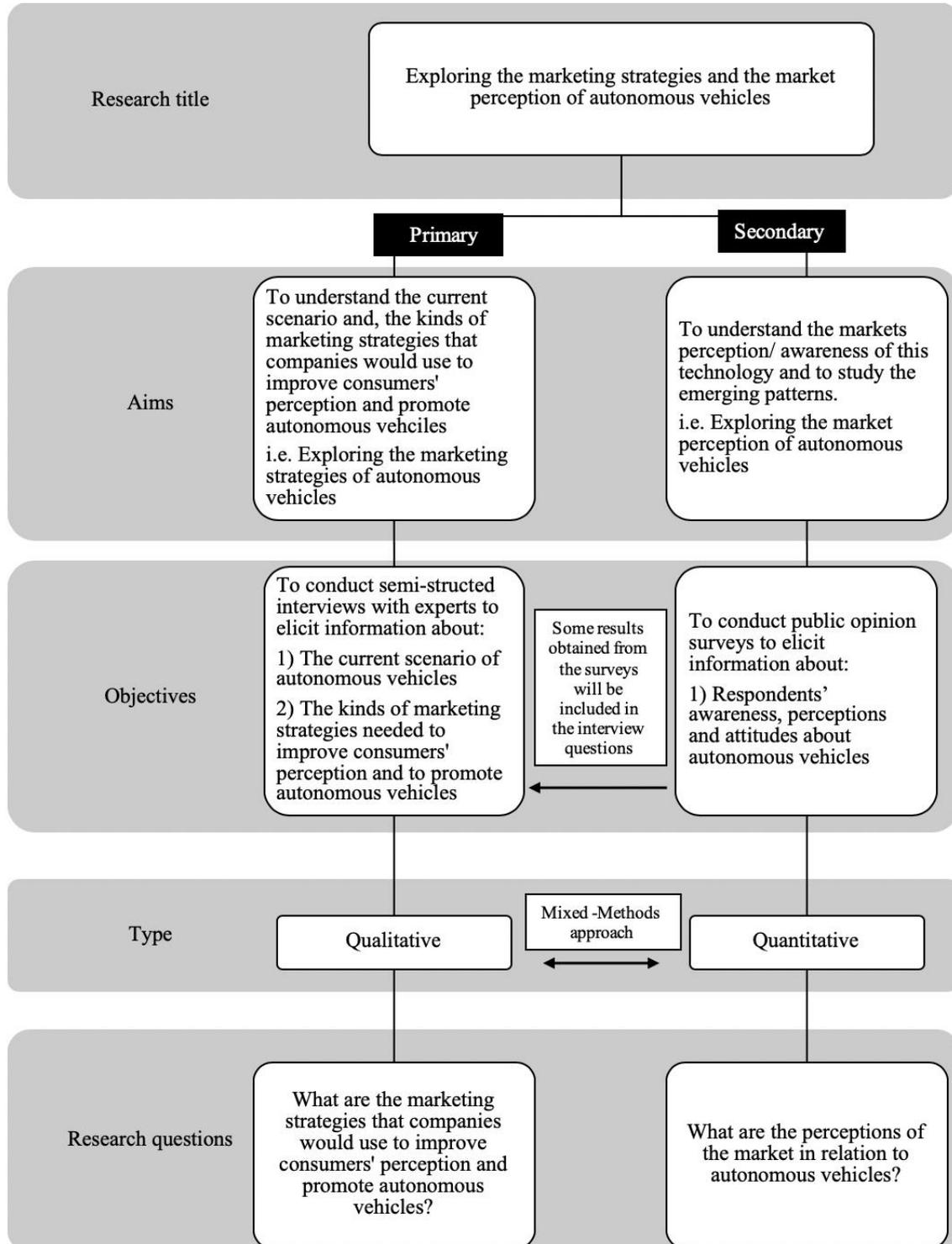

Figure 1: Overall Framework of this Research

This research was conducted to explore the kinds of marketing strategies needed to improve consumers' perception about autonomous vehicles and promote the same. The secondary aim relates to the market's perception about this technology. As shown in *Figure 1,* to achieve the primary aim, data was collected through interviews with experts and to achieve the secondary aim (and the primary aim to some extent), data was collected through public opinion surveys (questionnaires). Close-ended questions were asked in the questionnaire making the data entirely quantitative, while the interviews constituted a qualitative research type. Thus, a *mixed-methods approach* was used in this study.

As shown in *Figure 1,* the results of the public opinion surveys were used as a source of information when conducting the interviews with experts. The surveys were sent out first and once the results were obtained; based on some results, the interviewees were questioned. Therefore, henceforth in this research paper, the public opinion survey (questionnaire) is discussed first, and the interview details are presented after.

3.1 Participants

There were two types of participants in this research to achieve the objectives of this study: The questionnaire respondents and the interviewed experts. All the participants agreed to assist voluntarily in order to achieve the research aims set out in this research.

Questionnaires (Public Opinion Surveys) were sent across to the public through various digital platforms to gather many responses over a short period of time. These surveys were sent to achieve the secondary aim of the research and to provide some inputs for the interviews.

This survey was open to all as vehicles have a wide consumer base and self-driving vehicles would affect everyone (vehicle owners and non-vehicle owners). Online surveys were chosen, so as to reach many respondents. This survey polled in 160 random respondents. The 160 respondents who participated in the short online survey (of 7 questions) to obtain results about their awareness,

perceptions and attitudes, were from different geographies, age groups, genders, and educational backgrounds. These results were quantified and used as a part of the semi-structured interviews.

One-on-one interviews were conducted with experts from KPIT Technologies Limited to achieve the primary aim of the research. Experts from this company (both technical and marketing experts) were chosen because KPIT is a global technology company specialising in autonomous vehicles. The company has partnerships with some of the biggest global brands. Example: The BMW Group enlisted KPIT as a software development partner for autonomous driving.

Experts from this company were preferred because they are in a unique position of understanding the technical aspects of self-driving vehicles, the difficulties that various brands are facing and how to market autonomous vehicles to the general public.

In total, 7 experts were approached via LinkedIn to be interviewed virtually. Due to time constraints and their availability, 5 of these experts were interviewed. To obtain a global all-round perspective, participants of different designations and locations were chosen and interviewed. These details are provided below in *Table 2.*

Table 2: Interview Participants

Participant no.	Participant Designation	Location
1.	Senior Technical Lead	Tokyo, Japan
2.	Senior Technical Lead	Tokyo, Japan
3.	Director	Seoul, South Korea
4.	Doctorate & Solutions Architect	Tokyo, Japan
5.	Marketing Head & Team	Bengaluru, India

3.2 Design

The purpose of this research is to understand the kinds of marketing strategies, campaigns and techniques needed to enhance consumers' awareness of this technology and to promote self-driving

vehicles. Various variables were measured in this study to obtain results about consumers'
perceptions, attitudes, and awareness of autonomous vehicles.

The questionnaire sent out to the public comprised of 7 customised questions and each
question aimed to measure a variable. After thoroughly reviewing previous literature and empirical
studies the variables were conceptualised and a custom-made questionnaire was prepared online.
Appendix 1 is a copy of the public opinion survey questions and *Table 3* below explains the variables
measured along with the reasons.

Table 3:Variables in the Questionnaire

Question no. as per survey	Variables measured	Reasons
1.	Age	To obtain basic demographic details of the participants
2.	Awareness	To understand the level of awareness of the participants
3.	Perception	To obtain details about their overall perception or feedback of A.I.
4.	Future	To understand whether the participants believed that this technology would be the future or not
5.a	Benefit – Lesser Accidents	To know how the participants perceived this benefit of autonomous vehicles
5.b	Benefit – Fuel Efficiency	To know how the participants perceived this benefit of autonomous vehicles
5. c	Benefit – Pollution Reduction	To know how the participants perceived this benefit of autonomous vehicles
5.d	Benefit – Lesser Traffic	To know how the participants perceived this benefit of autonomous vehicles
5.e	Benefit – Lesser Travel Time	To know how the participants perceived this benefit of autonomous vehicles
5.f	Benefit – Efficiency in vehicle service	To know how the participants perceived this benefit of autonomous vehicles
6.	Data sharing comfort	To understand the extent to which consumers were comfortable or uncomfortable with sharing their real-time data with car companies
7.	Trust	To determine whether consumers would be able to trust a self-driven vehicle

This portion of the research (the public opinion survey) is a *descriptive type* wherein the
questions aimed to obtain details about the perception, awareness and attitudes of the population that

responded to the survey, followed by a discussion of the same. This research also followed a correlational design approach to connect statistical patterns. After obtaining the results of the survey, the emerging patterns or correlations among the variables were studied. The variables were measured in relation to each other to assess the relationship between them, with no manipulation of any independent variable.

This was the suitable method to collect and obtain objective results, as well as to understand the relationship between the variables. These quantified results were then used in the interviews.

For the semi-structured interviews, open-ended questions were asked to the experts from KPIT Technologies Limited. The pre-prepared interview questions are shown in *Appendix 2*. Along with these questions, some inputs based on the results of the public opinion surveys were included depending on the flow of the conversation. These pre-prepared questions focused on understanding their expert opinions on the current scenario of autonomous vehicles, followed by a series of questions about marketing strategies.

This portion of the research is an *exploratory type*. Exploratory research is often used at the start of a marketing plan to understand consumers' perception and to determine viability of a product. The intent of choosing this design is to generalise from a sample to a population.

Both the questionnaires (sent to the public) and the interviews (conducted with industry experts) constitute different types of survey research. However, the interviews comprised of more in-depth questions which were asked verbally (as opposed to the written responses received through the questionnaires) to the experts as they possessed knowledge on the topic.

3.3 Materials

3.3.1 Public Opinion Survey (Questionnaire)

To conduct the quantitative survey research, questionnaires containing 7 questions were sent out to the public, through various social media platforms. The survey questionnaire was prepared

using *Microsoft Forms*. The goal was to obtain information about each respondent's opinion regarding autonomous vehicles (i.e. the consumers' point of view).

These seven questions were framed to achieve the secondary aim of this research which related to understanding the market awareness and the current situation of accepting a new disruptive product. All the 7 questions were compulsory to answer and close-ended. This design was chosen to ensure that there was no missing data in the correlation analysis and to obtain objective responses which later were quantified.

All questions were multiple choice, where the options were mutually exclusive meaning that participants could only record one response for each question.

Some questions had a few options, like *'Yes/No/Maybe'* (as in question 4 in the questionnaire), while others used Likert scales. Likert scales are useful when trying to measure opinions with a greater degree of nuance and accuracy as opposed to simple *binary forced choice questions* i.e. *'yes/no'* answers. It provides a greater range by giving the participants more options so that they can record the extent or degree with which they agree or disagree with something (as in question 5 in the questionnaire).

Specifically, *5-point Likert scales* were used in this study. The 5-point Likert scale provides a neutral option which was deemed necessary in this research because autonomous vehicles are new and something of the future meaning that many people may not possess knowledge to give a positive or negative opinion. The mid-point option in these Likert scale questions contained choices like '*Neither Agree nor Disagree'* (as in question 5) and *'Neither comfortable nor uncomfortable*' (as in question 6) to give respondents a neutral choice when they weren't aware or were unsure of the same.

The only demographic detail asked on the questionnaire was in relation to age (question 1). This was asked in the questionnaire to later study correlational patterns between age and other variables. No other personal details were required to be disclosed by the participants. Categorial

options were given to the participants to identify which best age group they belonged to. Such as, *18-24* years of age, *25-31* years of age and so on.

Questions 2, 4 and 7 were basic questions aimed at obtaining information about their overall awareness of the term, whether they believed that self-driving vehicles are the future and whether they would be able to trust the technology. All three questions contained 3 possible responses each, question 2 contained the options *'Yes/ No/Somewhat'* and questions 2 and 7 contained the options *'Yes/No/Maybe'*. These questions were asked to understand the current level of awareness of the respondents, to obtain their opinions about the future of autonomous vehicles and to determine whether they would trust self-driving vehicles.

In question 3 regarding overall perception of self-driving vehicles, a *5-point Likert scale was* used, and the participants were asked to choose between, '*Completely Positive/ Positive/ Neutral/ Negative/ Completely Negative'* options. This question was designed with such range to capture each respondent's exact degree of their perception towards autonomous vehicles.

A similar design was used in question 6 which was about comfort levels about sharing real-time data with vehicle companies. The same range was given to the participants (5 options), '*Very Comfortable/ Somewhat Comfortable/ Neither Comfortable nor Uncomfortable/ Somewhat Comfortable/ Very Uncomfortable'*

The questions relating to overall perception (question 3), comfort levels of data sharing (question 6) and whether participants would be able to trust their vehicles (question 7) were inspired from previous studies like World Economic Forum, 2015; Ernst and Young, 2015; Forbes, 2019 and Deloitte, 2020.

Question 5 was about the perceived benefits of autonomous vehicles and was framed in line with the benefits given by the Department of Transportation (DOT) of America and previous studies analysed in the literature review (like Forbes, 2019; Deloitte, 2020 and so on). The benefits given by

the DOT of America includes: crash avoidance, reduced vehicle emissions, reduced travel times, improved travel time reliability, improved fuel efficiency (Montgomery, 2018). In total, for this survey, the respondents were asked for their opinions about six benefits of autonomous vehicles- Less Accidents, Fuel Efficiency, Reduction in Pollution, Reduction in Traffic, Less Travel Time and Efficiency in Vehicle Service.

Participants were asked for their opinions regarding each of the six benefits. The responses were designed with *symmetry* meaning that they contained equal number of positive and negative options with a *mid-neutral response* and the *5 response options* were: '*Highly Agree/Somewhat Agree/ Neither Agree nor Disagree/Somewhat Disagree/Highly Disagree*'

3.3.2 Interview Questionnaire

To conduct the qualitative survey research, semi-structured interviews were conducted with experts. The 11 interview questions can be found in *Appendix 2*. These questions were asked to 5 experts and were created to obtain their opinions about three main areas, namely:

1) A.I. in Automotive products

2) The current scenario of autonomous vehicles

3) The kinds of marketing strategies needed to improve consumers' perception and to promote autonomous vehicles

These questions aimed at achieving the primary aim of this research with respect to exploring the kinds of marketing strategies that would be used to successfully promote autonomous vehicles and improve consumer perceptions.

The foundation for these questions was from previous literature (like Sciaccaluga and Delponte, 2020; and Olson, 2017) which mentioned the key role of marketing in promoting autonomous vehicles and based on studies which highlighted important marketing strategies/ trends

for the sucessful promotion of products (like Goldsmith, 1999; Dou et al.; 2010; Todor, 2016; Maden, 2017; and Sahatcija et al., 2019).

The first four questions covered areas relating to A.I. in automotive products, the readiness of the market, the awareness of autonomous vehicles and the barriers relating to data-collection. These questions were more generic to gain insights about the topic and to understand the current scenario of autonomous vehicles.

In recent times, digital marketing has emerged as one of the most applied methods of marketing by companies to ensure their produts reach customers (Sahatcija et al., 2019). Though time spent online by consumers is constently increasing, the best marketing solutions for companies to increase visibility and awareness for their products is by combing traditional marketing and digital marketing stargeties (Todor, 2016). Thus, the fifth interview question was framed to inlcude both online and offline mediums of marketing. However, given the importance and rise of digital marketing, most questions focused on digital marketing elements (as in questions 6, 7, 8, 9 and 11 of the interview questions).

In the past, the focus of businesses traditionally was on principles of standardisation and 'one-size fits all' production. The marketing mix used to be just the 4 P's (price, product, place and promotion), however, these days increasingly brands are changing their approach to focus on customisation and personalisation to ensure consumer preferences are met (Goldsmith, 1999). Since the role of personalised marketing is crucial to the success of brands, a question regarding the role of personalised marketing with respect to self-driving vehicles was asked to the experts (question no.6 of the interview questions)

According to a recent study about the role of YouTube to understand consumers' attitudes towards autonomous vehicles, it was found that YouTube.com hosts many vidoes about self-driving vehicles with many mixed reviews. The top 15 YouTube vidoes about autonomous vehicles have a

total of over 60.9 million views (Das *et al.*, 2019). Thus, vidoes have a strong reach to potential consumers. This was also evident in the recent sucessful BMW 7 series self-driving prototype video which was aimed at improving consumers' percpertions (Capgemini, 2019). Since videos have the potential to impact so many people, the experts were asked about their opinion regarding the same (question no. 7 of the interview questions).

The use of search engine optimisation by companies, has helped brands achive success in the e-commerce world. A study also revealed that the spending patterns of companies in relation to search engine marketing is growing faster than other online advertising mediums (Dou *et al.*, 2010). Since search engine optimisation is growing so fast and could help brands, the experts were asked about its role in the marketing of self-driving vehicles (question no.8 of the interview questions)

Digital influencers have grown to be quite poweful in persuading consumers. Brands these days use them in their brand communication strategies as means to effectively reach target consumers, especially in the case of new products (Maden, 2017). Since these influencers have become an important marketing technique, a question was asked regarding their role (if they had one) with respect to marketing autonomous vehicles (question no.9 of the interview questions).

Question 10 of the pre-prepared questions related to the role of Governments. The experts were asked about their opinion regarding the roles of various Governments to promote autonomous vehicles. At present there is a lack of regulations regarding autonomous vehicles. Studies have suggested that Governments may promote the adoption of self-driving vehicles due to the saftey benefits, they may offer tax incentives (to manufactuers and vehicle owners) and they may even mandate the same. However, at this momement in time, there is uncertainity regarding the role of the Government (Hudda et al., 2013)

In line with the findings of Deloitte, 2019 which found that the media had an immense effect on consumers' perception of the technology and other studies focusing on the importance of social

media in marketing (as in Sahatcija et al., 2019), question 11 of the interview focused on how social media helps build goodwill for vehicle companies.

These 11 questions were custom-made based on previous literature. The questions were short and comprised of an average of 10 to 12 words. All interviews were conducted virtually and one-on-one. Depending on the flow of the conversation and the expert who was being interviewed (for instance more technical questions were asked to the technical experts) various elements of the public opinion results were intertwined into the questions (making the interviews semi-structured).

3.4 Procedure

This study was split into two branches (primary and secondary), the primary focus of this research was to understand the changing landscape of the automotive industry because of autonomous vehicles and to explore the marketing strategies that would aid in promoting the same, while the secondary focus was to understand the market's perception and level awareness of the product. The former aim required professional opinions to gain insights into the industry on a comprehensive level while the latter required the opinions of the general public. These public opinions were also used in the interviews as well.

The first step to obtain the required data, involved sending the public opinion surveys out to the public through various digital platforms. The survey questions (as shown in *Appendix 1*), were prepared using *Microsoft Forms*. The link to the survey was posted on various digital platforms along with a message which included the instructions and the reasons behind the study.

The survey was open to all. The participants who wanted to fill out the survey simply clicked the link and answered the 7 questions. All the questions within the survey were compulsory so respondents either completed the entire survey or, if they exited in-between then their partial responses were not recorded. It was a short survey which took the participants an average of 02:25 minutes to complete. The participants were informed that the survey was for academic purposes and

that there was full anonymity. The survey required the participants to disclose the age category that they belonged to, but no other personal detail was asked like name, phone no., address etc. The message to the participants concluded with a request to answer carefully, as each of their responses affected the outcome of the final study.

This survey focused on understanding the level of awareness regarding the term artificial intelligence, the perceptions of the public in relation to self-driving vehicles and the attitudes of the market toward embracing the disruption.

Once enough people responded to the survey, the survey was closed. Once the survey was closed, the results of the survey were subsequently analysed. Over 100 responses was deemed enough given the time constraints.

Only after the survey results, the interviews were conducted as the data obtained from the public opinion surveys was used as a source of data in the interview questions. However, as the respondents were answering the survey, experts from the industry were approached to request them for the interviews.

These experts were approached via LinkedIn with a formal message containing details of the research along with the reasons behind the study. The experts were informed that the meeting required about 15 minutes of their time, that it was a one-on-one meeting and that it was an audio call which would be scheduled as per their convenience. Once the 5 experts agreed to the interview, they were subsequently contacted via email with a consent form (shown in *Appendix 3*). The consent form contained details regarding the research and reassured the participants that there would be anonymity maintained throughout and that the files would be used solely for academic purposes. The consent form also informed participants that the interview would be recorded for academic purposes (to create transcripts) and that the files would be deleted on completion of the course.

Once the experts agreed to the details set out in the consent form (through email confirmation) and a convenient time was fixed, details of the virtual meeting were emailed to them.

These interviews were conducted using *Microsoft Teams* and each interview was conducted separately. The interview questions started with general information about A.I. in vehicles and gradually progressed to the possible strategies and plans of promoting the products. Some data from the results of public opinion survey was incorporated into the interview questions.

3.5 Ethics

Right from the beginning all the participants were assured that the use of the data would purely be for academic purposes and that there would be full anonymity maintained.

The survey participants were informed about the reasons for the study and the survey did not require any personal details. The participants were also informed about their right to exit the questionnaire at any time without penalty.

With respect to the interview participants, comprehensive consent forms (As shown in *Appendix 3*) were sent to them much prior to the interview date. All the participants voluntarily agreed to help with this research and were informed with transparency about the purpose of the study, their right to withdraw at any time, data storage (data is password protected) and data destruction (data would be deleted upon completion of the study).

These consent forms contained all the details about the project, the type of research, the purposes of the study and other information regarding privacy protection. Confirmation emails were required from the participants to obtain evidence that the participants understood the information and were willing to partake voluntarily.

Throughput this study (during the transcribing stage and when discussing the results), each participant was addressed by a number (Participant 1, 2 and so on). This number sequence is based

on the order in which the interviews were conducted (Shown in *Table 2*). This is to ensure anonymity is maintained throughout.

In addition, there was no conflict of interest to declare. The participants were approached based on their qualifications and industry knowledge, and there was no financial or non-financial stake in the outcomes of the research study.

3.6 Data Analysis

After the public opinion surveys were closed, the data was imported from *Microsoft Forms* to *Microsoft Excel* and subsequently analysed. To understand the correlations between variables, *IBM's SPSS Software* was used (to perform descriptive and inferential statistical tests).

First, data was analysed using *Microsoft Excel* through the Pivot Table functions (to summarise variables and show their relationship) and Graphs (to depict the results in a pictorial form). These were used as part of Descriptive Statistics portion to describe the results obtained from the public opinion survey.

From *Microsoft Excel*, the raw data was exported to *SPSS* to conduct statistical analyses of the variables. To use SPSS, each response option (i.e. the choices) of each variable, was assigned a code. SPSS was used for both Descriptive Statistics and Inferential Statistics. The Descriptive Statistics comprised of an analysis of the Mean, Standard Deviation, Minimum and Maximum of the data. Graphs and cross-tables (from *Microsoft Excel*) were presented along with the Descriptive Statistics of the data.

The Inferential Statistics comprised of various tests performed to prove correlational relations between variables. *Pearson's r correlation* was used to show the strength between two variables (like Age of the respondents' vs their level of trust in the technology). This test reveals the direction of the correlation (positive or negative) and the *Sig. (2-tailed)* score also shows the whether there is a significant relationship between the two variables analysed. Another test that was used was the *Chi*

Square Test (or Pearson's Chi Square Test). This test also reveals the association between two variables.

Thus, the quantitative data was assessed by describing the results obtained (Descriptive Statistics), depicting the results (Graphs), interpreting the emerging patterns (Cross tables) and proving the relationship between variables (Inferential Statistical tests).

Interviews with the experts were conducted after the public opinion survey responses were collected and the survey was closed. Five separate interviews were conducted and recorded using *Microsoft Teams*.

Each interview varied in time depending on the flow of the conversation and was based on the pre-prepared questions set out in *Appendix 2*. These interviews were conducted to obtain information about autonomous vehicles from the experts who directly deal with the technology in order to understand the current scenario and future plans.

These interviews were transcribed rigorously from the start to the end using the *thematic analysis* method. The six principles for the thematic analysis by Braun and Clarke (2006) namely, (1) getting familiarised with the data, (2) Generating the codes for the data collected, (3) Creating themes for each code, (4) Reviewing the created themes for the codes, (5) Defining the themes and naming them, (6) Creating and producing the report for the same; were used to transcribe the interviews.

After the interviews were saved from *Microsoft Teams*, the audio clips were imported to a computerised qualitative research software called *Nvivo 12 Plus*, followed by a software called *Otter*.

To successfully transcribe the audio clips and conduct this qualitative analysis, codes based on responses were framed. These codes were assigned based on the key terms or concepts told by the experts during the interview. Each time important relevant words were mentioned (words that directly related to the research), those words were noted and assigned unique codes.

After generating the codes, the next step was to create the themes. This step of the analysis allowed creating an interpretation for the study from the codes created from the data. These themes were then filtered down one to one single framework. The creation of themes for this study was considerably easy due to the similarity of the answers among the participants. Thus, an *inductive approach* was used to characterise their responses regarding self-driving vehicles in general and the marketing strategies regarding the same.

Throughout the transcribing process, the aims and the objectives of this study were kept in mind for interpretation of the data collected. As part of the Data Cleaning and Quality Control processes while transcribing the data, details that did not match the overall theme of the study were removed from the analysis portion but were noted. None of the original audio tracks of the interviews were tampered with.

4. Results

This section analyses, interprets and summarises the findings obtained/inferred from the surveys sent out to the public and the interviews conducted with the industry experts.

4.1 Quantitative results obtained from Public Opinion Surveys

The survey polled 160 participants, most of them were between the age of 18 and 24. The survey revealed great awareness of this technology (78.1% answered that they were aware) and most had a positive perception (62% answered positively) about the same. 52% of the respondents did not believe that autonomous vehicles would be the future (17 participants said 'No') or were unsure (67 participants said 'Maybe') about the same. The six benefits of self-driving vehicles were seen in a positive light with very few participants highly disagreeing with any of the benefits, though some were perceived more highly (like pollution reduction) than others (like reduction in traffic). Only 16% of participants were very comfortable to share their data with their car company and only a third of the participants said that they would trust their car. These results are subsequently discussed.

4.1.1 Descriptive Statistics

This portion of the research project discusses the statistics of the variables which were obtained during the data collection process. The 7 survey questions were broken into 12 variables and the descriptive statistics of the respondents are shown in *Table 4*.

Table 4: Descriptive Statistics of the Survey Variables

Variable	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Mean Std. Error	Std. Deviation
Age	160	.00	5.00	1.38	.14	1.74
Awareness	160	.00	2.00	.40	.06	.79
Perception	160	.00	4.00	1.33	.06	.79
Future	160	.00	2.00	.93	.07	.95
Less Accidents	160	.00	4.00	1.26	.07	.88
Fuel efficiency	160	.00	4.00	.75	.06	.80
Pollution reduction	160	.00	4.00	.73	.08	.97
Reduction in traffic	160	.00	4.00	1.58	.09	1.19
Reduction of travel time	160	.00	4.00	1.48	.09	1.09

Variable	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Mean Std. Error	Std. Deviation
Efficiency in vehicle service	160	.00	4.00	.88	.07	.88
Comfort of sharing data	160	.00	4.00	1.79	.10	1.30
Trust	160	.00	2.00	1.18	.06	.81
Valid N	**160**					
Missing	**0**					

Most of the respondents were between the ages of 18-24 and the least participants were from the 39- 45 age group as shown in *Figure 2*. Thus, more millennials responded to the survey (participants under the age of 35).
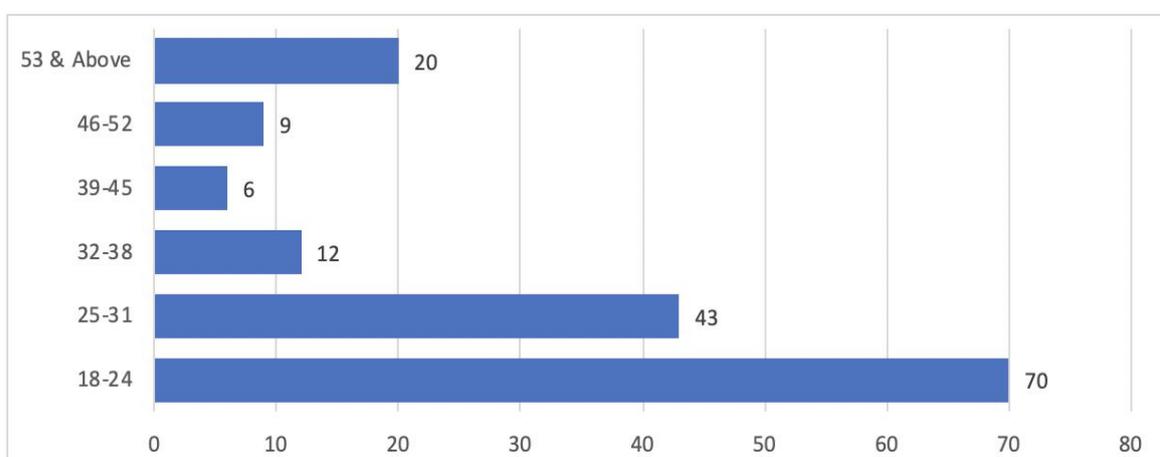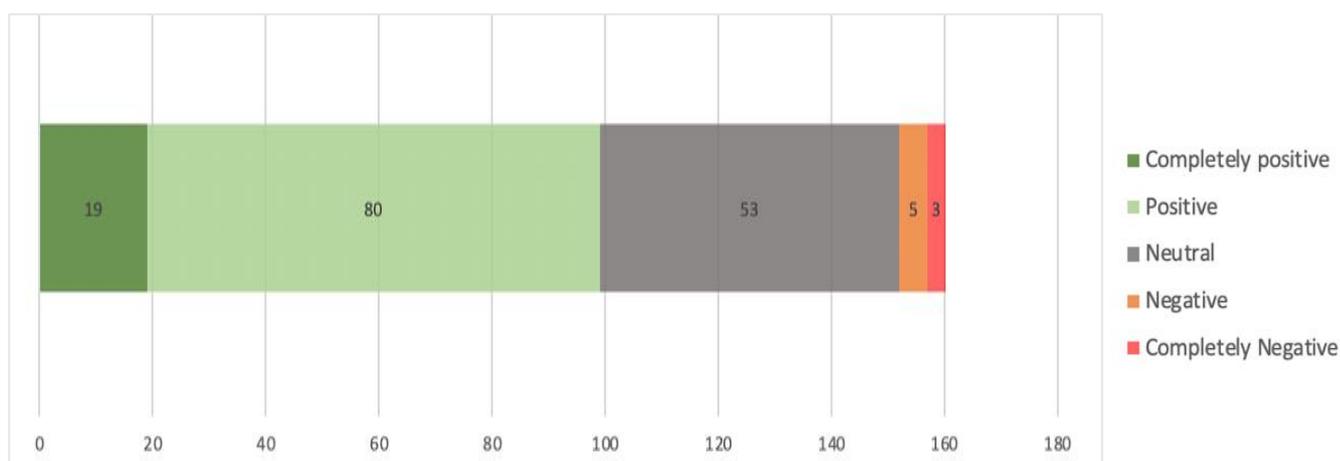

Figure 2: Survey Responses - Age of the participants

Of the 160 survey participants most of them were either fully aware (78.1% answered 'Yes') or at least partially aware (18.8% answered 'Somewhat') of the term A.I, as shown in *Figure 3*. Only 5 participants were not aware of the term A.I.
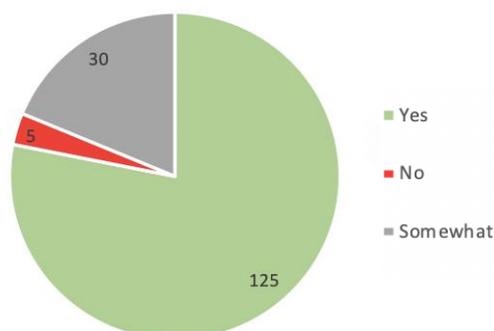
Figure 3: Survey Responses - Awareness of A.I.

The third survey question was about perception. Half of the participants (80 participants) had a positive opinion about this technology and 19 participants had a completely positive opinion. More than a third of participants had neutral, negative and completely negative opinions about the technology as shown in *Figure 4*. Since autonomous vehicles are not available in the market, consumer perception of this technology is mostly from what is they have heard or seen. From this survey, it can be inferred that most participants perceive this technology in a positive light. Which could be interpreted as a positive sign for market readiness.

Figure 4: Survey Reponses – Perception of A.I.

This is similar to the results obtained in Deloitte, 2020 (where 55% of the participants had a positive opinion) and in stark contrast to the results of other studies (like Forbes, 2019; and Ernst and Young, 2015) where most participants had a negative perception.

The fourth question of the survey was on whether the participants believed that autonomous vehicles would be the future. The responses are shown in *Figure 5*. Though 48% of the participants (76 participants) said 'Yes', 52% of them said 'No' and 'Maybe' (84 participants in total).

More than half of the participants answered 'Maybe' which is an unsure answer. This could be interpreted as an indicator of a lack of market readiness along with the answer 'no' (17 participants).
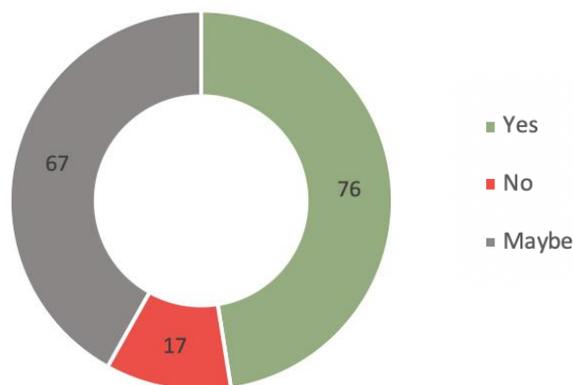
Figure 5: Survey Responses- Whether A.I. is the future

The fifth question focused on the benefits of autonomous vehicles. As shown in *Figure 6*, not all six benefits of autonomous vehicles were perceived with equal importance. The survey results of each benefit are subsequently discussed.

Fewer Accidents – Most participants (58%) somewhat agreed that autonomous vehicles would cause lesser accidents and only about 14% highly agreed on the same. In this survey, only 2 participants highly disagreed with this benefit. However, 25 participants (16%) did not agree or disagree, which could be an indication of a lack of awareness.

This is in line with the findings of previous studies (such as Deloitte, 2019; and World Economic Forum, 2015) which highlight that road safety through a reduction of collisions is a very important potential benefit of autonomous vehicles and very few participants disagree about the same.

Fuel efficiency – Almost an equal number of participants highly agreed (69 participants) and somewhat agreed (68 participants) that fuel efficiency is a benefit of autonomous vehicles. Fuel efficiency only had one participant highly disagree with the same.

This is line with previous survey results (such as Capgemini, 2019 where more than 70% of respondents agreed that autonomous vehicles would bring about fuel efficiency).
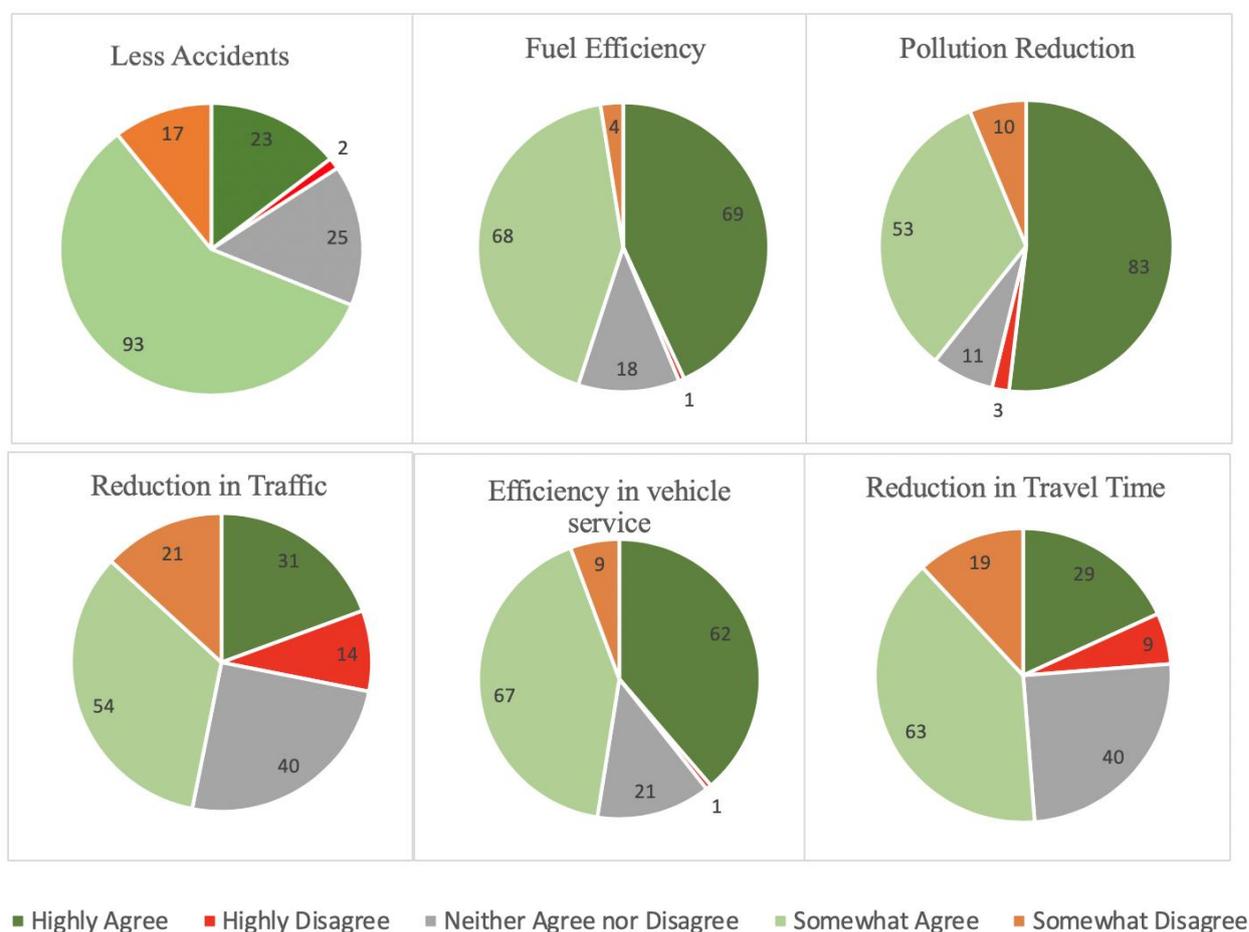
Figure 6: Survey Responses - Potential Benefits of Autonomous Vehicles

Pollution reduction – This benefit had the highest number of participants that highly agreed about the same. 52% (83 participants) highly agreed and 33% (53 participants) somewhat agreed that this was a potential benefit of autonomous vehicles. In this survey, this benefit had the least 'neither agree nor disagree' responses (11 participants) when compared to the other 5 benefits, meaning that most participants were clear about pollution reduction being a benefit of autonomous vehicles.

In previous surveys conducted (like Capgemini, 2019), a majority of the participants agreed that autonomous vehicles would be better for the environment and would aid in pollution reduction.

Reduction in traffic – 34% of the survey respondents somewhat agreed that a reduction in traffic is a potential benefit of autonomous vehicles and only about 19% highly agreed about the same. A quarter of the participants neither agreed nor disagreed and 9% highly disagreed. This benefit had the highest number of participants (14 participants) that highly disagreed that this is a potential benefit.

In previous studies (like Deloitte, 2019; Ernst and young, 2015; and World Economic Forum, 2015) traffic reduction was perceived very highly as a benefit of autonomous vehicles by most participants. This survey received many disagreeing views for this benefit.

Efficiency in-vehicle service – The responses to this benefit were similar to that of Fuel Efficiency with a large number of participants agreeing/ somewhat agreeing (a total of 129 participants) to the benefit. Only one participant highly disagreed and 21 participants neither agreed nor disagreed about this benefit.

In previous studies (like Deloitte, 2019), most participants agreed that autonomous vehicles would aid in vehicle service and maintenance through prompt detection using technology. This is like the responses collected in this survey.

Reduction in travel time – Most participants had a positive perception of this benefit, with 39% (63 participants) somewhat agreeing and 12% (19 participants) highly agreeing to the same. Like the reduction in traffic benefit, a quarter of the respondents had a neutral opinion about the benefit (i.e. they neither agreed no disagreed).

In previous studies (like Capgemini, 2019; and Deloitte, 2019), around half of the participants believed that autonomous vehicles would aid in reduction of travel time which is similar to the findings of this survey.

The sixth question on the survey was about the comfort level of sharing real time data with car companies and the responses are shown in *Figure 7*.
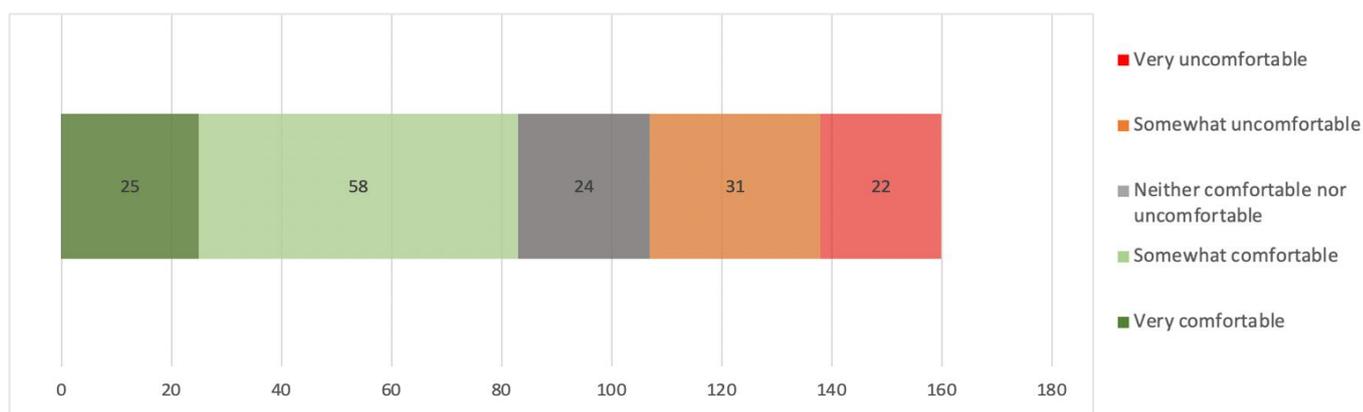
*Figure 7: Survey Responses – Comfort of Sharing Real-Time Data*

Only 16% of participants were very comfortable to share their data. Most of the respondents (58 participants) said that they were somewhat comfortable with sharing their data, and the percentage of respondents for each of the other three options were almost evenly dispersed.

A third of the participants expressed either extreme discomfort or some discomfort in sharing real-time data with car companies (a total of 53 participants) and 15% expressed a neutral opinion.

Most participants in previous studies (like Deloitte, 2020) expressed that they did not trust anyone with their data. The results of this survey seem to be more positive with a total of (83 participants) expressing comfort.

The final question on the survey was about whether participants would trust an autonomous vehicle. The results are shown in *Figure 8*. A third of the participants said that they would trust an autonomous vehicle. 44% of the participants answered (70 participants) 'Maybe', while 31% (50 participants) said 'No'.

In previous studies (like Forbes, 2019; and Deloitte, 2019) participants expressed concerns concerning trusting the technology. Though the question of 'trust' wasn't directly questioned in Volvo, 2016, the fact that over 90% of participants said that a human being should be able to take over at any time indicates a lack of trust in self-driving vehicles.
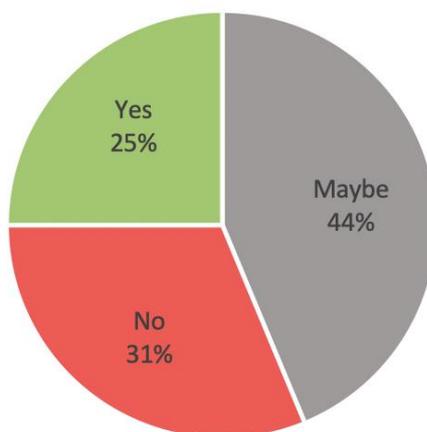
Figure 8: Survey Responses –
Trusting Self-Driving Vehicles

4.1.2 Inferential Statistics

This portion of the research project focuses on inferential statistical tests to further understand/determine patterns in the data collected. From the public opinion survey results, the following relationships and patterns were examined in this study:

    i.   Whether there is a relationship between the age of the participants and their trust of the technology – Using Pearson's r correlation

    ii.   Whether there is a relationship between awareness of the term A.I. and believing that self-driving vehicles are the future - Using Pearson's r correlation

    iii.   Whether there is a correlation between those who are comfortable sharing their real-time data and those who trust the technology – Using Chi-square test

    iv.   Whether all benefits of autonomous vehicles are perceived in the same manner – Using the correlation matrix and Cronbach's alpha

Each of these patterns is subsequently analysed in the above-mentioned order.

<u>The correlation between trusting the technology and the age of the participants:</u>

Most of the participants who answered the survey were in the younger age categories. Most respondents answered either 'No' of 'Maybe' when asked about trusting the technology. This relationship can be shown in *Table 5* which is a cross table with the two variables of Age and Trust.

Table 5: Cross Table Between Age and Trust

Which <u>age</u> group do you belong to?	Will you <u>trust</u> your car to drive by itself?			Total
	Yes	No	Maybe	
18-24	14	25	31	70
25-31	8	17	18	43
32-38	4	1	7	12
39-45	3	2	1	6
46-52	3	1	5	9
53 & Above	8	4	8	20
Total	**40**	**50**	**70**	**160**

Pearson's r is an inferential statistical test of the strength between two variables. This test aids in establishing a linear association. The Pearson's r for the correlation between Age and Trust is -0.198 and shown in *Table 6*. Since the correlation coefficient is negative, when one variable increases (Age), the second variable decreases (Trust). From the results of this survey, Age and Trust are negatively correlated and both variables tend to change in opposite directions.

The *Sig. (2-tailed)* score shown in *Table 6* is 0.012. Since the Sig. (2-tailed) value is lesser than 0.05, it indicates that there is a significant correlation between the Age of the respondents and whether they Trust self-driving vehicles.

Thus, there is a strong negative correlation between the two variables. This is in line with previous studies (like Capgemini, 2019), where millennials trusted the technology more than the older generations.

Table 6: Pearson's r Correlation Test – Age and Trust

Variables	Test	Pearson correlation	Sig. (2-tailed)
Age and Trust	Pearson correlation	-0.198	0.012
N		**160**	**160**

<u>The correlation between awareness and believing that autonomous vehicles is the future</u>

Only 5 participants were unaware of the term A.I. and a majority of the respondents answered that they were aware. However, only 48% of the participants (76 participants) said that they believed that autonomous vehicles would be the future. *Table 7* is a cross table of both the variables.

Table 7: Cross Table Between Awareness and Future

Are you <u>aware</u> of the term Artificial Intelligence (A.I)?	Do you think A.I is the <u>future</u> for vehicles?			Total
	Yes	No	Maybe	
Yes	65	14	46	125
No	1	0	4	5
Somewhat	10	3	17	30
Total	76	17	67	160

The *Pearson's r* for the correlation between Awareness and Future is 0.185 and shown in *Table 8.* Since the correlation coefficient is positive, when one variable increases (Awareness), the second variable increases (Future).

The *Sig. (2-tailed)* score shown in *Table 8* is 0.019. Since the Sig. (2-tailed) value is lesser than 0.05, it indicates that there is a significant correlation between the Awareness of term A.I and whether participants believed autonomous vehicles would be the future.

Thus, it can be inferred that, as awareness of the technology increased, so did the belief that self-driving cars would be the future.

Variables	Test	Pearson correlation	Sig. (2-tailed)
Awareness and Future	Pearson correlation	0.185	0.019
N		**160**	**160**

Correlation between those who are comfortable sharing their data and those who trust the technology

Only 40 participants said that they trusted autonomous vehicles and most participants were somewhat comfortable with sharing their data. *Table 9* is a cross table between both the variables of Comfort of Data Sharing and Trust.

How comfortable are you in sharing your daily travel data with your car company?	Will you trust your car to drive by itself?			Total
	Yes	No	Maybe	
Very comfortable	15	6	4	25
Somewhat comfortable	14	10	34	58
Neither comfortable nor uncomfortable	4	7	13	24
Somewhat uncomfortable	4	16	11	31
Very uncomfortable	3	11	8	22
Total	**40**	**50**	**70**	**160**

The *Pearson chi-square test* was conducted to examine whether there was a relationship between those who were comfortable sharing their data and those who said they trusted self-driving cars. The results of the chi-square test are shown in *Table 10.*

The results revealed that there was a significant association between the variables (Chi square value = 35.255, df = 8, p = .000). i.e. $x^2(8) = 35.25$.

Of the 40 participants who said they trusted self-driving vehicles, 38% of them (15 participants) answered that they would be very comfortable in sharing their data and 35% (14 participants) answered that they would be somewhat comfortable sharing their data.

Thus, most participants (73%) who trusted the technology answered that they were comfortable in data sharing. There is a significant relationship between the Comfort of Data Sharing and Trust.

Table 10: Chi-Square Test – Comfort of Data Sharing and Trust.

Test	Value	df	Asymptotic significance (2-sided)
Pearson Chi- Square	35.255	8	0.000
N	**160**		

The relationship between the perceived benefits

The relationship between the six benefits of autonomous vehicles is shown in *Table 11*. The inter-item *correlation matrix* indicates the extent to which each pair of variables are linearly related.

From *Table 11,* it is evident that a significant relationship exists between each variable. Lesser Traffic and Time Saving have the strongest positive correlation (r =.544), followed by Fuel Efficiency and Reduction in Pollution (r = .508). The weaker correlations belong to Fuel Efficiency and Saving of Time (r =.170) followed by, Reduction in Pollution and Time Saving (r =.195).

The *Cronbach's alpha* was also examined and the alpha coefficient for the six benefits was .720, suggesting that the benefits have relatively high internal consistency as well.

Table 11: Correlation Table – Benefits of Autonomous Vehicles

Benefits of autonomous vehicles	Fewer Accidents	Fuel Efficiency	Reduction in Pollution	Lesser Traffic	Time-Saving	Efficiency in Vehicle Service
Fewer Accidents	-					
Fuel Efficiency	.442**	-				
Reduction in Pollution	.298*	.508**	-			
Lesser Traffic	.247**	.197*	.305**	-		

Benefits of autonomous vehicles	Fewer Accidents	Fuel Efficiency	Reduction in Pollution	Lesser Traffic	Time-Saving	Efficiency in Vehicle Service
Time Saving	.236**	.170*	.195*	.544**	-	
Efficiency in Vehicle Service	.220**	.182*	.199*	.255**	.427**	-

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

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

Thus, the benefits were all perceived in the same manner (i.e. positively) with some pairs being more strongly related than others.

4.2 Qualitative Results obtained from the industry through interviews

Interviews were conducted with experts to understand more about autonomous vehicles and how they could be successfully marketed especially considering all the mixed perceptions about this technology (which were obtained from the public opinion survey responses).

The results of the interviews revealed that all 5 experts had similar opinions regarding most questions. For instance, in question 2 of the interview which was "Which markets are ready to accept it and why?, all five experts almost instantly answered with the words 'USA' and proceeded to reveal the reason behind that answer as 'Tesla'. Such unanimously agreed upon patterns were identified and formed as a code as there was clear stress and importance given by all experts to those particular words.

Based on their responses it is clear that vehicle companies, Governments and digital influencers have critical roles to play in order to market the product.

The experts all believed that Governments must oversee the entire automotive sector and ensure regulations regarding privacy and data storage are strong. Governments should also be responsible for improving infrastructure to support self-driving vehicles. The experts believed that companies must invest in social media marketing along with other digital campaigns and expositions.

All the experts specifically mentioned that digital influencers would have an impact on the perception of the product. Their overall responses are summarised in *Figure 9* and subsequently discussed.
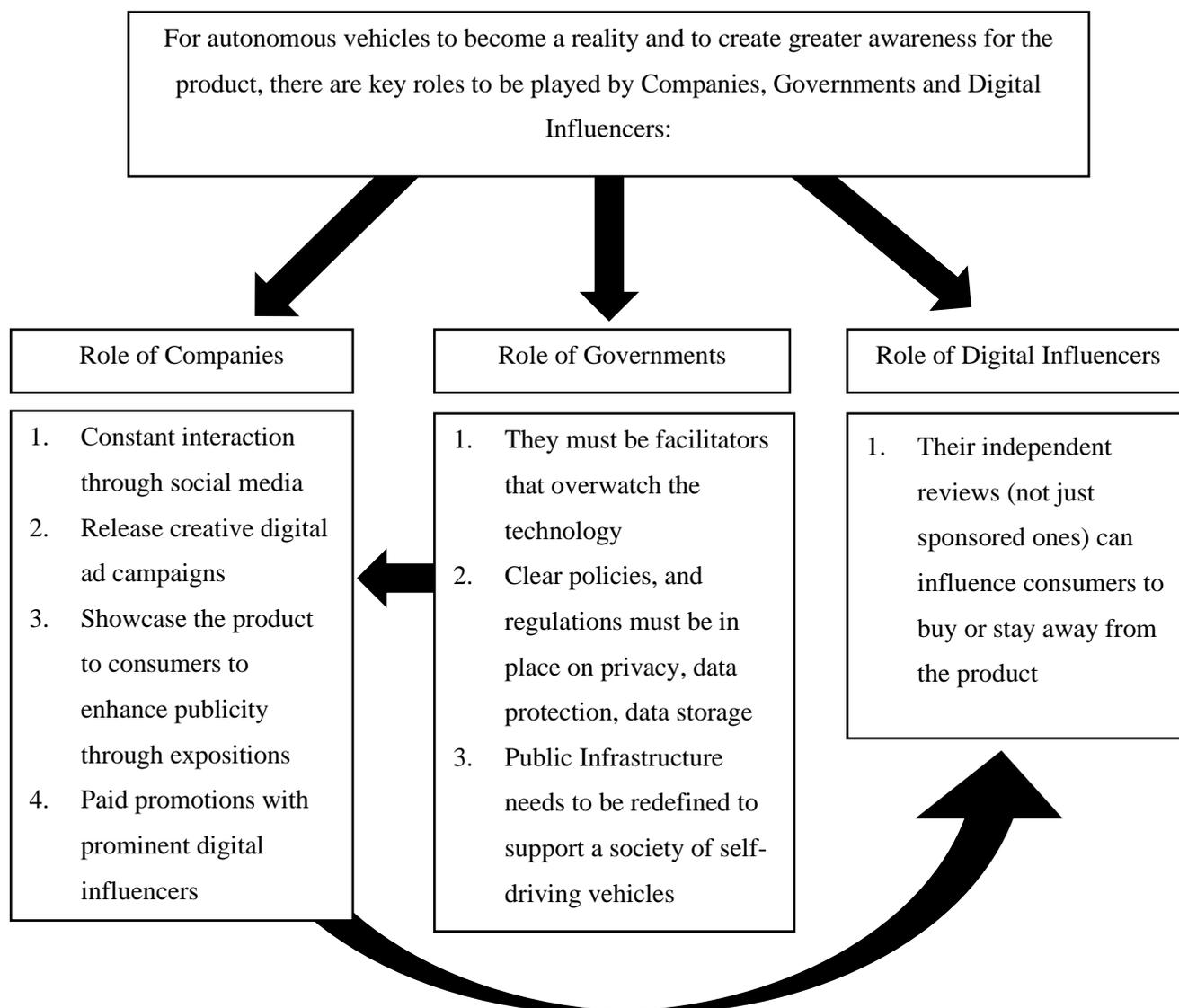
Figure 9: Summary of the Expert Responses Received in relation to Promotion of Autonomous Vehicles

The public opinion surveys revealed that the market may not be ready to embrace autonomous vehicles and there were participants who were not aware of the term A.I. The interview participants were asked about their opinions regarding how to improve awareness/ enhance

acceptance (based on the mixed responses received in the public opinion survey) and they were asked about specific marketing strategies that could aid in doing so.

4.2.1 Ad Campaigns (Online and Offline) to promote Autonomous Vehicles

The participants all agreed that online/ digital mediums would play a bigger role than offline mediums. Participant 3 also said that though the world is moving toward online platforms, traditional marketing through Television would play an important role in the promotion of autonomous vehicles as many people watch TV (especially older people). Thus, a combination of traditional and digital strategies would work best for companies, but more focus should be given to digital ones.

According to participant 5, car brands now focus a lot more on their advertisements to entice potential consumers. The focus is toward '*feature-rich advertisements*' which heavily promote the technology aspects of the vehicle. Example: The ability of a car to park by itself would be heavily publicised. In such a manner, each and every technological advancement should be communicated to build consumer trust and promote the product. This participant stressed on promoting the built-in technology of the vehicle through creative advertisements.

Participant 3 revealed that the best way to market self-driving vehicles would be for customers to actually see and touch them. Through expositions, CESs' (Consumer Electronics Show) and other live demos, companies can let people interreact with the vehicle and that would aid in improving their perception about the technology.

4.2.2 Personalised Marketing Strategies to promote Autonomous Vehicles

The participants all agreed that personalised marketing would play some role as car owners expect customisation, however, this would be a topic of the future as right now autonomous vehicles are not mass produced and sold. All the experts believed that this form of marketing would not play a crucial role at present. One participant expressed that at present, consumers would respond better to customisation in features and designs of the actual vehicles as opposed to customisation in marketing.

4.2.3 Creating Videos to promote Autonomous Vehicles

The experts agreed that companies should invest in making impactful and creative videos to improve consumers' perception about this technology and this would help in promoting the vehicles.

Participant 3 spoke about how YouTube has a proven track record for promoting automotive products. The participant spoke about how traditional brands in the past have had huge success through YouTube. This participant also spoke about how videos of self-driving vehicle walkthroughs along with a narration of its features, would aid in improving consumers' perception of the product. The trend of searching for products on YouTube to watch videos about the product and to read reviews will continue with self-driving vehicles.

Independent influencers will 'post' their opinions regarding the technology (even without being sponsored by companies) in due time, however companies must stay ahead and invest in making their own official videos to promote each product and attract potential consumers.

4.2.4 The Role of Digital Influencers in the promotion of Autonomous Vehicles

All 5 participants expressed that Digital Influencers would play a crucial role with respect to promoting autonomous vehicles. The participants believed that companies should sponsor prominent influencers as they would have a huge following, and this would aid in promoting self-driving vehicles. Many people spend a lot of their time viewing videos posted by influencers. Each influencer would have their own followers or fan-base, so companies need to invest depending on their target audiences and geographies (i.e. some influencers have a huge teenage fan base while others are popular in certain countries). Consumers tend to trust these influencers as they provide their independent views on each product. Participant 4 spoke specifically about Tesla as the company sends invites to such influencers to attend the launch events of their products. These influencers then make videos or posts on social media regarding their experience and many millions of people see

their content. Thus, it is agreed upon that companies must invest and promote their products through these digital influencers, as they act as a bridge between the product and the people.

4.2.5 Using Social Media as a Marketing Strategy

From the interviewed experts it was clear that social media was a primary pillar of the marketing space. All the above discussed points about videos, online campaigns and digital influencers are all related to social media platforms. The experts all agreed that each company's online presence needs to constantly be monitored. Timely and relevant content from vehicle brands needs to be pushed to the public. The experts believed that social media has the most power to promote autonomous vehicles. On social media, brands can build up 'Anticipation' and 'Excitement' among people for the new way for driving. Brands no longer sell products; they're trying to sell experiences.

The experts believed that companies which constantly interact with their consumers and post engaging content would be successful. A participant also pointed out that social media is tricky and can cause serious damage to a company's reputation. The expert narrated an instance of how Elon Musk's tweet about Tesla's share price caused the company to lose $3 billion. Thus, social media can build up the reputation of a product/brand or can taint the same.

The experts all said that social media will become the mainstream method of communication for the marketers of a brand to promote and advertise self-driving vehicles. Another reason why social media has become popular is because of the popularity of hand-held devices like mobile phones, iPads etc. One participant said *'consumers spend a lot of time on their phones, maybe around two to four hours a day on social media platforms like Facebook, Instagram, WhatsApp, and so everyone will have a photographic memory'*

Thus, brands should use social media to engage with their consumers to promote the product through engaging content and videos but should be wary about the same. Again, the example of Elon

Musk was given as he is constantly 'tweets' with consumers and has even asked them for their opinions to improve the Tesla's products.

4.2.6 The Importance of Search Engine Optimisation

Participant 5 in particular spoke about the importance of search engine optimisation. Since the technology is shared, brands should invest more on standing out. The expert revealed that at this stage (when the product is in testing), many people would use search engines like Google to 'search' about the product out of curiosity. Brands that invest more could have a better reach to potential consumers.

4.2.7 The Role of Governments

The participants all had similar opinions about the role of Governments. They all believed that Governments should focus on the creation of policies to oversee autonomous vehicles. At present there is a lack of privacy standards, a lack of regulations regarding safety and a lack of data privacy standards. One respondent said, *"when I say creating strong policies, it will be towards the safety aspect of these self-driving cars"*. Without a proper authoritative mediator in this scenario, there would be chaos and uncertainty among the people.

One participant pointed out that, storing and securing data will be challenging and will vary from country to country (for instance, General Data Protection Regulation or GDPR is a regulation in the European Union). The Governments around the world should frame and implement clear policies.

Governments have to also closely monitor the situation and ensure enough testing is done before the general public begin usage of the same. Before autonomous vehicles hit the public roads, Governments should invest in redefining the public infrastructure that would be able to support these self-driving vehicles. Thus, Governments have a crucial role to play.

According to the second participant, the Korean Government is co-ordinating with car companies like Hyundai to build prototype cities to see how the product co-exists with the society.

4.2.8 Other Findings

According to the public opinion survey results only 16% of participants were very comfortable sharing their data. Real time data is needed by car companies to successfully launch autonomous vehicles. As one of the participants said, *"if you want to prove this particular concept a lot of real data is required. So, when you investigate it, this real data is very very important for making decisions".*

As per the estimates of participant 3, complete automation (Level 5) within all the societies around the globe would take around 20 years. The participant believed that right now only certain cities in the USA would be suitable for this level of automation due to the efforts of Tesla.

Participant 4 mentioned that companies are working closely with the transportation services to promote and create the awareness of these vehicles. Self-driving vehicles have the potential to completely revolutionise the transport sector. This participant believed that the key to the acceptance of autonomous vehicles would be through public transport (just as how the world has accepted man-less bullet trains).

Thus, from these interviews it is clear that companies need to invest heavily on digital marketing tools to differentiate themselves. They all believed that the companies which have a better social media presence would be more successful. Companies need to keep their consumers updated with all their testing progress and should engage with their consumers constantly. Brands need to promote their products through creative marketing.

The success or failure of this technology isn't just with vehicle companies, but also with Governments. These interviews also highlighted the importance of the roles of the Governments around the world.

5. Discussion

Through conducting public opinion surveys and interviews with experts, several key inferences were obtained. This research focused obtaining more information regarding the marketing strategies that would aid in the promotion of autonomous vehicles and to get more insights into the markets' perceptions about the same. The survey results were compared with the results obtained from other larger surveys (like Deloitte, 2019; Deloitte, 2020 and so on) and subsequently analysed. The responses given by the experts to each question, highlighted the important marketing strategies that companies must use to succeed in promotion of the product.

From the surveys it was clear that most people were aware of the technology. The elderly (i.e., above the age of 53) also responded positively showing their awareness of the technology. According to participant 4 of the interviewed experts, *"countries like S. Korea and Japan are now adopting this technology because of this growing interest in self-driving vehicles due to the ageing population"*. Thus, self-driving vehicles can really aid the elderly (who cannot drive or who are unwell and so on)

Another interview participant specifically expressed that given the current circumstances (covid-19), the entire automotive industry and has undergone a change and each company's timeline for Autonomous vehicles is now set back.

According to an article by Deloitte about the auto industry during this pandemic, companies should come up with creative strategies 'online' and should plan effectively to not get pushed out by competition (Deloitte, 2020)

All the experts stressed on the importance of advertising to make the product compelling for the audience. The experts revealed that brands must focus on the distinctive qualities of their products and must invest heavily on social media to showcase the proclaimed benefits.

To improve consumers' perception about self-driving vehicles, companies must engage with consumers and convey the benefits of using the product to them. For instance, Elon Musk's Tesla recently posed questions to consumers in a way that promoted the vehicle and conveyed the benefits of the same. *"Do you care about the environment enough to buy a car you have to charge for 30 minutes every 300 miles (vs. stopping for a 5-minute refill of gas)? And are you willing to spend a little bit more money to let people know you care about the planet and the future of sustainable transportation?"*(Taparia, 2020).

The most concerning factor in this research study is privacy concerns, which refers to consumer data collection and storage by automotive brands. As per the public opinion survey, most people were comfortable by sharing the data to the companies. Albeit the positive response (83 participants) in this research, most people were not comfortable at all in another survey conducted by Deloitte, 2020.

Meanwhile, the qualitative analysis has given the importance of the data collection and its usage in the autonomous vehicles. The importance of Data in the automotive industry has been given an article by the European commission itself, which says the 30 to 40 % automotive services will be based on digital services such. These services are utilised by the Autonomous driving platform, vehicle to vehicle communications and other e-commerce platforms for the auto industry. (European Commission , 2017). It also has been discovered through the qualitative analysis, that the data is just not rudimentary towards the perfection of the technology but also for the personalised marketing of the customers.

The unsurprising fact that this research has given is the use of the digital medium as the platform for the automotive industry. The key element or tools that will be used in digital marketing has been exposed in this research and coincides with the exploratory theory where digital platforms will become a mandate to strategise and sell AV's (Autonomous Vehicles). Whereas the reports

given by other studies which are mentioned earlier tells the '*importance of marketing for automotive companies when a technology is being shared and needs differentiation for the brand itself*' (Olson, 2017). A key implication that the study has provided is that the importance of social media, the role of digital influencers and other digital platforms is likely to become the key to reach the consumers for the automotive brands, as AV's become the new normal in the coming period. Provided in an article *"The shift towards digital media has transformed how people shop for vehicles"* says Meredith Guerriero, Google's Global Head of Automotive (Guerriero, 2016). Not only that, but through the findings from the qualitative data, the OEM's were one of the first to embrace the digital platform for marketing. Thus, the inclusion of digital marketing as an important component in development for automotive companies will create a wider acceptance in this industry.

The bilious problem of this study is, the consumer perception gathered from the surveys and the responses gathered from the interviews for the strategies required to drive Autonomous Vehicles into the consumer are loosely linked due to the limited resource or data availability. Unlike the other global surveys conducted by the World Economic Forum in 2015, Ernst and Young's in 2015 and Deloitte's global survey that spread across 20 countries. On the other side of the story, the responses are data collected were from one automotive OEM (i.e., Original Equipment Manufacturer) company, which again has given only limited information relating to the marketing techniques that are required for the industry. Although semi-structured interviews offer some degree of flexibility, the questions were still pre-prepared, meaning that participants could only give their opinions for the questions asked. Thus, their opinions were limited to the questions. Insights/Data from multiple automotive brands if included would have streamlined the clarity and accuracy of the marketing strategies that could be used for the automotive industry. This could have given a more in-depth understanding and a diverse set of propositions at a global aspect for this research. The impact or disruption in the auto industry is not limited to the autonomous vehicles, but also the other business effects caused by it like, retail model, vehicle fleet business and the mobility insurance industries.

These were not included as part of this research when they were just limited to the field of marketing strategies. All these are correlational towards this study.

It is important to note that at present, people's opinions regarding this technology are bound to be mostly psychological. Only with time through more debates, discussions, trials, test drives, regulations and data will people's opinions be more factual and sophisticated. Thus, considering this, it is important to view the findings in this research with some caution. The survey is only meant to shed some light on the perceptions of the participants who responded to the survey. The patterns analysed may differ from other sample pools and should only be viewed as a representation of this sample pool of 160 participants.

On the bright side, this research has given an understanding of the public opinions towards AV's through the descriptive and inferential statistics that were conducted for the same. This study has also established the importance of various marketing techniques for the automotive industry when it is rapidly inclining towards the technology of self-driving cars. This preposition of the importance of creative ads and marketing strategies has also been established by a few other articles, like the one given by (Sciaccaluga and Delponte, 2020).

Through the surveys, it is noted that the majority number of the participants were millennials (i.e., the people under the age of 35) in this study. It also happens to be that most of the responses towards the perception of autonomous vehicles are positive, which in this case is a whopping 80% out of the people (i.e., 160 respondents) who responded. Another survey conducted by Deloitte, 2020 had obtained similar responses (around 55% of its respondents) for the same question, unlike the surveys by Forbes, 2019 and Ernst and young, 2015 mostly received a negative discernment over this question.

This work has only opened the door to other marketing insights that can be studied, but this research study on self-driving vehicles and the transformation of vehicles has opened even more research possibilities for researchers.

This research can be an assistive tool for future researchers to analyse the impacts, effects, disruptions that have caused to the dependent industries (e.g., Fleet management business, Insurance, consumer telematics, etc) of the automotive sector and the corresponding plan of actions of those. In the future, a deeper analysis of the perception of the market for autonomous vehicles, along with the various market strategies for different demographics could be done.

Conducting mixed research studies again at a global level could prove to be more useful and insightful that could create variable strategies in the coming years. The implications of this research are well sure to be perceptible but as the current stage of autonomy is not the final (i.e., the current stage of autonomy is level 2). It is significant as this technology evolves further, the very nature of the automotive business and its related businesses (e.g.: Insurance business) will have to change. This in turn could create a broader spectrum in the field of marketing and the automotive industry. This research can further be expanded by studying the role of the governments of different countries in relation to the autonomous vehicles and its implementation in its respective markets.

5.1 Conclusions

This research study has produced a report on the marketing strategies (online and offline) that can be created for the autonomous vehicles and to measure the user perception of the same.

This exploratory study has incorporated 7 interview questions for the public survey questionnaire and coupled with a 11 set of questions for the interview to determine the strategies that are proposed for the autonomous vehicles. Through this research it has demonstrated that the Digital platforms such as YouTube, Facebook are the key role players for the autonomous vehicles and its industry for marketing and sales. This research has also discovered that role of 'digital influencers'

will be humongous for the automotive brands; in promoting, creating reputation for the automotive brands and its products. Through these findings, it is to be noted that the current study on marketing strategies for automotive industry is not sufficient, but further studies on the types of marketing techniques involved in the autonomous business is essential as the technology is product of the future. This research is still in the early stages as is the product in the market. Only time will tell, as it is the product of the future, its market acceptance and the business environment will see a drastic change when L5 (Fully autonomous level) becomes a reality, as it may be the crucial period for the industry. Participants in general had a positive opinion towards the autonomous vehicles, but the voting across various other factors regarding the autonomous vehicles were mixed and slightly were poor

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Appendices

Appendix 1 – Public opinion Survey (Questionnaire)

1) Which age group do you belong to?

- 18-24

- 25-31

- 32-38

- 39-45

- 46-52

- 53 & Above

2) Are you aware of the term Artificial Intelligence (A.I)?

- Yes

- No

- Somewhat

3) What is your overall perception/feedback of Artificial Intelligence in vehicles?

- Completely Positive

- Positive

- Neutral

- Negative

- Completely Negative

4) Do you think A.I is the future for vehicles?

- Yes

- No

- Maybe

5) To what extent do you agree or disagree with the below potential benefits of A.I. in vehicles?

Potential benefits	The extent of agreement or disagreement				
	Highly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Highly Disagree
Fewer Accidents					
Fuel-Efficient (assuming all are electric as per forecasts)					
Reduced Pollution					
Less Traffic					
Less Travel Time					
Efficiency in-vehicle service (due to computer detection of issues in the vehicle)					

6) A.I. in vehicles may require real-time data to operate efficiently and improve accuracy, how

   comfortable are you in sharing your daily travel data with your car company?

   - Very comfortable

   - Somewhat comfortable

   - Neither comfortable nor uncomfortable

   - Somewhat uncomfortable

   - Very uncomfortable

7) Will you trust your car to drive by itself?

   - Yes

   - No

   - Maybe

Appendix 2 – Interview Questions

1. When do you think self-driving cars will be the norm?

2. Which markets are ready to accept it and why?

3. How important is real-time data and what are the barriers in data collection?

4. What are the plans to create customer awareness for autonomous vehicles?

5. What would future Ad campaigns look like (both online and offline)?

6. Do you think that personalised marketing is crucial for the success of this sector?

7. Do you believe that brands should invest in videos to attract more customers?

8. Is Search Engine Optimisation crucial for the automotive industry and how?

9. Do you think Digital Influencers are important to the Automotive industry?

10. In your opinion, what roles would the world Governments play in marketing autonomous vehicles?

11. How do you think Social Media platform helps in building the intangible assets (goodwill, reputation etc) for the company?

Appendix 3 – Consent Form

Information Form and Consent Sheet

INFORMATION SHEET FOR PARTICIPANTS

PROJECT TITLE: Exploring the marketing strategies and perception of the market for autonomous vehicles

You are being asked to take part in a research study on the Automotive industry and the marketing strategies of companies within the industry of how they plan to strategize and push autonomous vehicles into the current market environment. This research is being conducted by Srinivasan Nagarajan for academic purposes at 'Dublin Business School' under the supervision of Professor Naomi Kendal.

WHAT WILL HAPPEN

In this study, you will be asked to provide your expertise and industry knowledge on how companies such as yours going to act, plan and strategize to push this new technology of autonomous vehicles; as this research aims to find how this changing landscape in the industry is going to convince the market in the current environment.

TIME COMMITMENT

The study typically takes 5 to 10 minutes.

PARTICIPANTS' RIGHTS

You may decide to stop being a part of the research study at any time without explanation required from you. You have the right to ask that any data you have supplied to that point be withdrawn/destroyed.   You have the right to omit or refuse to answer or respond to any question that is asked of you.   You have the right to have your questions about the procedures answered (unless answering these questions would interfere with the study's outcome. A full de-briefing will be given after the study). If you have any questions because of reading this information sheet, you should ask the researcher before the study begins.

CONFIDENTIALITY/ANONYMITY

The data I collect does not contain any personal information about you except your name, designation, company name and work location. All the data and information collected in this interview from the participants will be used for academic purposes only. All the data collected from the interviews, questionnaires collected through Microsoft Forms (DBS's Microsoft student account) and the recordings during the interviews conducted online will be stored electronically in the school system under password protection. This password will strictly be discreet to the research team of Dublin Business School. This data will permanently be erased upon graduation from the school. The transcripts and data files, if retained will remain under the password protection of Dublin Business School, Ireland.

FOR FURTHER INFORMATION

I or/and Mrs Naomi Kendal will be glad to answer your questions about this study at any time. You may contact my supervisor at

INFORMED CONSENT FORM

PROJECT TITLE: Exploring the marketing strategies and readiness of the market for autonomous vehicles

PROJECT SUMMARY:

This research study explores, where companies are in achieving the self-driving cars and at the same time to understand where the market stands in awareness of this technology. This study aims to discover, how the entire automotive industry is transforming technologically, through the creation of autonomous vehicles and focuses on how they intend to market the same. This project aims to discover the public's readiness to embrace this new disruption and showcases the situation and opinions of the market. The project's goal is to find out the marketing strategies of companies to bring out this product into the masses based on the current market environment. This can be achieved by conducting semi-structured interviews with experts from the field and obtain understandings of the present and the future, which will also answer the opinions of the public which were obtained from surveys conducted online. To summarise, this project's goal is to find out marketing strategies of companies to push the disruptive product of autonomous vehicles into the current market and to find out the future of the automotive industry for the same.

By signing below, you are agreeing that: (1) you have read and understood the Participant Information Sheet, (2) questions about your participation in this study have been answered satisfactorily, (3) you are aware of the potential risks (if any), and (4) you are taking part in this research study voluntarily (without coercion).

Participant's Name:

_____   Date:

Student Name:

SRINIVASAN NAGARAJAN

*This consent form has been sent to all participants and agreed upon by them through the medium of email.