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Consumer Perceptions towards Radical Innovation: Autonomous Cars

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Summary

This study aims to investigate consumer perception towards radical innovation in order to provide practitioners with an understanding of consumer behaviour with a particular focus on the correlation between consumer resistance to innovation and intention of adoption. Such knowledge is likely to provide guidance to organisations for the upcoming launch of their radical innovation, and hence to reduce the innovation failure rates. Technological developments over the years have changed how consumers manage their lives. Nowadays consumers' lives are getting "smarter" stimulated by the development of "smart phones", "smart homes", "smart offices" and most recently "smart cars". In this paper, autonomous cars have been selected as the radical innovation due to its unique status as a widely discussed and globally promoted product but still in the pre-launch stage. Our survey identified financial, tradition and norm as major barriers for consumer resistance towards radical innovation. In comparison, image and status associated with driving an autonomous car was perceived to be a highly valued factor.

1. Introduction

The importance of innovation is outlined as "innovations are a crucial determinant of a firm's success and competitive advantage" (Pallas et al., 2013, p1). In a similar vein, Lettl (2005) refers to radical innovation as a central factor in business success while Littunen (2010) states innovation as a key ingredient for organizational growth, success and even survival. However, despite constant developments in technology, product design and marketing, most innovations still fail to survive (Srinivasan et al., 2009; Lee and O'Connor, 2003).

Innovation failure can be related to various factors, such as the product itself in relation to its (a) compatibility and the level of innovativeness, (b) target market acceptance, and (c) business and marketing strategies. Another reason for innovation failure is the lack of consumer acceptance. Consumers are now exposed to large number of technological new product launches, giving consumers more choices for selection, less time for consideration and higher expectations of product quality and performance. In addition, consumers' perceived risk and their desire to preserve the status quo are other barriers for radical innovation. Consumers like to preserve their status quo (Dalziel et al., 2011) and are hence cautious about new innovative products (Stone and Grønhaug, 1993 cited in Kleijnen and Antioco, 2010; Labay and Kinnear, 1981). There is also some uncertainty about assessing the product value, performance and its symbolic value when it comes to radical innovations. Overall, consumers' perceived risk is regarded as high and a significant barrier for most innovative products: "Such risk and uncertainty have been widely documented as barriers to

innovation adoption" (Castano et al., 2008, p321) although the perceived risk and resistance intensity is likely to change depending on the product type.

There is a wide body of literature on consumer perceived risk. However, there are limited studies that focus on consumers' perception of imminent technologically innovative products. Previous research investigates the consumer perception of innovative products after the launch of given products, with limited insight on pre-launch phase. Thus, this paper aims to contribute to this under-researched area by focusing on innovative products at pre-launch phase. Moreover, building on technological adoption likelihood model by Saaksjarvi (2003) we will investigate if differences in consumer groups by professional background will play a role in consumer acceptance of radical products. Consequently, the following research questions are developed:

RQ1. What are the major areas of resistance regarding the consumer adoption of radical innovative products?
RQ2. Do image and status gains by consumers when adopting technological innovation influence their acceptance of the new product?
RQ3. Do consumers with a similar industry background to the innovative product have the same usage barriers in comparison with those with different industry backgrounds?
RQ4. Are consumers with a similar industry background to the innovative product more likely to accept the radical product than those with different industry backgrounds?

2. Literature Review

2.1. Defining Innovation

According to Zahra and Covin (1994, p183), "innovation is widely considered as the life blood of organization survival and growth". Corporations use innovation as a tool to positively influence growth, create value and leverage competitive advantage as well as reaction towards changes in the environment (Moss et al., 2013; Baregheh et al., 2009; Damanpour, 1991). While some authors highlight that innovation is the "the creation of new knowledge and ideas" (Plessis, 2007, p21), others put the emphasis on innovation as new products and processes (Moore, 2002). Although there is no common definition of innovation, two views are repeated across its definitions: First, an innovation has to consist of novelty or rejuvenation, and second it has to cause change to status quo (Gabler and Herausgeber, 2015; Damanpour, 1991; Thompson, 1965).

Scholars identify different types of innovations. For example, Moore (2002) identifies application, organic, process, product enhancement and platform innovations, each of which is diverse and requires a different strategy to succeed (Moore, 2002). Being one of the most acclaimed innovation scholars, Christensen (2007) categorizes innovation into two types: incremental and disruptive. They both differ according to the impact they have to status quo. Incremental innovation is about changing consumer behaviour step by step incrementally (e.g. shifting from iPhone6 to iPhone6s) while disruptive (or radical) innovation acts as a "game changer" (e.g. shifting from conventional mobile phones to the first smart-phone). In this study, we will focus on radical innovation, in which the new offerings come with a very high degree of innovativeness.

2.2. Drivers of Innovation: Megatrends

A key element that drives organizations for continuous innovation is related to macroeconomic forces that guide their strategic decisions by allowing organisations realize the opportunities and conquer the challenges. Megatrends have been recognized in different scales of vitality, most common rising trends are like "Internet of Things" (IoT). Demographic shifts and patterns are other key megatrends that are widely discussed by consulting firms. Higher life expectancy and explosive population growth in some areas against declines in other regions contribute to everything from shift in economic power to resources scarcity to the changes in societal norms. Finally, megatrends in climate change and resources scarcity are driving innovation in the energy and resources space. The changes demand innovative solutions for a better use of natural resources and alternative materials to protect healthy ecosystem.

2.3. Consumer Resistance to Innovation – Uncertainties and Perceived Risk

An adoption of a new product primarily happens due to its functional and symbolic value, but there is also uncertainty surrounding these value estimates (Castano., et al., 2008). Uncertain consequences are considered as a component of risk (e.g. Hoyer and MacInnis, 1997; Dowling and Staelin, 1994). Perceived risk has been defined as "risk in terms of the consumer's perceptions of the uncertainty and adverse consequences of buying a product (or service)'' (Dowling and Staelin, 1994, p119). Littler and Melanthiou (2006) state that perceived risk is a combination of several categories of risk, which have been identified as performance, physical, financial, psychological and social initiated and time loss. Related to perceived risk, two main types of barriers are highlighted in the literature (e.g. Porter and Donthu, 2006; Lunsford and Burnett, 1992):

- Functional barriers where consumers evaluate the consequences of adoption in terms of usage, value and performance risk.
- Psychological barriers which mostly arise through conflicts with consumers' prior beliefs (tradition and image) and financial risk.

2.4. Consumer Adoption of Technological Innovations

Consumers' adoption of technological innovations is documented by Rogers (1962) and Saaksjarvi (2003). In this section we will first discuss the innovations type followed by the classification of consumer adoption of technological innovation and the characteristic of factors that affect the level of successful adoption of a new product.

The innovation classification is an important outline to differentiate the types of innovation, as the intention of adoption directly influence the kind of knowledge transferred and it can also anticipate the changes required in consumer behaviour. Robertson (1971) and Solomon et al. (2006) classified innovations based on their impact on behaviour and social structure with the following 3 categories: continuous, dynamically continuous and discontinuous. Technological innovations have a high tendency to fall into the discontinuous category where they are usually regarded as knowledge intensive innovation (Moore, 2002). For this study, discontinuous classification is applied, where it demands an extensive learning or unlearning from consumers.

As the degree of innovation is subjective, consumers' perception of innovation varies according to their level of expertise (Saaksjarvi, 2003). For example, a photo shooting professional will be more prone to adopt an innovative camera with additional stylish

functions and extra cost, whereas non-professional consumers will tend to stay with a simple functional camera for casual usage. The intention to adopt such innovation is lower for the non-professional due to lack of knowledge, and may perceive such innovation as too complicated. Consequently, Saaksjarvi (2003) reclassified consumer adoption to four different categories (technovaters, supplemental experts, novices and core expert).

Rogers (1962) introduced the consumer classification for new products or technology adoption model (TAM), where the two dimensional classification in percentage of adopting and product life cycle was used in five categories of adopters as innovators, early adopters, early majority, late majority and laggards. The traditional model by Rogers (1962) has received criticism in recent years. For example, Goldsmith and Hofacker (1991) commented that the model applied temporal concept with time-of-adoption approach and it will not be applicable when it comes to predicting future behaviour (Goldsmith and Hofacker, 1991). The reliability of the model when it comes to measuring the perception of innovation characteristic was also highlighted (Eastlick and Lotz, 1999). Boyd and Mason (1999) and Mahajan and Muller (1998) argue that the model presents the notion of potential business volume in the area of majority where 68% of adoption rates are anticipated and not on the introduction phase (Boyd and Mason, 1999; Mahajan and Muller, 1998).

Further, Saaksjarvi (2003) criticised the model from two perspectives. First, the model itself was developed more than five decades ago where the "traditional personality variables given for innovators seem to be less appropriate regarding technological innovation" (p93). Second, the perceived innovativeness in the technologies market is characterized by an extensive technical knowledge, where it considers the "consumer with extensive technical knowledge are assumed to be more innovative than novices" Saaksjarvi (p94). This resulted in Saaksjarvi's (2003) introduction of a new classification of consumer adoption in technological innovations as:

- technovaters
- supplemental experts
- novices
- core expert.

2.5. Automotive Megatrends Demand Innovative Solutions

The innovation the automotive industry started when electronic systems were introduced into vehicles in the 1960s (Moessinger, 2010). The automotive industry is driven by several megatrends, where the vehicles are required to be built with more intelligence. First is related to safety. Car to car communication infrastructure (Car2X) is designed with the purpose of avoiding collision. The trend has a closer link to Internet of Things (IoT) (Ashton, 2009) and digital future, where the internet connectivity could enable the vehicles to 'talk' or 'exchange' and 'come to an agreement' on which vehicle should drive first and when. The strength of IoT has also become an enabler for other megatrends, such as urbanization in the megacities. Car sharing was an initiative going back to 1940s, and the introduction of Over-The-Air (OTA) car access right management further boosted the car sharing idea. OTA enables users to book a vehicle via a user's Smartphone. Megatrends in smart environment protection and resource scarcity further elevated the demand for innovative lightweight and greener vehicles in the area of vehicle powertrain, which resulted in the production of electric vehicles.

These developments in automotive industry towards intelligent vehicles suggest autonomous driving is the next revolutionary trend in the industry. The recent development of driverless technologies includes an automated slide into tight parking space feature as well as cars following a safe distance and staying in lane in steady traffic flow. Vehicle connectivity comprises a set of functions and capabilities that digitally links automobiles to drivers, services and other vehicles. In addition to safety, these features serve to optimize vehicle operations and maintenance as well as driver comfort and convenience. Autonomous vehicles are expected to offer many benefits and advantages, namely:

- avoiding traffic collisions that are caused by human driving errors with a broad range of sensors that detect obstacle and react faster than human (Miller, 2014);
- time saving and freeing up the roadway capacity with dynamic real-time information that result in better management of the traffic flow (Cowen, 2011);
- reduce total number of cars by increased car sharing (Woodyard, 2015);
- relief of vehicle occupants from driving and navigation chores (Cowen, 2011);
- elimination of redundant passengers as the car could drive unoccupied to wherever it is required, such as pick up passengers or to go in for maintenance (Google, 2015) and
- a smoother ride (Simonite, 2013).

Selective developers and their recent development of autonomous vehicles are presented in Table 1:

Google: Self-driven over 1 million miles, these are special safety fitted cars, and Google is looking for community feedback for a fully self-driving vehicle (Google, 2015).

Daimler: First autonomous truck tested in German autobahn at 80km/h. Tested S500 Intelligent Drive vehicles on both interurban and urban routes, followed by the introduction of futuristic F 015 luxury model (Daimler, 2015; Mercedes-Benz, 2015).

Audi: Tests conducted for more than 15 years in various locations, recent piloted drive is when a journalist passenger rode 550 miles autonomously from Silicon Valley to Las Vegas, and Audi RS7 field test in Grand Prix track Hockenheim Germany with top speed of 140mph (Audi, 2015). The company announced they will offer for sale their first cars with driverless technology in 2017 (Telegraph, 2015).

In conclusion, the continuous invention in radical innovation is inevitable for organizational survival. Main forces from megatrends and the advancement of technology triggered the needs for a better social system and environmental products. The challenge of continual radical innovation is the low adoption rate by consumers which is related to consumer resistance and perceived risk.

This study aims to present further understanding on consumer perception towards radical innovation products by considering both functional and psychological barriers. Informed by this literature review, consumers' perception towards radical innovation will be investigated in three dimensions, namely industrial backgrounds, key resistances and usage and image barriers in relation to adoption.

3. Research Methodology

A quantitative approach was taken in this research in the form of a survey study. The primary data were collected through an online questionnaire from a total of 139 individuals as outlined in Table 2.
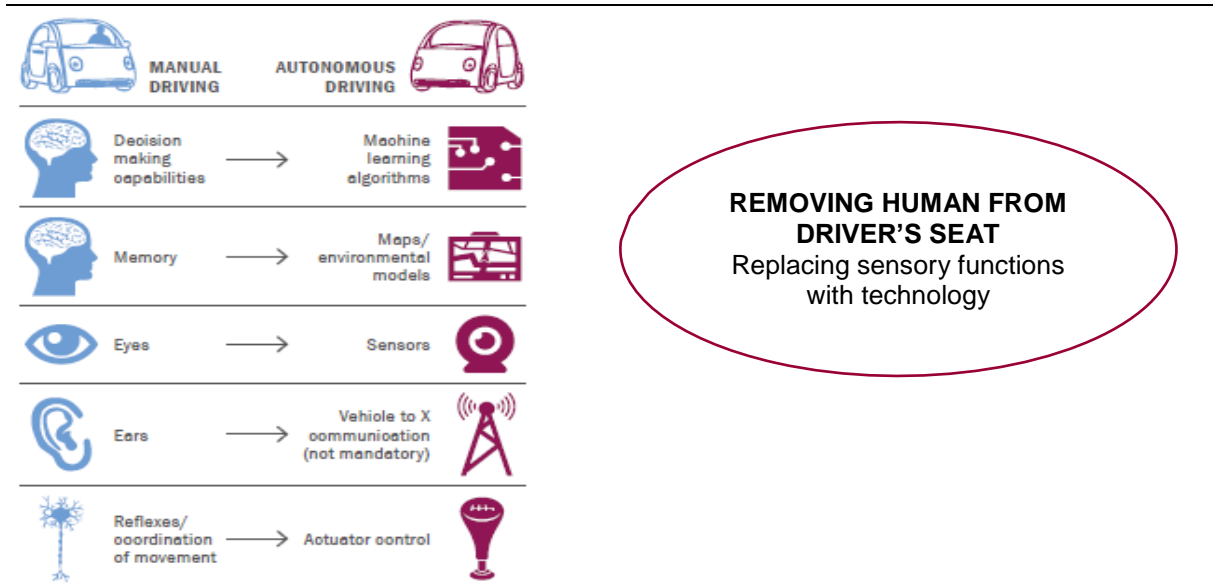
Table 2: Questionnaire design

Total respondents	139
Respondents profile	47 (non-automotive background); 92 (automotive background)
Duration of data collection	31 days
Number of questions in the q're	26
Structure of the questions	8 variables in 3 categories [1 (profile), 6 (resistances), 1 (adoption)]
Multiple choice questions	Ranking scales from 1 to 5

Although non-probability sampling methods were undertaken, the sampling frame was structured in order to reflect the viewpoints of a range of consumers including (a) international mature students registered for a distance learning postgraduate programme in a UK university, (b) residents in Germany and (c) employees of German automotive supplier. This framework is informed by technological adoption likelihood model and the classification by Saaksjarvi (2003). The purpose was to test whether consumers who worked at the automotive industry demonstrated a higher rate of potential adoption due to their higher level of expertise and knowledge in comparison with consumers who were not employed in automotive indutry.

3.1. Research Context

As radical innovation, autonomous driving was selected since it is a recent innovation and is likely to redefine the automotive industry. Several globally known vehicle manufacturers (such as Audi, Daimler, Toyota and Volkswagen) and technology companies (such as Google) currently invest in autonomous driving. Current generation cars are already fitted with several functions that are paving the road towards the autonomous driving technology. Such as ADAS functions - advanced driver assistance systems (that provide features like active lane assistant or monitoring, adaptive cruise control and self-piloted parking and automated braking system) (Figure 1). Despite its popularity in media, autonomous driving is still at a pilot stage. Vehicle manufacturers (such as Audi, BMW, Mercedes-Benz and Volkswagen) started to run the test concept phase with no commercialization taking place currently. Therefore, autonomous driving is seen as an appropriate context for investigating consumers' barriers towards radical innovation and understanding the factors that facilitate their adoption of radical products.

Figure 1: What is Autonomous Vehicle?

Source: Roland Berger (2014)

3.2. Questionnaire Design

Our questionnaire consisted of eight categories (one category for respondent demographics, six categories for resistance and one category for potential adoption) and a total of 26 questions (Table 2).

Table 2: Variables included in the questionnaire design

Constructs	Reference	No of questions	Categories
Demographic info.	Researcher defined (age and professional background)	2	Demographics
Usage barriers	Venkatesh and Shih (2006); Ram and Seth (1989)	3	Resistance
Value barriers	Mathwick et al. (2001)	2	Resistance
Financial risks	Bruner et al. (2001)	3	Resistance
Performance risks	Bruner et al. (2001)	4	Resistance
Tradition and norms	Reidenbach and Rodin (1990)	3	Resistance
Image barriers	Graeff (1996)	4	Resistance
Intention to adopt	Bruner et al. (2001)	5	Adoption

Along with the questionnaire, a brief introduction of the autonomous car was distributed to the respondents. The introduction covered the definitions of radical and incremental innovation with examples from vehicle manufacturers (including Audi, Daimler and Mercedes-Benz) and an internet platform company (Google). This was to ensure the respondents had a common understanding of the given product and to reduce the possibility of misinterpretations of radical innovation and autonomous car.

A pilot study with four people was conducted with the purpose of testing the respondents' understanding and the clarity of the questionnaire. The results were analysed by using descriptive statistics, correlation and comparing t-test results.

4. Research Findings

4.1 Consumers' Perception of Radical Innovation

Investigating if the level of consumer knowledge impacts on consumers' perception of radical innovation, we compared people who work in automotive industry with those who do not. According to Saaksjarvi's classification of consumer adoption in technological innovations, consumers with some technological knowledge and understanding of the role of innovation to their existing values and lifestyle are more likely to adopt technological innovation (Saaksjarvi, 2003).

The overall mean values (Figure 2) suggest that consumers from the two different industrial backgrounds have some differences in their perception of autonomous car. Conducting a t-test, our analysis suggests that the groups' perception of performance risk differs from each other statistically (p=0.02; *df*=137). Performance risk is related to the (potential) performance of an innovation product in comparison with consumers' initial expectation from the product. We observed a significant difference in the perception of performance risk between people with automotive background and non-automotive background. All the other remaining variables were insignificant between the consumer from automotive background and non-automotive background. This result is not unexpected since people with automotive background are likely to have better access to and understanding of autonomous car development than consumers with non-automotive background. Information exposure and knowledge of current automotive technologies are likely to increase consumers' confidence on vehicle performance for consumers with automotive background.

However, it was surprising to see the results on adoption variable (mean values: 3.10 for automotive group and 2.93 for non-automotive group; and p=0.39). Results suggest that consumer with automotive background had a stronger intention of adoption. Yet, the two groups of consumers did not differ significantly in relation to their intention of adopting an autonomous car.

Another unexpected finding was related to the perception of value risk. Consumers look for additional value gains when it comes to new product adoption, which could be monetary and non-monetary. Investment in value (i.e. price to pay) is also an influential factor for decision making when consumers consider whether adopting a new product will be worthwhile (Song and Chintagunta, 2003). Our results show no statistical difference between the two groups (p=0.63) in terms of their value risk perception.

With the exception of performance risk perception, no variables showed statistical differences between the two groups. At the same time, it should be underlined that the overall mean values for all perceived risk variables were more positive for consumers with automotive backgrounds (Figure 2).

Figure 2: Mean values for computed variables
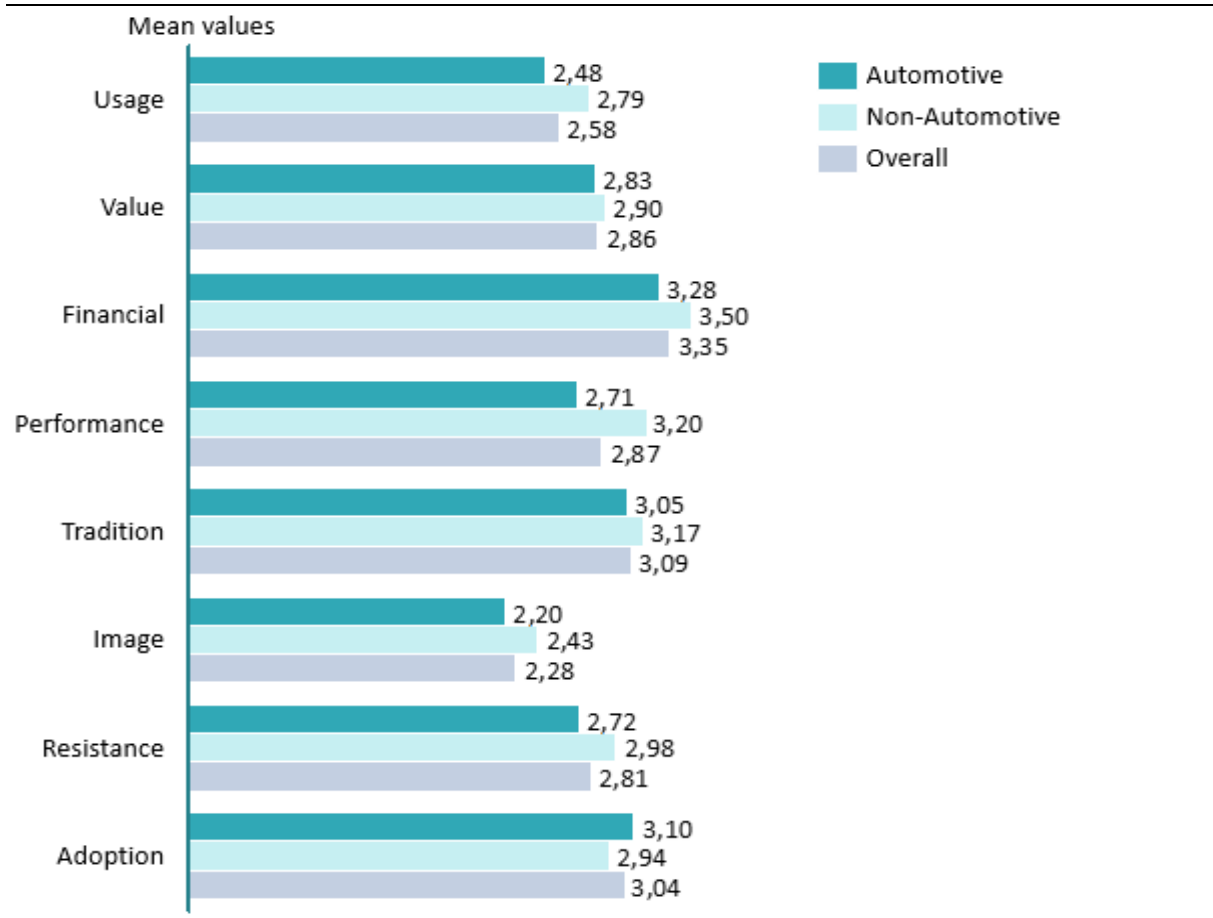
4.2 Consumers' Perception of Key Resistances to Technological Adoption

In this research, we identified financial risks and tradition & norms barriers as highest resistance variables across the data set (Figure 3).

Figure 3: Key resistances on consumer adoption of radical innovative products
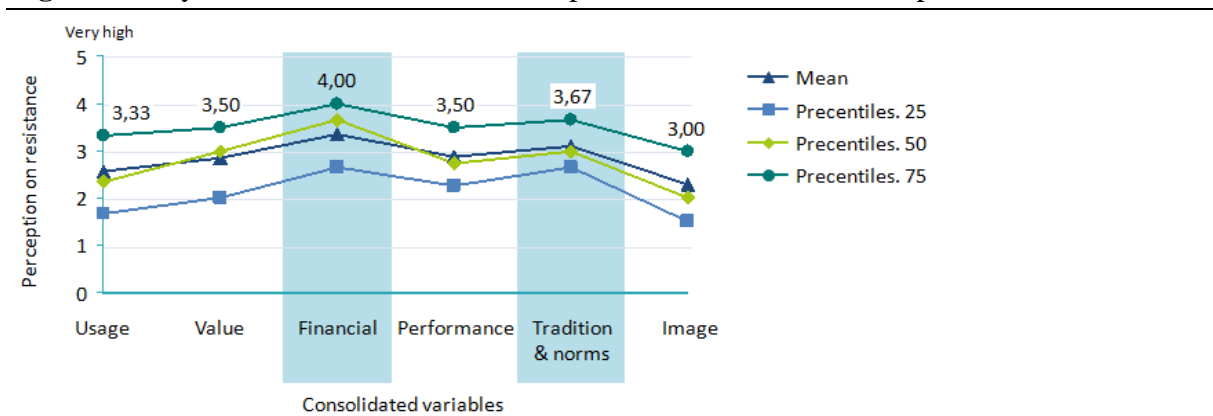
There is evolving literature (e.g. Bruner et al., 2001; Ram and Sheth, 1989) on consumers' resistance towards innovation adoption and uncertainties in their new product adoption behaviour. Automotive industry is one of the industries with perpetual introduction of

innovative products, especially in the area of enhancing driver comfort, environmental friendly and safety features. However, it is unusual to have radical innovation in automotive industry due to its complexities and demand of tremendous changes in transportation framework. Radical innovation in autonomous driving will demand changes in road infrastructure, legal framework, organizational revenue streams and most importantly changes in consumer driving behaviour. Despite the benefits of autonomous vehicles such as improving safety, saving time and freeing up driver from driving, such expected benefits appeared to be insufficient to justify financial investment for autonomous cars by the respondents.

Moreover, tradition and norms barriers were identified as the second most resistance variable against technological adoption. Autonomous car requires changes from the traditional human controlled car to machine (computer) controlled car. Consumers will have to give up how they control their cars and their driving habits such as its speed and overtaking other vehicles. This can be very difficult for drivers with strong passion to be in full control of their vehicles. In addition, it can be bizarre for a driver to seat in the driver's seat without paying attention to driving. Autonomous car disrupts significantly driving tradition and norms, and it demands consumers to behave in a totally different manner, and hence explains why this variable was identified as the second most resistance variable against autonomous vehicles.

In contrast, image barrier was identified as the least resistance variable against autonomous vehicles. At 75th percentile level, the mean values for image barrier was on 'neutral' perception and it was the only resistance variable that was recorded at such low level. This suggests that image is perceived as the most positive variable for consumers in comparison with other resistance variables.

4.3 Correlation Between Consumers' Usage Barriers and Adoption

Usage barriers have significant influence on the intention of adoption. The greater the usage barriers, the greater the resistance by consumers (Ram and Sheth, 1989). If the perceived difficulties and challenges are more than expected benefits, consumers are likely to reject the adoption of technological innovation.

However, in our data there was no evidence of a direct linear relationship between usage barriers and intention of adoption, but only a medium linear relationship at 0.588. This suggests that consumers' perception of usage barriers has some influence on their acceptance of autonomous cars, but it is not a strong one (Figure 4).

Figure 4: Mean values comparison according to UsageTotal variable
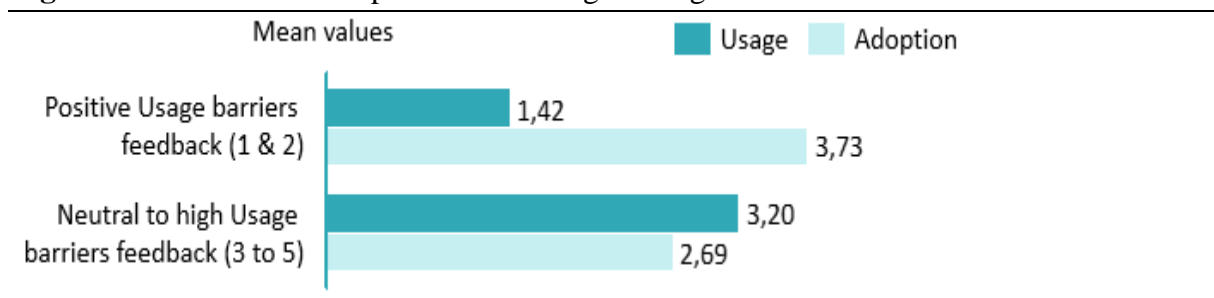
We conducted a second test by creating a new usage variable labelled "UsageTotal" and split the responses according to the scaling obtained from the questions. New group labels created as "positive usage barrier feedback 1 & 2" (usage on mean value is 2 or below) and "neutral to negative usage barrier feedback 3 to 5" (usage on mean value is above 2). t-test was conducted based on new UsageTotal variable. There were 48 respondents who provided positive answers to these questions, and so can be considered as having no usage barriers towards autonomous cars. The same respondents showed a strong intention of adoption with 3.73 mean value. The strong differences on the mean values suggest that consumers who do not perceive usage as a barrier are likely to adopt autonomous car.

On the other hand, the remaining 91 respondents had the mean value of 3.20 which is slightly more than the neutral level. However the intention of adoption was merely 2.69, which is below the neutral level. Consequently, the overall result confirms the relationship between consumers' usage barriers and innovation product adoption.

4.4 Correlation Between Consumers' Technological Adoption and Image / Status Gained

"Image is a highly influential factor, especially with regards to technological innovations" (Kleijnen and Antioco, 2010, p1706). Potential image and status perceived by society plays a crucial role in influencing consumers' intention of adoption. Similar to the previous section, "ImageTotal" variable was created by splitting the cases according to the scaling obtained from the questions. New groups were labelled as "positive usage barrier feedback 1 & 2" (image on mean value is 2 or below) and "neutral to negative usage barrier feedback 3 to 5" (image on mean value is above 2). The split categories derived from 81 respondents for positive feedback and 58 respondents with neutral to negative feedback (Figure 5).

Figure 5: Mean values comparison according to ImageTotal variable
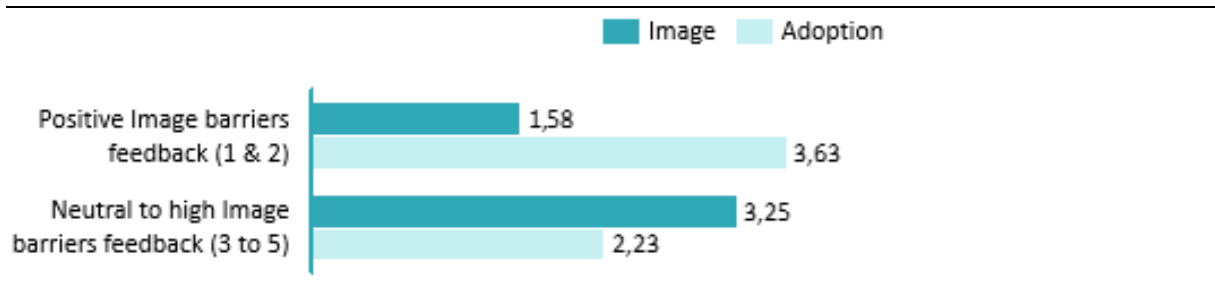
Image barrier and intention of adoption had a strong linear relationship (r=0.757). This is the highest score comparing the strength of linear relationship among all other resistance variables (r=0.506 for performance risk, r=0.423 for tradition and norms barriers, r=0.337 for financial risks and r=0.336 for value barriers). These results suggest that image barrier has the strongest correlation with consumers' intention of autonomous car adoption. Similarly, the statistical results from "ImageTotal" variable support a relationship. There were 81 respondents with positive feedback and a mean value of 1.53. The same respondents also had a high intention of adoption with a mean value of 3.63. In comparison, the mean value for the remaining 58 respondents was 3.25 on image barrier and 2.23 on intention of adoption. This result suggests the positive correlation between image perception and intention of adoption.

5.   Conclusion and Implications

The purpose of this research was to investigate consumers' perception towards radical innovation. In particular, we focused on consumer resistance and its relation to intention of adoption by using consumer technology adoption likelihood model by Saaksjavi (2003). Our research extends the understanding of this model by (1) testing the applicability of the model at a pre-launch phase (2) presenting further empirical support for the model.

According to Saaksjarvi's model (2003), knowledge and compatibility contribute to the intention of adoption, which may look contradictory with our findings. Consumers who worked in the automotive industry were not statistically different than those who did not. The only difference between these two groups of consumers was related to performance risk, where consumers who worked in the automotive industry perceived a lower risk than respondents with no-automotive background.

The second key finding is about consumers' resistance towards radical innovation. Our results suggest that financial risk and tradition and norm barriers are the most resistance variables (ie negative relationship). In comparison, perceived image of the innovation product had the strongest positive relation with the intention to adopt.

Finally, we found a medium correlation between usage barrier and intention to adopt. This is likely to be because an autonomous car requires a radical change in how consumers drive their new car and hence presents a resistance to changing their driving habits and current usage pattern.

In terms of the implications of our research, this paper contributes to three areas in product innovation literature. The first contribution is related to consumers with different knowledge level of the given product. We found evidence that knowledge level played a significant role in people's evaluation of performance risk, while knowledge level was insignificant for other types of risks. In addition, knowledge level seemed to play a limited role in consumers' intention of product adoption. Consequently, the results suggest that knowledge level does not have a strong impact on consumers' intention to adopt, which requires further investigation on Saaksjarvi's model (2003).

The second contribution of the study is related to consumers' resistance towards radical innovation. Previous research (such as Stone and Grønhaug, 1993; Assael, 1981; Stem et al., 1977) highlights that different types of innovation will create different levels and categories of resistance. A main reason behind innovation failures is due to the lack of understanding of consumers' underserved needs (Bartels and Reinders, 2011). While many organizations recognize the importance of product innovation for their survival, it is also important to ensure that organizations understand consumers' resistances and are able to foster innovation adoption by bridging the gap between consumer needs and product development. New products should also be promoted by using the appropriate communication mix. Our findings illustrate that consumers perceive financial risks and tradition and norm barriers as the key resistances for purchasing autonomous cars. This also signifies the role of psychological barriers in terms of radical innovation. However, it is interesting that not all psychological barriers were perceived in a similar way. Image barriers achieved mean value of 2.28 as compared to mean value of 3.22 for financial risks and tradition barriers. Image appeared to have the highest impact on autonomous car acceptance. Therefore, it can be concluded that while recognizing the functionality gained, consumers are at the same time highly concerned

about the potential financial risks and are reluctant to the possible changes required on the tradition and norms when considering this radical innovation.

The third contribution of the study is related to its integration of consumers' radical innovation resistance with their intention of adoption, which is not widely documented in the literature. Our results suggest that image has the strongest linear relationship with intention of adoption; usage barriers and performance risks have a medium linear relationship in comparison with other resistance variables. Other resistance variables had no direct relationship with the intention of adoption. Consequently, we argue that the perceived image of radical innovation plays a significant role in fostering consumer intention of adoption while the contribution of usage barriers and performance risks is only a moderate one.

This research is also valuable for the automotive industry by disclosing consumers' views and intention of the autonomous vehicles, which can be valuable when designing the product launch and marketing communication strategies.

Industry experts could utilize the positive perceived image of autonomous vehicles and its strong influence on future adoption. Promotion campaigns are needed to communicate the value of the radical innovation for consumers (ie freeing up time, safety, time saving, and so on) and status gained. This might help to overcome the negative perceptions on financial risks and perceived complexity of autonomous vehicles.

Further, industry experts need to think about how to overcome the perceived resistances in tradition and norms. Autonomous vehicles are developed with the intent to ease drivers from driving, but manufacturers cannot ignore the fact that there are features and feelings on human controlled vehicles that are still emotionally attached to the driver. Having emerged in our research as one of the most perceived resistance, vehicle manufacturers may need to continue to provide options for human controlled features on autonomous vehicles or promote the compatibility of vehicles values in terms of usage benefits. Lastly, industry practitioners should strengthen the assurance of the vehicles performance by continuously feeding the technology roadmap towards autonomous driving, such as autopilot parking, automated braking system, and sensorics advancement for adaptive cruise control. This is crucial especially in view of the latest Volkswagen software manipulated scandal (BBC, 2015) and hacks on Jeep cars (Forbes, 2015) which have badly damaged the trust in software and connectivity of vehicles. The technology exchange could elevate the trust in consumers as they can witness the degree of expansion in the vehicles technology.

5.1 Study Limitations

This study is limited to a future radical innovation. Given that the chosen product (autonomous vehicle) is a future technology, the quality of responses may have been distorted since the product might not have been easily understood by all participants. Furthermore the selected product is generally associated with a high investment compared to normal consumer products (such as telephone, bicycle and television) and the results can only be used or compared to a similar level of consumer technological products.

Next, we compared two groups of consumers however the size of each group was limited: non-automotive group: 34 percent and automotive group: 66 percent. The composition of respondents is another potential limitation. The majority of the respondents were recruited from a car company in Germany (automotive group) and international mature students in a

UK university (non-automotive group). This is not a representative sampling method for either group.

Finally, our finding seems to contradict with research by Saaksjarvi (2003). This could be related to conceptualisation of "knowledge level". In this study, we used professional background as a proxy for knowledge level by assuming that people working in the automotive industry are likely to have a higher level of knowledge about autonomous vehicles. Knowledge level does not need to be restricted to people's professional background. It can be conceptualised differently, for example by asking respondents a set of questions to identify their level of knowledge for the given product(s).

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