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Understanding Customers' Attitude and Intention to Use Driverless Cars

Ruihan Zhang

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Understanding Customers' Attitude and Intention to Use Driverless Cars

Ruihan Zhang

A thesis submitted in partial fulfilment of the requirements of University of Northumbria at Newcastle for the degree of Doctor of Philosophy

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Abstract

The use of driverless cars is a future trend in road transportation and set to improve quality of life. Although marketing studies on technology acceptance are abundant and cross a variety of contexts, few studies investigate thoroughly the key factors influencing customers' intention to use, and explicitly demonstrate the mechanisms in which each factor affect the acceptance of driverless cars. This research adds new knowledge to the body of marketing literature and studies in technology acceptance towards driverless cars. Specifically, this study extends cognition-oriented theories by integrating factors such as perceived enjoyment and perceived societal benefits into the new model to explain how individual perceptions impact user attitude and intention to use driverless cars. The research further uses the habit literature and integrates the status quo bias perspective to hypothesise that in addition to cognitive factors, incumbent system habit as a subconscious source of inertia that contribute to the resistance of adopting driverless cars lies in the use of a traditional automobile vehicle. Drawing on qualitative evidence from 13 interviewees, the key themes that influence customers' perceptions towards driverless cars are disclosed, including perceived travel efficiency, enjoyment, helpfulness, and societal benefits. On the other side, technological issues, hacking and privacy issues, laggard regulations and policies, and concerns about the deterioration in driving skills are barriers to customers' intention to use. The proposed conceptual model is empirically assessed using data collected from 493 potential customers through an online survey. The results illustrate the significant influences, in descending order, of attitude, perceived enjoyment, concerns, perceived travel efficiency and gender on customers' intention to use, and also confirm perceived enjoyment, perceived societal benefits and age as strong factors in consumers' attitude toward driverless cars. Incumbent system habit influences two paths among variables: 1) dampens the positive relationship between attitude and intention to use, and 2) strengthens the negative relationship between concerns and intention to use. Attitude is verified as a mediator between the perceived enjoyment and intention to use. Age differences are also revealed. There are practical implications too for research and development managers in the manufacturing process, and for marketing managers in the retail market.

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Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of the other.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by the Newcastle Business School's Ethics Committee at Northumbria University in November 2018.

I declare that the Word Count of this Thesis is 78,829 words.

Name: Ruihan Zhang

Signature: Ruihan Zhang

Date: 06/03/2020

List of Abbreviations

ADAS	Advanced driver-assistance systems
TRA	Theory of reasoned action
TAM	technology acceptance model
UTAUT	Unified theory of acceptance and use of technology
IS	Information Systems
CFA	Confirmatory Factor Analysis
SEM	Structural Equation Model
TPB	Theory of planned behaviour
CTAM	Car Technology Acceptance Model
ARTS	Automated road transport systems
DOI	Diffusion of innovation theory
PCA	Principle components analysis
EFA	Exploratory factor analysis
MLE	Maximum likelihood estimation
GOF	Goodness-of-fit (GOF)
$\mathbf{x^2}$	Chi-square
$\mathbf{x^2/df}$	Normal chi-square
GFI	Goodness-of-fit (GFI)
AGFI	Adjusted goodness of fit index
NFI	Normed fit index (NFI)
CFI	Comparative fit index (CFI)
TLI	Tucker-Lewis index (TLI)
RMSEA	Root mean square error of approximation
SRMR	Standardized root mean residual
MI	modification index
CRC	Computer resource center
AVs	Autonomous vehicles
NHTSA	National Highway Traffic Safety Administration
α	Cronbach’s Alpha
KMO	Kaiser-Meyer-Olkin

VIF	Variance inflation factor
MSV	Maximum Shared Squared Variance
CR	Construct reliability
AVE	Average variance extracted
CMB	Common method bias
VIF	Inflation factor
CLF	Common latent factor

Chapter 1 Introduction

1.0 Overview of Chapter

This chapter provides a brief introduction to this thesis. The research background is profiled at the beginning and followed by the identified research gaps. The main research question is proposed by four sub-questions, along with two research objectives. The main research contributions are summarized afterwards from theoretical and practical perspectives. The chapter is closed by a structure of the thesis.

1.1 Research Background

Driverless cars are those equipped with on-board sensors, cameras, GPS, and telecommunications to collect information in order to make their own decisions and act appropriately in a variety of conditions (NHTSA, 2013). Driverless cars are also called self-driving cars and automated vehicles (Kaur & Rampersad, 2018) and these terms are usually used interchangeably. Driverless cars are based on autonomous driving technology that allows the cars to take control of acceleration, braking and steering, almost without human interaction (Fagnant & Kockelman, 2015; John & Troy, 2012). Driverless cars are, along with drones and the internet, now viewed as one of the key disruptions in the technology revolution, aiming to improve quality of life (Kaur & Rampersad, 2018). There is no doubt that driverless cars not only represent the biggest technological advance in personal transport but also a potentially disruption to and revolution in our transportation system (Bansal, Kockelman & Singh, 2016; Fagnant & Kockelman, 2015), along with other allied advanced car technologies such as connected vehicles, to make modern transportation safer, more sustainable, and more convenient (Howard & Dai, 2014).

The levels of automation in driving have been classified from level 0 to level 4, corresponding to No-Automation and Full Self-driving Automation (NHTSA, 2013). The definitions of each level of vehicle automation are given below according to the National Highway Traffic Safety Administration (NHTSA):

- Level 0-No Automation: The driver is only expected to carry out the primary vehicle controls (brake, steering, throttle and motive power) at all time, and only responsible for monitoring the roadway and for safe operation of all vehicle controls.

- Level 1-Function-specific Automation: The driver has overall control, and is solely responsible for safe operation, but can choose to cede limited authority over a primary control. For example: cruise control, automatic braking, and lane keeping.
- Level 2-Combined Function Automation: Vehicles at this level of automation can utilise shared authority when the driver cedes active primary control in certain limited driving situations. The driver is still responsible for monitoring the roadway and safe operation and is expected to be available for control at all times and on short period. For example, the combination of adaptive cruise control and lane centering.
- Level 3-Limited Self-Driving Automation: Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in those conditions to reply heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. For example, the driverless car that can determine when the system is no longer able to support automation.
- Level 4-Full Self-Driving Automation: The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. The driver will provide destination or navigation input, however is not responsible for control at any time during the trip.

This research is focussed on automation of driverless cars up to NHTSA's level 3 and 4: such cars can drive autonomously, without intervention from the driver, when in fully automated mode (Payre, Cestac & Delhomme, 2014). A good example is Google's self-driving car, which is controlled by the system in fully automated mode, although an engineer is required to sit in the driver's seat (Payre et al., 2014). Other high-tech companies, such as Tesla and Baidu, are also using this transportation revolution to test their autonomous driving technology (BBC, 2018; Tim & Los, 2018). For example, Baidu's Apollo programme focusses on developing driverless cars up to automation levels 3 and 4 in its current stage (Henry, 2018).

Reviewing recent developments in the automobile industry, there are many commercial efforts. Besides high-tech companies, the majority of traditional automotive manufacturers are also following the rapid technological trend to develop autonomous driving by concentrating on developing and optimising advanced driver-assistance systems (ADAS), such as emergency braking, back-up cameras, adaptive cruise control, and self-parking systems (Kersten, Philipp, Armen & Emily, 2017). Some named car manufacturers have focussed on the development of their own autonomous driving systems and products, such as BMW's Traffic Jam Assist, Mercedes-Benz's Stop-and-Go Pilot, and Cadillac's Super Cruise etc., as well as announcing that they will have commercially viable self-driving capability by 2020 in multiple vehicle models (KPMG, 2013; Motavalli, 2012; Nissan, 2013; Peter, 2018).

Besides these market participants, some start-up companies have also raised money to develop their driverless cars and enter the automotive market regionally and globally, such as DeepBlue Technology. It is one of dozens of Chinese start-ups which is focused on commercially viable self-driving technologies and selling its autonomous buses to city governments in China and oversea markets, such as Thailand and Greece (Shephred, 2019). Specifically, the Chinese government has encouraged the development of state-led "smart" city trail zones in the country as well as gradually loosened restrictions on tests for driverless cars. So far, eight automobile manufacturers have tested driverless cars for more than 153,600 km in Beijing in 2018 (Shephred, 2019). No doubt China's government has actively pushed the rapid development of autonomous driving technology in recent years with the purpose of launching the smart city project by 2020 (Shephred, 2019). Thus, the widespread implementation of driverless cars for China's government and automobile manufacturers is especially critical for the realisation of a "smart" city. A report from Continental (2013) revealed that 79% of Chinese survey participants welcomed driverless cars, which was higher than the participants in other countries. Therefore, this research recruit participants from China to deeply understand potential customers' intention to use driverless cars.

Simultaneously, some big projects, such as CityMobile2, the large EU-funded project, has been implemented in 12 cities across Europe (Merat, Madigan, & Nordhoff, 2016). All of these actions told us that a reshaped automotive ecosystem and the realisation of smart cities will come soon (KPMG, 2013; Tussyadiah, Zach & Wang, 2017). The advisory services company KPMG (2013) also forecasts that by 2019 autonomous driving technology packages would be available on new cars, and that by 2030 fully autonomous technology would be a reality.

The momentum around driverless cars is astonishing, and there is a huge amount of expectation from the public, elected officials and some transportation professionals (KPMG, 2013). Driverless cars have been viewed as a suitable alternative to conventional cars as they can offer a multitude of advantages to users, transportation systems and the environment: such as shorter commute times, a reduction in the measurable ill effects of driving stress, a reduced number of vehicle collisions caused by human error and negligence, lower traffic congestion, reduced fuel consumption and traffic emissions (Kaur & Rampersad, 2018; KPMG, 2013; Paden, Čáp, Yong, Yershov & Frazzoli, 2016; Payre et al., 2014). However, the realisation of these potential benefits is dependent on the widespread implementation of driverless cars and mass-market penetration. Interestingly, the pace and scale of marketing development will be decided by consumer acceptance and use patterns (Zmud, Sener & Wagner, 2016). In the same vein, substantial studies found that understanding potential customers' attitude toward driverless cars is critical, as customer have the power to shape the demand for the technology, the policies and regulations that govern them, and future investments in infrastructure (Howard & Dai, 2014). In addition, the future of driverless cars will be determined by customers who have the ultimate power to decide whether they succeed or fail by accepting or rejecting them (KPMG, 2013).

From a theoretical perspective, consumer behavioural intention is a direct and significant predictor of actual usage behaviour (Agarwal & Prasad, 1998). From a practical perspective, being able to predict customer acceptance of driverless cars would be helpful in developing appropriate systems and avoiding issues that could be a substantial impediment to implementation, especially for such new technology (Osswald, Wurhofer, Trösterer, Beck & Tscheligi, 2012). Transportation experts expect that consumers will show a high inclination to accept and use driverless cars once they have extensive knowledge about them, whereas so far the public only has a basic awareness of them (Zmud et al., 2016). Thus, it is critical to know how the public feels about this advanced driverless technology, will they buy into it, and for what reasons, what they expect from driverless cars and what they fear. In the same vein, KPMG (2013) stressed that a series of questions have not yet been answered, for example, customers' views on the availability of driverless cars, what are the critical factors for customers and how these influence a customer's decision to accept driverless cars.

Although there has been an increasing number of studies examining driverless cars since 2013, the majority of them focus on examining the technical aspects and feasibility of driverless cars, rather than attempting to detect potential behavioural shifts and the underlying motivations to use driverless cars (Haboucha, Ishaq & Shiftan, 2017). Meanwhile, other authors criticised that existing studies merely examined general public opinions of, concerns about, and acceptance of automated driving in lower level of automation, rather than the automation level 4 as the products are not available in the mass market (Nordhoff et al., 2016). Furthermore, the research method-online surveys-which adopted by more than half of studies to examine significant factors that could influence user acceptance of driverless cars (Kaur & Rampersad, 2018). Nonetheless, the existing findings could be laggard to some extent, as not enough effort has been made to assess potential customers' perspectives toward driverless cars via interviews. In fact, prior research has mentioned that there are some unexplored variables which influence consumers' intention to use driverless cars (Payre et al., 2014). Additionally, the popular theories used in the study of acceptance of driverless cars are criticised by authors (Osswald et al., 2012), who illustrate that not all the significant influencers can be covered by the technology acceptance model (TAM) (Davis, 1989), the unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis & Davis, 2003) and their extensions.

In addition, the automobile manufacturers are overwhelmingly focused on developing technical aspects of driverless cars. In other words, efforts have been focussed on improving levels of automation from limited self-driving automation to fully self-driving automation (Kaur & Rampersad, 2018), rather than on evaluating the current opportunities and challenges in the mass market by investigating the underlying motivations about intention to use driverless cars. No matter how advanced driverless cars are, understanding customers' attitudes and their intention to use is critical, and will assist automotive marketing managers to develop and optimise their marketing strategies. The answers to the above questions would also be valuable for automotive manufacturers and policy-makers who endeavour to implement driverless cars widely. Additionally, the answers are important in reshaping the automobile industry (KPMG, 2013). The details of identified research gaps are presented in the following sections.

1.2 Research Gaps

Understanding potential customers' perceptions and their intention to use driverless cars enables automobile manufacturers to be aware of the opportunities and challenges of implementing driverless cars in the mass market before starting a commercial campaign. However, in reviewing previous research in the literature of technology acceptance and studies regarding acceptance of driverless cars, three gaps are identified.

1.2.1 Factors beyond TAM

The first research gap is that previous studies were overwhelmingly reliant on TAM (Davis, 1989) in understand user acceptance of autonomous driving systems through incorporating new determinants with the original model. TAM argues that perceived usefulness and perceived ease of use are the main determinants of consumer behavioural intention to use, which in turn has an influence on actual consuming or purchasing behaviours in the context of technology acceptance. In extant studies of acceptance of driverless cars, researchers adopted TAM to extend new conceptual models to predict potential customers' intention and behaviour towards driverless cars. For example, Payre et al. (2014) integrate the knowledge of TAM with prior acceptability, personality traits and behavioural adaption to automated driving, to study customers' intention to use driverless cars, with 67% of variance explained in the study. However, Osswald et al. (2012) criticize the adoption of TAM in the car studies because the original TAM is designed for desktop-based computer systems in an organizational context, while context can differ widely and have different characterises. Thus, the car-related contextual influences should be taken into account, such as motion, environmental conditions or properties of advanced driving technologies (Osswald et al., 2012). Bearing these in mind, Osswald et al. (2012) propose the car technology acceptance model (CTAM), which is a hybrid of safety and anxiety determinants with UTAUT (Venkatesh et al., 2003) to explain drivers' acceptance of in-car technology. Unfortunately, they merely examine the reliability of variables' scales without empirically investigating the influencing power of these factors as predictors of consumers' intention towards driving technology systems (Madigan et al., 2016).

The unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003) is another model frequently used to explain technology acceptance, which accounts for around 70% of the variance of behavioural intention to use (Kaur & Rampersad, 2018) but which, in the context of studies on cars, has a low explanatory power. For example, Madigan et al. (2016) confirmed the significant influences of the UTAUT constructs as predictors of acceptance of automated road transport systems, while the predictor variables only accounted for 22% of variance in their study. Similarly, Adell (2010) also adopted UTAUT to investigate the acceptance of driver support systems; the explanatory power of the research model was only 20%. These demonstrate that factors which influence an individual's intentions to use driverless cars are hardly to be covered by TAM, UTAUT and their extensions.

In addition, studies that adopted TAM and its extended models to study technology acceptance have been criticised as the value of attitude in predicting consumer behavioural intention is underestimated and normally excluded from frameworks (Kim, Chun & Song, 2008). However, attitude as one of the essential factors in the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) that reflects one's personal reaction to a target behaviour and can be used to predict behavioural intention or behaviour (Fishbein & Ajzen, 1975; Madden, Ellen & Ajzen, 1992). Thus, it should be appropriate to use TRA as a fundamental framework to build up a conceptual model in the study of driverless cars acceptance, and taking hedonic concept into account (Fitzmaurice, 2005). This is because a hedonic factor plays a critical role in the influences of utilitarian factors in consumer context, and this is the main difference from organizational context (Childers, Carr, Peck & Carson, 2001; Van der Heijden, 2004; Yue et al., 2018).

Regarding driverless cars, we can picture that under autonomous driving mode the role of the driver may be transformed into that of the passenger without any requirement to intervene in the performance of the car, implying that the drivers can free up their hands, relax in their seat, and do others things while driving (Bjørner, 2017; Payre et al., 2014). Or, simply expressed, hedonic factors including enjoyment, fun and relaxation are the emotional reaction to a functioning and trusted system (Buckley, Kaye & Pradhan, 2018). In addition, the inclusion of hedonic concept, that is, an affective variable into TRA would also further broaden the cognitive approach taken to model consumers' behavioural intention as it reflects motivations (Fitzmaurice, 2005). This demonstrates the dual characterisation of motivations. It has been noticed that an individual being emotionally involved in reaching a goal was associated with being committed to reaching his or her goal, which also significantly relates to one's subsequent behaviour (i.e., intentions) (Cox & Blount, 2000). This is consistent with that consumer consumption behaviours are either motivated by the need for achieving hedonic gratification or by the benefit gained from instrumental functions of targeted products and services (Batra & Ahtola, 1991; Hirschman & Holbrook, 1982). In other words, consumer motivations stir, push or prod an individual to take action (Fitzmaurice, 2005). Thus, it is better to explain user behaviour through the conventional TRA that reflects one's cognitive perceptions toward driverless cars (i.e., shorter commute time), also incorporating the role of hedonic variables that reflects an individual's need for achieving hedonic aspects of driverless cars (i.e., fun) via an emotional commitment. By doing so, the embedded factors can better explain potential customers' desire to use driverless cars and demonstrate individuals' goals and internal motivations.

On the other hand, factors with detrimental influences on the acceptance of driverless cars also need to be emphasised and investigated as extant studies explored that customers' affective response towards driverless cars have a significant impact on their intention to use, for example, anxiety (Osswald et al., 2012). This is relevant to individuals' emotion that can impair adaption by interfering with cognitive functioning, in which anxiety-related thoughts impede functioning because they are irrelevant to or counterproductive for performance (Folkman & Lazarus, 1988). Regarding the acceptance of driverless cars, survey findings disclosed that potential customers have lots of concerns about driverless cars, for example, concerned with privacy and data security (Parasuraman, Sheridan & Wickens, 2000), liability, the cost of the technology and losing control of the vehicle (Howard & Dai, 2014), and some of the technological challenges (e.g., performance in different types of situations and weather conditions) (Bjørner, 2017) and etc.

This can be explained through Lazarus and Folkman's transactional theory of stress and coping (Lazarus, 1966; Lazarus and Folk, 1984), individuals are consistently appraising stimuli within their environment then generate emotions, and when stimuli are appraised as threatening, challenging, or harmful that will generate stressor, the resultant distress initiates coping strategies to manage emotions or attempt to address the stressor itself (Biggs, Brough & Drummond, 2017). Based upon this theory, if users reappraised that they are unable to cope the stressor when interacting with driverless cars, this will result a negative affect and the behavioural response of avoidance or rejection (Edwards, 1992). Therefore, individuals' concerns about driverless cars reflect their negative perceptions that will restrict user intention to use directly, but to what extent these factors impact on consumer acceptance is not yet know.

There is, therefore, much scope for future research to explore and rework the relevant technology acceptance models for the car context, especially in state-of-the-art autonomous driving technology and driverless cars.

1.2.2 Personal Factors

The second research gap is that limited studies explore and assess how acceptance of driverless cars differs due to personal factors, including personal traits and socio-demographics variables. For example, previous studies have noticed that some customers have a higher tendency to accept driverless cars, while others are reluctant and prefer to wait until they have been trialled over a period of time. How can researchers explain this phenomenon? How do these personal factors influence the process acceptance? Although the findings have emphasized that personal factors can play a significant role in explaining different customers' intention to use driverless cars, little research has attempted to explore answers to the above questions regarding the role of personal factors in the acceptance of driverless cars. In other words, we need to examine how such personal trait variables function in the acceptance of driverless cars, through hypothesising them as moderators to influence the antecedents as well as the consequences of individual attitude (Agarwal & Prasad, 1998).

Furthermore, extant studies recommend a future research to evaluate participants' interest in technology as a factor in acceptance of driverless, because individuals who have higher interest in new technology might be more enthusiastic about using a driverless car than others (Payre et al., 2014). This can be explained by a personal trait: personal innovativeness. It refers to the risk-taking propensity of an individual which has significant influence on technology acceptance, and is normally hypothesised to act as a moderator of the model to examine individuals' attitude and behaviour towards new technology (Agarwal & Prasad, 1998; Sun & Zhang, 2006). The evidence has proved that this personal trait can affect individuals' perceptions of their capabilities to accept and adopt unfamiliar innovation technology with a more positive attitude towards it (Goldsmith & Hofacker, 1991; Rogers, 2010).

Additionally, driverless cars are more likely to appeal to individuals who are not sticking in an incumbent system (i.e., traditional automobile vehicles) than those who have a strong incumbent system habit (Polites and Karahanna, 2012). This is known as a subconscious source of inertia that reflects a preference to stay with the incumbent course of action even if there were better alternatives or incentives to change, which may negatively affect a new system acceptance (Polites and Karahanna, 2012). Findings indicate that a strong incumbent system habit may have a negative impact on intention and its antecedents (Polites and Karahanna, 2012). However, there is paucity of research examined how habitual behaviour toward an incumbent system (e.g., traditional automobile vehicles) affect a newly introduced one (e.g., the driverless cars) based upon the literature of status quo bias and habit. Thus, the role of incumbent system habit and the manner in which its impact occurs should be examined in the study of driverless cars acceptance.

Socio-demographic factors, such as gender, age, driving experience and income have been touched on by previous studies as complementary factors to further explain customers' intention to use driverless cars. It has been noticed that such individual differences play significant roles in user acceptance of driverless cars (Haboucha et al., 2017; Kyriakidis, Happee & de Winter, 2015; Payre et al., 2014). Interestingly, the previous studies present opposing views regarding gender and age, with some claiming that men are more likely to use driverless cars than women (Payre et al., 2014), and others showing that women would like to use driverless cars as well (KPMG, 2013). In addition, substantial studies have noticed and emphasized the importance of age in retail marketing (Lee, 2009; Schlossberg, 2016). To the best of the researcher's knowledge, although previous studies demonstrated that customers' perceptions and behavioural intentions differed with age, none of them depicted consistent differences between generations. For example, some studies conclude that younger people are more open to the introduction of driverless cars (John & Troy, 2012; MORI, 2014; Schoettle & Sivak, 2014b). Conversely, Rödel, Stadler, Meschtscherjakov, and Tscheligi (2014) observed a strong intention to use driverless cars with an increasing age.

The latest study suggests that marketing retailers should prepare well for customers from different generations, especially those from Generation Z, also called post-millennials or ‘iGeneration’, who were born in 1995 or later (Priporas, Stylos & Fotiadis, 2017; Van den Bergh & Behrer, 2016; Williams & Page, 2011) and are less than 25 years old as of 2018. Generation Z is the future of retail and has been viewed as the biggest challenge for marketing and retailing, particularly in advanced technologies, because they are eager to customise and individualise, have higher expectations of business, brands and retailers, caring about ‘experience’, but have less loyalty than earlier generations (Buckley et al., 2018; Schlossberg, 2016). For the automobile industry and market, individuals from Generation Z are likely to be the mainstream consumers in 2030 (Van den Bergh & Behrer, 2016). Potential customers from different generation cohorts will form a multi-generational marketing base which will require automobile manufactures and marketing managers to understand their audiences and be ready for the future. Thus, it is necessary to investigate how customers’ perspectives and intention to use differ between Generation Z and earlier generations.

1.2.3 The use of Mixed Methods

The third research gap exists in the research methods. There is a dearth of empirical studies using a combined-methods approach to investigate in-depth user acceptance of driverless cars by taking potential customers’ perspectives into account (Becker & Axhausen, 2017). To date, the online survey is the most popular approach adopted by researchers to study acceptance of driverless cars by identifying the significant determinants of intention to use, Stanton and Young (2000) criticise that the studies conducted by this method are restricted to the examination of a limited set of variables. Notably, there are some unexplored factors behind consumer behavioural intention to use driverless cars that would better be extracted through interviews.

In addition, previous studies conducted solely through either a quantitative or a qualitative approach are hardly likely to present a complete picture of public opinion and behavioural intention toward driverless cars. For example, Hohenberger et al. (2016) found that the factor of emotions can reduce gender differences in customers’ intention to use driverless cars, but were not able to explain this as the data was collected through an online survey. KPMG Automotive Team (KPMG, 2013) approached customers directly to ask whether, if driverless cars were available and safe, they would use them, without further examining the potential determinants of user intention to use driverless cars, or clarifying how these factors impact on the user decision. However, it is critical to specify the exact extent of influential factors on customers' intention to use. Thus, it is imperative to use a mixed-methods approach in exploring and assessing the significant determinants of user intention to use driverless cars, with substantial resources to explain the findings achieved. By doing so, the accuracy of the findings will be enhanced (Rossman & Wilson, 1985), along with in-depth explanations and feasible implications for automobile manufacturers.

1.3 Research Questions and Research Objectives

To address the above gaps in the literature, this study aims to:

- Understand customers' perspectives towards driverless cars and whether they would like to use them
- Explore and evaluate the significant factors that influence customers' perceptions and their intention to use, and to what extent these factors impact on customers' acceptance

The main research question is: What are the significant factors influencing consumer acceptance of driverless cars?

The main research question is divided into four sub-questions:

1. What do potential customers feel about driverless cars?

2. What are the potential factors that influence customers' intention to use driverless cars?

3. What are the significant factors that influence consumers' intention to use driverless cars?

4. How do the key factors influence customers' intention to use driverless cars, and to what extent do the significant factors impact on intention to use?

In order to answer the main research question and meet the above mentioned two purposes, the researcher adopts a three-step approach that echoes the addressed sub-questions. The first step is to review the literature across marketing, sociological, consumer psychology, the status quo bias and habit in the field of technology acceptance to understand theories and rationales behind consumer behaviours, and also to obtain substantial knowledge about public perceptions toward driverless cars (Bansal et al., 2016; Schoettle & Sivak, 2014a, 2014b, 2014c, 2015; Tussyadiah et al., 2017; Underwood, 2014). The literature review provides a direction and a fundamental framework for the researcher to design the empirical study, which includes the qualitative interview (Step 2) and quantitative survey (Step 3). In the second step, the purpose is to conduct a semi-structured interview for a better understanding of participants' thoughts and perceptions of driverless cars. After this process, core themes and subthemes are elicited and grouped into different constructs. The combination of the first and second step will provide answers for question 1 and question 2. In the third step, the objective is to explore and identify the significant factors and their influence on customers' intention to use driverless cars. The findings are based on the practical implementation of the survey questionnaire and the structural equation modelling. By doing so, question 3 and question 4 will be answered with convincing statistical evidences to explain customers' intention to use driverless cars. In order to precisely demonstrate the entire process of accomplishing the above-mentioned research purposes and answering a series of sub-questions, Figure 1.1 depicts the structure of this thesis shown on section 1.5.

1.4 Contributions

The findings of this research will make a fruitful contribution to marketing literature on the acceptance of driverless cars as well as shedding light on a new direction of future study. The results also provide meaningful practical implications. These can be summarised as following points:

Firstly, this study extends the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) in the context of driverless cars via a reworked version. The extended conceptual model discloses the key determinants of intention to use driverless cars from the cognitive and emotional perspectives that reflect each personal's goal(s) and internal motivations towards driverless cars. In details, the embedded contextual factors reflect user beliefs towards driverless cars that can be categorised as three types, namely enablers, barriers, and individual difference variables (personal trait variables and socio-demographic variables). Using marketing, sociological, consumer psychology, the status quo bias and habit literatures as theoretical cornerstones, the study explains how explored factors influence user intention to use driverless cars via the rationale of belief-attitude-intention-behaviour; whilst the variable of incumbent system habit as a moderator that can be used to explain the potential gaps between attitude/intention and behaviour via its moderating effects on the relationships between 1) attitude and intention to use, and 2) concerns and intention to use. The mediating role of attitude is also confirmed. The model explains 76% of the variance in intention to use driverless cars, which outperforms previous studies either based on the technology acceptance model (TAM) (Davis, 1989), or the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003).

Especially, this research develops a better theoretical understanding of the role of incumbent system habit in the decision to use an innovative product in the car context. The findings demonstrate the mechanism by which this bias operates in impact user intention to use driverless cars. The study indicates that individual incumbent system habit strengthens the negative relationship between concerns and intention to use driverless cars, which implies that for customers who have stronger incumbent system habit toward traditional automobile vehicles (i.e., the status quo), their concerns impact more heavily on intention to use driverless cars than for others with less incumbent system habit. It also dampens the positive relationship between attitude and intention to use driverless cars, which indicates for customers with stronger incumbent system habit, their attitudes towards driverless cars have a lesser influence on intention to use than for customers who have less incumbent system habit. The finding proved that incumbent system habit as one subconscious source of resistance to adopting a new system (Polites and Karahanna, 2012) which should be considered in the study of driverless cars acceptance.

Second, this research further answers the call to place greater emphasis on investigating the significant determinants of attitude and intention to use driverless cars and synthesises them with frequently mentioned factors suggested by other researchers, for example, feeling of comfort (Delle Site et al., 2011), hedonic motivation (Venkatesh, Thong, & Xu, 2012), and individual difference variables (e.g., personal innovativeness) (Payre et al., 2014). The findings disclosed that attitude towards driverless cars, perceived enjoyment and perceived travel efficiency have positive impacts on user intention to use driverless cars. The perceived enjoyment and perceived society benefits impact positively on user attitude toward driverless cars. Meanwhile, users' concerns about driverless cars, including technological issues, hacking and privacy issues, laggard regulations and laws, unaffordable costs, and a deterioration in driving skills which significantly restrict intention to use. In addition, customers who are aged above 25 years old have a higher expectation of receiving an enjoyable experience in driverless cars than younger customers (age between 18 and 25).

Thirdly, this research describes operational measures for new proposed constructs. Perceived travel efficiency, defined as the extent to which a person believes that driverless cars can improve user performance, is measured against three items. The construct of perceived helpfulness refers to the extent to which a person believes using a driverless car will be convenient for mobility, and is measured against four items. Perceived societal benefits, identified as a person's belief or expectation that driverless cars can generate a series of societal benefits, are again measured against four items. Incumbent system habit refers to consumers incumbent system use, is measured against three items. Besides, the measurement scales for other constructs are borrowed from previous studies and tailored to the context of driverless cars. These measurement scales have good reliability and validity when examined through statistical analysis. Further study can test and develop these measurement scales further in different contexts.

Furthermore, the generated results and findings provide suggestions and a series of instrumental strategies for stakeholders in the development of driverless cars to modify user perceptions and relief their concerns, also disrupt individual incumbent system habit, thereby improving driverless cars acceptance. In other words, automobile manufactures, marketing managers, policy-makers and governmental bodies should work together not only to deal with the barriers that restrict customer receptivity towards emerging driverless cars, such as technological issues, regulation and policies, hacking and privacy issues, but also to meet customers' expectations of cars. The following points briefly summarise some practical implications.

Marketing managers should emphasise in their advertising material the benefits driverless cars bring to users, for example, in saving time commuting, freeing up drivers' hands, extending the ability to undertake secondary tasks, increasing access to mobility, reducing traffic emission, and relieving traffic congestion. Amongst these expected benefits, they should especially publicise the enjoyable feelings brought by using driverless cars, such as a mental break and chance to relax, a private space to take a nap and relieve driving pressure. It would be useful to publicise these benefits to customers aged above 25 years old.

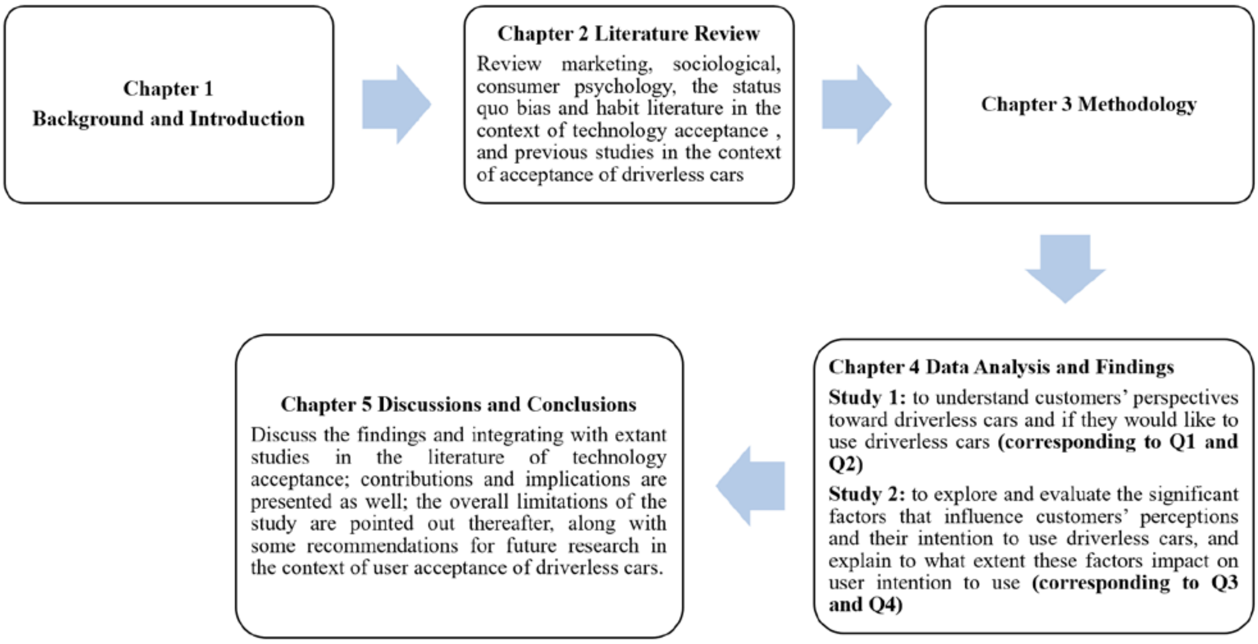
Meanwhile, automobile manufacturers should strive for the realization of the societal benefits of driverless cars (e.g. reduced emission and fuel consumption, decreased traffic congestion, reduced parking problems, freed up social space, fewer traffic accidents and more sustainable transportation) as these positively affect user attitude toward driverless cars. In addition, it is important to look at the price of regular vehicles and conduct a marketing survey to understand what customers are willing to pay before setting the price for driverless cars. Managers from research and development (R&D) departments should lead their teams to work on methods to prevent hacking and minimise customers' privacy concerns. Approaches such as encryption, anonymization, minimisation of personal information, and regular destruction of data would be useful to protect personal information and guard against privacy risks. Policy-makers and government bodies should clearly define conditions for using driverless cars, and balance the obligations between users and automobile manufacturers in order to deal with the unprecedented issues that could surface with the introduction of driverless cars.

Notably, these findings can ensure their precious resources (e.g. marketing budget, human resources, time, and construction investment) are focused in the right direction, with marketing strategies targeted at the right customers.

1.5 Structure of the Thesis

This thesis is organised into six chapters. Figure 1.1 depicts the process of conducting this research. First, the research reviews the extant literature across marketing, sociological, consumer psychology, the status quo bias and habit in the field of technology acceptance, particularly in the context of driverless cars. Thus, the researcher has a broad view of public perceptions and behavioural intention towards driverless cars (Chapter 2). After that, the description of the research methodology used to guide the research procedure, and the adopted methods are presented (Chapter 3), followed by an exposition of the process of conducting the interviews, analysing narrative data, extracting core themes, generating the hypotheses and the conceptual model, and examinations (Chapter4). The results of examining determinants that affect technology acceptance of driverless cars are discussed, as is any synergy with previous studies in the literature of technology acceptance. The original contributions to knowledge and practical implications are included in this chapter (Chapter 5). Finally, a conclusion to the entire study and the review of proposed core research objectives are presented (Chapter 6).

Figure 1.1 Structure of the Thesis



Chapter 1 focuses on providing background information about driverless cars, identifying the research gaps in the study of acceptance of driverless cars, and detailing the core research question and research objectives, along with the methodology used and contributions generated.

Chapter 2 reviews the literature on marketing, sociological, consumer psychology, the status quo bias and habit and previous studies in the context of acceptance of driverless cars. The core themes or variables that significantly affect customers' behavioural intention towards driverless cars are categorised into three types by literature review, simply entitled enablers, barriers, and individual difference variables (personal characteristics and socio-demographic variables). The conventional theories used to study technology acceptance are also reviewed.

Chapter 3 describes the philosophical assumptions and research methods used. The principles of conducting qualitative study (Study 1) and quantitative study (Study 2), and the detailed requirements of analysing collected narrative data and quantitative data are explained and described in a logical order. The consideration of ethical issues is also mentioned in this chapter.

Chapter 4 outlines the detailed procedure of conducting an interviews study and the findings achieved after a content analysis based upon the participants' perceptions toward driverless cars, which also examined the pre-categorised three types of influential variables. The subsequent quantitative study examines the determinants of acceptance of driverless cars and evaluates the proposed hypotheses among variables through confirmatory factor analysis (CFA) and the structural equation model (SEM). The influential power of each variable is confirmed with the final results shown on the confirmed conceptual model.

Chapter 5 provides detailed discussions on the generated findings that confirmed the significant determinants of user intention to use driverless cars and illustrated the mechanism in which each factor affects the acceptance of driverless cars. The research contributions are presented from theoretical and practical perspectives, as well as the limitations of the research and suggestions for future studies in driverless cars acceptance. The proposed research questions and objectives are reviewed, along with the procedure of accomplishing these research objectives and answering the research questions.

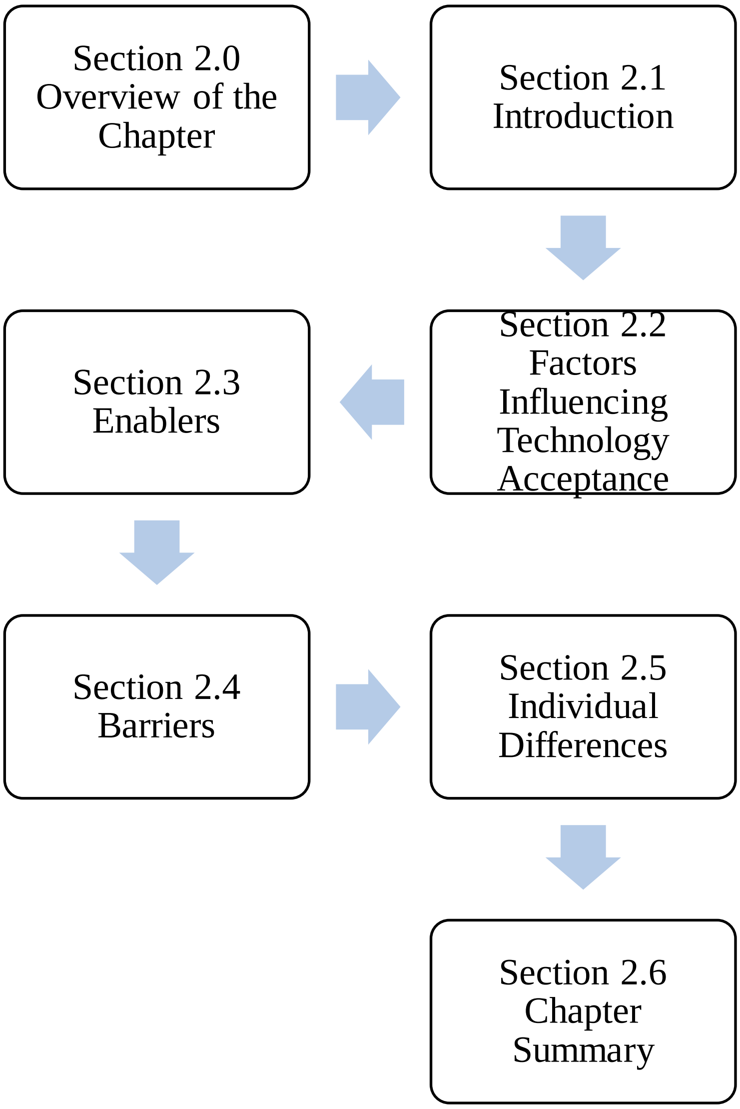
Chapter 2 Literature Review

2.0 Overview of Chapter

The purpose of Chapter 2 is to provide an overview of the literature dealing with technology acceptance, and some relevant knowledge in marketing, sociological and consumer psychology. The substantial studies that have been done in the context of acceptance of driverless cars will also be reviewed with the aim of understanding the factors behind and the reasons most often given for the acceptance of driverless cars. The theories and the rationale behind consumer behaviours in marketing are explained in this chapter.

The chapter starts from reviewing a series of cognition-based behavioural theories, including the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), the theory of planned behaviour (TPB) (Ajzen, 1991), the technology acceptance model (TAM) (Davis, 1989), the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003), and the innovative Car Technology Acceptance Model (CTAM) (Osswald et al., 2012), along with an explanation of the fundamental rationale behind consumer behaviours, that is, the belief-attitude-intention-behaviour (section 2.2). This is followed by a review of the significant factors explored in the acceptance of driverless cars, which are categorised into three groups, namely enablers (section 2.3), barriers (section 2.4) and individual differences (section 2.5). More specifically, five motivating factors are identified as enablers: perceived travel efficiency (section 2.3.1); perceived helpfulness (section 2.3.2), perceived societal benefits (section 2.3.3), perceived enjoyment (section 2.3.4), and attitude toward driverless cars (section 2.3.5). Four types of detrimental factors constitute barriers: technological issues (section 2.4.1); hacking and privacy issues (section 2.4.2); regulations and laws (section 2.4.3), and costs (section 2.4.4). The potential influences of individual difference variables, including incumbent system habit and personal innovativeness are presented in section 2.5.1. This is followed by information about socio-demographic factors (e.g., age, gender, and driving experience) in the acceptance of driverless cars (section 2.5.2). Thereafter, a short summary is used to close this chapter (section 2.6). Figure 2.1 depicts the literature review for this chapter.

Figure 2.1 Structure of Literature Review



2.1 Introduction

The automobile industry faces innovation in the form of driverless cars that are deemed to be one of the key elements of the next technology revolution (Kaur & Rampersad, 2018). No doubt of that, driverless cars are now viewed as one of the key disruptions in the technology revolution and represent the biggest technological advance in personal transport (Bansal, Kockelman & Singh, 2016; Fagnant & Kockelman, 2015).

Innovation implies newness, which is essential to the concept of innovation as it serves to differentiate innovation from change (i.e., adaption) (Slappendel, 1996). Johannessen, Olsen & Lumpkin (2001) specified what is new from six different dimension of innovation, including new products, new services, new methods of production, opening new markets, new source of supply, and new ways of organising. Conversely, adaption is described as the process of modifying an existing product so it is suitable for different customers or markets (Linton, n.d.). Thus, Johannessen et al. (2001) stated that all innovation presupposes change, but not all change presupposes innovation. A critical difference between innovation and product adaption in the consumer context is that innovation adoption correlates with all of the cognitive-personality variables known to be associated with consumers' initiation, the early purchasing of new products (Foxall, 1995). Meanwhile, mainstream studies divide technological innovation scope as two types, namely incremental and disruptive. An incremental innovation is evolutionary, continuous and generally understood as improvement of technology performance or product feature enhancement, whereas a disruptive innovation is revolutionary, discontinuous and breakthrough technology that creates a dramatic change and transforms current markets or industries, or even creates new ones through introducing new products (Gross, 2016; Hacklin, Raurich & Marxt, 2004). Due to the differences between incremental and disruptive innovation, the critical factors that impact on user intention to use disruptive innovation (i.e., driverless cars) should be different with accepting incremental innovation (i.e., limited self-driving automation). The critical reason for the switch of consumer choices from sustaining to disruptive innovation was the decreasing marginal utility from the performance improvements in major dimensions, as well as the new value propositions and affordable prices (Adner, 2002).

Driverless cars, as a new technology will be introduced to the mass market in the near future, and it is therefore vital for automobile manufactures and marketing managers to understand customers' attitudes and intentions towards driverless cars, by assessing and evaluating their different perspectives. Investigating the factors which influence the acceptance of driverless cars can provide critical clues in identifying the degree to which an individual intends to use a driverless car (Adell, 2010). In addition, potential customers' attitudes toward driverless cars are increasingly significant, as the end-user shapes the demand and market for the cars, and future investment in infrastructure (Howard & Dai, 2014). In the same vein, Nordhoff, van Arem, and Happee (2016) emphasise that user intention to use driverless cars is a prerequisite for the implementation success and determines whether the vehicles will be used.

In the context of the automobile industry, research into innovative forms of automated transportation systems is gains momentum (Merat et al., 2016). The majority of studies asked respondents about how likely they would be to use the technology, their willingness to pay for new services or buy a driverless car and when, and what types of usage they prefer (e.g., a private driverless car or a shared vehicle) and etc. Thus, the following subsections review recent studies from the context of driverless cars as well as literature in sociological and consumer psychology, status quo bias and habit, which are relevant in terms of intention to perform, attitude as a determinant of intentions, and the antecedents of attitude (Agarwal & Prasad, 1998).

2.2 Factors Influencing Technology Acceptance

The studies which focused on technology acceptance have mainly adopted cognition-based behavioural models, the most commonly used of these being TAM (Davis, 1989), UTAUT (Venkatesh et al., 2003), TPB (Ajzen, 1991), which was originally extended from TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) with an emphasis on the belief-attitude-intention-behaviour rationale.

TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) posits that behavioural intentions, viewed as the immediate antecedents to behaviour, are a function of salient information or beliefs about the likelihood that performing a certain behaviour will lead to a specific outcome. Madden et al. (1992) further demonstrate that information or salient beliefs affect intentions and subsequent behaviour either through attitudes and/or through subjective norms. Grounded in social psychology, Ajzen (1985) proposed TPB, which extends TRA by explicitly incorporating perceived behavioural control as one of the determinants of behavioural intentions and behaviour. Thus, the more resources and opportunities individuals think they possess, the higher extent of their perceived behavioural control should be gained (Madden et al., 1992). The inclusion of perceived behavioural control significantly enhances the prediction of intentions and target behaviour, as TPB explains more variation than TRA (Madden et al., 1992).

In the study of consumer behaviour towards the new technology, Davis (1989)' TAM model has been widely applied and enhanced with factors deriving from multidisciplinary knowledge. This model explains and forecasts users' behavioural intention and practical behaviours in terms of using information technology, by assessing user perceptions of usefulness, ease of use, and attitude towards a certain form of technology (Kuo & Yen, 2009; Venkatesh & Goyal, 2010). The model is viewed as an adaptation of TRA that, based on social psychology studies, provides the soundest, most parsimonious and most influential theoretical paradigm in understanding user acceptance of technology (Bhattacherjee, 2001; Dishaw & Strong, 1999; Legris, Ingham & Collerette, 2003; Lymperopoulos & Chaniotakis, 2005).

The UTAUT from Venkatesh et al. (2003) expands TAM and postulates that performance expectancy, effort expectancy, social influence, and facilitating conditions are four determinants of user acceptance. Meanwhile, the theory reveals the moderating influences of gender, age, experience, and voluntariness of use on causalities between key constructs in behavioural intention and use behaviour (Slade, Dwivedi, Piercy & Williams, 2015). It is viewed as a robust theory through which to investigate consumer adoption of technology and is normally applied to study the use of Information Systems (IS) (Madigan et al., 2016).

From within the automobile industry, earlier studies such as those of Van Der Laan, Heino, and De Waard (1997) conducted a simple procedure for the assessment of acceptance of advanced transport telematics through focusing on the usefulness of the systems and user satisfaction. Osswald, Meschtscherjakov, Wilfinger, and Tscheligi (2011) conducted an online survey measuring user acceptance of the pre-prototype technology, when interacting with the steering wheel with the help of the TAM scales. Of the model adopted to study behavioural intentions towards automated driving systems, the UTAUT only accounted for 20% of the variance in behavioural intentions in the study of Adell (2010), and presented 22% of the explanatory power in the study of acceptance of automated road transport systems in the work of Madigan et al. (2016). In the latest studies, Kaur and Rampersad (2018) incorporate the TAM with the UTAUT to investigate the key factors influencing the adoption of driverless cars, by assessing relationships between trust, security, privacy and their relevant factors. While the amount of generated variance in the adoption of driverless cars has not been mentioned, the confirmed positive impact of trust on adoption is barely accepted ($p>0.05$). Especially, it should be noted that the discussion topics for driverless cars is very different from that of regular cars among the public, such as handling, safety, innovation, quality, insurance and less on engine, transmission, and styling (KPMG, 2013). As the opinion towards dimension profile of driverless cars changed, thus the determinants of driverless cars acceptance need to be explored further.

There is no doubt that we can understand and explain customers' attitude and their intention to use driverless cars through examining their perspectives. Generally speaking, customers' perceived benefits and risks of driverless cars will be central predictors of users' intention to use (Kohl, Mostafa, Böhm & Krcmar, 2017), as well as their personal preferences (KPMG, 2013). The theoretical rationale behind consumer behaviours in the literature of technology acceptance, that is, the belief-attitude-intention-behaviour, should be adopted in this research. However, this conventional causality was criticised by others (Mouter, Granenburgh & Wee, 2018) who emphasized that this rationale may not fully reflect citizens' preferences over goods, which refers to a concept known as the consumer-citizen duality. It used to describe the general belief that choices made by consumers differ in some way from those made by citizens.

In transport economics, findings disclosed that individuals do indeed assign comparatively more value to safety in their role as citizens than their role as drivers, that is, individuals make different choices because their perceptions of accident risk differ between the role as citizens and consumers (Mounter et al., 2018). It could be possible that one has positive subjective evaluation of a technology and the weak intention to use it. Nevertheless, the 'consumer-citizen duality' received limited attention in the study of technology acceptance regarding autonomous driving technology. Payre et al., (2014) noticed a potential paradox in the acceptance of the automated driving system and posited that the personal traits of the consumer can be used to explain this. For example, the driver might think he or she is substituted by the automated driving system rather than assisted if the person has a strong sense of control, thereby lead to a rejection to use it (Payre et al., 2014). Thus, it would be worthwhile to consider a duality exists in the acceptance of driverless cars by considering personal difference variables into account, as well as explore the influencing mechanism behind it.

Based on prior studies about driverless cars, the recurring potential benefits and constraints from customers' perspectives can be categorized as positive and negative factors which have assumed significant influences in determining user acceptance of driverless cars. More specifically, benefits of driverless cars reflecting customers' positive perspectives can be called enablers of intention to use; concerns that restrain customers' tendencies to use driverless cars are treated as barriers. Individual differences are also mentioned by prior researchers and assumed to be potential determinants of user acceptance of automated transportation technologies. For example, technology innovativeness (Bansal et al., 2016), incumbent system habit (Polites and Karahanna, 2012), sensation seeking, locus of control (Payre et al., 2014) and etc. In considering the importance of individual factors in technology acceptance, the researcher believes that the inclusion of important individual characteristics and socio-demographic variables would facilitate an explanation of how various customers' perceptions are formed, and how they influence customers' intention to use driverless cars.

2.3 Enablers

As stated above, the benefits of driverless cars mentioned by customers reflect their own positive perspectives toward this innovation, and can be treated as enablers of user acceptance of driverless cars. Briefly speaking, the recurring positive features of driverless cars can be split into five types.

2.3.1 Perceived Travel Efficiency

Intrinsic (hedonic) motivation and extrinsic (utilitarian) motivation are key elements of consumer attitudes that influence individual purchases of IT products because consumers are viewed as either "problem solvers" or individuals seeking "fun, fantasy, arousal, sensory stimulation, and enjoyment" (Hirschman & Holbrook, 1982). In the same vein, existing marketing studies (Voss, Spangenberg, & Grohmann, 2003) emphasise that customers' overall attitudes toward a product are fundamentally based on utilitarian functional aspects or on hedonic aspects.

Utilitarian motivators can be viewed as equal to perceived usefulness from the TAM and relative advantages from the diffusion of innovation theory (DOI)(Rogers, 2010) as both constructs are used to describe users' belief and expectation in using an innovative product to enhance their performance or improve their work efficiency (Barry, Darden & Griffin, 1994; Holbrook & Batra, 1987; Kim & Han, 2011; Taylor & Todd, 1995). There is no doubt that perceived usefulness and relative advantages are significant indicators of intention to use in the IS context (Venkatesh et al., 2003) as well as applicable for studies in the context of technology acceptance across various types of technologies, while the meaning of utilitarian motivators should be updated along with features and purposes of designed technology.

With regarding to driverless cars, perceived travel efficiency can be described as the extent to which a person believes that driverless cars can allow the user to carry out other activities or tasks while driving. It has been acknowledged that customers use public transport as it allows them to make productive use of travel time, and this benefit will be extended to private transport with driverless cars (Begg, 2014). Driverless cars as a breakthrough of traditional non-autonomous vehicles that will change the role of drivers into passengers, thus users no longer need to keep their eyes on the road. Users can use their travelling time to do other things and make days more productive. Extant surveys have revealed that the ability to be more productive while travelling in a driverless car (e.g. the potential to free up hands and to have more time to do other things while driving) was frequently mentioned by interviewees (Buckley et al., 2018; Schoettle & Sivak, 2014c; Zmud et al., 2016), especially among people aged between 30 and 45 years (Zmud et al., 2016). Along the same line, Casley, Jardim, and Quartulli (2013) assert that the core benefit of a driverless car in terms of productivity is that it frees the time of drivers and allows them to do more productive tasks (e.g. work on their computer or interact more attentively with their fellow passengers) rather than spend time driving or being stuck in traffic.

Specifically, the increased expectation of travel efficiency with increased self-driving automation has also been viewed as an economic conceptualization of time (Gordon

& Lidberg, 2015; Kala & Warwick, 2015). In other words, spending, wasting and saving time while travelling in driverless cars have led to travel time being viewed as an economic commodity (Bjørner, 2017). In the same vein, Silberg & Wallace (2012) mentioned that users' receptivity will increase significantly if driverless cars can shorter commute times, because consumers are eager for new mobility alternatives that would allow them to recapture the time squandered in traffic. It is a common issue for commuters who spend lots of hours a year behind the wheel of a vehicle for doing nothing; whether the value of that time is measured in lost productivity, lost time pursuing other interests, or lost serenity, the loss is huge (Silberg & Wallace, 2012).

Thus, adoption of driverless cars is likely to result in improved travel efficiency as driverless cars can allow the user to carry out other activities or tasks while driving without any disruption. From this point of view, perceived travel efficiency represents one of important utilitarian benefits of driverless cars that is likely to impact customers' attitudes and intention to use driverless cars.

2.3.2 Perceived Helpfulness

Perceived helpfulness is used to describe the extent to which a person believes that using a driverless car will be convenient for mobility. Driverless cars are viewed as an effective transportation method that can improve quality of life (Kyriakidis et al., 2017). The existing findings reveal that customers praise driverless cars as convenient for children, the elderly, disabled people, and also those without driving licenses as they may require someone to accompany and drive them (Becker & Axhausen, 2017). There is no doubt that one of the benefits of launching driverless cars is increased access to mobility for all, including people who cannot drive by themselves due to physical restrictions or age (Becker & Axhausen, 2017; Daniel, 2017). In addition, one report reveals that human error or bad driving habits, such as reckless driving, changing lanes without signalling, driving on the hard shoulder, and driving while intoxicated are main causes of traffic accidents (Olivia, 2011). Therefore, the emergency of driverless cars could be viewed as an promising approach which can curb the rising trend of traffic fatalities worldwide, because existing studies have revealed that potential customers would like to use driverless cars while their judgment is impaired or driving while affected by alcohol, drugs, or medical conditions (Buckley et al., 2018; Payre et al., 2014). Those were viewed as favourite situations in which to use driverless car. For example, in traffic congestion or on highways, users can delegate driving to autonomous driving systems that can adjust speed and headway distance without requiring any intervention from the driver, implying drivers can have a proper rest during their journey. Thus, using driverless cars can reduce traffic accidents by human error, and increased safety. The above-mentioned benefits are equivalent to the benefit of increased access to mobility from the micro-behavioural benefits of driverless cars (Bjørner, 2017). Meanwhile, autonomous driving technology professionals, social media, and the public all have a high expectation that the widespread use of driverless cars could effectively eliminate road accidents caused by human error (Buckley et al., 2018; Underwood, 2014). Thus, perceived helpfulness is likely to influence user attitudes toward driverless cars.

2.3.3 Perceived Societal Benefits

The term of customers' awareness of social responsibility has been mentioned in the study of consumers' readiness to support socially responsible organizations (Maignan, 2001). It refers to 'a consumer who takes into account the public consequences of his or her private consumption or who attempts to use his or her purchasing power to bring about social change' (Webster Jr, 1975). Therefore, consumers with a greater sense of social responsibility would prefer to buy products with a social benefit than others (Brown & Dacin, 1997; Mohr, Webb & Harris, 2001).

In this research, the variable of perceived societal benefits refers to a person's belief or expectation that the adoption of driverless cars can generate a series of societal benefits. Firstly, the usage of driverless cars would improve traffic safety, such as a reduction in traffic collision and fewer accidents (Deb et al., 2017), as car sensors can automatically follow traffic rules, and be more alert and responsive than human drivers (Howard & Dai, 2014). In addition, autonomous driving technology includes elements of vehicle-to-vehicle communication systems that can effectively address safety issues and improved traffic safety (Howard & Dai, 2014). This is no doubt that the goal of developing driverless cars is not only to make advanced vehicles as "safe" as human drivers, who, are no not very safe at all; instead, the goal is to develop "crash-less" cars (Silberg & Wallace, 2012). Secondly, the implementation of driverless cars would facilitate sustainable transportation, control fuel consumption and pollution (Mersky & Samaras, 2016). The evidence from the MIT Media Lab who has published a report said that in congested area, about 40 percent of total gasoline use in cars (i.e., conventional automobile vehicles) looking for parking (Silberg & Wallace, 2012). On the other hand, KPMG (2013) emphasized that the emerging of driverless cars represent a new era of personal transport coming with the purpose of whisk users where they want to go quickly and efficiently, then scurry away. Thus, users do not need to waste time finding a parking area, also parking areas would be free especially benenfitting urban areas as more public spaces become avilable that could be used for other purposes. Also, a driverless car can navigate along a highway with a precision that human drivers cannot, it can enable vehicles to be powered in an energy efficient way and reduce the fuel consumption (Howard & Dai, 2014). Driverless cars would able to choose a route that minimizes delay for all users in the systems and avoid bottlenecks and congestion prone areas before they begin to slow down traffic (Howard & Dai, 2014). Therefore, the adoption of driverless cars is likely to result in reduced parking problems and traffic congestion, improved city planning and land use patterns (Daniel, 2017).

Moreover, some experimental studies have tested and examined the benefits of 16 allied autonomous driving technologies (i.e., adaptive cruise control, wireless communication, and a smart parking system) to prove the implementation of autonomous driving technologies can effectively reduce emissions, save fuel and improve transportation infrastructure (Julia & WireClimate, 2014). Driverless cars as a new mobility alternative that supported by the latest autonomous driving technologies, thus these mentioned societal benefits should be foreseeable. The adoption of driverlsss cars would reshape and update automotive ecosystem and lead towards smart cities (Xiang, Tussyadiah & Buhalis, 2015).

In addition, those expected societal benefits, also described as macrosocietal factors (Bjørner, 2017), are the primary motivators behind the creation of driverless cars (Payre et al., 2014). They are tightly interwoven with microbehavioral factors that refer to individual benefits from the customers' perspectives, including increased access to mobility (e.g. for the elderly, children, or disabled), lower levels of driver stress, and more efficient use of time while driving (Bjørner, 2017). Today, the higher societal expectations have come from governments, the public, and the scientific community, reflecting the importance of societal benefits in the implementation of driverless cars. Perceived societal benefits are therefore likely to have a significant impact on user attitudes toward driverless cars.

2.3.4 Perceived Enjoyment

Perceived enjoyment as a hedonic concept to capture consumers' emotional reactions to travelling in driverless cars, for example, relaxed, enjoyable, and safe feelings (Buckley et al., 2018). It defined as the degree to which a person believes that using driverless cars will bring them hedonic feelings. Venkatesh et al. (2012) state that consumers would like to experience enjoyment, fun, or pleasure from purchasing or using technology products, such as microcomputer (Igbaria, Schiffman & Wieckowski, 1994), online video games (Lin & Bhattacherjee, 2010), or mobile data services (Kim & Han, 2009) and this could be applicable equally in the context of driverless cars. In the research of IS, hedonic value is viewed as more subjective and personal than utilitarian value and is generated from the enjoyment derived (Holbrook & Batra, 1987). Regarding technology product, Nordhoff et al. (2016) emphasise that the hedonic aspects of the product use has a significant influence on users' satisfaction at a level beyond its utilitarian aspects. In the earlier studies of autonomous driving technologies, Delle Site et al. (2011) notice that variables such as comfort significantly influence users' intention to use automated road transport systems (ARTS). This implies that hedonic aspect of motivation is usually embedded into technology products to appeal to customers (Kim, 2006).

In the context of driverless cars, Walker and Stanton (2017) state that the vehicles have a purpose only if divers are freed from the driving task, are not supposed to supervise the system, and not liable for it. This indicates a potential benefit of driverless cars in that they can relieve drivers' mental stress and reduce their workloads. This is corroborated by Nordhoff et al. (2016), who proposed that driverless cars refined the interaction between human and their vehicles and the joy of being driven. Because one of the prominent advantages of driverless cars is that users can use private vehicle space to relax and enjoy their journey. Thus, it is reasonable to assume that driverless cars are perceived to be both enjoyable and exciting. In addition, it is critical to take into account the characteristic variables of driverless cars that may improve the explanatory power of the model (Madigan et al., 2016). Thus, the perceived enjoyment of travelling in driverless cars is verified as the hedonic aspect of driverless cars, which should be treated as a determinant in their acceptance.

2.3.5 Attitude

Attitude is defined as one's personal reaction to a target behaviour and can be used to predict behavioural intention (Fishbein & Ajzen, 1975). It also refers to a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour (Eagly & Chaiken, 1993). Attitude toward driverless cars is defined as an individual's overall affective reaction upon using a driverless car (Osswald et al., 2012). Normally, the classic rationale of belief-attitude-intention-behaviour can be used to explain technology acceptance across different technology contexts, such as adoption of wireless mobile technology (Lu, Yao & Yu, 2005), acceptance of smartphone-based shopping (Marco Hubert, Markus Blut, Christian Brock, Christof Backhaus & Eberhardt, 2017), and acceptance of wearable technology (Dehghani, Kim & Dangelico, 2018). Nonetheless, Kim, Chun, and Song (2009) criticised that the value of attitude was underestimated in revised TAM and its extended models in predicting technology acceptance. This is consistent with Yang and Yoo (2003) persist that attitude deserves more attention in technology acceptance for its considerable influences on the individual, which can enhance the model's predictability about user acceptance of technology. Therefore, this research takes attitude into account to better explain users' intention to use driverless cars.

Regarding driverless cars, researchers have mentioned that attitudes towards simulated autonomous driving systems are positive worldwide (de Waard, van der Hulst, Hoedemaeker & Brookhuis, 1999; Walker & Stanton, 2017) but nevertheless express caution (Schoettle & Sivak, 2014a; Tussyadiah et al., 2017). For example, participants from the U.S., the U.K., and Australia showed a positive attitude towards driverless cars and had high expectations for the benefits of this technology (Schoettle & Sivak, 2014b). Schoettle and Sivak (2014c) further report that 61.9% Australia respondents have a positive impression of this technology, following by 56.3% of U.S. respondents and 52.2% U.K. participants. This is similar for Continental (2013), in which 61% of Japanese respondents welcomed driverless cars, greater in China it rose to 79%. Zmud et al. (2016) collected the samples from Austin, half of the respondents viewed the use of driverless cars as a positive change in their travelling experience and wanted to use them daily. It is interesting to note that Osswald et al. (2012) developed the CTAM through restoring the construct of attitude, and integrated new factors (e.g. safety, anxiety, and facilitating conditions) with UTAUT to assess behavioural intentions towards car technology, but did not investigate the exact impact of these factors on intention to use. Nonetheless, earlier studies have verified the influence of attitude on customers' behavioural intentions towards driverless cars, for example, the study conducted by Payre et al. (2014) reveals that customers' intention to use driverless cars can be predicted by their attitudes, contextual acceptability, and concern about human error in driving. Also, Tussyadiah et al. (2017) emphasize that understanding the public attitude towards driverless cars is essential in predicting the adoption rate of such vehicles.

This is no doubt that knowing potential customers' attitudes toward autonomous driving technology is the premise from which to predict their subsequent behaviours, which is critical for the implementation of driverless cars in the mass market. Thus, attitudes toward driverless cars are likely to influence intention to use.

2.4 Barriers

Despite many surveys which reveal that the public have high levels of interest in and expectations of driverless cars, there is also evidence that they have many questions about this technology and hesitate to embrace it. Kohl et al. (2017) emphasize that people may only begin to recognise potential issues of driverless cars once the vehicles become available. Thus, customers' concerns and potential issues of driverless cars should be monitored and used to address how these factors restrain customers' receptivity. Specifically, the variable of concerns relates to a concept of 'psychological stress' that developed within the field of cognitive psychology by Lazaurs and Folkman (1984). Stress refers to a relational concept that can be viewed as a relationship between individuals and their environment (Krohne, 2002). Lazaurs and Folkman (1984) further explained that stress as a product of a transaction between a person (e.g., cognitive, physiological, affective, and psychological) and surrounding environment. It is relevant to defensive mechanism and results of resistance (Walinga, 2014).

The influencing mechanism behind individual concerns and behaviours can be explained through Lazarus and Folkman's transactional theory of stress and coping (Lazarus, 1966; Lazarus and Folk, 1984). The theory posits that individuals are consistently appraising stimuli within their environment then generate emotions, and when stimuli are appraised as threatening, challenging, or harmful that will generate stressor, the resultant distress initiates coping strategies to manage emotions or attempt to address the stressor itself (Biggs, Brough & Drummond, 2017). Based upon this theory, if users reappraised that they are unable to cope with the stressor when interacting with driverless cars, which will result in a negative affect and the behavioural response of avoidance or rejection (Edwards, 1992). Therefore, individuals' concerns about driverless cars reflect their negative perceptions that will restrict user intention to use directly, but to what extent these factors impact on consumer acceptance is not yet known.

The previous surveys explored that the main reasons for being reluctant to use driverless cars or rejecting the technology related to safety, liability, the operation of the systems (KPMG, 2013), or hacking of the automated systems and privacy disclosure (Schoettle & Sivak, 2014b). In the same vein, Casley et al. (2013) reveal that safety, legislation and costs are the most influential features in determining the desirability of driverless cars for participants. Howard and Dai (2014) point out that liability and costs are the key factors that restrict customers' interest in driverless cars. In addition, Schoettle and Sivak (2014a) argue that concerns about autonomous technology continue to intensify amongst the general public, causing resistance to autonomous vehicles, although the manufacturers are trying their best to convince customers of the reliability of driverless cars. The latest study also reports that driverless cars would introduce new risks that do not exist now, which could inhibit user acceptance (Kohl et al., 2017). Therefore, clarifying the potential barriers to acceptance of driverless cars is critical for the implementation of this technology in the mass market.

2.4.1 Technological Issues

The technology and computing power carried by driverless cars are viewed as a major constrain in customer trust of driverless cars, because driverless cars replace human drivers with artificial intelligence (AI), and the car's ability to cope with unlikely events is uncertain (Kaur & Rampersad, 2018). In the same vein, although it has been acknowledged that driverless cars can perform better than human drivers in many driving situations, designing a system that can perform safety in almost every situation is still challenging (Campbell, Egerstedt, How & Murray, 2010). Similar issues are noticed by Bansal et al. (2016) who indicate that customers perceive fewer crashes as the primary benefit of driverless cars, and are mainly concerned with the technology malfunctioning and performance failure, such as the performance of driverless cars' sensor recognition in poor weather (e.g. fog and snow), or where there are changes in physical infrastructure (e.g. road layout), and the ability of computer vision to identify an object and material composition in the vehicle's path (e.g. concrete blocks and passengers) (Fagnant & Kockelman, 2015). It is crucial that driverless cars can accurately recognise the objects and avoid a crash in every situation. In addition, Osswald et al. (2012) proposed a theoretical CTAM by integrating the factors of perceived safety and anxiety into UTAUT, implying the driver is constantly placed in a potentially risky situation. Thus, the concerns users have expressed about autonomous driving technology should be considered as one of the barriers to acceptance of driverless cars.

2.4.2 Hacking and Privacy Issues

Concerns about privacy and security of systems, and legal liability for drivers are also frequently mentioned by participants in surveys (Schoettle & Sivak, 2014b, 2014c). The same issues are outlined by Buckley et al. (2018) who focus on participants' experience of travelling in stimulated driverless cars and note that participants were concerned about hacking and disclosure of personal data. The earlier studies have mentioned that driverless cars are highly likely to raise concerns about personal information privacy when the cars generate information about the people who use them, such as travel patterns, travel plan, or customers' autonomy privacy interests (Glancy, 2012). In other words, driverless cars are repositories of users' information, as the system will record it, and there is a potential risk that such information would be vulnerable to hacking and access by investigators (Glancy, 2012), leaving customers susceptible to "targeted marketing" or monitoring. In addition, the driverless cars' system highly dependents on data for registering and controlling the vehicle, in which situation it might highly possible attacks by hackers or terrorists (Fraedrich & Lenz, 2014). Amongst the latest research, Zmud et al. (2016) and Kohl et al. (2017) noted that individuals who were concerned more about data privacy and hacking, the less likely they would use driverless cars.

2.4.3 Regulations and Laws

Research indicates that there is a lack of clarity over the level of supervisory control and cooperation in the adoption of driverless cars because it is still unclear who is performing which part of the driving task (Banks & Stanton, 2016). The authors suggest that the legal and societal challenges may be more difficult to solve than the technological barriers to the success of an automated highway system as the role of the driver in driverless cars is ambiguous (Kyriakidis et al., 2015). It is not clear whether the user is still technically the driver, with authority to control the driving system, or whether the user has no power to intervene during autonomous driving mode, and who therefore is to blame if a driverless car is involved in a collision. Findings confirmed that liability for incidents which happen under autonomous driving mode is a major concern and could be a crucial obstacle to the implementation of driverless cars (Fagnant & Kockelman, 2015). Furthermore, the conflicts of law between the manufacturers of driverless cars and society could intensify with such dilemmas in critical situations as running over pedestrians or sacrificing the driver to save the pedestrians (Bonnefon, Shariff & Rahwan, 2016; Hohenberger et al., 2016).

The main reason for laggard regulations and laws associated with driverless cars is that autonomous driving technology moves faster than the legal or regulatory systems (KPMG, 2013). More specifically, advanced technologies open up new possibilities, and regulators rush in afterwards to establish order (KPMG, 2013). Thus, new legislation about driverless cars is required to solve a series of new issues. In other words, concerns associated with regulations and laws regarding driverless cars are another crucial barrier to user acceptance of driverless cars.

2.4.4 Costs

Previous studies have mentioned that customers fear that they are unable to afford driverless cars and other car-related costs, such as future insurance premiums (Fraedrich & Lenz, 2014; Haboucha et al., 2017; Howard & Dai, 2014), although the technology can reduce some of the costs associated with driving, for example, fuel costs which controlled by the embedded computer system in the car (Fraedrich & Lenz, 2014; Kyriakidis et al., 2015). Findings from an online survey by Zmud et al. (2016) also indicate that the main reason cited for not owing a driverless car was the affordability of the purchase price. In the earlier study, Howard and Dai (2014) noticed that the retrofitting option for users to use autonomous driving technologies is encountered by those who are concerned about cost, also issues with cost are shared by customers of all incomes. Unsurprisingly, the Google Car, an example of driverless cars, is priced much than the average consumer is willing or able to pay (Casley et al., 2013). The main reason for this is the high cost of the sensor arrays-the most expensive element of equipment within a driverless car (Alisa & Chris, 2012). If the price falls into a reasonable range, affordable for customers, the demand for driverless cars may increase. To date, however, the high cost seems to be prohibiting customers' interest in driverless cars.

In summary, these concerns listed above are assumed to have significant negative influences on the acceptance of driverless cars. The categorised concerns are congruent with the verified challenges of widespread implementation of driverless cars in the mass market, including issues around safety of technology, regulation and insurance issues, ethics, and economic challenges (Bjørner, 2017). Notably, these concerns are associated with different features of driverless cars and likely to have a detrimental influence on intention to use.

2.5 Individual Difference Variables

2.5.1 Personal Characteristics

Among existing studies in public opinion surveys about adoption of driverless cars, one of the main findings is that personal trait variables, such as consumers' incumbent system habit, personal innovativeness, and sensation seeking have positive or negative influences on user acceptance of driverless cars (Bansal et al., 2016; KPMG, 2013; Payre et al., 2014; Zmud et al., 2016). In generally, such personal trait variables are manifested in technology acceptance behaviour through its relationship with beliefs or perceptions (Agarwal & Prasad, 1998). More specifically, personal trait variables are normally proposed as key moderators for the antecedents as well as the consequences of perceptions in technology acceptance (Agarwal & Prasad, 1998). However, there is a paucity of research which closely explores and evaluates the influencing mechanism of personal trait variables behind user intention to use driverless cars.

Incumbent system habit

In the study of human-technology interactions, the variable of incumbent system habit is used to describe consumers incumbent system use, which has been treated as one subconscious source of resistance to adopting a new system (Polites and Karahanna, 2012). In other words, incumbent system use (e.g., traditional automobile vehicles) that has become to automatic response for obtaining specific instrumental goals (e.g., daily commute) (Polites and Karahanna, 2012). Findings from social psychology literature reveal that extent of incumbent system habit have different negative impact on user intention to use a new system. Verplanken and Aarts (1999) explained that an individual is less attentive to new information and courses of action owing to "habitual mind-set" from the perspective of enduring cognitive orientation, and contributes to the maintenance of habitual behaviour. Consistent with the finding from Murray and Haubl (2007), the "skill-based habits of use", developed through repeated use of an incumbent automobile vehicle (e.g., learning how to steering the vehicle), could lead to cognitive switching costs that "lock-in" customers to sticking in an incumbent system and inattentive to new systems (e.g., driverless cars).

In addition, habit is often associated with inertia which can be defined as attachment to, and persistence of, existing behavioural patterns (i.e., the status quo), even if there are better alternatives or incentives to change (Polites and Karahanna, 2012). Individuals may consciously tend to keep making similar decisions (e.g., continues to use traditional automobile vehicles) despite the presence of new products (e.g., the driveress cars) that can be described as cognitive-based inertia (Polites and Karahanna, 2012). In addition, it is possible that customers continue to use an incumbent automobile vehicle because they enjoy or feel conformable doing so, that refers to affective-based inertia (Polites and Karahanna, 2012). On the other hand, from the perspective of status quo bias that posits individuals are biased toward maintaining the status quo, toward "doing nothing or maintaining one's current or previous decision" (Samuelson and Zeckhauser, 1988). Deliberate inertia as a form of status quo bias reflecting consumers' rational choice in terms of value, benefits, and assurance to continue use of an incumbent product, even if better alternatives or incentives to product change are available (Samuelson and Zeckhauser, 1988); hence, it represents consumers' rational decision-making and can be seen as a conscious source of the continuance use of an incumbent product. Individual's incumbent system habit as a typical subconscious source is likely working together with inertia contribute to the persistence of using driverless cars.

Empirical findings revealed that a person's habitual way of driving toward an incumbent vehicle has strong manual driving styles (Elander, West & French, 1993). This will be transferred to being driven in a driverless car, normally reflecting a person's sense of control and freedom, which have detrimental influences on all aspects of emerging self-driving motilities (Bjørner, 2017). Moreover, Bellem, Thiel, Schrauf, and Krems (2018) reveal that individuals' driving style preferences towards incumbent driving vehicles, such as speed, acceleration profiles, and preferred headway distance, also influence their intention to use driverless cars.

Regarding the driverless cars, an individual might recognise that driverless cars would be more advanced than traditional automotive vehicles (e.g., manual driving cars) or efficient for users to use travelling time, but the costs of learning a new system are perceived as greater than the potential gains (Polites and Karahanna, 2012); or if users have limited knowledge about driverless cars or no hands-on experience trying them out, as a result of that they may stick to the incumbent driving system although driverless cars are superior than the traditional automobile vehicles. Meanwhile, it would be meaningful to examine how individuals' habitual behaviour towards an incumbent driving vehicle may affect their intention to use superior alternative vehicles-driverless cars. Thus, a person's incumbent system habit is likely associated with customers' receptivity to driverless cars and, when assessed, has a negative impact on user acceptance of driverless cars.

Personal innovativeness refers to the risk-taking propensity of an individual and the willingness to try out any new information technology (Agarwal & Prasad, 1998). This variable has been embedded into DOI (Rogers, 2010) and plays an important role in determining the outcomes of user acceptance of new technology. Early adopters of new technology proactively accept unfamiliar innovation with less uncertainty and a more positive attitude than others (Goldsmith & Hofacker, 1991; Lin & Filieri, 2015; Rogers, 2010). Normally, this personal trait variable is hypothesised to act as a moderator of the model to examine individuals' attitude and behaviour toward new technology (Agarwal & Prasad, 1998; Sun & Zhang, 2006). It has had a long-standing tradition in the domain of marketing in the literature of technology acceptance across a variety of technologies, such as intention to use driverless taxis (Tussyadiah et al., 2017), adoption of wireless Internet services via mobile technology (Lu et al., 2005) and acceptance of the smartwatch (Hong, Lin & Hsieh, 2017) etc. In the context of driverless cars, Payre et al. (2014) indicate that technophiles might be more enthusiastic about envisioning riding in a driverless car than others.

Sensation seeking is used to describe the tendency to seek out novel, varied, complex and intense sensations and experiences, and a willingness to take risks for the sake of such experience (Zuckerman, 1994). Findings indicated that high sensation seeking tendencies are associated with risk-taking behaviour, including risk driving and aggressive driving (Jonah, Thiessen & Au-Yeung, 2001; Zuckerman, 1994). The latest study further confirmed that sensation seeking positively correlated with risky driving, aggressive driving and driving errors (Zhang, Qu, Tao & Xue, 2019). In the context of driverless cars, authors noticed that individuals who have high sensation seeking tendencies are more likely to use driverless cars more than those without (Payre et al., 2014).

Based upon above information, the researcher posits that these personal trait variables are important concepts for explaining the acceptance of driverless cars and should be treated as moderators embedded in the conceptual model.

2.5.2 Socio-Demographic Variables

Socio-demographic variables were also examined in prior studies to help researchers understand participants' opinions of driverless cars. It has been noted that there are significant differences in perception of driverless cars between different groups. Gender, age, education, income and presence of children were considered as significant socio-demographic variables when examining customers' attitudes, behavioural intentions, and willingness to pay (Becker & Axhausen, 2017; Hohenberger et al., 2016).

As noted, there is a consistent difference in user attitude towards driverless cars between genders. Generally, men have a more positive attitude towards new technology and fewer concerns than women (Schoettle & Sivak, 2014b). Schoettle and Sivak (2014b) note that females are more concerned about autonomous driving technology than males. In the meanwhile, Howard and Dai (2014) point out that men are more concerned with liability, while women are likely to be concerned with losing control of the vehicle. This is consistent with Kyriakidis et al. (2017) disclose that men are less worried about automation failures, while they are more concerned about liability issues than do women. The findings contradicting this trend is conducted by KPMG (2013), which showed that women were slightly more receptive to driverless cars, as they would have more time to take care of their children in the back seat, while men were more resistant, as they would be forced to stay in lane and to follow speed limits. Therefore, gender should be considered in the study of driverless cars as it will generate some interesting results and provide more information to explain findings.

Age is another demographic variable which been found to be important in studies on acceptance of driverless cars (Hohenberger et al., 2016). For example, Rödel et al. (2014) found that older participants were more likely to use driverless cars than younger people. A different outcome was observed by Payre et al. (2014) who noticed that as age increased the intention to use driverless cars decreased. The same finding was also noticed by Schoettle and Sivak (2014b), who found that younger customers were more likely to embrace driverless cars and have higher expectations of this technology than older customers. A plausible reason was that older customers have greater concerns than younger customers, such as, concerns about learning to use and trust in driverless cars (Bansal et al., 2016).These direct effects of age on acceptance of driverless cars indicate that this demographic variable might be a significant factor in explaining customers' attitudes and intention to use driverless cars.

Zmud et al. (2016) evaluated the importance of education as a factor in understanding consumer acceptance of automated vehicles, and found educational attainment was not associated with intent to use. However, the Eurobarometer survey on autonomous systems found that individuals spend 20 years or more in their studies are more likely to accept and use driverless cars than those who finished their education at the age of 15 or under (Eurobarometer, 2015). To some extent, this may be correlated with employment status as managers are most likely to embrace this new technology, while house persons the least likely (Eurobarometer, 2015). In the same vein, Kyriakidis et al. (2015) noticed that individuals with higher levels of education were more worried about data privacy, as they may realistically believe the threat of data misuse exists and is harmful for them. Another reason behind this finding is that individuals with low income may be more concerned with basic physiological and safety needs rather than consider 'higher-level' factors, such as privacy (Maslow, 1943). Thus, Kyriakidis et al. (2015) suggested that it would be worthwhile to consider the effect of education in understanding public opinion on driverless cars.

In addition, customers' driving experience related to customers' current mobility behaviour is viewed as the best predictor of future behaviour (Kyriakidis et al., 2015). Kyriakidis et al. (2015) noted that individuals who drive more would be prepared to pay more for driverless cars. A plausible explanation is that people who drive frequently and travelling more are more likely to appreciate cars, and thus are more likely to buy a driverless car. Moreover, Nordhoff et al. (2016) emphasized that individuals who have crash experiences are more likely to appreciate the enhanced safety benefits of driverless cars and pay for them.

To sum up, the research quoted above showed mixed findings and evidence to illustrate how socio-demographic variables influence acceptance of driverless cars. Therefore, it is critical to examine more closely these personal traits and socio-demographic variables to understand better the determinants of customers' intentions to use driverless cars, and to explain effectively the mechanisms which influence customer behavioural intention.

2.6 Chapter Summary

This chapter presents an overview of the literature across marketing, the status quo bias, habit, sociological and consumer psychology in the domain of technology acceptance, and gives a comprehensive picture of studies on acceptance of driverless cars. A series of cognition-based behavioural theories have been reviewed, including TRA, TPB, TAM, UTAUT, and CTAM, as well as the long-standing rationale behind them that is, belief-attitude-intention-behaviour. In addition, factors identified as important influences on technology acceptance in the context of driverless cars were categorised as three types. Enablers are made up of positive features of driverless cars from customers' point of view, including perceived travel efficiency, perceived helpfulness, perceived societal benefits, perceived enjoyment, along with user attitude toward driverless cars. User concerns about driverless cars are viewed as barriers to driverless cars' acceptance, including technological issues, hacking and privacy issues, laggard regulation and laws, and costs. Additionally, personal difference variables (i.e., personal innovativeness and incumbent system habit) and socio-demographic variables have been introduced. In summary, this chapter provides a framework for the researcher to conduct the subsequent interviews and create a conceptual model in quantitative study.

Chapter 3 Methodology

3.0 Overview of Chapter

This chapter delineates the philosophical assumptions behind this research and how these shaped the research methodology and method used in this thesis project. Mixed methods are used in this study, as the researcher chose pragmatism paradigm as the framework to guide the research process. In other words, both qualitative and qualitative methods are involved in this research.

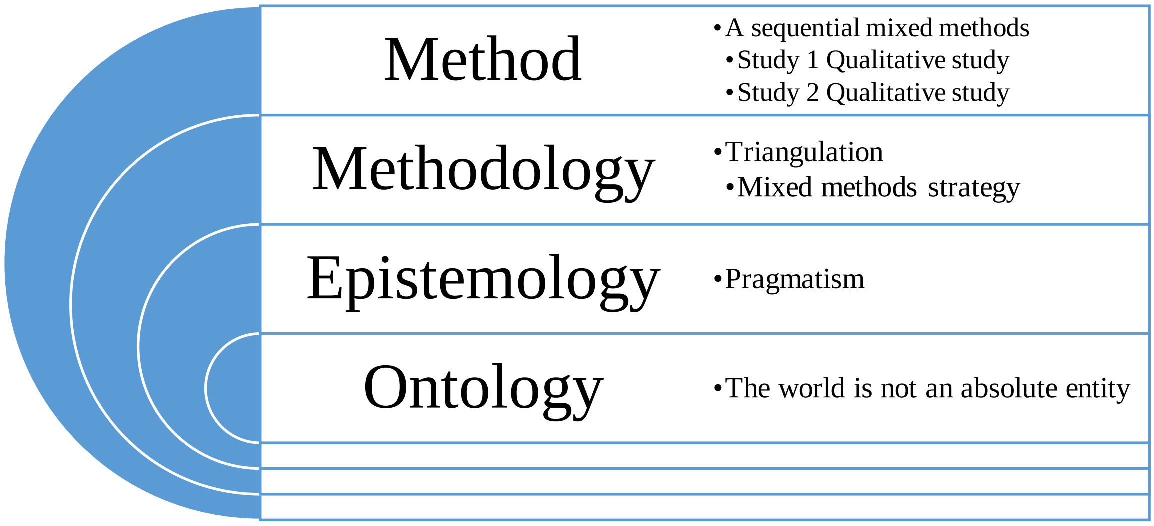
3.1 Overview of the Research Process

After answering the first question of what research issue this study wants to deal with, the next step is to think about the research strategy that will be used to guide the researcher in the appropriate direction to find answers. There are four elements that constitutes a research process and they inform one another, including ontology, epistemology, methodology, and methods (Crotty, 2009). The four elements are expanded into the four questions listed below:

- What method the researcher proposes to use?
- What methodology supports the chosen methods?
- What epistemology underlines the methodology?
- What ontology informs the epistemology?

A diagram depicts the research process of this study and presents philosophical assumptions from the inner circle (ontology) to the outside circle (methods), along with the chosen research design and the research methods (Figure 3.1)

Figure 3.1 Research Philosophy and Design



3.2 Research Philosophy

The appropriate way to clarify the philosophical assumptions of this research is to answer the above mentioned four questions in a logical order. Ontology, is the starting point to explaining philosophy, which is identified as the nature of reality and existence (Easterby-Smith et al., 2015). Next is epistemology which refers to a set of assumptions regarding ways of inquiring into the nature of the world (Easterby-Smith et al., 2015). The term methodology is used to describe a combination of techniques that provide specific direction for procedures in a research design (Creswell, 2014). Methods as the most visible and obvious features of a project; it involves the techniques of collecting data, analysing data, and interpretation, which depend on ontological, epistemological, and methodological assumptions and decisions in a logical order (Creswell, 2014). Table 3.1 shows four elements of universal philosophical assumptions that also represent four components of the research process.

Table 3.1 Four Elements of the Research Process

Four elements	Description	Representative sampling
Ontology	It is concerned with 'what is', with the nature of existence, with the structure of reality.	Realism, Idealism, etc.
Epistemology	A certain way that is used to understand the nature of reality.	Positivism, Interpretivism, Pragmatism, etc.
Methodology	The research design or strategy that shapes a researcher's choice and use of particular methods and links them to the desired outcomes.	Qualitative, Quantitative, Mixed methods, etc.
Methods	The concrete techniques or procedures a researcher plans to use for gathering, analysing, and interpreting data.	Questionnaire, Interview, Data collection, Data analysis, etc.

Resource: Crotty (2009)

3.2.1 Paradigm Perspectives

It is important to make explicit philosophical assumptions because that is the foundation of choosing appropriate research strategy and research methods to approach the research problem (Creswell, 2014). The terms of paradigms (Guba & Lincoln, 1994), worldviews (Creswell, 2014), ontologies and epistemologies (Crotty, 2009) are used by different philosophers to describe the same concept of general orientation about the world and the nature of research chosen by the researcher. In this research, the paradigm is used to describe the framework and helps to guide the researcher.

Normally speaking, positivism and interpretivism are two main paradigms as the extremities rest on the two sides of a continuum paradigm, with pragmatism resting in the middle (Collis & Hussey, 2009). Positivism is based on the principles of realism that provides a framework for the researcher to conduct a study in the research field of social science. Positivists believe that there is only one reality and it is independent of us (Collis & Hussey, 2009). Researchers who are conducting business research under a positivism paradigm focus on theories that explain social phenomenon through establishing cause-and-effect relationships between variables, and adhere to a deductive process to provide explanatory theories (Collis & Hussey, 2009). On the other side, interpretivism has its roots in the philosophy known as idealism that proposes social reality is in our mind and shaped by our perceptions (Collis & Hussey, 2009). Therefore, it is impossible to get rid of what is in the researcher's mind from what exists in the social world, in other words, the researcher's values, feelings and attitudes should be taken into consideration when interpreting the data (Hesse-Biber, 2010). Research underpinned by interpretivism should follow an inductive process through collecting qualitative data to describe and interpret the meaning of social phenomenon within a specific context.

Pragmatism is underpinned by the belief that the world is not an absolute unity, pragmatism is not committed to any one system of philosophy and reality. These assumptions about the world are important for the formation of mixed methods in social science and provide pluralistic approaches to generate knowledge from a research problem (Morgan, 2007; Patton, 1990; Tashakkori & Teddlie, 2010). In earlier research, Daft (1983) and Rossman and Wilson (1985) claimed that quantitative methods are not absolutely positivistic nor are qualitative ones necessarily phenomenologic. Therefore, it is possible to make the most efficient use of both methods in the same research to understand a social phenomenon. Additionally, pragmatists advocate researchers should be free to choose appropriate research methods that best meet their needs and purposes, implying both qualitative and quantitative approaches can be involved for collecting and analysing data to generate knowledge about the meaning of social phenomenon (Creswell, 2014). The differences between three types of paradigm perspectives are presented in Table 3.2.

Table 3.2 Comparison of Research Paradigms between Positivism, Pragmatism, and Interpretivism

	Positivism	**Pragmatism**	**Interpretivism**
Ontology: Nature of reality	Social reality is objective and is not affected by the act of investigating it There is only one reality and everyone has the same sense of reality	The world is not an absolute unity An external world independent of the mind as well as that lodged in the mind	Social reality is not objective but highly subjective because it is shaped by our perceptions There are multiple realities
Epistemology : What constitutes valid knowledge	The researcher and the investigated 'object' are assumed to be independent entities that can be measured through objective methods. Experimental science in search of relationship between variables	The only way the researcher can acquire knowledge is through the combination of action and reflection. Provide the best understanding of a research problem	Knowledge gathering and truth are always partial The researcher interacts with that being researched and its properties being inferred subjectively through sensation, reflection or intuition. Interpretive science in search of meaning
Methodology: The process of research	The researcher takes a deductive research The results are unbiased and value-free	Triangulation: combining methods in a single study Real-world practice oriented	The researcher takes an inductive research The findings are biased and value-laden

	Studies cause and effect, and uses a static design where categories are identified in advances Analysis through variables thus testing theories Results are accurate and reliable through validity and reliability		Studies the topic within its context and uses an emerging design where categories are identified during the process Analysis through cases thus building theories Findings are accurate and reliable through verification
Methods: techniques for data collection and analysis, etc.	Quantitative methods: Surveys Experiments	Mixed methods Sequential Concurrent	Qualitative methods: Narrative research Case study

Resources: Guba and Lincoln (1994); Corbetta (2003); Collis and Hussey (2009); Tashakkori and Teddlie (2010); Neuman (2014); Creswell (2014); Easterby-Smith et al. (2015).

3.2.2 Justification

In this research, the researcher follows pragmatists' ontology to view the world, thus, there is no strict gap between human being and reality (Collis & Hussey, 2009). In addition, the philosophical assumptions held by the researcher is shaped by the pragmatism paradigm, implying the approach used to acquire the knowledge of driverless cars acceptance can be done through a mixed-method and reflects a real-world practice orientation. As the researcher adopted a sequential mixed method to study driverless cars acceptance, the weakness of one method can be offset with the strengths of the other at the same time (Collis & Hussey, 2009). As other researchers previously mentioned there are still some unexplored variables which will influence customers' intention to use driverless cars that have not been covered by extant findings, therefore, the adoption of mixed methods will not only help the researcher to deeply understand customers' thoughts about driverless cars, it will also evaluate the influential power of each factor on customers' intention to use. Obviously, the focus point of this research is to answer the core question of what are the significant factors that influence customers' intention to use driverless cars rather than research methods, which is different with positivists and interpretivists (Creswell, 2014; Rossman & Wilson, 1985). Although the data generated from a mixed-methods is both in narrative and numerical form of information that will not raise particular problems, because text and numbers are only different forms of information or two modes of representation (Tashakkori & Teddlie, 2010). Furthermore, this hybrid and creative method can provide the most comprehensive answer to the research question through accomplishing the proposed research objectives (Grbich, 2013) described in section 1.3.

Therefore, the researcher conducts a qualitative study first with the aim to understand customers' perceptions toward driverless cars and if they would like to use driverless cars. Afterwards, a quantitative study is conducted to explore and evaluate the significant factors that influence customers' perceptions and their intention to use, and to what extent these factors impact on customers' acceptance. Thus, the combination of qualitative and quantitative studies in this research can provide a richer understanding of driverless cars acceptance.

3.3 Methodology and Methods

Methodology is viewed as a theoretical bridge that connects the research problem with the research method (Hesse-Biber, 2010). It is driven by certain ontological and epistemological assumptions and comprises of research questions and hypotheses, a conceptual approach to a topic, a method to collect and analyse the data (Grix, 2010).

Methods are identified as tools and concrete techniques for collecting and analysing data (Crotty, 2009; Hesse-Biber, 2010). The core spirt of research method is contextually linked to the proposed research questions and the sources of data (Grix, 2010). In this research, pragmatism paradigm is used as the philosophical underpinning which indicates a mix-methods approach can be used to answer the research question with combined qualitative and quantitative data.

3.3.1 Categories of Research Design

Research designs are defined as plans and the procedures of conducting research that are made of the decisions from broad assumptions to detailed methods of data collection and analysis (Creswell, 2014). There are three types of designs, namely qualitative, quantitative, and mixed methods. Qualitative and quantitative approaches are resident on different ends of a continuum, while mixed methods research posits in the middle (Creswell, 2014). Therefore, mixed methods research combines elements of both qualitative (using words) and quantitative (numerical numbers) approaches. In this research, a mixed-method is used which is decided by the proposed ontological and epistemological assumptions the researcher brings to the study, and the methods of data collection, analysis and interpretation (Creswell, 2014). This research begins with a qualitative approach to interviewing the participants in order to know their thoughts and tendencies to use driverless cars, followed by a quantitative method to collect large scale of samples via online survey with the purpose to test proposed hypotheses and the conceptual model. The following sections present detailed descriptions of three types of research design and their differences between each other.

3.3.1.1 Mixed Methods

The mixed-methods, and known as triangulation is verified as the combination of using both qualitative and quantitative data to study one particular question or set of questions (Hesse-Biber, 2010). The purpose of using mixed methods in a study is looking for a convergence of the collected qualitative and quantitative data in a study to enhance the credibility of the research findings (Hesse-Biber, 2010).

Triangulation is normally conducted by marketing researchers who employ a positivist orientation and use qualitative research to support quantitative study in a subsequent order (Bahl & Milne, 2007; Hesse-Biber, 2010). This sequential mixed-methods approach allows the researcher to enhance the accuracy of results by relying on data from more than one method (Rossman & Wilson, 1985). This is also viewed as a complementary strategy, because research findings from quantitative techniques are the most appropriate source for corroborating findings generated from qualitative methods; qualitative methods can provide detailed explanation and rich knowledge to service quantitative findings (Rossman & Wilson, 1985). In the same vein, Morse (2003) states that the popular type of mixed methods research design is formed via a qualitative component incorporating into a quantitative study with aims to assist the quantitative data in developing and satisfying the need for generalisation. In other words, within a mixed-methods design, the goal of the qualitative components is to assist the quantitative data in developing and exploring something new (Creswell, Shope, Plano Clark & Green, 2006), as well as serving to enhance the explanatory power and generalizability of quantitative data (Hesse-Biber, 2010).

In this research, using a mixed-methods approach to study driverless cars acceptance is appropriate as the weakness of one method can be offset with the strengths of the others simultaneously (Collis & Hussey, 2009). The utilization of both qualitative and quantitative research methods in this research, not only secure the validity of this study, but the complementarity of the two datasets can produce a more comprehensive explanation about users' intention to use driverless cars. In addition, an initial qualitative study can generate high volume of narrative data about how potential customers think about driverless cars and whether they would like to use them. This information would be used to develop a questionnaire and provide in-depth explanations for the findings generated from the following quantitative study that aims to specify the exact extent these significant factors impact on customers' acceptance of driverless cars. Another benefit from this sequential mixed-methods approach is that, the generated quantitative data can be useful for establishing generalizability of qualitative results. This is consistent with Bahl and Milne (2006) where tey noted that within marketing research most researchers employ a "positivist orientation", using qualitative research in a "supportive role" to assist quantitiave study. Meanwhile, uisng qualititative approach also illustrates the importance of mutilple subjective realities as an important source of knowldege buidling, especially for a new research topic (e.g., intention to use driverless car) this would be particular friutful. Thus, the interviews in Study 1 is essential and critical for the subsequent quantitiavtive study. Moreover, Hesse-Biber (2010) mentioned that using mixed methods is initiation that means findings generated from a study may raise questions or contradictions that will require clarification, thus it is necessary to conduct an complementary study. In other words, the qualitative component is primary and is used to generate specific theoretical constructs; while the quantitative component is used to test out ideas generated from the qualitative component (Hesse-Biber, 2010).

In sum, this sequential mixed-methods design allows the findings of the former study to apply into the latter one and generate richness and detail to explain customers' intention to use driverless cars. Other considerations are also taken into account, such as time and resources. Drawn upon above mentioned points, the adoption of a mixed-methods strategy in this research is unproblematic.

3.3.1.2 Quantitative Study and Qualitative Study

Quantitative research and qualitative research uses two fundamental clusters of research strategies to conduct business research, such as survey research, experimental research, case studies, grounded theory, narrative research and etc. (Bryman & Bell, 2015; Creswell, 2014). Qualitative research focuses on exploring and understanding the meaning individuals or groups ascribe to a social or human problem, researchers interact with that being researched, researchers acknowledge that research is value-laden and biases are present, qualitative data is generated (e.g. text and image), research is context bound, and findings are accurate and reliable through verification. This is, the finding of one study can be generalised to another similar setting; quantitative research refers to an approach to test theories through examining any causal relationships among variables, with relevant evidence from theories (Collis & Hussey, 2009). In addition, researchers are independent of that being researched, research is value-free and unbiased, quantitative data is generated (e.g. numerical data), research is context free, results are accurate and reliable via validity and reliability. The results can be generalised from the sample to the population (Collis & Hussey, 2009). However, both research strategies has its own limitations, so use of only one method to study a given research issue will generate biased and uncompleted results (Greene, Caracelli & Graham, 1989). For example, Crowther and Lancaster (2008) criticise that qualitative data tends to be more detailed and generates from a smaller size of database, thus a greater element of judgment is required in its analysis. It implies that there is a need for using different data or different analysis to provide corroborative evidence for the interpretations drawn from the qualitative data. Table 3.3 presented an overview of three research designs and their corresponded strategies of inquiry.

Table 3.3 Research Design and Strategies of Inquiry

	Qualitative Research	**Mixed Methods Research**	**Quantitative Research**
Definition	An approach to explore and understand the meaning individuals or groups ascribe to a social or human problem	An approach to investigate a phenomenon by using multiple sources of data, and different research methods	An approach to test theories by examining the relationship among variables
Philosophical standpoint	Constructivist knowledge claims	Pragmatic knowledge claims	Positivist knowledge claims
Research methodologies	Case study, narrative, grounded theory etc.	Sequential, concurrent, transformative	Surveys, experiments etc.
Research Methods	Qualitative methods • Open-ended questions • Interview data, observation data, document data, audio-visual data • Text or image data • Themes, patterns interpretation	Mixed methods • Both open- and closed-ended questions • Both emerging and predetermined approaches • Statistical and text analysis • Across databases interpretation	Quantitative methods • Closed-ended questions • Predetermined approaches • Attitude data, census data, observational data • Statistical analysis • Statistical interpretation

Resource: Creswell (2014) and Collis and Hussey (2009)

3.3.1.3 Comparison of Qualitative, Quantitative and Mixed Methods Designs

It is better to discuss strengths and weaknesses of qualitative and quantitative designs individually, and why both strategies may best be combined.

The strengths of qualitative design are summarized as few points. Qualitative methods provide natural ways to collect data less artificially; questions tend to be exploratory and open-ended that allow researchers to understand people's meaning, and to contribute to theory generation (Easterby-Smith et al., 2015; Grbich, 2013). Additionally, qualitative data provide a good way to detect latent and underlying issues as this type of information can reflect individuals' perceptions, assumptions, prejudgments toward a specific event or phenomenon (Miles, Huberman, Huberman & Huberman, 1994; Van Manen, 1977). Moreover, this approach allows the researcher to check the validity and relevance of data as it is collected (Crowther & Lancaster, 2008). On the flip side, the process of data collection is normally time-consuming; analysing and interpreting of data may be complex and depend on the researchers' skills and knowledge (Easterby-Smith et al., 2015).

Regarding quantitative design, the main strengths are that the research process is easy to be replicated and examined in different contexts; the phase of data collection and analysis can be time-saving and economical, and the generated results have high generalisability (Easterby-Smith et al., 2015). While, authors criticise that quantitative methods are inflexible and artificial; they are not good for process, meanings, or theory generation; the data collected through these methods may not all be relevant to real decisions (Easterby-Smith et al., 2015).

Mixed methods research provides a good option for researchers to overcome the weaknesses of both qualitative and quantitative research and combine the strengths of both. They create a compromised position by allowing two or more methods to investigate the same research problem from different perspectives, thus, biases and limitations of one method will be offset by another, thus the validity and reliability of inquiry findings is enhanced (Greene et al., 1989), the generalizability of results will be improved as well (Easterby-Smith et al., 2015). Notably, richer and in-depth information will be generated by using a mixed-methods to investigate a phenomenon. In addition, it is a trend and requirement for researchers to draw from many disciplinary methodologies and traditions in order to move toward interdisciplinary scholarship (Hesse-Biber, 2010). This method is also encouraged by some researchers in social sciences (Brewer & Hunter, 2006; Crowther & Lancaster, 2008; Grbich, 2013).

The Following points delineate how this research can benefit from a mixed-methods design in studying the degree of acceptance of driverless cars. Firstly, qualitative research emphasises the participants' perceptions and experience, which can help the researcher develop a good measurement of items for each construct, especially newly explored variables (Crowther & Lancaster, 2008). For example, in this study the measurement scale for incumbent system habit was based on the collected narrative data, which was then conveniently translated into a numerical dimension for the subsequent quantitative analysis. Secondly, quantitative studies usually focus heavily on detecting cause-and-effect relationships between variables. Details regarding individual experiences behind the statistics and the meaning of behavioural intention (in this case toward driverless cars) can only be understood through a qualitative study (Grbich, 2013; Tashakkori & Teddlie, 2010). In other words, narrative data collected from the participants is useful in providing supplementary information to validate and explain the numerical data from the statistical analysis (Hesse-Biber, 2010; Miles et al., 1994), which in this instance can be used to clarify the significant determinants of customers' intention to use driverless cars.

To sum up, in this research, the researcher positioned herself as a pragmatist with a pragmatic view, and chose triangulation as the methodological position. Therefore, the approaches to data collection, analysis and interpretation are consistent with the mixed-methods approach. In doing so, the researcher can use the relative strengths of individual methods to compensate for their particular limitations (Brewer & Hunter, 2006). While being precise as regards details, qualitative studies are weak in terms of generalisability, and quantitative studies are weak at explaining why the observed results have been obtained. A combination of the two means that certain elements of both methods can complement each other, and as a result ample and comprehensive knowledge can be attained for the researcher to explain the phenomenon under scrutiny.

Additionally, using a mixed-methods approach for this research is consistent with the proposed research objectives: to understand customers' perceptions of driverless cars and whether they would like to use such vehicles; to explore and evaluate the significant factors that influence customers' perceptions of and intention to use driverless cars, and the extent to which these factors impact on customers' acceptance of such vehicles. Tashakkori and Teddlie (2010) argued that 'understanding' aims to clarify the intentions and reasons behind certain actions, while 'explaining' seeks to find causes of events or, correlations between them. Therefore, and in order to stay consistent with the purposes of this research, using mixed methods is deemed an appropriate approach to meeting the research objectives. In addition, using a mixed-methods approach to study driverless cars acceptance meets the call made by Payre et al. (2014), Zmud et al. (2016), and Lang et al. (2016), namely that more research be done using this method.

Using qualitative interviews will enable the researcher to ask clarifying questions and make sure that accurate information is collected. This type of interviews will also provide an opportunity to discover the thoughts, perceptions, and behaviours of potential customers through their own words. In addition, the explored information can guide the researcher to design an appropriate questionnaire and create measurement scales for newly explored constructs, which is a good way to help the researcher understand each measurement scale deeper. The subsequent survey will allow the researcher to gather a relatively large amount of data in a short amount of time, and to examine and evaluate the significant factors behind the intention to use driverless cars where little data exists (Casley et al., 2013). Thereby, the verified determinants of intention to use will be more convincing (Crowther & Lancaster, 2008), and the generalisability of the proposed conceptual model will be improved as well (Greene et al., 1989).

3.4 Study 1-Interviews

An interview is identified as an approach to ask participants questions in order to find out what they do, think, and feel (Collis & Hussey, 2009). It is acknowledged as being one the most effective methods of collecting data in the social sciences (Crowther & Lancaster, 2008; Easterby-Smith et al., 2015). Interviews as one of questioning technique is a significant way of collecting data which can present depth and details (Crowther & Lancaster, 2008). The underlying assumption is that the researcher need to know what people think in order to understand why they behave in the ways that they do (Minichiello, Aroni & Hays, 1995). This approach provides the researcher much greater flexibility as it is a way of designing questions to suit different circumstances and allows various questions to be asked. For example, the researcher can ask the participants if they would like to use driverless cars or not and ask them to give reasons. No doubt it is a relatively quicker technique to collecting data as question can be designed and implemented in a short amount of time, allowing the researcher to check the validity and relevance of immediately collected data (Crowther & Lancaster, 2008). Different with focus groups method, which explicitly use group interaction to encourage people to talk to one another with aims to exploring people' s knowledge and experiences; while interview method allowed the researcher to ask each participant to respond to a question in turn then collect data (Kitzinger, 1995). Thus, focus groups method is suitable for researchers in the field of health and medicine as they do not discriminate against people who cannot read or write and they can encourage participants who are reluctant to be interviewed on their own or who feel they have nothing to say (Kitzinger, 1995). Also, focus groups are useful when there are power differences between the participants and decision-makers or professionals, and when one wants to explore the degree of consensus on a given topic (Morgan & Kreuger, 1993).

Nonetheless, the drawback of focus groups is that the articulation of group norms may silence individual voices of dissent (Kitzinger, 1995). This is because the way of focus groups research collecting respondents' attitudes, feelings, beliefs, experiences and reactions may be partially independent of a group or its social setting, thus sometimes it is difficult for the researcher to clearly identify an individual message (Gibbs,1997). Especially, the researcher has less control over the data produced than the interview as the researcher has to allow participants to talk to each other, tell their personal experiences, ask questions and express opinions, while having little control over the interaction (Gibbs,1997). Therefore, it is difficult for the researcher to ensure participants focused on the given topic during an entire meeting. In addition, using focus groups may discourage certain people from participating, for example those who are not trusting others with personal information. Unavoidably, focus groups are not fully confidential or anonymous (Gibbs,1997). From a practical point of view, getting people to group gathering can be difficult and time-consuming, especially if no immediate benefits or incentives for participants.

In this research, the purpose of conducting Study 1 is to obtain individual attitudes and perceptions towards driverless cars rather than collect data by focusing on a group context. Especially, the researcher would like to retain control over the interaction and make sure individual participant focused on the topic. Therefore, a semi-structured interview is conduced to ensure the content of interviews is central to understanding the participants' thoughts regarding driverless cars, also allowing them to express their perceptions in a natural way and in their own languages. In addition, a semi-structural interview is relatively flexible when needed and helpful in steering questions into areas that appear promising from the researcher's point of view (Crowther & Lancaster, 2008). Benefit from a semi-structural interview in which the researcher can use probing questions to encourage the interviewees to elaborate on previous answers or clarify vague and incomplete answers (Minichiello et al., 1995). By doing so, the researcher can guide the interviewees as well as give them more flexibility than the standard structured interview. Moreover, this approach of interviews can provide a more relaxed atmosphere in which participants may feel more comfortable having a conversation with the researcher. Thereby, the interviewees can express their opinions towards driverless cars freely and even answer questions not on the questionnaire. Based upon above discussions, the researcher adopts semi-structural interview method to conduct Study 1 rather than a focus group method.

Additionally, the participants described the most possible situations and scenarios, in which they would use driverless cars in relation to their current life situation. The information is specifically important for the implementation of driverless cars in current customer-oriented retail marketing. Thus, using a semi-structural interview to understand the public perceptions toward driverless cars can extract in-depth and detailed information behind their further behaviours.

3.4.1 Recording the Interview

Note-taking is one of the commonly used methods to record the interview. It allows the researcher to start analysis and interpretation earlier in the research, because the researcher can use their own version of shorthand to make notes (Minichiello et al., 1995). In other words, note-taking allows partial analysis to occur as well as letting the researcher pay more attention to what the interviewee is saying. Although this method may restrict non-verbal contact as the researcher focuses on taking notes rather than interacting naturally (Minichiello et al., 1995). In this research, the researcher recorded interviews by taking notes with extra attention to key words and sentences that are relevant to driverless cars and follow these as they develop in a conversation.

3.4.2 Qualitative Data Analysis

There are several broad alternative ways to analyse qualitative data, the prominent approaches include content analysis and grounded theory (Crowther & Lancaster, 2008).

3.4.2.1 Content Analysis

Content analysis is a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns (Hsieh & Shannon, 2005). Content analysis is a widely used and a flexible qualitative research technique that allows the researcher to test theoretical issues while enhancing understanding of the data and the phenomenon under study (Cavanagh, 1997). Basically, this approach works on the principle that the more frequent a particular topic is mentioned by the interviewee then the more important it is. In other words, it is an approach to quantify qualitative data by noting, for example, frequencies of events, words, and so on (Crowther & Lancaster, 2008).

By using this method, the researcher can rely on existing theories, or simply intuition to determine the units to be measured before the data is collected and amend them during the research if the initial unites and categories are not appropriate (Crowther & Lancaster, 2008). A key feature of content analysis is the distillation that means words or phrases can be classified in the same categories and share the same meaning (Cavanagh, 1997). However, the shortcoming of content analysis is that participants often use different words to express the same concept or same words for different concepts (Crowther & Lancaster, 2008) which may generate much fewer content categories, while some of them maybe presumed to have similar meanings (Weber, 1990).

Template Analysis

Template analysis is the first way of doing thematic analysis that allows the researcher to use hierarchical coding to analyse textual data with the flexibility to adopt it to a specific study (Brooks, McCluskey, Turley & King, 2015). In other words, the main purpose of conducting template analysis is to create a coding template on the basis of a subset of the data, which is then applied to further data, revised and refined in a flexible style and format (King, 2012).

This approach is suitable for various types of qualitative data collected from different channels, including interview transcripts (Lockett et al., 2012), textual data (Brooks, 2014), and open-ended question responses (Kent, 2000). In order to prepare interview data for analysis, transcription and preliminary data analysis are required. Transcription refers to getting the narrative off the devices on which the researcher used to record it and into a document, thereof, the researcher can add notes alongside the content of transcription (Grbich, 2013). Preliminary data analysis involves a process of checking and tracking the data in order to get a brief idea of what have been collected from interviews and identify areas that require follow up, which is an engagement process with the text (Grbich, 2013). During this process, the researchers can go over the data initially and list topics while grouping them (Ely, 1997). Thereafter, thematic analysis can be conducted to explore the content of the transcription of interviews as a process to define themes within the data and organise those themes into some type of structure for better interpretation (Brooks et al., 2015). By doing so, repeated words, phrases, or narratives can be imposed by the researcher derived from initial narrative data.

In this research, the researcher followed Brooks et al. (2015)'s four steps of template analysis to understand customers' thoughts regarding driverless cars. The procedures are described as below:

- To pre-identify some themes via highlighting the important words in text that can be helpful and relevant to driverless cars.
- The emerging themes can be organised into different clusters with an initial version of the coding template to be formed afterward.
- The initial template should be applied to further data and check if any new themes may be generated or modify the pre-formed themes.
- To finalise the core themes and sub-themes and make sure no extra information need to be coded.

3.4.2.2 Grounded Theory

Grounded theory is another approach to analysing qualitative data that is flexible according to the nature and purpose of the research project and the preference of the individual researcher (Glaser & Strauss, 2017). In grounded theory, the researcher collects the qualitative data and identified key themes, patterns, and categories from the data itself without predetermined external structure, implying the researcher's personal values and preconceptions will inevitably come through in the final results (Glaser & Strauss, 2017). In addition, theories or explanations developed by the researcher are derived from the phenomenon under investigation, which implies the derived theory may be limited in a particular context, that is, the generalizability of the findings is restricted. Therefore, this is not an effective approach to producing or proving general theories (Crowther & Lancaster, 2008). In addition, a grounded theory does not set out to test for an hypothesis (Glaser & Strauss, 2017). Meanwhile, grounded theory requires the researcher to accept the data itself and findings irrespective of what the research set out to find. Nonetheless, this approach can be extremely valuable for the researcher who is not certain about the nature of the research problem and the information required when dealing with various types of qualitative data. Additionally, grounded theory as an inductive approach to research can present a much more holistic view to analyse qualitative data, and often appropriate for organizational research (Glaser & Strauss, 2017). Because the researcher is required to accept the data itself even if the outcomes and findings contradict their initial hypothesis.

In this research, the researcher is interested in customers' perspectives toward driverless cars. Thus, the content of the interviews can be examined through quantifying qualitative data by noting frequencies of words, phrases and statements involved with driverless cars. This is viewed as a useful approach to convert the material into quantitative data, because the content analysis works on the principle that the more a topic is mentioned then more important it is considered to be (Crowther & Lancaster, 2008). The prior themes that may potentially influence driverless cars acceptance are defined by the researcher in advance which draw upon the extant literature in the study of technology acceptance across different contexts. Template analysis allows the researcher to develop ideas by consulting existing theories, extant studies in the similar research area, or simply intuition to define the priori themes before the analysis process (Crowther & Lancaster, 2008). Also, the initial defined categories can be refined and improved during the research. Conversely, the identified concepts and key themes generated via grounded theory are inevitably influenced by the researcher's preconceptions and personal values as the researcher assess the data with an open mind. Therefore, grounded theory is not adopted to analyse narrative data in this research.

Using template analysis implies that the researcher is flexible in designing the technique to deal with the data as this method is not bound to any epistemological and methodological assumptions (Crowther & Lancaster, 2008). Therefore, from the view of bottom-up, explored factors that influence users' intention to use driverless cars are perceived risks and benefits of this technology (Kohl et al., 2017), including rational factors (e.g. perceived usefulness and reliability), affective factors (e.g. driving pleasure and emotions), social influence, attitude towards using autonomous driving technology, personal characteristics (e.g. sense of control, sensation seeking, and technology awareness), and socio-demographic factors (e.g. age, gender, income and number of children) (Bansal et al., 2016; Bjørner, 2017; Buckley et al., 2018; Kyriakidis et al., 2015; Osswald et al., 2012; Payre et al., 2014). Thus, the researcher has some clues to map out an initial structure of core themes to study driverless cars acceptance.

By doing so, the researcher conducted the template analysis to sort the collected narrative data and generated the hierarchical coding structure with core themes and sub-themes to reflect customers' perspectives towards driverless cars and their intention to use. The finalised coding structure can be replicated by other researchers in future studies which enables the validity of findings to be assessed (Crowther & Lancaster, 2008).

After an iterative process of template analysis, the raw data were extracted into different categorises that also synergize with the prior defined themes to present customers' perspectives toward driverless cars. The finalised core themes and their potential impacts on intention to use are reflective of the mechanisms of belief-attitude-intention as well.

3.5 Study 2-Survey

Compared with the relative infancy of qualitative techniques of analysis, there are clear conventions the researcher can use to deal with quantitative data (Crowther & Lancaster, 2008). The following sections describe a clear procedure of collecting quantitative data for understanding the public perceptions and acceptance towards driverless cars.

The most commonly used method for collecting quantitative data in marketing research is the survey questionnaire. It aims to find out more about customers in different scenarios, including customer satisfaction with services or products, launching of new products, effectiveness of promotions etc. The findings can help the organization profile their customers and enhance target goods and services, customers' opinions on the introduction of new product can also be assessed (Crowther & Lancaster, 2008). From the methodological standpoint, the method for collecting data should be based upon the purpose of the study and coincide with the chosen ontological, epistemological and methodological assumptions that underpin the research (Collis & Hussey, 2009). In addition, the quantitative data generated from survey questionnaire can be used to explore the relationships between and among variables that also contribute to the examinations of proposed research hypotheses and the generalizability of the findings (Bryman & Bell, 2015). These are in line with the advantages of quantitative analysis which include increased objectivity in interpreting data, measures of validity and reliability and can be used to analyse large volume of data (Byrne, 2002). In terms of Study 2, the purpose is to explore and verify the potential relationships between variables through a series of statistical methods applied to the quantitative data, thereof, the final results can generalise from a sample to a population.

The layout and structure of the survey questionnaire are described as follows. A short statement is presented at the front of the questionnaire to explain what the research is about, how the results will be used, and whether or not the participants agree to join in this survey. In the main section, the closed questionnaire is presented in three parts following a logical order. It presents a convenient way for participants to answer, thereof, the results can be easily summarised and analysed (Crowther & Lancaster, 2008). Although closed-ended questionnaire design is criticised for being superficial as answers depends on anticipated responses (Crowther & Lancaster, 2008), the applied survey questionnaire is the synergy findings from the qualitative study with several pre-designed questions to explore and probe public perceptions and attitudes regarding the acceptance of driverless cars. The researcher has chosen a pragmatism paradigm as the philosophical guideline, thereof, triangulation is the methodological assumption behind this research that implies both qualitative and quantitative approaches can be used together to 'dig deeper' into the customers' acceptance of driverless cars. Thus, to design the survey questionnaire in the way described above is reasonable and suitable for studying the acceptance of driverless cars.

Web-based tools have been used broadly to disseminate questionnaires in order, to retrieve and analyse data. In other words, the researcher can view the preliminary results anytime and download the data file to EXCEL, SPSS and other formats that are easy to be analysed via software packages (Collis & Hussey, 2009). In addition, the questionnaire software (e.g. WJX.CN) have variety of features that can assist questionnaire construction, such as pre-designed layout, questionnaire appearance, preview, and personalisation. Thus, web-based survey is viewed as a time-saving, low cost, and easy to conduct approach. While, web-based survey is inevitable to limit the scale of general population as people who have difficulties accessing the Internet are excluded from the survey, and the results may be biased (Collis & Hussey, 2009). The advantages and disadvantages of a web-based survey design are summarized in Table 3.4 below.

Table 3.4 Advantages and Disadvantages of Using a Web-Based Survey

Advantages	Disadvantages
Low data collection costs and the speed of data collection (normally 10-20 days);	The quality of Web-based survey is hard to measure because the answering process is easy and cheap
Surveys can provide a lot of data quickly	Response rate is low
Allow researchers to reach a large audience; save time, and human and financial resources	limits the scale of general population, such as people who are unable to get access the Internet, the older people, or illiterate
	less effective for exploratory type research which requires more qualitative information

Table 3.4 Advantages and Disadvantages of Using a Web-Based Survey

Advantages	Disadvantages
The sample size and geographic distribution of the sample seldom effect on the cost of an Internet survey	Respondents can decide to break off and not finish the questionnaire
Allows flexible design and can use visual images and even audio or video	Must be carefully designed to be accessible and understandable to respondents
Easy for participants who are without technique training	Concerns regarding design complexity and flexibility
Offers great anonymity because no face-to-face interaction between respondents and interviewers	There is a self-selecting bias as those who return their questionnaire may have attitudes, attributes or motivations that are different from those who do not
Data can be downloaded and saved directly into analysis programs, such as SPSS or Excel, avoiding the cost of data entry and transcription errors	A response cannot be supplemented with other information The data normally shown in the form of tables, pie charts and statistics, with a loss of linkage to theories and issues

Resources: Easterby-Smith et al. (2015); Blair, Czaja, and Blair (2013); Neuman (2014); S. Kumar and Phrommathed (2005); William G. Zikumund (2013); Blaxter, Hughes, and Tigh (2010); Saunders, Lewis, and Thornhill (2016); Robson and McCartan (2016).

3.5.1 Sampling Frame

Sampling frame is defined as members of the population for the purpose of possible selection (Blair et al., 2013). It is vital for the subsequent selection of samples. This study concerns potential customers' perceptions and attitude toward driverless cars and intention to use it. At least, the respondents should be screened with respect to demographic characteristics, that is, age 18 or older. In addition, the respondents must have access to the Internet because the data will be conducted through online survey questionnaire.

Data collected from China is supported by three reasons. First, China has overtaken the United States as the world's biggest automobile market (Srivari, 2016). It is estimated that by 2020, automotive sales in China will hit 22 million units, China will be a larger market than the combined North America and Western Europe (Srivari, 2016). This big market attracted foreign direct investments and fostered lots of start-up companies to develop their autonomous driving technology and driverless cars. In addition, China's government actively pushes the rapid development of autonomous driving technology in recent years with the purpose to launch the smart city project by 2020 (Shephred, 2019). Thus, to collect samples from Chinese automotive market is meaningful. Second, the survey conducted by Continental (2013) reveal that 79% Chinese survey participants welcomed driverless cars, which was higher than the participants in other countries. Thus, it is essential to understand how Chinese customers think about driverless cars and their behavioural intention to use this advanced transport vehicle. Third, it is important to make sure respondents for the pre-test and for the substantive study are drawn from the same population. The participants who involved in the pre-test and pilot study are all from China, thus, it would be better to collect samples from China to investigate user acceptance of driverless cars in main studies. Thus, the participants come from China are appropriate for this research and be a part of the sampling frame.

3.5.2 Back-Translation Technique

The back-translation method has been widely used to improve translation equivalence especially in different linguistic and cultural contexts in the domain of marketing research (Craig & Douglas, 2005). It is critical to make sure verbal and nonverbal stimuli is translated properly and accurately in order to convenient respondents in their own language, especially when they do not understand the foreign language (Stening & Zhang, 2007). Especially since this process is vital for developing the measurement items in different cultures as the formed scale may not work exactly the same. Thus, both source and target questionnaire through successive iterations of translation and retranslation is necessary, which is a useful method to ensure the accuracy of the translation as well as improve participants' understanding of terminologies and measurement scales in their language context (Craig & Douglas, 2005).

Considering the survey questionnaire used in this study was originally designed in English, thus it should be translated into Chinese. Following the back-translation procedure, the questionnaire was translated from English into Chinese by the researcher and re-checked by three senior lecturers from China who are knowledgeable of marketing research and worked hard to make sure each sentence and word are clear enough; and then back-translated into English which is also rechecked by a native English speaker. Afterwards, the original version of the questionnaire is compared with the back-translated one to check for errors and the quality of the translation. This is consistent with suggestions from Craig and Douglas (2005). In addition, to ascertain the quality of the questionnaire, a small group of participants were involved in a pre-test study. All participants in the pre-test study all speak Chinese and English fluently, have oversea study experiences, and have some knowledge of business studies. Details are described in the section 3.7.4.

3.5.3 Survey Instrument Design

The first part of the questionnaire is about factual questions relating to previous experience with cars, including how often respondents had used cars, to what extant their cars have automated systems, if they had heard of self-driving cars before, what type of self-driving cars they would like to use, and their general attitude towards automated vehicles. Next, to examine whether the explored variables that generated from Study 1 can predict users' intention to use driverless cars, the researcher developed measures. The survey measurement for each construct either derived from previous studies in the literature of technology acceptance or self-designed scales based on the outputs of a series of interviews conducted with 13 participants regarding perceptions of, and attitude towards, driverless cars. Demographic questions were asked in the third part which is comprised of five questions, including gender, age, education, employment status, and monthly income.

3.5.5 The Seven-Point Likert Scale

A Likert scale is a prominent representative of summated rating scale that is widely used in survey research to give participants the ability to indicate whether they agree or disagree with a statement (Neuman, 2014). It is treated as an effective method to measure and reflect participants' attitudes toward an issue from different aspects and express those opinions through one overall indicator (Kumar & Phrommathed, 2005), albeit using a Likert scale may need more time for participants to complete a survey as they need to read all statements (Malhotra & Briks, 2007). A Likert scale does not measure attitude per se, while it allows researchers to see whether one observation is ranked too high or too low among whole observations (Collis & Hussey, 2009). Additionally, using a Likert scale can create a neat questionnaire that is easy for the respondents to answer. For researchers, this method is attractive due to its simplicity and ease of use, and convenient for the researcher to conduct further statistical analysis (Collis & Hussey, 2009).

The number of interval scales depends on how finely the extent of intensity of the attitude in question that researchers want to measure (Kumar & Phrommathed, 2005). Normally, each scale has five response categories, from “strongly disagree” to “strongly disagree” and the appropriate number of categories should be seven, plus or minus two (Malhotra & Briks, 2007). Neuman (2014) also suggests that it is better to adopt four to eight points on a categorical scale to ensure precision of the results. Zikmund and Babin (2010) posit that in marketing research, when interval scales containing five or more categories of response as interval, the assumption is appropriate, because the differences between the different levels will become smaller as more levels are adopted. It implies that the use of seven-point Likert scale should be better than five-point Likert scale and fewer categories. Also, Viswanathan, Sudman, and Johnson (2004) provide evidence that a seven-point Likert scale will lead to higher accuracy as it can provide a valid basis for making inferences regarding respondents’ decision-making process. Furthermore, offering a midpoint to respondents is critical as they should have the possibility of expressing neutrality or ambivalence which makes people more comfortable when giving their opinions (Nunnally & Bernstein, 2010; Weijters, Cabooter, & Schillewaert, 2010).

Accordingly, in line with previous studies in the literature of technology acceptance, Seven-Point Likert scale is commonly used to measure users’ attitudes and judgement cross contexts. For example, adoption of wireless Internet services (Lu et al., 2005), cross-product purchase intention in an IT brand extension context (Yue et al., 2018), drivers’ responses to partially automated vehicles (Buckley et al., 2018), and intention to use self-driving cars (Payre et al., 2014). Therefore, this study adopts the Seven-Point Likert scale.

In this research, the participants were asked to indicate their level of agreement/concern with corresponding statements using a rating scale of 1 to 7. In doing so, the seven-point Likert scale ranges from 1 (strongly disagree/not concern at all) to 7 (strongly agree/ strongly concern) are used to measure each statement in the questionnaire.

3.5.6 Pre-Testing and Pilot Study

3.5.6.1 Pre-Testing

Pretesting is defined as an approach to test the questionnaire on a small sample of respondents in order to improve the questionnaire by identifying and reducing potential problems (Malhotra & Briks, 2007). It is imperative to conduct a pre-test otherwise a questionnaire should not be used in the field survey, especially when data is collected by an self-administered questionnaire (Visser, 2000). In line with this, Hair, Black, Babin, and Anderson (2010) also mention that when measurement items are either developed for a study or borrowed from extant studies, some type of pretest should be done. In this process, various features of an survey questionnaire such as, question content, wording, sequence, form and layout, question difficulty, and instructions are all to be tested; and the quality of translated measurement scales will be examined with respect to linguistic differences; the feedbacks and comments will be collected from the respondents as they will critical for the enhancement of the questionnaire (Malhotra & Briks, 2007). No doubt, it is a vital process to allow respondents to verbalize their thoughts about the questionnaire from respondents' perspectives. Additionally, it also shows how long it takes to complete the questionnaire and allows a researcher to adjust the length of the questionnaire within a reasonable time (De Vaus, 2013). Blair et al. (2013) suggest that the appropriate way to conduct a pre-test is informally involving family, friends, colleagues, and so forth as the feedbacks can be achieved quickly. The suggested sample size for a pre-test varies from 15 to 30 participants (Malhotra & Briks, 2007).

3.5.6.2 The Pilot Study

It is critical to write a draft of the questionnaire and try this out as a pilot on a few people before administering it to the main study (Crowther & Lancaster, 2008). The purpose of conducting a pilot study is to examine completeness of responses, reliability, and construct validity before administering it in the principal study to test hypotheses (Karahanna, Straub, & Chervany, 1999). In addition, it provides a chance for the researcher to become familiar with potential problems of data collection, and ensure the researcher will be able to analyse the results in the way that the researcher want (Buckingham & Saunders, 2004). One thing that needs to be highlighted is that the matching of particular characteristics of the pilot and final sample, that is, demographic characteristics of the participants should be same as the participants in the main study (De Vaus, 2013).

More often than not, 100 to 200 participants could be a proper sample size to conduct a pilot study (Dillman, 2000), while somewhere between 75 and 100 respondents is also suggested (De Vaus, 2013). Therefore, the researcher collected 188 valid samples for the pilot study in this research.

3.5.6.3 Advantages of Pilot Study

- To identify how well the questions flow and whether it is necessary to move some of them around to improve features of a questionnaire, such as deleting less valuable questions that do not form a variable (Bryman & Bell, 2015). Also, it is a way to measure the reliability of the instructions and the time taken for completing a questionnaire (Bryman & Bell, 2015).
- To improve the reliability of the measurement scales and the scales' face validity, that is, to check if the questions shown on the survey make sense and the interpretation of each item by the researcher and the participants is the same (Neuman, 2014). The measurement criterion is calculated by Cronhach's alpha which is commonly used to test the internal reliability, the value should be above 0.80 (Alan Bryman, 2015; Hair et al., 2010). The outcomes of the analysis are shown in Table 3.7 below.
- To create a chance for the researcher to identity the most suitable approaches for data collection and analysis. It is a good opportunity to assess the appropriateness of the chosen research methodology, approach and strategy and therefore allow necessary reference for use in the substantive study (Bryman & Bell, 2015).

3.6 Sampling Methods

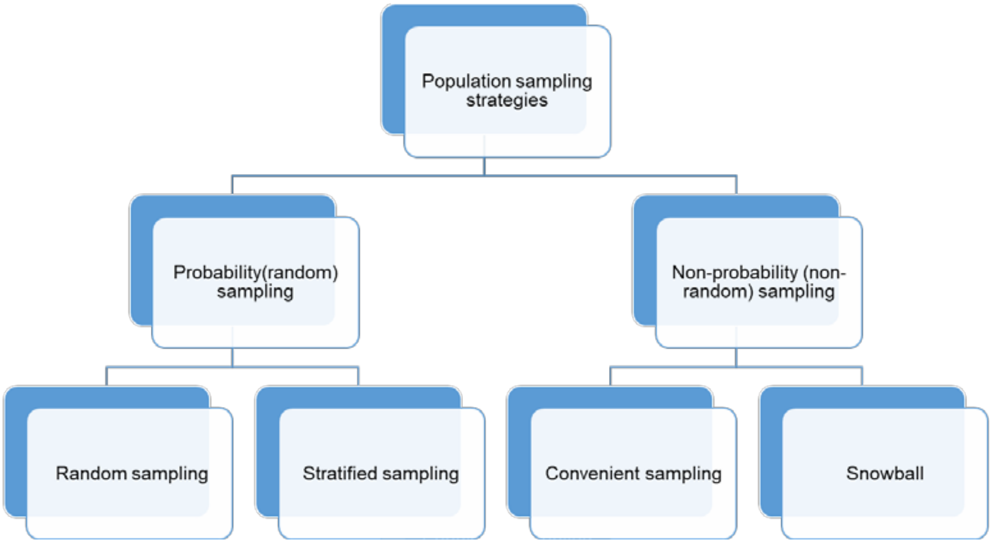
The population refers to the entire set of people the researcher intends to study (Minichiello et al., 1995). A sample is defined as a component of that population which is considered to be representative of it (Minichiello et al., 1995). Sampling is viewed as an effective process that allows the researcher to select a sample from the sample population in order to get information about a particular event (Kumar & Phrommathed, 2005). It is important to notice that selection of a sample in qualitative and quantitative research is totally different. In qualitative research, the purpose of sampling is to gain substantive knowledge either about a situation or event or about different perspectives of an individual on the assumption that he or she belongs to the group and hence will provide insight into the group; while, the purpose of sampling in quantitative research is to draw causalities based upon the collected data, which is the group from the which researcher selected the sample (Kumar, 2014). Thus, it requires the collected samples are unbiased. In this research, the data collection procedure is involved in qualitative and quantitative studies simultaneously. As the sampling methods are totally different in Study 1 and Study 2, thus the considerations in the selection of samples are distinctive.

3.6.1 Sampling in Quantitative Research

There are two types of sampling strategies, probability (random) sampling and non-probability (non-random) sampling, each of which can be categorised into different sampling methods (Bryman, 2015). Figure 3.2 depicted the types of sampling briefly.

Probability sampling technique is viewed as the most rigorous method to sampling because every unit in the universe under study has an equal chance to be selected. While, selecting samples by this method needs more precision, time, and effort (Neuman, 2014). Conversely, non-probability sampling technique adopts a random selection method that relies on the personal judgment of the researcher (Malhotra & Briks, 2007), in other words, this means estimating and guaranteeing the probability of units being included in the sample with a same chance to be selected (Bryman, 2015). Nonetheless, using non-probability sampling is easy, cheap and quick for the researcher to obtain samples. This approach may generate good estimates of the population characteristics (Malhotra & Briks, 2007).

Figure 3.2Types of Sampling



Source: Kumar and Phrommathed (2005)

3.6.1.1 Probability Sampling

Random sampling- a fundamental method of probability sampling. A researcher creates a sampling frame and uses a pure random process to select cases that implies each unit of the population has an equal probability to be selected (Bryman & Bell, 2015). Samples will be selected at the same time and independent with each other. Therefore, it provides a group that is representative of the population and can help the researcher to collect non-subjective biased data. While, the major disadvantage is that the researcher need to list every member of the population which is viewed as impossible (Minichiello et al., 1995). Therefore, the researcher must adhere to the criteria of probability sampling that requires the excess costs and time expenditure.

Stratified sampling-a researcher first identifies a set of mutually exclusive and exhaustive categories, divides the sampling frame by the categories, thereafter uses random selection to select cases from each category (Neuman, 2014). Thus, this method is highly based on the ability of the researcher. Nonetheless, this method can ensure the collected samples will be distributed in the same way as the population in terms of the stratifying criterion (Bryman & Bell, 2015). Under this situation, all the significant groups are proportionately represented and the exact representativeness of the sample is known. In many instances, the cost is prohibitive.

3.6.1.2 Non-Probability Sampling

Different with probability sampling strategies, non-probability sampling designs do not follow the theory of probability in the choice of elements from the sampling population (Kumar, 2014). The most commonly used non-probability sampling designs include convenience sampling, snowball sampling, judgemental or purposive sampling, which are used in both qualitative and quantitative research (Kumar, 2014).

Convenience sampling-a researcher selects anyone he or she happens to come across, thus, the primary criteria for selecting cases are easy to reach and convenient (Neuman, 2014). This is a time-saving and economical method among compared with other sampling approaches. Sampling units are accessible, easy to measure, and cooperative (Malhotra & Briks, 2007). However, convenience samples are unable to represent any definable population, thus this method is not appropriate for marketing research involving population inferences; but, it is recommended to adopt in exploratory research for generating insights or hypotheses and for pre-testing questionnaire or pilot-study (Malhotra & Briks, 2007).

Snowball sampling-as a process of selecting a sample using network (Kumar, 2014). A researcher selects an initial group of participants randomly, and subsequent participants are selected based on the referrals that leads to a snowballing effect (Malhotra & Briks, 2007). The major advantage of using snowball sampling is that it can increase the sample size while taking account of the desired characteristic in the population. Also, it is low costs and time saving. While, the collected samples may have similar demographic and psychologic characteristics that implies they are not representative of any definable population (Malhotra & Briks, 2007). Nonetheless, this non-random sampling is the ideal method to select samples and ensure the results can be generalised into the lager population (Neuman, 2014).

Judgemental or purposive sampling-based on the judgement of the researcher as to who can provide the best information to help the researcher achieve the objectives of the study. It is useful when the research aims to explain a phenomenon or develop something about which only a little is known (Kumar, 2014). This sampling method is commonly used in qualitative research.

3.6.2 Sampling in Qualitative Research

Normally, the predominate sampling methods in qualitative research are judgemental sampling and expert sampling, the only difference is that the sampling population consists of experts in the field of enquiry (Kumar, 2014). Regarding the sample size, these are some considerations can be considered in qualitative research, such as, the ease to approach the potential participants; the researcher's judgement that the person has extensive knowledge about the studied object (Kumar, 2014). Especially, the researcher do not need to decide the number of respondents in advance but continue to select additional cases until the number of samples reach the data saturation point then stop collecting additional information from other respondents (Kumar, 2014). Also, snowball and quota sampling can also be adopted in qualitative research without the predetermined sample size, albeit they are normally used in quantitative research (Kumar, 2014).

Drawn upon above statements and suggestions of probability and non-probability sampling methods, the researcher adopted non-probability sampling strategy to select samples in Study 1 and Study 2. As the main aim in qualitative enquiries is to explore diversity, thus sampling strategy and sample size do not play a critical role in the selection of a sample (Kumar, 2014). As all non-probability sampling designs can be used in qualitative research, the research chosen convenience sampling in Study 1 as it is primarily guided by the convenience to the researcher. That implies the involved participants are accessible easily and approval for undertaking the study. As there is no requirement to predetermine a sample size in qualitative studies, the researcher interviewed 13 participants and attained the saturation point. This is guided by the researcher's judgement as to when to stop collecting data.

For Study 2, considering the difficulties of reaching a sample frame as required for probability sampling, the longer time requirement, higher costs and other limitations, using non-probability sampling is appropriate. In addition, adopting a convenient sampling strategy in quantitative studies adheres to Creswell (2014) who mentioned that only a convenient sample is appropriate because the researcher must use naturally formed groups, such as, a classroom or volunteers. Furthermore, this sampling method is broadly used by extant studies in the literature of technology acceptance across different contexts. Table 3.5 shows some evidence to prove how common it is to use convenience sampling strategy in the study of car related technology acceptance.

Table 3.5 Empirical Studies using Non-Probability Sampling

Authors/Year	Research purpose	Contexts	Methodology Sampling method/ sample size	Approach	Tool
Osswald et al. (2011)	To investigate the pre-prototype user acceptance of the three different steering wheel modalities as well as a lab-based driving simulator study	N/A	Mixed methods ***Study 1:*** Non-probability sampling-Convenience sampling (N=301) ***Study 2:*** Non-probability sampling ***(****N=10)*	Online survey Lab-based driving simulator study	The questionnaire for TAM scales
Howard and Dai (2014)	To understand public perceptions toward driverless cars	California	Non-probability sampling-purposive sampling N=107	Online survey	A questionnaire and a video that helps participants understand how the driverless cars works
Rödel et al. (2014)	To investigate how user acceptance and user experience differ with regard to the degree of autonomy in cars	N/A	Non-probability sampling N=336	Online survey	A questionnaire and five driving scenarios

Table 3.5 Empirical Studies using Non-Probability Sampling

Authors/Year	Research purpose	Contexts	Methodology Sampling method/ sample size	Approach	Tool
Kyriakidis et al. (2015)	To investigate user acceptance, concerns, and willingness to buy partially, highly, and fully driverless cars	109 countries	Non-probability sampling N=5000	Online survey	A questionnaire
Zmud et al. (2016)	To understand consumer acceptance and travel behaviour impacts of automated vehicles	Austin, Texas	Non-probability sampling N=556	Online survey	A 35-question survey 5-point Likert scales
Hohenberger et al. (2016)	To investigate how and why do men and women differ in their willingness to use driverless cars	Germany	Non-probability sampling N=1603	Online survey	A questionnaire
Kyriakidis et al. (2017)	To identify commonalities and distinctive perspectives regarding human factors challenges in the development of driverless cars	N/A	Non-probability N=12	Interview	A 35-question survey
Tussyadiah et al. (2017)	To investigate the influence of attitude and trust in technology on intention to use self-driving taxi	The US	Non-probability sampling N=325	Online survey	20 Items in Computer Attitude Scale (CAS)

Table 3.5 Empirical Studies using Non-Probability Sampling

Authors/Year	Research purpose	Contexts	Methodology Sampling method/ sample size	Approach	Tool
Haboucha et al. (2017)	To understand who will use autonomous vehicles under various scenarios and to gain insight into these hesitations and how to overcome them	Israel, the U.S and Canada	Non-probability sampling- Convenience sampling N=721	Survey	Stated preference (SP) experiments and models
Madigan et al. (2016)	Using UTAUT to understand public acceptance of automated road transport systems	Greece	Non-probability sampling N=315	Survey	57 items questionnaire
Hulse, Xie, and Galea (2018)	To survey perceptions of driverless cars by focusing on the public who would interact with them	The UK	Non-probability sampling N=925	online survey	A questionnaire
Nordhoff et al. (2016)	To explain, predict and improve user acceptance of driverless podlike vehicles	Cross countries	Non-probability sampling	Survey	A questionnaire

3.7 Sample Size

Sample size represents the number of samples to be collected in the study. The determination of sample size in qualitative and quantitative research is distinctive.

3.7.1 Impacts on Qualitative Study

The main purpose of sampling in qualitative research is to gain in-depth knowledge about a phenomenon on the assumption that the individual is typical of the group and hence will provide insight into the group, thereof, sampling strategy and sample size do not play critical roles in the selection of a sample (Kumar, 2014). The way to decide sample size in qualitative research is subjective to some extent, because, there is no predetermined sample size applied on qualitative research, once the data reach a saturation point no more new information can be collected from other respondents (Kumar, 2014).

In terms of Study 1, a qualitative study has been conducted with the aim to collect information about consumers' perceptions and their intention to use driverless cars via in-depth interviews. In line with the guideline proposed by Kumar (2014), a judgemental sampling method was adopted as the researcher aims to select 'information-rich' respondents who have a higher education background rather than randomly choosing a sample. 13 participants were involved in the study who came from different age groups, with different gender, social status, driving experience, income, and education background. Substantial information about consumers' perceptions toward driverless cars were generated that allowed the researcher to abstract key themes or constructs to prepare the subsequent study.

3.7.2 Impacts on Quantitative Study

In quantitative research, it is imperative to set a predetermined sample size because it has direct influences on the statistical power of the significance testing and the generalizability of the results (Hair et al., 2010). Normally, the more diverse a population, the more precise is the statistical analysis, the more variables will be examined concurrently, thus the larger sample size is preferred, especially for the studies which are designed to test hypotheses or establish an association (Kumar, 2014). In order to ascertain the accuracy of the results in quantitative research, the following considerations are to be considered (Kumar, 2014; Malhotra & Briks, 2007).

- **The type of the research and the possible use of the findings-**large sample size is required for studies which are designed to test hypotheses or relationship among variables.
- **The number of variables -**large samples are required if there is a large number of variables within a study.
- **The sample size used in similar studies-**consult the number of samples used by previous studies in a similar research context. It can be treated as a rough guideline, especially when conducting a non-probability sampling strategy.
- **Completion rate and resource constraints-**the collected data need to be adjusted for the incidence of eligible respondents and the completion rate.

Especially, sample size has critical impact on proposed method of analysis. That is, the accuracy of results generated from multivariate analysis techniques will be influenced by sample size, which involves principle components analysis (PCA), exploratory factor analysis (EFA), and structural equation modelling (SEM) in this research. In details, Field (2013) and Hair et al. (2010) state that the reliability of factor analysis is dependent on sample size, the ratio of cases to variables is at least 10:1 or 15:1. Comrey and Lee (2013) also suggest that the comfortable size is at least 300. In addition, considering the requirement for SEM proposed by Tabachnick and Fidell (2014) whom mention 'collecting at least 300 cases for factor analysis, and just three or four indicators for each factor is a comfortable size'. Furthermore, Hair et al. (2010) claim Maximum Likelihood Estimation (MLE) is the most commonly used estimation technique along with SEM, however a sample size of greater than 400 cases will result in poor fitting goodness-of-fit measures. Hence, blindly collecting a large sample cannot guarantee precision.

Staying consistent with the literature review presented in the previous chapter regarding the study of consumer intention towards automated transport systems, 40 observations were involved in this research, meaning the minimum sample size for the quantitative study should be 400. The samples that attended the survey are 556, 493 samples contributable after the data screening test which is big enough for subsequent statistical analysis.

3.8 Method of Data Analysis

3.8.1 Structural Equation Modelling (SEM)

SEM is one of the statistical models that aims to explain the relationships among multiple variables (Hair et al., 2010). In other words, it allows the researcher to examine a series of multiple regression equations simultaneously. These equations present all of the relationships among constructs, that is, the dependent and independent variables involved in the analysis (Hair et al., 2010). Specifically, SEM is guided by theory over empirical results (Hair et al., 2010). Thus, SEM can help establish cause-and-effect relationship among variables then examine the extent to which the theoretical model is supported by sample data (Schumacker & Lomax, 2004). If good-of-fit is adequate, the proposed relationships between variables are accepted; if it is inadequate, the plausibility of postulated relations is rejected (Barbara, 2016).

SEM consists of two components, a measurement model and a structural model. The measurement model specifies to what extent a set of measured variables represent the latent construct they are designed to measure, whilst the structural model shows how constructs are associated with each other, often with multiple dependence relationships (Hair et al., 2010). Therefore, SEM is viewed as a unique combination of factor analysis and multiple regression analysis (Hair et al., 2010). There is no doubt that SEM analyses should be dictated first and foremost by a strong theoretical base in all instances (Hair et al., 2010). Amos as the proper program to test SEM model is acknowledged as it is simple and user-friendly (Schumacker & Lomax, 2004).

3.8.2 Advantages for Using SEM

SEM as an appropriate statistical model chosen by the researcher to examine the relationships between explored variables in this research. SEM has at least five desirable benefits over other statistical models (Hair et al., 2010; Schumacker & Lomax, 2004).

- SEM models and techniques can provide the researcher with a capability to analyse theoretical models in order to understand complex phenomena and allows less reliance on basic statistical methods.

- SEM techniques explicitly takes measurement error into account once statistically analysing data. SEM has the ability to incorporate latent variables into the analysis that provides multiple measures to represent a concept then reduces the measurement error of that concept. This can ensure the greater validity and reliability of observed measurement scales is recognized.
- SME provides a procedure to assess and correct measurement error. While traditional multivariate procedure is incapable of doing these at the same time
- SEM is a widely and easily applied method for modelling multivariate relations.

To sum up, using SEM techniques can allow the researcher to assess the contribution of each indicator variable in representing its associated construct and to what extent the combined set of indicators represents the construct. In addition, the proposed indicators for measuring a construct always has some measurement error, while SEM can automatically correct the amount of measurement error in the constructs (Hair et al., 2010). In this research, the constructs that are encompassed into the conceptual model are latent factors, which are hypothesized concepts and can be represented by observable or measurable variables (Hair et al., 2010). That is, the constructs have different facets and cannot be measured through one indicator. Therefore, all constructs are measured through at least three indicators, implying that the measurement error of theoretical constructs would be corrected via SEM. Therefore, SEM techniques allow the researcher to assess how sets of variables define constructs and how these constructs are related to each other with minimal measurement error. The role of theory is of critical important in SEM and viewed as a prior requirement for the specification of both the measurement and structural models (Hair et al., 2010). In other words, SEM is useful for testing and confirming theory. In this research, the proposed conceptual model is based upon the cognition-oriented theories and existing knowledge in the literature of technology acceptance.

3.8.3 Exploratory Factor Analysis (EFA)

EFA as one of the oldest statistical procedure is used to search for structure among a set of variables or as a data reduction method (Hair et al., 2010). This factor analysis is suitable for exploring the unknown or uncertain relations between the observed and latent variables. Therefore, how and to what extent the observed variables are linked to their underlying factors can be explored (Byrne, 2016). Specifically, in EFA analysis, all variables should be considered simultaneously without categorising them as dependent variables or independent variables (Hair et al., 2010). In addition, EFA is viewed as a useful procedure to conduct data reduction that not only retains the nature and character of the original variables by generating the most parsimonious set of variables, it also allows the researcher to justify the research, which attempts to replicate other's work (Hair et al., 2010).

In this research, it is critical to conduct EFA in factor analysis, because the researcher aims to identify the minimal number of factors that account for covariation among the observed variables. It is also viewed as an appropriate approach to develop a measurement scale for measuring a latent factor by examining the extent to which the item measurements are related to the latent factor. In addition, EFA can help the researcher further develop the conventional conceptual models through exploring new conceptual factors to explain new phenomena, as well as assessing the generalizability of others' works.

3.8.4 Reliability and Validity

Reliability is a measure of the degree to which a set of indicators of a latent construct is internally consistent in their measurements (Hair et al., 2010). Validity refers to an instrument's capability of measuring what it is designed to measure (Kumar & Phrommathed, 2005) or 'the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration' (Babbie, 1998). Reliability and validity are complementary concepts, the ideas used to analyse the social world will be poor without tests of reliability and validity (Neuman, 2014). The greater the degree of consistency and stability in an instrument, the greater its reliability (Kumar & Phrommathed, 2005). As reliability is inversely related to measurement error, a higher extent of reliability represents a greater relationship between a construct and its indicators, thereof, lower measurement errors will be generated (Hair et al., 2010). Individual items or indicators of the scale should be highly intercorrelated to make sure they are measuring the same construct, especially for psychological and social science research (Schmitt, 1996). Because in such conditions, one construct is normally measured by multi-items from different facets. Also, no single item is a perfect measure of a construct, therefore, using a series of diagnostic measure to assess internal consistency is necessary (Schmitt, 1996). Cronbach's alpha (α) is a widely used diagnostic index for measuring the reliability of measures. Normally, a value of 0.70 to 0.80 is an acceptable limit for Cronbach's alpha, value lower than this benchmark implies an unreliable scale (Hair et al., 2010; Straub, 1989). The examination of internal consistency for each individual construct is an compulsory step before moving to the subsequent phase for full measurement model and hypothesis-testing (Neuman, 2014).

Consulting the accepted scale of Cronbach's alpha adopted by previous studies of exploring predictors of consumer behavioural intention toward automated driving systems, for example, Madigan et al. (2016) decided to use 0.70 as the threshold for Cronbach's alpha in the study of acceptance of automated road transport systems. Adell (2010) adopted 0.70 as a benchmark of Cronbach's alpha to assess the internal consistency reliably of the summated scale variables in the study of driver support systems. Tussyadiah et al. (2017) accepted the results of alpha ranged from 0.77 to 0.95 by using 0.70 as the minimal accepted level to test measurement scales of attitudes toward self-driving taxis. As the rule of thumb, the researcher also adopted an alpha of 0.70 (Hair et al., 2010) as the minimal accepted level to test measurement scales of consumers' perceptions and intention to use driverless cars in this research. The results of reliability measurement shown in Table 4.23. All constructs presented acceptable values for Cronbach's Alpha within the range from 0.887 to 0.941 greater than the threshold of 0.70 (Hair et al., 2010) meaning the measurement items used in this research can adequately measure its targeted construct.

In terms of validity, construct validity test aims to evaluate how confident the created item measures taken from a sample represent the actual true score that exists in the population (Hair et al., 2010). It is difficult to establish a logical link between questions and objectives when the questions are related to intangible concepts (Kumar & Phrommathed, 2005), such as attitude toward a technology, perceived enjoyment, or perceived effectiveness gained from automated driving systems. In this research, adopted constructs are intangible and measured by several questions based upon extensive literature review and the findings collected from the interview study (Study 1), thus, the formed measurement scales have a capability to demonstrate different facets of the concept and ascertain the questions asked are actually measuring the targeted construct.

3.8.5 Estimation Method

Estimation method refers to a mathematical algorithm that will be used to identify estimates for each free parameter (Hair et al., 2010). The method of MLE is the most widely used approach that bounds with the SEM program (Hair et al., 2010). The advantage of using MLE is that this method is flexible to parameter estimation and ensure the best model fit could be found (Hair et al., 2010). In terms of model fit criteria, a set of goodness-of-fit (GOF) indices should be adopted, including Chi-square (x^2), Normed chi-square (x^2/df), goodness-of-fit (GFI), normed fit index (NFI), comparative fit index (CFI), Tucker-Lewis index (TLI), along with a group of badness-of-fit measures, root mean square error of approximation (RMSEA) and standardized root mean residual (SRMR) (Hair, 2010). In short, the above selected goodness/badness-of-fit indices adopted in this research are appropriate to indicate the model fit of proposed SEM model.

3.9 Ethical Issues

Before the researcher approached the participants, the researcher should receive formal ethics approval from the appropriate ethical committee. Because the consideration of the possible ethical issues is an important pre-requisite before collecting data from respondents, especially a study involving human participants (Collis & Hussey, 2009). Considering the objective of this study is to understand consumers' perceptions and behavioural intention towards driverless cars, the researcher conducted interviews first then a survey questionnaire to collect data based on a large sample. Ethical approval was granted by the Newcastle Business School Ethics Committee. Ethical considerations of this research fully adhered to Northumbria University's Research Ethics and Governance Handbook: https://www.northumbria.ac.uk/research/ethics-and-governance/-/media/corporate-website/documents/pdfs/research/ethics-in-research-policy-statement.ashx.

Voluntary participation is viewed as one of the most important principles to conduct a survey. In this research, all respondents were informed of the nature and objectives of the research, the right to withdraw at any point and skip any questions if they do not want to answer. Therefore, participants' voluntary right to attend this study can be confirmed. In addition, the issues of anonymity and confidentiality are another obvious and critical ethical concern in social research. Giving participants the opportunity to remain anonymous may contribute to a higher response rate, increased honesty, and ensure accuracy (Collis & Hussey, 2009; Easterby-Smith et al., 2015). Thus, respondents involved in Study 1 were assigned a coded number to substitute their name individually (M represents Male and F represents Female). In the survey questionnaire, participants were all kept anonymous with coded number only. Also, the collected data of this research are only used for academic purposes, so the information provided will not be traceable to the individual. In the meantime, all data was stored safely and securely with password protection on the researcher's laptop. Any hard copy versions of the survey questionnaire or collected data were locked in a personal cabinet (No. 14, 4th floor, CCE1, Newcastle Business School). Once the research has been done, hard copy record can be sent to the university's offsite storage facility or arrangements for the archiving of electronic materials will be made within the Business and Law Faculty.

Above mentioned critical information are listed in several forms that were required to be signed by participants individually before becoming involved in Study 1 and Study 2. In the consent form, the researcher explained the purpose of this research, the procedure that will take place, and the methods to protect participants' personal information and required respondents to agree to their participants through reading the informed consent form (Appendix B) for both studies and additional participants debrief form (Appendix C) for Study 2.

3.10 Chapter Summary

This chapter has delineated the whole process and rationale behind adopted pragmatism paradigm as the standpoint to design the research, the research strategy as triangulation through the combination of interviews and survey questionnaire. Appropriate justifications of these selected methods are presented for readership to understand assumptions and decisions underpinning this research. Using mixed methods would be the best approach for explaining user acceptance of driverless cars as this is a new phenomenon in the study of human-technology interactions. This strategy can help the researcher to deeply understand this phenomenon. Additionally, the techniques of collecting qualitative data and quantitative data, designing a questionnaire, conducting a pre-test study and a pilot study, selecting samples, and the procedure to conduct data analysis are all enclosed in this chapter.

Chapter 4 presents the findings generated from Study 1 and Study 2 individually.

Chapter 4 Data Analysis and Findings

4.0 Overview of Chapter

Given the need to focus on understanding potential customers' perceptions and behavioural intention toward driverless cars, the scope of this chapter is comprised of two parts, one is to understand potential customers' perceptions toward driverless cars via the interview study based on 13 participants. Another one is to understand the relationships between explored determinants via rigorous statistical approaches based on the proposed conceptual model in the context of driverless cars, thereof, a sample of 493 participated in the study. The two studies complement each other with the aim to explore the significant determinants of driverless cars acceptance, as well as explain the rationale behind customers' behavioural intention. The interviews study is conducted as Study 1 (section 4.1), following with a seamless quantitative survey in Study 2 (section 4.2). Detailed procedure of adopting a mix-methods are described in the subsections. A brief chapter summary is presented (section 4.3).

4.1 Study 1

The aims of Study 1 are two folds. First, to know potential customers' perceptions toward driverless cars and if they would like to use such vehicles by answering a series of pre-designed questions. Second, to sort the narrative information into different content categories that indicates similarities and distinctive perspectives among the interviewees, followed by the capsulized core themes and subthemes regarding the acceptance of driverless cars. This procedure is critically important as it not only offers detailed information regarding customers' perceptions towards driverless cars it also provides some clues for developing a questionnaire in the subsequent quantitative study.

The interviews were conducted following a semi-structured interview guide, by doing so the discussion remained flexible and open-ended which provide the researcher with elaborated perspectives to the topic of intention to use driverless cars. In addition, this allows the researcher to get a more in-depth understanding of the meaning interviewees attach to the questions. Considering the meaning of driverless cars focused on by this research is ambiguous, a short description of driverless cars was given to the interviewees. That is, a driverless car is a vehicle which can drive autonomously in the condition of fully automated mode without the intervention from the driver. It is able to master the speed, headways, braking, and manoeuvres of the vehicle and designed to be used by all kind of customers (Payre et al., 2014). The examples are Google's self-driving car and Tesla Auto Pilot that are viewed up to NHTSA's level 3 and level 4.

4.1.1 Participants

13 interviews were conducted with 7 males and 6 females from 8th December to 22th December in 2018, with their duration varying between 25 and 40 minutes. Interviewees aged between 22 and 55 years, and 8 out of 13 posited within the age range from 26 to 35. To make ensure diversity, 13 participants came from different social groups, including 3 students (23%), 6 employed staffs (46.2%), and 4 owner of private enterprisers (30.8%), shown in Table 4.1. Except for the 3 students, the rest of them worked in different fields, including transportation industry, banking, higher education institution, manufacture industry, and chemical industry. To ensure the participants remain anonymous, the capital letter M and F were used to represent gender (e.g., M1 is a first male participant and F2 is a second female participant).

Table 4.1Dempgraphic Information of Interviewees

Category	Variable	Frequency	Percentage (%)
Gender			
	Male	7	53.8%
	Female	6	46.2%
Age			
	18-25	2	15.4%
	26-35	8	61.5%
	36-45	2	15.4%
	46-55	1	7.7%
Heard of driverless cars before			
	Yes	10	77%
	No	3	23%
Current level of employment			
	Employed staff	6	46.2%
	Students	3	23.0%
	Owner of private enterprise	4	30.8%

4.1.2 Procedure

Four questions were presented to the participants by following the technique of laddering which allows the researcher to explore the participants' understanding of a particular issue regarding driverless cars. Laddering is described as a product of the repertory grid technique (Kelly, 1963), enabling a hierarchy of concepts to be established (Corbridge, Rugg, Major, Shadbolt & Burton, 1994) and widely used in the field of knowledge elicitation in psychology (Bannister & Fransella, 1986). Repertory grids are used to determine the individual's view of the world without explicitly questioning an individual about the structure per se (Bannister & Fransella, 1986). It can be used by researchers as a "technique" in its original form, that is, as an interview with a predefined structure (Bannister & Fransella, 1986). In the same vein, Gallup (1947) described laddering technique as a strategy that builds up opinion questioning by asking a series of questions from fundamental level to higher level. Therefore, the researcher arranged laddered questions in an order that starts with the least invasive questions and proceeds to the most invasive questions (Price, 2001).

Consistent with a convention that inquiries about action or behaviour ('have you heard of driverless cars?') are less invasive than questions about knowledge ('what made you do think that?') and that both are less invasive than questions about feelings, beliefs and values ('why you intention to use/reject to use driverless cars?'). This interview technique has been adopted by Payre et al. (2014) to evaluate if drivers have the intention to use driverless cars and generated fruitful findings. Thus, this research adheres to laddering technique with aims to collect enrich information about how customers think about driverless cars and their intention to use.

First, the participants were asked if they heard of driverless cars before. Second, the question asked their general thoughts about driverless cars. Third, the individuals were asked if they would like to use driverless cars once the vehicles are released in the mass market. If they answered YES, the fourth question would ask them to give reasons for this answer; If they answered NO, the participants would be required to tell reasons for rejecting driverless cars. By doing so, four questions are posed clearly and orderly that can make the respondent engage in the interview deeply and share more stories or experiences of their own (Price, 2001).

4.1.3 Results

To stay consistent, Brooks et al. (2015) suggest four steps of template analysis, an initial narrative was generated to describe the participants' main thoughts regarding driverless cars. First, the initial transcription of interviews was pre-identified by coding via highlighting the repeated words, phrases, or narratives that reflect their perceptions toward driverless cars (e.g. convenience, good for environment, safety concern, technological issues, regulations, policies, and insurance issue) (shown in Appendix D).

Second, the emerging themes were organised into different clusters based upon the frequency mentioned by the interviewees (e.g. hacking and privacy issues, limited conditions, increased productivity, fun and cool, convenience, and environment friendly) which was then applied to further data to examine if new themes were generated (shown in Table 4.2). Third, the pre-designed themes were modified to make sure themes can cover the information within new data. Forth, the hierarchical coding structure was formed with six core themes, including potential concerns, emotional response, travel efficiency, societal benefits, helpfulness, and individual characteristics, along with corresponding sub-themes.

Table 4.2 Generating Initial Codes

Sub-themes	Mentioned times	Core Themes
Safety concern Technological issue Software systems Limited conditions Costs Insurance fee Liability issue Regulations and policies Deterioration of driving skill Hacking and privacy issue	7 6 4 6 3 1 2 4 2 3	**Barriers** • **Safety concern** limited in certain conditions (e,g. weather conditions and complex urban environment) • **Technological issue** Software systems (e.g. performance of navigation system) Immature of underlying technologies • **Expenses of driverless cars** high price of a car and high insurance cost • **Regulation and policies issues** Ambiguous liability and responsibility • **Hacking and privacy issue** • **Deterioration of driving skills**
Comfortable experience Relax No interrupt Safer Cool and fun Reduced driving pressure Private space Increased productivity Saving time Convenience Do other things while driving Environmental friendliness Reduced traffic emission/congestion Reduced parking problem New road transportation planning Increased access to mobility (younger, elder, and disabled people; impaired driving; inexperienced drivers, people without driving licenses) Not interested in technology Control feeling Enjoy driving Interest in new technology Open-mind	4 2 1 1 1 2 1 3 3 3 3 3 3 3 1 6 1 2 2 1	**Enablers** • **Enjoyment** Comfortable Relax/reduced driving pressure Cool and fun Safer (described feeling) • **Travel efficiency** Convenience Increased productivity Time saving Do other things while driving • **Societal benefits** Environmental friendliness (e.g. reduced traffic emission, saved more energy and fuel) Mitigate traffic congestion Reduce parking problem New road transportation planning • **Helpfulness** Enhanced mobility for customers from different groups (e.g. younger, elder, disabled, and without driving licences) Impaired driving • **Individual difference variables** Personal innovativeness (anti-technology/interest in technology; conservative) Incumbent system habit

Table 4.2 Generating Initial Codes

Sub-themes	Mentioned times	Core Themes
Do not trust own driving skills	1 1	(control feeling/lower confidence in driving/enjoy driving)

By doing so, the key themes can be split into enablers and barriers of acceptance of driverless cars. Detailed explanations of each themes are presented in the following section.

4.1.3.1 Enablers

Interviewees described lots of benefits of driverless cars that were condensed into four core themes, including enjoyment, travel efficiency, helpfulness, and societal benefits.

Perceived enjoyment

Many interviewees expressed they would have comfortable experiences if riding in driverless cars (identified by 31%), feelings of relaxation (identified by 15%), reduced driver pressure (identified by 15%), cool and fun (7%). Interviewees often simply described, "*…smoother speed adjustment and a comfortable experience*" (M2), "*Those sounds pretty cool and fun.*" (M7), "*… the driverless cars would bring more comfort and convenient experience to users*." (M1). This is consistent with Buckley et al. (2018) mentioned customers' emotional reactions to driverless cars. In addition, it has been noticed that a number of psychological variables pertinent to driver automation, while perceived driving pleasure as a complex term involves aesthetic, emotional, and sensory responses to driving which varies among different levels of self-driving automation (Bjørner, 2017). Regarding the different level of automation adopted by vehicles, the different types of emotive outcome will be generated. That is, user could enjoy 'hands off' that corresponds to level 2, then 'eyes off' (level 3), 'mind off' (level 4) and 'wheel optional' (level 5) (Daniel, 2017), the optimal target is no human intervention to be required and entirely free of drivers. Especially, the simulated automated driving test revealed that the highest driving pleasure from riding in driverless cars were relaxed themselves, feeling enjoyment and safe (Buckley et al., 2018), or within certain scenarios, including parking and traffic jam situations in the city (Bjørner, 2017).

Perceived travel efficiency

Majority of participants (23%) mentioned that use of driverless cars could increase productivity, saving lots of time on the road, and have more transportation options, "*I will have lots of transportation methods to choose, such as riding a bike, walking, driving, or using a driverless car which all depend on my mood and my outdoor purpose.*" (M6), or "*Driverless cars could make our day more productive, potentially saving travel time….*" (M1). Also, they would have more spare time to do other things while riding in a driverless car (23%), including take a break, chat with friends on WeChat, take care of kids in the back seat, read a magazine, reply to mail, or working on laptop. For example, "*I will be free to do other things while riding, for example, taking a nap, especially during the mid-day because I'm used to taking a nap at certain times*." (M6), or "*I can take care of my kid during the journey rather than split my attentions to drive a car, or I can read a magazine, text my friends, reply to a mail or do other things.*" (F3), or "*I think riding in a driverless car can also allow people to conduct business, for example, a team can arrange a business meeting in the car while the car drives itself to their destination. It can save everyone's time and makes work more efficient.*" (F5).

Perceived helpfulness

Interviewees also mentioned the expected benefits of increased mobility (identified by 63%) for children, the elderly, disabled people, inexperienced drivers, and individuals without driving licenses. In addition, the participants mentioned that driving while affected by alcohol, drugs, or medical conditions would be appropriate situations in which to use driverless cars. Because these could affect driving abilities. For example, "*I feel like it would be very beneficial for the older generation who are over 70 years old and not permitted to drive a car anymore, driverless cars can take them to anywhere without bothering someone else. Also, individuals who are interested in impaired driving (drunk, taking medication, or feeling tired) could benefit from driverless cars*." (M1). "*Especially useful to reduce the phenomenon of drunk driving. Also, it can help customers who are do not have driving licenses or inexperienced to drive by themselves*." (M7). One female participant declared that driverless cars would be appreciated by female customers as embedded autonomous systems can relieve their nervous and parking frustrations. For example, "*I think driverless cars would be more popular among female customers as it can enhance their mobility and help them to drive easier and safer. As I know various driver assistance systems are already* *available in the market, like autonomous valet parking system that can help drivers to park cars into smaller parking spaces and reduce their parking frustrations.*" (F5). Indeed, another female interviewee expressed her opinion, "*I think driverless cars will become to the best option for female customers or female drivers. In my opinion, driving a car on the road is not hard, parking is the hardest task to me.*" (F2).

Perceived societal benefits

The participants mentioned various societal benefits of implementing driverless cars as such vehicles are environment-friendly, reduce the amount of traffic emissions (23%), reduce parking problems (23%), decrease traffic congestion (23%), also create a new transportation ecosystem. For example, "*driverless cars good for environment, reduce the carbon footprint to some extent.*"(M1), "*I believe that would reduce the amount of car emission, save resources, mitigate traffic congestion, reduce the needs of parking space in urban areas, freeing scarce land for other purposes, such as expanding landscaping, public areas and social uses."*(F2). Meanwhile, the interviewee believed that the public's awareness of social responsibility was gradually increased, "*I think people's awareness of social responsibilities (e.g. protect environment) are facilitated than before, also the government encourage citizens to use environment-friendly products, such as, electric motor car, and provide preferential policies to users. The similar subsidies may be launched by the government again to facilitate the implementation of driverless cars and achieve good societal results.*" (F2).

4.1.3.2 Barriers

The participants also expressed their concerns regarding driverless cars or riding in such vehicles. Majority of them prefer to wait for this new technology to spread and become affordable. This is congruency with Kyriakidis et al. (2017) state that the implementation of driverless cars in the mass market is tough as there lots of barriers prohibit customers' interest in driverless cars.

The most frequent reasons cited by participants for being unlikely to use driverless cars were safety issues (identified by 54% of participants) especially relevant to solutions for different types of situations and weather conditions (e.g., extreme weather and road change), and technological issues "*Probably the underlying technology is still in its infancy and need more time to develop. Also, if the software* *system of the driverless car got some problems, and I wasn't aware of it when I am riding in the car, I cannot imagine the result....*" (F1). "*the autonomous driving technology is still in its infancy. Lots of works need to be done to resolve technological issues, such as accurately distinguishing obstacles*" (M4). Another one described, "*I may not trust its navigation system because such autonomous driving technology requires high-quality specialised maps to support. However, as far as I know, these maps are not available yet. Also, artificial intelligence (AI) still need some time to improve its accuracy and self-learning capability. These should be technological obstacles for the widespread use of driverless cars.*" (M1).

The participants considered regulations and policies regarding driverless cars (31%) as well as liability issue (15%). For example, "*if traffic police closed the road, how to notify an autonomous car in advance? Another concern is about liability if an autonomous car is involved in a traffic accident, who should take the responsibility in this case? The regulations for autonomous cars are still blank.*" (F3). One male described that "*the liability issue and drivers' responsibility in traffic accidents will be a problem, I don't know when the government will release new regulations and laws to clarify these disputes.*" (M1).

The participants are also concerned about hacking and privacy (23%). For example, "*autonomous cars controlled by computer systems, imply a potential threat from hacking. If the driving system got a virus or shut down while driving, or is targeted by terrorism, what should I do?*" (M5). Also, interviewees worried about being tracking by somebody via GPS or other advanced information systems embedded in the car. In addition, one participant mentioned the disclosure of private information but more concerned cars' systems attacked by hackers, "*it is hard to say if our privacy data and personal information will be protected by automobile companies or mobile carriers. If they get access to my data and use it for other purposes, how would I know that?... um, I don't think using driverless cars will encounter serious privacy issues if compared with a concern about hacking. Because that will break down the autonomous driving systems and endanger my life. That's what I am really concerned about*" (M5). This is congruency with Buckley et al. (2018)'s finding that hacking was correlated with the global measure of trust and creates a level of uncertainty.

The consideration of costs of a driverless car was mentioned by 23% of participants, they fear the price of a driverless car would be too high as well as other expenses relevant to car driving, such as insurance fee. For example, "*Well, price of a driverless car is another factor I am concerned about. The car would be so expensive when it is first released on the automobile market and probably targets only rich people…umm, car insurance may also increase.*" (M1). One female described *"If the price of driverless cars is quite high, well, I am definitely not going to use it. If the price drops down and is widely used by others, I may consider buying one and chose a popular brand, the one that has a good reputation."* (F6). The participant also expected there will some subsidises for users of driverless cars, which will probably be similar to the strategy applied for the deployment of electric vehicles.

Interestingly, concerns about deterioration of driving skills were mentioned by 23% of participants while there were mixed thoughts. Two participants expressed their concern about deterioration of driving skills if engaged in driverless cars for a while. For example, *"I think users may highly rely on driverless cars gradually and forgot how to drive cars."* (F5), and *"I'm concerned about the deterioration of peoples' driving skills. It's not a good thing that people highly reply on driverless cars.*" (M1). with the evidence has revealed that if drivers use automation systems for a long period of time, their reaction times could increase, and sensitivity could decrease (Körber & Bengler, 2014). This could be a signal of that drivers' abilities to stay attentive in driverless cars could decrease if compared with how they performed in the condition of manual driving. On the other side, one participant thought driverless cars could relieve driving pressure especially parking in tiny spaces as she is not confident in her driving skill.

4.1.3.3 Personal Characteristics

Interviewees who mentioned that they prefer to drive or used to drive were less receptive of driverless cars than others. For example, "*…but I enjoy driving. I especially enjoy the feeling of control, no matter how popular driverless cars may become in the automobile market…I still prefer manual driving.*" (M2). "*I prefer to wait for a while rather than to be a first person to try driverless cars…I still prefer to drive a car by myself even the car have some autonomous features, for example, adaptive cruise control and lane keeping system." (F4).* "*I have so many years driving* *experience so far, if I were allowed to sit in the 'driver' position but did not have an authority to control the car... that makes me uncomfortable and distressed…I am care about the feeling of control, the car's safety equipment and safety systems when I decided to buy a new car… although use of a driverless car is a good idea but I don't think I would like it.*" (M3). One participant mentioned that she has got a driving license but still not confident in her driving skills, thus, the use of driverless cars could be a good alternative transport method. Thus, it is likely that those who have a less incumbent system habit may be more inclined to use a newly introduced vehicle (i.e., driverless cars) and vice versa.

On the other hand, one participant did mention that people have more open minds to embrace new technology and likely to use driverless cars especially for the younger generations. For example, *"I think people have more open minds toward new technology than few years before, and willing to try new things, especially the younger generations.*" (F2)

Interviews also provided different scenarios when people will be willing to adopt, such as in a closed geofenced area (campus, airport, theme park), an automated car with or without steering wheel, brake pedal, and gas pedal/accelerator, driverless cars with or with driver chaperone. The abstract of themes and corresponding example quotes from different interviewees are presented in Table 4.3.

Table 4.3 Summary of Themes and Example Quotes from Interviews

Themes and sub-themes	**Example quotes**
Travel efficiency Various transportation methods; convenience; time saving; increased productivity; do other things while driving	• I think using a driverless car for daily commute would be a good idea as it could save lots of time. Assuming some special roads will be designed for driverless cars, implying an upscale road infrastructure is coming soon (M6) • I will have lots of transportation methods to choose, such as riding a bike, walking, driving, or using a driverless car which all depend on my mood and my outdoor purpose (M6) • It would be super easy to go anywhere by using a driverless car as I just need to provide destination or navigation information to the system then can relax in my seat (M5)

Table 4.3 Summary of Themes and Example Quotes from Interviews

Themes and sub-themes	**Example quotes**
	• If I am riding in a driverless car, well, I can play my phone, watch a show online and do whatever I want. Also, it is so convenient for me to go anywhere by simply inputting the destination details in the navigation system (F1) • I can take care of my kid during the journey rather than split my attentions to drive a car, or I can read a magazine, text my friends, reply to a mail or do other things (F3) • I think riding in a driverless car can also allow people to conduct business, for example, a team can arrange a business meeting in the car while the car drives itself to their destination. It can save everyone's time and makes work more efficient (F5)
Helpfulness Enhanced mobility for customers from different groups (e.g. elder, disabled, and without driving licences); Impaired driving	• I feel like it would be very beneficial for the older generation who are over 70 years old and not permitted to drive a car anymore, driverless cars can take them to anywhere without bothering someone else. Also, individuals who are interested in impaired driving (drunk, taking medication, or feeling tired) could benefit from driverless cars (M1) • People don't need to attend the driving test anymore…or maybe there is another kind of driving licence that need to be obtained before we could use driverless cars, but it would be much easier to pass. As you know, passing the driving test is a hard challenge and attending driving lessons is tough and time-consuming (M5) • I will buy a driverless car if it available on the mass market now. Because I do not trust my own driving skill even though I have passed the driving test and got a driving license, I lack driving experiences. Um, such cars would be very beneficial if the traffic is bad or the parking area is too tiny, these are big challenges for me. If I could have a driverless car in the near future, it would be a dream come true and relieve my driving pressure as I am always nervous when driving (F3) • I think driverless cars will become to the best option for female customers or female drivers. In my opinion, driving a car on the road is not hard, parking is the hardest task to me (F2)

Table 4.3 Summary of Themes and Example Quotes from Interviews

Themes and sub-themes	**Example quotes**
	• I think driverless cars would be more popular among female customers as it can enhance their mobility and help them to drive easier and safer. As I know various driver assistance systems are already available in the market, like autonomous valet parking system that can help drivers to park cars into smaller parking spaces and reduce their parking frustrations. Did you notice that Cadillac Super Cruise TM and Audi advanced car all use female super models as their spokesperson? See, their potential targeted customers are female (F5) • The elderly and disabled people can benefit from autonomous cars as that can drive them go anywhere, very comfortable and convenient (F6)
Emotional response Comfortable; Relax/reduced driving pressure; Cool and fun; Safer (described feeling); Private space	• The driving condition would be quiet, comfortable, and smooth (F3) • I will have more time to do other things, such as reading a book, taking a nap, or just relax. Also, I don't like small talk with drivers, I think lots of people have the same feeling like me, right? So using driverless cars would allow me to have a private space. Also, in this autonomous mode, I don't need to monitor the roadway (F6) • It sounds cool (M5) • I think driverless cars should be user-friendly, no driving pressure, and allow the drivers to chat with friends, replying emails etc. Those are sounds pretty cool and fun (M7)
Societal benefits Environmental friendliness; Reduced traffic emission; Mitigate traffic congestion; Reduced parking problem; New road transportation planning; develop transportation system	• Driverless cars could make our day more productive, potentially saving travel time, good for environment, reduce the carbon footprint to some extent…It would save parking areas and free some public spaces (M1) • Assuming some special roads will be designed for driverless cars, implying an upscale road infrastructure is coming soon. By doing so, traffic congestion will be reduced (M6) • Especially useful to reduce the phenomenon of drunk driving (M7) • I believe that would reduce the amount of car emission, save resources, mitigate traffic congestion, reduce the needs of parking

Table 4.3 Summary of Themes and Example Quotes from Interviews

Themes and sub-themes	**Example quotes**
	space in urban areas, freeing scarce land for other purposes, such as expanding landscaping, public areas and social uses (F2)
Barriers/Concerns **Safety concern** limited in certain conditions (e,g., weather conditions, complex urban environment) **Technological issue** (e.g. performance of navigation system) **Expenses of driverless cars** **Laggard regulations and policies** **Hacking and privacy issue** **Deterioration of driving skills**	• Such autonomous driving technology requires high-quality specialised maps to support. However, as far as I know, these maps are not available yet. Also, artificial intelligence (AI) still need some time to improve its accuracy and self-learning capability. These should be technological obstacles for the widespread use of driverless cars (M1) • The autonomous driving technology is unreliable, especially in unforeseeable conditions (M3) • Price of a driverless car is another factor I am concerned about. The car would be so expensive when it is first released on the automobile market and probably targets only rich people…umm, car insurance may also increase. Also, the liability issue and drivers' responsibility in traffic accidents will be a problem, I don't know when the government will release new regulations and laws to clarify these disputes. I am also concerned about the deterioration of my driving skill. It's not a good thing that people highly reply on driverless cars (M1) • I am quite concerned about the safety, so I would like to wait for a while and see the reviews and comments from customers who are technology savvy and have tried an autonomous car. Also, I will consider the price of autonomous cars, if it is too expensive and out of my budget by a lot, then I will not consider to buy one (F2) • I am also concerned about safety. Imagine that driverless cars and normal vehicles using one driveway on highways or city roads, no one can guarantee driverless cars will always perform very well and perfect. How a car can react in unforeseen edge cases? Like raining day and heavily snowing day. Additionally, if traffic police closed the road, how to notify an autonomous car in advance? (F3) • I think I have some safety concerns toward autonomous driving technology and other underlying technologies, such as artificial intelligence. Many people say that AI still isn't able to function

Table 4.3 Summary of Themes and Example Quotes from Interviews

Themes and sub-themes	**Example quotes**
	properly in chaotic city roads. I am not an expert so...I don't know, I just don't trust this technology currently. Also, I would worry about my personal privacy if someone hack the system and track users' information, then my home address and my daily route will be disclosed for other purposes…as I know a driverless car use radar or wireless communication technique to sense its surrounding environment, but how it works in underground parking areas. Especially in my city-Chongqing, more than half of parking areas locate in underground (F4) • I think users may highly rely on driverless cars gradually and forgot how to drive cars (F5) • Driving a car without human intervention sounds marvellous but it is limited in specific conditions and emergency situations. Such as bad weather, unforeseen cases etc. How an autonomous car can react under this situation and protect me? I don't know (F6) • I don't know what kind of power source will be used by driverless cars, gasoline-powered or electric drive…if driverless cars use electric that will be difficult for users to charge cars as it would be a huge project to build charging stations widely, not just in cities also the rural areas, while enlarging petrol stations is relatively easier (F6)
Individual difference variables Personal innovativeness (anti-technology/interest in technology); Incumbent system habit (control feeling/lower confidence in driving/enjoy driving)	• I think people have more open minds toward new technology than few years before, and willing to try new things, especially the younger generations…I would like to wait for a while and see the reviews and comments from customers who are technology savvy and have tried an autonomous car (F2) • I still prefer to drive a car by myself even the car have some autonomous features, for example, adaptive cruise control and lane keeping system. I would say I'm quite conservative, it will take some time for me to accept driverless (F4) • If I decide to buy a new car, I will consider the performance of the car and my feeling of operation, umm…the control feeling as well. That's why I decided to buy a SUV as my first car (F5)

Table 4.3 Summary of Themes and Example Quotes from Interviews

Themes and sub-themes	Example quotes
	• When I am getting older, another 20 years maybe, and the autonomous driving technology should be developed more maturely, I may consider buying one (F6)

As can be seen in Table 4.4, the template consists of four highest-order codes, and sub-divided into one, two or three levels of lower-order codes. Template analysis normally starts from pre-defined codes that are derived from previous literature review (Chapter 2) in this research. Meanwhile, the main questions from the interview guide can serve as higher-order codes, with subsidiary questions as lower-order codes (King, Cassell, & Symon, 2004). Thus, recalling the questions listed in the interview guide (Appendix A), the main questions are "what do you think of driverless cars?" and "do you think you would use a driverless car …once the product is available on the mass market? And the reasons you would like to use/reject."

Therefore, the first level-one code 'benefit perceptions' relates to the expected benefits of driverless cars from the participants' perspectives. The level-two codes are relevant to various facets of positive features of driverless cars. Further, the level-three codes specify particular types of benefits that can be achieved from driverless cars. 'Risk perceptions' is the second level-one code that relates to the participants' potential concerns about driverless cars. The level-two codes are components of five types of concerns. The level-three codes present the particular functions, services, and features of driverless cars that may cause users' concerns. Beside these factors, "individual difference variables" is treated as level-one code with two lower-order codes, including incumbent system habit and personal innovativeness.

By doing so, the created template reflects depth of analysis with a clear hierarchy that covers all important information relevant to the main questions, also integrated with the knowledge derived from the literature.

Table 4.4 Template Analysis

1. Benefit perceptions	1.1. Enjoyment	1.1.1 Comfortable 1.1.2 Reduced driving pressure 1.1.3 Cool and fun 1.1.4 Safer
	1.2. Travel efficiency	1.2.1 Convenience 1.2.2 Time savings 1.2.3 Increased productivity 1.2.4 Extended activities 1.2.4.1 Do other things while driving
	1.3. Societal benefits	1.3.1 Environmental friendliness 1.3.1.1 Reduce traffic emission 1.3.1.2 Reduce fuel consumption 1.3.2 Sustainable transportation 1.3.2.1 Mitigate traffic congestion 1.3.2.2 New road transportation planning 1.3.3 Reduced parking problem
	1.4. Helpfulness	1.4.1 Increased mobility 1.4.1.1 The young, elderly, or disabled, without driving licenses 1.4.1.2 Impaired driving
2. Risk perceptions	2.1. Technological issues	2.1.1 Software systems 2.1.1.1 Navigation system 2.1.1.2 Programmed system 2.1.2 Immature of underlying technologies 2.1.2.1 Predicting weather condition 2.1.2.2 Predicting all types of situations
	2.2. Hacking and privacy issues	2.2.1 GPS tracking 2.2.2 Personal information disclosure
	2.3. Regulations and laws	2.3.1 Liability and responsibility

Table 4.4 Template Analysis

	2.4. Costs	2.4.1 Unaffordable price 2.4.2 Expenses relevant to driverless cars
	2.5 Deterioration of driving skills	
3. Personal characteristics	3.1. Personal innovativeness	3.1.1 Willingness to try 3.1.2 Hesitate to use
	3.2. Incumbent system habit	3.2.1 Control feeling 3.2.2 Enjoy driving 3.2.3 Driving preferences

4.1.4 Pre-designed Conceptual Model

Drawing upon the results from template analysis, the key themes and sub-themes that represent participants' perceptions toward driverless cars are extracted. These are proposed as significant factors that influence user intention to use driverless.

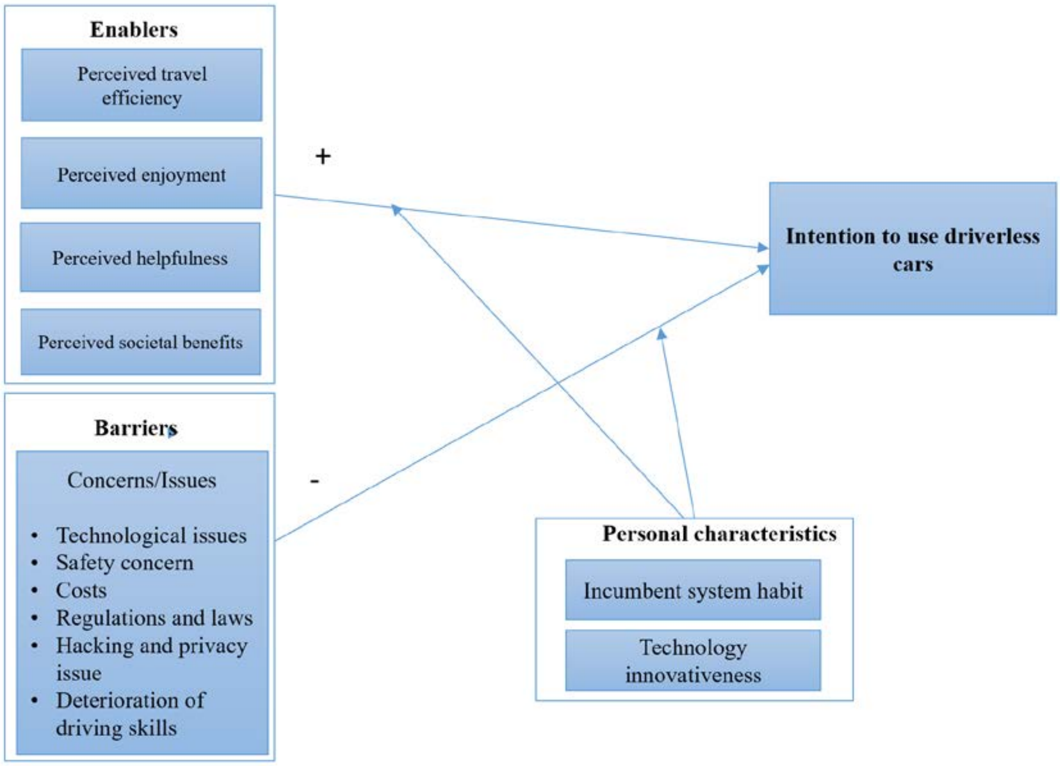
The collected narrative information reflected the participants' positive and negative perspectives toward driverless cars. Thus, the extracted key themes can be categorized as enablers or barriers in the implementation of driverless cars. The pre-designed conceptual model is made appropriately. Firstly, the benefits perceptions should have positive (+) influences on user intention to use driverless cars. In other words, in the context of driverless cars, the perceived travel efficiency, perceived enjoyment, perceived helpfulness and perceived societal benefits positively impact on user intention to use.

Reviewing the example quotes from the interviews study, the inferences should be supported. For example, "*Driverless cars could make our day more productive, potentially saving travel time….*" (M1), or "*I will be free to do other things while riding, for example, taking a nap, especially during the mid-day because I'm used to taking a nap at certain times.*" (M6), or "*I can take care of my kid during the journey rather than split my attentions to drive a car, or I can read a magazine, text my friends, reply to a mail or do other things.*" (F3). Those reflect the participants' perception that they would be able to use their travel time more efficiently. Regarding perceived enjoyment, the participants described that "*…smoother speed adjustment and a comfortable experience*" (M2), or "*… the driverless cars would bring more comfort and convenient experience to users*" (M1). Those reflect the participants' perception that using the driverless cars will bring them hedonic feelings. In terms of perceived helpfulness, the participants mentioned that "*I feel like it would be very beneficial for the older generation who are over 70 years old and not permitted to drive a car… individuals who are interested in impaired driving (drunk, taking medication, or feeling tired) could benefit from driverless cars*." (M1). "*…to reduce the phenomenon of drunk driving. Also, it can help customers who are do not have driving licenses or inexperienced to drive by themselves*." (M7). Those reflect the participants' perception that using driverless cars would increase mobility for people who physically restricted from driving a car. Regarding perceived societal benefits, the participants mentioned that "*I believe that would reduce the amount of car emission, save resources, mitigate traffic congestion, reduce the needs of parking space in urban areas, freeing scarce land for other purposes, such as expanding landscaping, public areas and social uses.*" (F2) or "*Especially useful to reduce the phenomenon of drunk driving.*" (M7). Those reflect the participants' perception that using the driverless cars would generate a series of societal benefits. Thus, these extracted core themes would positively influence user intention to use driverless cars.

Secondly, the various user concerns toward driverless cars (technological issues, costs, regulations and laws, hacking and privacy issue, and deterioration of driving skills) should have negative influences (-) on intention to use driverless cars. For example, "*Probably the underlying technology is still in its infancy and need more time to develop. Also, if the software system of the driverless car got some problems, and I wasn't aware of it when I am riding in the car, I cannot image the result....*" (F1). "*the autonomous driving technology is still in its infancy. Lots of works need to be done to resolve technological issues, such as accurately distinguishing obstacles*" (M4). Those reflect the participants' concern about technological issues. In addition, some mentioned "*…if an autonomous car is involved in a traffic accident, who should take the responsibility in this case? The regulations for autonomous cars are still blank.*" (F3). "*the liability issue and drivers' responsibility in traffic accidents will be a problem, I don't know when the government will release new regulations and laws to* *clarify these disputes*." (M1). Those reflect the participants' concern about liability, regulations and policies regarding driverless cars. The participants are also concerned about hacking and privacy. For example, "*autonomous cars controlled by computer systems, imply a potential threat from hacking. If the driving system got a virus or shut down while driving, or is targeted by terrorism, what should I do?*" (M5). Meanwhile, they fear the price of a driverless car is too high as well as other expenses relating to car driving (e.g. insurance fee). For example, "*… price of a driverless car is another factor I am concerned about. The car would be so expensive when it is first released on the automobile market and probably targets only rich people…umm, car insurance may also increase.*" (M1). The participants also expressed their concern about deterioration of driving skill. For example, "*I'm concerned about the deterioration of peoples' driving skills. It's not a good thing that people highly reply on driverless cars.*" (M1). These summarized various concerns would prohibit user intention to use driverless cars.

Thirdly, individual difference variables are enclosed in the model as a supplement part to facilitate explanation power of the model. Some participants described that "*…I enjoy driving. I especially enjoy the feeling of control, no matter how popular driverless cars may become in the automobile market…I still prefer manual driving.*" (M2). "*…I still prefer to drive a car by myself even the car have some autonomous features, for example, adaptive cruise control and lane keeping system." (F4).* Obviously, this reflects the impact of incumbent system use in the acceptance of driverless cars. It is likely that individuals who have a strong incumbent system habit may be more receptive to driverless cars. Another factor, personal innovativeness is also mentioned by the participant. For example, "*I think people have more open minds toward new technology than few years before, and willing to try new things, especially the younger generations…I would like to wait for a while and see the reviews and comments from customers who are technology savvy and have tried an autonomous car*." (F2). Thus, individuals who are interested in new technologies may be willing to try driverless cars once the vehicles are available on the mass market. The pre-designed conceptual mode is shown in Figure 4.1.

Figure 4.1 Pre-designed Conceptual Model



4.2 Study 2

The aim of Study 2 is to assess if user intention to use driverless cars can be predicted by elicited factors from Study 1, and also to specify to what extent the explored factors impact on intention to use. Additionally, the mechanisms behind individual behavioural intention to use driverless cars will be assessed through taking individual difference variables into account. Thus, the researcher proposes a series of hypotheses to detect relationships among variables. Thereby, the proposed sub-questions 3 and 4 are answered.

4.2.1 Hypothesis Development and Model Design

The proposed conceptual model was built up basing upon a long-standing cognition-oriented model-TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) along with the new generated factors from Study 1. More specifically, the TRA-based models are underpinned by the rationale of belief-attitude-intention-behaviour that is normally used in the study of individual behaviours in general and suitable to be applied in the domain of technology acceptance in particular. In addition, the acceptance of a newly introduced product implies fully or partly replacing an incumbent system, thus potential sources of resistance to adopting a new product should be taken into account in the study of driverless cars acceptance. Generally, there are three approaches to extend the cognition-oriented theories (e.g. TAM): 1) to introduce new factors from related models, 2) to add additional or alternative belief factors, 3) to explore antecedents and moderators of perceived usefulness and perceived ease of use (Wixom & Todd, 2005).

Consistent with above suggestions, a series of explored new factors were integrated into the original TRA model which reflected user beliefs toward driverless cars. Positive perspectives include perceived travel efficiency, perceived enjoyment, perceived usefulness, and perceived societal benefits. On the other hand, customers' concerns were considered to play significant roles in the acceptance of driverless cars as well, including technological issues, hacking and privacy issues, regulations and laws, costs, and deterioration of driving skills. The individual difference variables (personal innovativeness and incumbent system habit) are included in the model that would help the researcher to further understand the manner in which these impacts occur in user acceptance of driverless cars. The control variables (age, gender, education background, and driving frequency) also are enclosed in the model as a source to provide supplement information in this research.

4.2.1.1 Main Hypotheses

According the results generated from Study 1, seven core themes were elicited and entitled as enablers and barriers of user acceptance of driverless cars. The researcher posits that factors which are enablers have positive influences on user intention to use driverless cars, while factors identified as barriers have negative influences on intention to use them. This is congruent with Madigan et al. (2016) state that consumers' decision to use any automated system is based on different attitudinal factors. The main hypotheses were formulated and presented as follows:

The first hypothesis was that customers would appreciate the utilitarian benefit of driverless cars, that is, allowing them to carry out other activities or tasks. This is equivalent to the meaning of perceived usefulness that is identified as users' belief and expectation toward using an innovative product (e.g. driverless cars) to enhance their task performance or improve their work efficiency (Barry et al., 1994; Holbrook & Batra, 1987; B. Kim & Han, 2011; Taylor & Todd, 1995). Reviewing the narrative information collected from Study 1, the majority of participants mentioned that they would expect to be more productive while travelling in a driverless car. More specifically, for daily commuters, their travelling time could be reduced by lot and become more efficient, such as working on their computers, holding phone conferences, or socializing on mobile apps, watching movies, and reading etc. In the latest interview study, Buckley et al. (2018) highlighted that drivers recognised potential benefits of undertaking secondary tasks while riding in driverless cars, such as reading, replying emails, responding texts, dealing with kids in the back seat, or doing other things etc. Indeed, above described benefits would enhance user travel efficiency brought on by the utilitarian feature of driverless cars. Especially, this is consistent with Nordhoff et al. (2016) who addressed that driverless cars can turn wasted driving time into a valuable economic asset, because users can enjoy the multidimensional functions of vehicle space and adjust it based upon their needs and preferences. This is also corroborated by Bjørner (2017) who proposed that spending, wasting and saving time while travelling in driverless cars have led to travel time being viewed as an economic commodity. Thus, the researcher proposed that **perceived travel efficiency has positive influence on user attitude (H1a) and intention to use driverless cars (H1b)**.

Furthermore, the participants expressed their hedonic expectations towards driverless cars, such as feeling relaxed, enjoyment, fun, pleassure and feelings of safety. These findings are congruent with Venkatesh et al. (2012) who proposed that consumers would like to experience enjoyment, fun, or pleasure from purchasing or using technology products. Moreover, the hedonic aspects of technology use can increase users' satisfaction at a level beyond its utilitarian aspects (Nordhoff et al., 2016). The prior study has proposed that users' affective reactions to driverless cars use can relate to the feeling of pleasure, such as fun, relaxed and comfortable (Delle Site et al., 2011). Rödel et al. (2014) defined fun as the degree to which using a specific system is enjoyable, while it will decline with higher levels of automation. In the same vein, Kyriakidis et al. (2015) found that the full automation is considered to be the least enjoyable mode compared with manual driving. However, Nordhoff et al. (2016) emphasized that one of the most remarkable benefits of driverless cars is that users can enjoy their own spaces when travelling in driverless cars. For example, a private and quite moment to have a break, take a step back from their busy lives, and refresh their minds. Such benefits echo with the feeling of users when they are riding in driverless cars, that is, pleasure. In addition, the conventional interaction between humans and their vehicles and the joy of being driven could be changed in the context of driverless cars (Nordhoff et al., 2016). Thus, it is appropriate to assume that driverless cars are perceived to be enjoyable.

Meanwhile, it is acknowledged that users evaluate new technology products based on utilitarian and hedonic perspectives simultaneously (Hassenzahl et al., 2000). Thus, the perceived enjoyment should work together with perceived travel efficiency on user intention to use driverless cars. Thus, the following hypothesis is derived: **perceived enjoyment has positive influences on user attitude (H2a) and intention to use driverless cars (H2b)**.

The participants also mentioned that driverless cars could increase door-to-door mobility for the young, elderly, disabled, or people without driving licences, also to provide transport to deal with people who are drunk or who have taken medicines that could affect driving abilities. This is consistent with previous findings that driving while impaired by alcohol, drugs, or medical conditions were favourite scenarios to use driverless cars (Buckley et al., 2018; Payre et al., 2014). In addition, in the above described situations, using driverless cars could reduce traffic accidents caused by human error and increase safety. In addition, these benefits reflect users' beliefs that using driverless cars will not only be convenient for mobility but may also improve quality of life (Kyriakidis et al., 2017). This is congruent with the construct of perceived helpfulness that was mentioned in previous studies in the context of driverless cars (Bjørner, 2017; Buckley et al., 2018; Daniel, 2017). Especially, users' interest in using driverless cars while impaired is verified as a predictor of intention to use a fully automated car (Payre et al., 2014). Consistent with above evidence, the researcher hypothesised that **perceived helpfulness positively influences user attitude toward driverless cars (H3)**.

Furthermore, the participants described their perceived advantages of driverless cars relating to societal dimension: reduced traffic emission, mitigated traffic congestion, reduced parking problem, and facilitated road transportation planning. Similar findings have been noticed by Schoettle and Sivak (2014b), who investigate public opinion across the U.K., the U.S., and Australia, found that the respondents were confident that driverless cars can reduce fuel consumption, lessen emissions, and improved traffic congestion etc. Fraedrich and Lenz (2014) analysed comments on German and US print media website articles and indicated that the public expect driverless cars will be more fuel economical with less traffic emissions, better traffic flow, and optimize transportation system. In other words, these are user expectations about the benefits of the driverless cars, which should have positive effects on acceptance (Nordhoff et al., 2016). These potential benefits are also described as macrosocietal factors (Deb et al., 2017) that reflected customers' beliefs that the acceptance of driverless cars can generate some societal benefits. Bjørner (2017) also states that the above mentioned macrosocietal factors and microbehavioral factors (e.g. reduced driver stress, increased access to mobility and the potential for doing other things while driving) are potential benefits of driverless cars that are relevant to customer' interest in driverless cars. This led to the hypothesis that **perceived societal benefits positively influence consumer attitude toward driverless cars (H4).**

Notably, the participants expressed various concerns about owing or using driverless cars that are challenges for the implementation of driverless cars. For example, technological issues (e.g. failed performance of software systems and underdeveloped underlying technologies), safety concerns (e.g. equipment failure in unforeseeable situations), unfordable financial costs (e.g. high price of a driverless car and insurance cost), lagging regulation and policies (e.g. legal liability for drivers/owners), hacking and privacy issue (e.g. data privacy) and deterioration of driving skills. These concerns have a detrimental influence on customers' interest in driverless cars (Schoettle & Sivak, 2014b), as they will hesitate to accept or directly reject its use. The influencing mechanism can be explained through the theory of stress and coping (Lazarus, 1966; Lazarus and Folk, 1984), which also referred to active and passive coping styles.

Previous studies also highlighted that safety issues, privacy issues and legal liability are main concerns with respect to driverless cars that continue to intensify amongst the general public and cause resistance to driverless cars (Bansal et al., 2016; Tussyadiah et al., 2017). This is consistent with Kohl et al. (2017) who proposed that customers' concerns toward driverless cars reflect their risk perceptions and act as direct predictors of intention to use. Thus, the researcher hypothesized that **customers' concerns negatively influence intention to use driverless cars (H5)**.

Although the participants expressed their concerns about driverless cars and hesitated to embrace this innovative technology, they still show a positive attitude toward it. This is consistent with the previous studies (Continental, 2013; Schoettle & Sivak, 2014b; Zmud et al., 2016) that revealed customers' attitudes are globally positive toward driverless cars, whilst they also expressed high levels of concerns about riding in driverless cars. In addition, attitude towards using technology is commonly used as a main predictor to explain technology acceptance across various technology contexts. In car technology context, Osswald et al. (2012) reintroduce the factor of attitude towards using technology into UTAUT, along with the determinants safety and anxiety into consideration. The construct of attitude as a determinant can reflect the beliefs of the user regarding technology usage and its effects (Osswald et al., 2012). In addition, literature in social psychology has examined attitude as a determinant of intentions and revealed the consistent rationale of belief-attitude-intention-behaviour that is behind human behaviours in general, that is, behavioural intention can be predicted by attitudes (Albarracín, Johnson & Zanna, 2005; Fishbein & Ajzen, 1975). Therefore, user attitude towards driverless cars is a crucial predictor of intention to use. Thus, the researcher hypothesized that **customers' attitude toward driverless cars has positive influence on intention to use (H6)**.

4.2.1.2 Moderation and Mediation Hypotheses

The moderator effect refers to a third independent variable changes the form of the relationship between another independent variable and the dependent variable, depending on the value of the moderator variable (Hair et al., 2010). Normally, personal trait variables are appropriately to be viewed as moderators in the study of consumer behaviours in the field of technology acceptance across contexts, including driverless cars (Nordhoff et al., 2016). Therefore, the present study takes personal trait variables into account to explore how these variables impact on user intention to use driverless cars and the mechanism behind it. The findings would complement the explanations of driverless cars acceptance. Based upon the findings generated from Study 1, two personal trait variables were extracted, that is, incumbent system habit and personal innovativeness.

The incumbent system habit has been introduced by Polites and Karahanna (2012) to examine how habitual behaviour toward an incumbent system may negatively affect perceptions of a newly introduced one, therefore, to be treated as an inhibitor to new system acceptance. The mechanism behind this action is described as individual decision makers may be biased toward sticking in the status quo through their conscious (e.g., perceived costs of transitioning to a new system) and subconscious sources (e.g., incumbent system use that gradually became to incumbent system habit) (Polites and Karahanna, 2012). Indeed, Casley et al. (2013) noticed that individuals possessed driving licenses would like to reject driverless cars because they may fear a loss of driving enjoyment which can be achieved from their incumbent automobile vehicles (e.g., manual driving). Obviously, losing of driving enjoyment should be treated as the perceived cost of transitioning to driverless cars.

Meanwhile, the influence of a person's habitual way of driving is emphasised by Elander et al. (1993) that can reflect his or her strong manual driving styles. These driving habits will be transferred to being driven in a driverless cars and generate detrimental influences on all aspects of emerging self-driving motilities (Bjørner, 2017). It also been noticed that a strong incumbent system habit may have a negative impact on intention to use new information systems (Polites and Karahanna, 2012). From the status quo bias perspective, the stronger of an individual's preference for an incumbent system (e.g., traditional manual driving), the higher of the bias the person has toward a superior alternative (e.g., autonomous driving); hence, less willingness to use driverless cars. Thus, incumbent system habit is likely associated with customers' receptivity to driverless cars and, when assessed, has an inhibiting impact on intention to use through its motivating influence on beliefs and intention to use.

In the study of technology acceptance, personal trait variables, which are normally hypothesized as key moderators for the antecedents as well as the consequences of perceptions in technology acceptance (Agarwal & Prasad, 1998). Incumbent system habit as a type of psychological factor that can be used to explain individual different reactions toward the driverless cars through its moderating role for an activity (Lafrenière et al., 2012). Hence, it is reasonable proposed following hypotheses:

H7: (a) The impact of perceived travel efficiency on the attitude toward driverless cars is significantly lower among customers who have stronger incumbent system habit

(b) The impact of perceived travel efficiency on the intention to use driverless cars is significantly lower among customers who have stronger incumbent system habit

(c) The impact of perceived enjoyment on the attitude toward driverless cars is significantly lower among customers who have stronger incumbent system habit

(d) The impact of perceived enjoyment on the intention to use driverless cars is significantly lower among customers who have stronger incumbent system habit

(e) The impact of perceived helpfulness on the attitude toward driverless cars is significantly lower among customers who have stronger incumbent system habit

(f) The impact of perceived societal benefits on the attitude toward driverless cars is significantly lower among customers who have stronger incumbent system habit

(g) The impact of concerns on the intention to use driverless cars is significantly higher among customers who have stronger incumbent system habit

(h) The impact of attitude on the intention to use driverless cars is significantly lower among customers who have stronger incumbent system habit

Individuals who possess the higher personal innovativeness have greater willingness to experience new ideas, they are more eager to try new technology than their peers. Also, these consumers are more knowledgeable than others about new technologies (Agarwal & Prasad, 1998; Engel, Kegerreis & Blackwell, 1969). It is acknowledged that early adopters were likely enthusiasts or pragmatists, while laggards were likely rejecters or traditionalists (Zmud et al., 2016). Normally, personal innovativeness is hypothesised to act as a moderator of the model to examine individuals' attitude and behaviour toward new technology (Agarwal & Prasad, 1998; Sun & Zhang, 2006). It has had a long-standing tradition in the domain of marketing in the literature of technology acceptance. In the context of driverless cars, Payre et al. (2014) indicate that technophiles might be more enthusiastic about envisioning riding in a driverless car than others. In addition, Tussyadiah et al. (2017) specify that personal innovativeness is a significant predictor of intention to use a self-driving taxi for travel. Therefore, the authors assume that individuals who are early adopters of new technology might accept driverless cars more proactively than their peers. Thus, the following hypotheses are generated:

H8: (a) The impact of perceived travel efficiency on the attitude toward driverless cars is significantly higher among customers who have stronger personal innovativeness

(b) The impact of perceived travel efficiency on the intention to use driverless cars is significantly higher among customers who have stronger personal innovativeness

(c) The impact of perceived enjoyment on the attitude toward driverless cars is significantly higher among customers who have stronger personal innovativeness

(d) The impact of perceived enjoyment on the intention to use driverless cars is significantly higher among customers who have stronger personal innovativeness

(e) The impact of perceived helpfulness on the attitude toward driverless cars is significantly higher among customers who have stronger personal innovativeness

(f) The impact of perceived societal benefits on the attitude toward driverless cars is significantly higher among customers who have stronger personal innovativeness

(g) The impact of concerns on the intention to use driverless cars is significantly lower among customers who have stronger personal innovativeness

(h) The impact of attitude on the intention to use driverless cars is significantly higher among customers who have stronger personal innovativeness

Mediators as third variables that also can help the researcher to understand the relationship between independent and dependent variables. The central idea behind this mechanism is that the effects of stimuli on behaviour are mediated by various transformation processes internal to the organism (Baron & Kenny, 1986). In other words, the independent variable causes the mediator, then the mediator causes the outcome (Shadish & Sweeney, 1991). Reviewing the rationale of TRA (Fishbein & Ajzen, 1975), it emphasises that attitude has mediating infuence on the relationship between belief and behavioural intention. In the context of technology acceptance, although some extant studies disclosed an inconsistent mediating role of attitude in the relationships between beliefs and behavioural intention and actual system use (Legris et. Al., 2003) by adopting TAM as a fundemantal model. Others still persisted that the mediating role of attitude in the technology acceptance is important and perform well as a partial mediator (Davis et al., 1989; Venkatesh, 2000). Thus, the research hypothesized that:

H9: (a) Attitude mediates the positive relationship between perceived travel efficiency and intention to use driverless cars

(b) Attitude mediates the positive relationship between perceived enjoyment and intention to use driverless cars

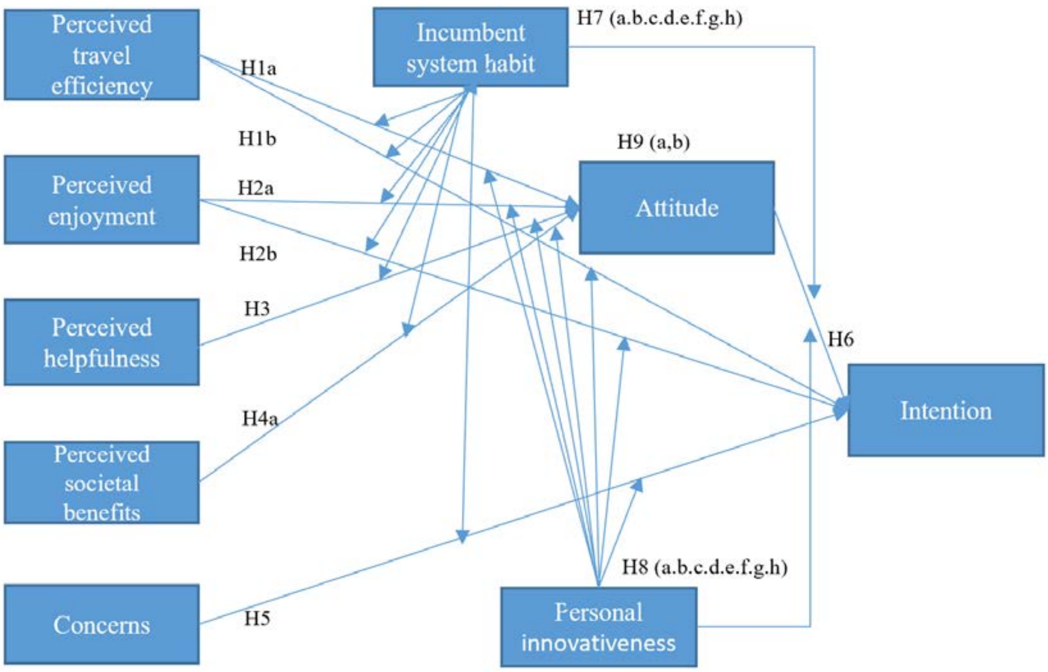
4.2.1.3 Socio-Demographic Variables

Socio-demographic variables that demonstrate demographic and socioeconomic characteristics of the individuals, which play an active role in quantitative studies and treated as control variables (Creswell, 2014; Zhu & He, 2002). In other words, those variables normally need to be controlled when evaluating research models. In this research, gender, age, education background, and driving frequency were added into the model as control variables.

Evidence shows that males and females, the young and the elderly have different perceptions toward driverless cars with different extent of concerns in the car context (Casley et al., 2013; MORI, 2014; Payre et al., 2014; Rödel et al., 2014; Schoettle & Sivak, 2014b). For example, men were significantly more likely to believe driverless technologies important than women (MORI, 2014). Also, men were more likely to adopt and enjoy driverless cars than women (Casley et al., 2013).

In terms of age, some studies revealed a positive relationship between the age of the consumers and the intention to use driverless cars (Rödel et al., 2014) while other achieved a negative finding (Schoettle & Sivak, 2014c) or no relationship (Payre et al., 2014; Zmud et al., 2016). The possible reason could be the sample selection criteria, the culture difference, and the time gap among studies (Akman & Mishra, 2010; Zhou, Dai & Zhang, 2007). In this research, age, gender, education and experience are taken into consideration in the model with the aim to generate more information to explain customers' behavioural intention toward driverless cars. Figure 4.2 depicts the research model and hypotheses.

Figure 4.2 Research Model



4.2.2 Questionnaire Design

Perceived travel efficiency was measured with three items, which would capture the extent to which a person believes that driverless cars can allow the user to carry out other activities or tasks while driving (e.g., playing with phone, replying to emails, or taking a short break). Although this factor is similar to the perceived usefulness from the TAM, the meaning of such utilitarian motivators should be updated along with the features and purposes of driverless cars. Thus, self-designed questions were used to measure perceived travel efficiency.

Four items used to measure perceived helpfulness with one item borrowed from Payre et al. (2014) and another three items self-designed. This construct refers to the extent to which a person believes that using a driverless car will be convenient for mobility. In extent studies, researchers have revealed that customers would like to use driverless cars while their judgment is impaired or driving while affected by alcohol, drugs, or medical conditions (Buckley et al., 2018; Payre et al., 2014). Payre et al. (2014) emphasized this feature of driverless cars and treated it as a new theme in their study.

In this research, this theme refers to a facet of perceived helpfulness thus can be combined with other self-designed items to measure a new construct.

Perceived enjoyment as a hedonic concept to capture consumers' emotional reactions to travelling in driverless cars (Buckley et al., 2018). It refers to the degree to which a person believes that using the driverless cars will bring them hedonic feelings. This construct was measured with four items, with three items borrowed from Schoettle and Sivak (2014c) and one self-designed that was derived from interviews.

Four self-designed items were used to measure customers' perceived societal benefits that defined as a person's belief or expectation that the adoption of driverless cars can generate a series of societal benefits. Based upon the narrative data collected from Study 1 and synthesized with literature review (section 2.3.3), four items were generated from different dimension to measure perceived societal benefits.

The construct of users' concerns is viewed as a multidimensional theme that reflect users' various concerns towards driverless cars. It was measured with eight items from different dimensions, including technological issues, hacking and privacy issues, regulations and laws, costs, and deterioration of driving skills; five were derived from Schoettle and Sivak (2014c) and two was created by the researcher.

Three items, created by Taylor and Todd (1995) were used to measure users' attitudes towards driverless cars. It defined an individual's overall affective reaction upon using a driverless car (Osswald et al., 2012). The variable of intention to use is refers to the intensity or frequency of usage that users expect once driverless cars are available in the mass market (Nordhoff et al., 2016). It was measured by four items obtained from Osswald et al. (2012). A new self-designed measurement scale with four items was created for measuring individuals' incumbent system habit. The construct of personal innovativeness refers to the risk-taking propensity of an individual and the willingness to try out any new information technology (Agarwal & Prasad, 1998). It was measured by four items from Jensen, Cherchi, and de Dios Ortúzar (2014) and Lu et al. (2005). Jensen et al. (2014) studied the impact of real life experience with electric vehicles (EVs) over a relatively long period of time on individual preferences and attitudes. They conducted a "long panel" survey to collect data before and after individuals experienced an EV during a three-month period then did factor analysis to cluster the indicator statements into relevant groups of attitudes or perceptions. Two items were loaded together to measure technology interest (TI) in their study. Another two items were borrowed from Lu et al. (2005) who mainly focused on evaluating the influences of personal innovativeness and social influences on intention to adopt wireless mobile technology. Table 4.5 shown the whole picture of measurement items and their original sources, as well as the corresponding emendations in the context of driverless cars acceptance.

Table 4.5 Measurement Scale Development

Constructs	Measurement items	Source/Literature	Modification
Perceived Travel Efficiency	Using time for entertainment (e.g. watching TV, reading, playing games) Dealing with important things (e.g. replying to emails) Good for socializing (e.g. chatting with friends, replying to texts on WeChat/Weibo)	Self-designed	The item was generated from the transcript of interviews from Study 1
Perceived Helpfulness	Benefit for individuals without driving licenses Benefit for inexperienced drivers Benefit for the older or disabled people Benefit for people drinking alcohol, taking medication	Self-designed Self-designed Self-designed (Payre et al., 2014)	The items were generated from the transcript of interviews from Study 1
Perceived Enjoyment	Using driverless cars can free up drivers' hands Users can enjoy a break mentally, especially in a long journey Users can enjoy private space Speed change smoothly and quietly	Self-designed (Schoettle & Sivak, 2014c) Self-designed	The item was generated from the transcript of interviews from Study 1.
Perceived Societal Benefits	Lower vehicle emissions, protect the environment Less traffic congestion Less traffic accidents Reduce occupation of public spaces (e.g. public parking place)	Self-designed	The items were generated from the transcript of interviews from Study 1.
Concerns	I am concerned about ……………………navigation inaccurate, unable to find passenger(s)' location or destination …………………….the clash of reserved parking space ……………………underlying autonomous driving technologies are immature ……………………relevant regulations and policies are blank ……………………urban infrastructures are not ready …………………… high selling price of automated vehicles …………………….hacking the vehicle's computer systems, software error or hardware error or data privacy	(Schoettle & Sivak, 2014c) Self-designed	

Table 4.5 Measurement Scale Development

Constructs	Measurement items	Source/Literature	Modification
	disclosure (e.g. location and personal phone number)		
	…………………….. deterioration of driving skills (new item)	Self-designed	
Attitude	Using driverless cars would be a good idea Using driverless cars would be a wise idea Using driverless cars would be pleasant experience	(Taylor & Todd, 1995)	The items were originally used to measure students' attitude toward a computer resource center (CRC) by four items. While one of the item 'I (dislike/like) the idea of using the CRC' was dropped by the researcher in this study. This was because the participants from the pre-test study suggested removing this item, which seems overlap with other items to measure the same construct.
Intention to Use	Assuming I had access to a driverless car, I intend to use it If driverless cars are available on mass market within 1 year, I intend to use it If driverless cars are available on mass market in the next 5-10 years, I intend to use it I intend to buy a driverless car now I plan to buy a driverless car within 1 year I intend to buy a driverless car in the next 5-10 years	(Osswald et al., 2012)	The original three items were adopted while the feedback from the pre-test study suggested that it would be easy to imagine the availability of driverless cars in different time line. For example, 1-5 years, 5-10 years. Meanwhile, the respondents suggested that it is better to consider the buying decision as well. Meanwhile, acceptance sometimes includes the intention to purchase in the car context (Van Der Laan et al., 1997). Thus, questions about consumers' behavioural intention to purchase driverless cars are also included.
Incumbent system habit	I like driving by myself I care about cars' safety performance when I buy a car I like the feeling of being in control when I am driving I am used to driving by myself	Self-designed	The items were generated from the transcript of interviews from Study 1.
Personal innovativeness	I like to experience with new technologies It is important for me to follow technological development I expect new technologies to come out	(Jensen et al., 2014; Lu et al., 2005)	

Table 4.5 Measurement Scale Development

Constructs	Measurement items	Source/Literature	Modification
	I always buy new technology products, although they are expensive		

4.2.3 Pre-testing and Pilot Study

Before conducting the principle study, the questionnaire needs to be assessed through a pretesting and a pilot study to make sure all questions presented in the questionnaire make sense. In this research, the aim of conducting the pre-test is to detect and amend potential problems with respect to the designed questionnaire, for example, question content, wording, form and layout, and instructions etc. Especially, the refined measurement scales and self-designed items need to be tested in terms of wording and translating to make sure participants can understand the meaning of each question. This is a critical step to ensure the format of the questionnaire is user-friendly. In addition, it is a prerequisite to move to the subsequent study for collecting quantitative data in a large scale.

4.2.4.1 The Pre-testing Study

The researcher conducted the pre-testing among 25 participants within the age range of 20 to 56 years old. 6 out of 25 participants were academics who have either business management or psychology knowledge and easily noticed potential problems with the questionnaire and then provided professional suggestions. 19 regular respondents were full-time employees also viewed as potential customers of driverless cars. Feedback and comments were obtained from the participants that involved the wording of measurement items, questions ambiguity, the format of the scales, construct validity, and any problems they encountered answering the questionnaire. Meanwhile, the participants were asked if there were any factors that had not been covered in the questionnaire which they may consider importantly. After editing the original questionnaire, another pre-testing was conducted to make sure no further modifications are needed. The feedback and suggestions from the pre-testing are summarised in Table 4.6.

Table 4.6 Summarised Feedback and Suggestions from the Pre-testing

Issues	Evidence
Adjusted the format of original questionnaire, labelled each question using appropriate numbering and avoided splitting a question.	• The format, spacing, and positioning of questions have significant influence on the results (Malhotra & Briks, 2007). • Do not save space by cramming as many items as possible on to one page; construct

Table 4.6 Summarised Feedback and Suggestions from the Pre-testing

Issues	Evidence
	clear boxes; use wide margin (Buckingham & Saunders, 2004). • Split questions can mislead the respondents to think that the question has ended at the end of a page (Malhotra & Briks, 2007).
Using the term 'driverless cars' instead of 'automated vehicles (AVs)' which is easier for customers to understand	• Self-driving cars, autonomous vehicles (AVs), and driverless cars (Kaur & Rampersad, 2018) are interchangeable.
Re-organise the order of questions from factual question (Part1) to construct measures (Part 2), then closed by demographic questions (Q3) with thank you notes. Q5 change from 'do you have a car' to 'do you have driving experience Q6 add 'if drive a car by yourself' Q7 re-write this question and clearly describe different level of automation Q8 change the question from 'which type of vehicles should adopt autonomous driving technology firstly' to 'what type of automated vehicles you would like to use?' re-categorise the types of driverless cars.	• It is useful to divide a questionnaire into several parts by following a logical order (Malhotra & Briks, 2007). Especially, it is a good idea to start off with factual and background information, subsequently followed by the main questions the interviewer intends to explore (Crowther & Lancaster, 2008). • To list different levels of automated technologies embedded in vehicles to be consistent with the guideline proposed by NHTSA (2013).

Table 4.6 Summarised Feedback and Suggestions from the Pre-testing

Issues	Evidence
To make sure each question is described parsimoniously (e.g. Q12、Q13、Q14、Q15 and Q16). For example, Q15c (changed 'I like the feeling of being in control when I am driving' to 'I care about control feeling') and Q16a (changed 'I like to experiment with new technologies' to I would like to try new technology'). To clarify the type of students in Q20 (Full-time students and Part-time students)	
To clarify the wording of some words that appear to be unambiguous and normally used to describe frequency, such as a few times, several times, and sometime. For example, Q6. To discriminate the meaning of similar words (intend to, plan to, and predict) that were used to describe different statements within a same measurement scale in Q4. The translating of these words need to be done precisely.	• There is a risk that words do not match up across languages, and difficulties in translating words that will be exacerbated by differences between cultures and countries. For example, "usually", "normally'', "frequently", "often," "regularly" and "sometimes" are appear to be unambiguous (Craig & Douglas, 2005; Crowther & Lancaster, 2008). • It would be better to use a consistent frame of reference for all respondents, thus the measurement scales in Q6 changed to "a year", "a month". "a week", and "each day".
Allowed questionnaire can be viewed as a single unit, participants can scroll from the first question to the last and back.	• It Is better to construct Web-based questionnaires that can scroll from beginning to end (Dillman, 2000).
Using simple transition sentences to report what proportion of the questionnaire is complete	• Use graphical symbols or words that convey a sense of where the respondent is in the completion process (Dillman, 2000).

Table 4.6 Summarised Feedback and Suggestions from the Pre-testing

Issues	Evidence
Make sure the categorised groups for age, education background, monthly income, and current status can cover broader range of participants.	• To categorize the type of groups based on previous used questionnaire in the context of technology acceptance. • To re-categorise the income level according to the individual income tax guideline in China.

4.2.4.2 The Pilot Study

The questionnaire contains 21 questions, including factual questions, questions related to the construct measures, and demographic questions in three parts. The questionnaire was uploaded on the Internet, using an online survey tool (www.wjx.cn). 220 participants were involved in this pilot test, while after removing 32 unusable questionnaires, a final sample of 188 participants remained. The data obtained from the pilot study was examined for completeness of responses, the extent of reliability and construct validity. This study generated a high response rate that was 85%. The results shown (Table 4.7) that the measurement scales adopted to measure all constructs have high level of reliability as Cronbach's Alpha (α) for all constructs were above 0.80, ranging from 0.892 to 0.962. After the pilot study, modifications have been taken based upon the feedback and suggestions from the participants. Certain measurement scales were rewording to make sure the participants can precisely understand the meaning of the questions.

Table 4.7 Scale Items, Factor Loadings and Reliability Measures for Constructs

		Cronbach's Alpha	Factor Loading	Mean	St.Dev
Perceived travel efficiency		0.942			
	Using time for entertainment (e.g. watching TV, reading, playing games)		0.692	5.19	1.514
	Dealing with important things (e.g. replying to emails)		0.670	5.21	1.540
	Good for socializing (e.g. chatting with friends, replying to texts on WeChat/Weibo)		0.660	5.09	1.590
Perceived helpfulness		0.911			
	Benefit for individuals without driving licenses		0.808	4.60	2.028
	Benefit for inexperienced drivers		0.817	4.85	1.865
	Benefit for the older or disabled people		0.759	5.18	1.735
	Benefit for people drinking alcohol, taking medication		0.753	4.62	2.092
Perceived enjoyment		0.947			
	Using automated car can free up drivers' hands		0.685	5.13	1.612
	Users can enjoy a break mentally, especially in a long journey		0.724	5.34	1.488
	Users can enjoy private space		0.778	5.21	1.483
	Speed change smoothly and quietly		0.767	5.29	1.446
Perceived societal benefits		0.959			
	Lower vehicle emissions, protect the environment		0.751	5.27	1.518
	Less traffic congestion		0.811	5.14	1.621
	Less traffic accidents		0.778	5.09	1.647

Table 4.7 Scale Items, Factor Loadings and Reliability Measures for Constructs

		Cronbach's Alpha	Factor Loading	Mean	St.Dev
	Reduce occupation of public spaces (e.g. public parking place)		0.772	5.06	1.637
Concerns		0.962			
	I am concerned about				
	……………………navigation inaccurate, unable to find passenger(s)' location or destination		0.693	5.17	1.478
	……………………the clash of reserved parking space		0.696	5.15	1.544
	……………………underlying autonomous driving technologies are immature		0.784	5.39	1.532
	……………………relevant regulations and policies are blank		0.787	5.46	1.633
	……………………urban infrastructures are not ready		0.726	5.35	1.623
	…………………… high selling price of driverless cars		0.699	5.38	1.593
	…………………….hacking the vehicle's computer systems, software error or hardware error or data privacy disclosure (e.g. location and personal phone number)		0.772	5.49	1.669
	…………………….deterioration of driving skills		0.528	5.16	1.655
Attitude		0.929			
	Using driverless cars would be a good idea		0.755	5.04	1.733
	Using driverless cars would be a wise idea		0.764	4.63	1.800
	Using driverless cars would be pleasant experience		0.753	4.92	1.758
Intention to use					
	Assuming I had access to a driverless car, I intend to use it	0.902	0.745	4.83	1.747
	Given that I had access to the driverless car, I predict that I would use		0.771	4.46	1.774
	If driverless cars are available, I plan to use a driverless car in the next months		0.706	5.25	1.594
	I intend to buy a driverless car now		0.748	3.98	1.869
	I plan to buy a driverless car within 1 year		0.746	3.82	1.876
	I intend to buy a driverless car in the next 5-10 years		0.592	4.78	1.741
Incumbent system habit		0.892			

Table 4.7 Scale Items, Factor Loadings and Reliability Measures for Constructs

		Cronbach's Alpha	**Factor Loading**	**Mean**	**St.Dev**
	I like driving by myself		0.846	5.05	1.538
	I care about cars' safety performance when I buy a car		0.690	5.67	1.413
	I care about control feeling		0.828	5.32	1.468
	I am used to driving by myself		0.834	5.00	1.551
Personal innovativeness		0.905			
	I would like to try new technology		0.807	5.24	1.438
	I know lots of information about new technology		0.856	5.39	1.297
	I expect new technology comes up		0.855	5.51	1.302
	I always buy new technology products, although they are expensive		0.656	4.66	1.602

4.2.4.3 Exploratory Factor Analysis

Exploratory factor analysis (EFA) is a statistical approach used to explore the underlying structure of a set of variables. After this approach, a grouping of variables has been produced based upon strong correlations that not only demonstrates which items belong to which constructs but also tests and revises the questionnaire. SPSS is used to reduce the number of attitudinal variables through a factor analysis.

The method that applied to extract the number of factors in SPSS is the principle component analysis (PCA), which is the typical default method in conducting factor analysis (Hair et al., 2010). It is imperative to test the adequacy of data before conducting PCA. Kaiser-Meyer-Olkin (KMO) is normally used for measuring sampling adequacy, having statistic variability between 0 and 1 (Field, 2013). The minimal acceptable value should be greater than 0.50 (Field, 2013). Meanwhile, the value of Bartlett's test of sphericity was calculated to test whether the correlation matrix is significantly different from an identity matrix (Field, 2013). According to the results shown in Table 4.8, the value of KMO is 0.929 (marvelous) and the value of Bartlett's test less than the threshold of 0.05 that verified the sampling adequacy for the analysis. In other words, the variables do relate to one another enough to run a meaningful EFA (James Gaskin, 2018).

Table 4.8 KMO and Bartlett's Test (1)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.929
Bartlett's Test of Sphericity	Approx. Chi-Square	8919.089
	df	780
	Sig.	0.000

Meanwhile, it also necessitates to assess the communalities of the variables to make sure they are adequately accounted for by the factor (Hair et al., 2010). Any variables with communalities less than 0.50 are poorly performing and usually deleted. According to the results in Table 4.9, the minimal amount of common variate extracted from these questions is 0.667, which is higher than the threshold level of 0.50 (Hair et al., 2010). Additionally, in terms of factor extraction, factors with an eigenvalue larger than 1 normally retained implies a substantial amount of variation can be explained by a factor. However, using eigenvalue 1 as a criterion is criticized by Field (2013) who contends that this method overestimates the number of factors. In particular, the researcher can use this approach to replicate other's work and extract the same number of factors that was previously found. In other words, it is acceptable to set reasonable criteria when the researcher has gained the amount of prior knowledge about the variance in the variables (Hair et al., 2010). Thus, EFA analysis is viewed as a good way to detect if any new set of measurement items can be grouped together and partially or completely replace the original variables. To be consistent with above suggestions, the researcher specified that nine factors could be extracted from the EFA analysis. In addition, a scree plot as a complementary explanation could be used to depict the result of factor deduction because it can demonstrate the optimum number of factors that can be extracted. The shape of the resulting curve demonstrates the cutoff point.

Table 4.9 Communalities (1)

	Initial	Extraction
2a. using driverless cars would be a good idea	1.000	0.915
2b. using driverless cars would be a wise idea	1.000	0.926
2c. using driverless cars would be pleasant experience	1.000	0.897
3a. assuming I had access to the driverless car now, I intend to use it	1.000	0.778
3b. If driverless cars are available on mass market within 1 year, I intend to use it	1.000	0.782
3c. If driverless cars are available on mass market in the next 5-10 years, I intend to use it	1.000	0.831
4a. I intend to buy a driverless car now	1.000	0.839
4b. I plan to buy a driverless car within 1 year	1.000	0.835
4c. I predict that I would buy a driverless car in the next 5-10 years	1.000	0.803
10a. for entertainment	1.000	0.843
10b. dealing with important things	1.000	0.858
10c. socializing	1.000	0.873
11a. benefit for individuals without driving licenses	1.000	0.848
11b. benefit for drivers who are lack of driving experiences	1.000	0.868

Table 4.9 Communalities (1)

	Initial	Extraction
11c. benefit for the older or disabled people	1.000	0.806
11d. after drinking alcohol, taking medicines	1.000	0.779
12a. free of drivers' hands	1.000	0.772
12b. mental relax, especially suitable for long journey	1.000	0.780
12c. enjoy private space	1.000	0.867
12d. speed change smoothly	1.000	0.864
13a. lower vehicle emissions, protect the environment	1.000	0.858
13b. less traffic congestion	1.000	0.879
13c. less traffic accidents	1.000	0.898
13d. reduce occupation of public spaces	1.000	0.880
14a. navigation inaccurate, unable to find passenger(s)' location or destination	1.000	0.814
14b. reserved parking space clash	1.000	0.815
14c. underlying driverless technologies are immature	1.000	0.895
14d. relevant regulations and policies are blank	1.000	0.880
14e. urban infrastructures are not ready	1.000	0.841
14f. higher selling price	1.000	0.821
14g. hacking the vehicle’s computer systems, software error or hardware error or data privacy disclosure (location and personal phone number)	1.000	0.870
14h. deterioration of driving skills	1.000	0.667
15a. I like driving by myself	1.000	0.859
15b. I care about cars' safety performance when I buy a car	1.000	0.828
15c. I care about control feeling	1.000	0.850
15d. I am used to driving by myself	1.000	0.833
16a. I would like to try new technology	1.000	0.886
16b. I know lots of information about new technology	1.000	0.911
16c. I expect new technology comes up	1.000	0.902
16d. I always buy new technology products, although they are expensive	1.000	0.834

Extraction Method: Principal Component Analysis.

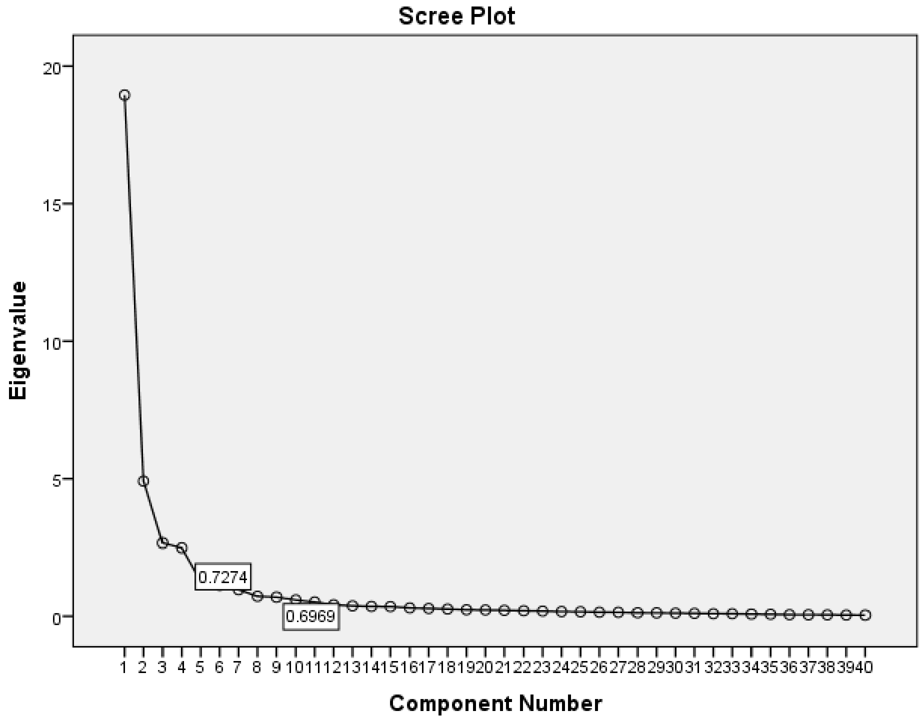
To be congruent with Field (2013)'s suggestions, a principle component factor analysis was conducted on these 40 items with Promax Rotation Method. The purpose of rotation is to simplify the factor matrix in order to facilitate interpretation (Hair et al., 2010). As can be inferred from Table 4.10, nine factors generated eigenvalues over Jolliffe (2002)' criterion of 0.70 and in combination explained 84.46% of the variance that was higher than the threshold level of 60% in social science (Hair et al., 2010). Additionally, referring to the results generated from Study1 imply eight factors could impact on intention to use driverless cars. Thus, the grouped nine factors (including customers' intention to use) should be retained.

Table 4.10 Selected SPSS Text Output for Factor Analysis (1)

Total Variance Explained							
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	18.94	47.36	47.36	18.94	47.36	47.36	16.72
2	4.91	12.28	59.64	4.91	12.28	59.64	10.30
3	2.66	6.65	66.29	2.66	6.65	66.29	9.73
4	2.48	6.21	72.49	2.48	6.21	72.49	11.43
5	1.27	3.17	75.66	1.27	3.17	75.66	10.25
6	1.13	2.82	78.48	1.13	2.82	78.48	8.66
7	0.97	2.42	80.90	0.97	2.42	80.90	13.29
8	0.73	1.82	82.72	0.73	1.82	82.72	3.83
9	0.70	1.74	84.46	0.70	1.74	84.46	2.90

The scree analysis indicates that nine factors can be retained (see Figure 4.3) as the eigenvalue of ninth factor is 0.697 that approximately meets the criterion of 0.70 (Jolliffe, 2002).That is, the plot slopes steeply downward initially from the first factor and then becomes to a horizontal line gradually when approaches to a ninth factor. Thus, the first nine factors would qualify.

Figure 4.3 Scree Plot (1)



Regarding the rotated factor solution (Table 4.11), there are some problematic variables which need to be sorted out. Normally, two remedies can be adopted to solve issues individually or as a combination in the stage of factor reduction: 1) ignore those problematic variables if the objective is solely data reduction, 2) evaluate each of those problematic variables, depending on the variable's overall contribution to the research as well as its communalities index then delete it (Hair et al., 2010). The researcher conducted the combination of two methods to remedy the issues by deleting five variables, including 4a, 4b, 14a, 15b, and 16d. Consulting the literature of status quo bias and habit, incumbent system habit as a variable that reflects a person's habitual way of using an incumbent automobile vehicle (Elander et al., 1993), thus, consumers tend to become locked-in to an incumbent automobile vehicle and less likely to switch to driverles cars (Murray and Häubl, 2007). Question 15b "I care about cars' safety performance when I buy a car" is not an appropriate item used to measure individuals' incumbent system habit, thus deleted 15b. The cross-loading issue happened on 16a and 16d. While under a certain circumstance, the cross-loading phenomenon can be tolerated in which a primary loading should be at least 0.20 larger than second loading (Gaskin, 2017). In terms of 16a that loaded on factor 7 and factor 9 with values of loading 0.847 and 0.336 individually. The difference between these factor loadings is larger than 0.20, thus, 16a being kept and16d deleted. Thereafter, the researcher re-specified the factor analysis.

Table 4.11 Initial Rotated Factor-Loading Matrix (1)

	Component								
	1	2	3	4	5	6	7	8	9
2a. using driverless cars would be a good idea					1.047				
2b. using driverless cars would be a wise idea					1.037				
2c. using driverless cars would be pleasant experience					0.916				
3a. assuming I had access to the driverless car now, I intend to use it				0.509					
3b. If driverless cars are available on mass market within 1 year, I intend to use it				0.643					
3c. If driverless cars are available on mass market in the next 5-10 years, I intend to use it				0.358					
4a. I intend to buy a driverless car now				1.018					
4b. I plan to buy a driverless car within 1 year				1.066					
4c. I predict that I would buy a driverless car in the next 5-10 years				0.799					
10a. for entertainment								0.489	
10b. dealing with important things								0.476	
10c. socializing								0.554	
11a. benefit for individuals without driving licenses			0.996						

11b. benefit for drivers who are lack of driving experiences			0.929						
11c. benefit for the older or disabled people			0.788						
11d. after drinking alcohol, taking medicines			0.853						
12a. free of drivers' hands	0.678								
12b. mental relax, especially suitable for long journey	0.567								
12c. enjoy private space	0.828								
12d. speed change smoothly	0.852								
13a. lower vehicle emissions, protect the environment	0.937								
13b. less traffic congestion	0.946								
13c. less traffic accidents	1.025								
13d. reduce occupation of public spaces	1.102								
14a. navigation inaccurate, unable to find passenger(s)' location or destination		0.839							
14b. reserved parking space clash		0.934							
14c. underlying driverless technologies are immature		0.921							
14d. relevant regulations and policies are blank		0.929							
14e. urban infrastructures are not ready		0.889							
14f. higher selling price		0.867							
14g. hacking the vehicle’s computer systems, software error or hardware		0.895							

error or data privacy disclosure (location and personal phone number)									
14h. deterioration of driving skills		0.764							
15a. I like driving by myself						0.978			
15b. I care about cars' safety performance when I buy a car							0.627		
15c. I care about control feeling						0.812			
15d. I am used to driving by myself						1.034			
16a. I would like to try new technology							0.874		0.336
16b. I know lots of information about new technology							0.981		
16c. I expect new technology comes up							1.135		
16d. I always buy new technology products, although they are expensive							0.540		0.693

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 8 iterations.

4.2.4.4 Respecification of the Factor Analysis

To deal with the potentially problematic items, the initial factor model is respecified five times with a final decision to remove five items for the remaining analyses, including 4a, 4b, 14a, 15b, and 16d in a logical order. The obtained factor structures have both empirical and conceptual supports. As shown in Table 4.12, the values of KMO and Bartlett’s test for the final respecified factor model performed very well, with KMO larger than 0.50 and Bartlett’s test of Sphericity less than 0.05 (Field, 2013).

Table 4.12 KMO and Bartlett's Test (2)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.925
Bartlett's Test of Sphericity	Approx. Chi-Square	7813.263
	df	595
	Sig.	.000

Additionally, Table 4.13 shows the results of communalities among 35 items that are larger than the threshold of 0.50 and meets acceptable levels of explanations. Table 4.14 shows that seven factors had eigenvalues over Jolliffe's (2002) criterion of 0.70, although factor 8 and factor 9 have lower eigenvalues that named as perceived travel efficiency and perceived enjoyment based upon the previous studies in the context of driverless cars acceptance. For example, Buckley et al. (2018) indicate that consumers’ emotional reactions (e.g. relaxing, enjoyable, and safe feelings) toward driverless cars could be viewed as a hedonic concept. In addition, freed from the driving task and not being liable for it also could relieve drivers’ mental stress and facilitate their hedonic experiences when riding in a driverless car (Walker & Stanton, 2017). In addition, the grouped nine factors after the respecification can explain 86.27% of the variance that is still higher than the threshold level of 60% in social science (Hair et al., 2010). Thus, the formed nine factors are maintained.

Table 4.13 Communalities (2)

	Initial	Extraction
2a. using driverless cars would be a good idea	1.000	0.921
2b. using driverless cars would be a wise idea	1.000	0.925
2c. using driverless cars would be pleasant experience	1.000	0.890
3a. assuming I had access to a driverless car, I intend to use it	1.000	0.820

Table 4.13 Communalities (2)

	Initial	Extraction
3b. If driverless cars are available on mass market within 1 year, I intend to use it	1.000	0.813
3c. If driverless cars are available on mass market in the next 5-10 years, I intend to use it	1.000	0.835
4c. I predict that I would buy an AV in the next 5-10 years	1.000	0.796
10a. for entertainment	1.000	0.900
10b. dealing with important things	1.000	0.875
10c. socializing	1.000	0.907
11a. benefit for individuals without driving licenses	1.000	0.846
11b. benefit for drivers who are lack of driving experiences	1.000	0.872
11c. benefit for the older or disabled people	1.000	0.780
11d. after drinking alcohol, taking medicines	1.000	0.771
12a. free of drivers' hands	1.000	0.873
12b. mental relax, especially suitable for long journey	1.000	0.885
12c. enjoy private space	1.000	0.900
12d. speed change smoothly	1.000	0.867
13a. lower vehicle emissions, protect the environment	1.000	0.877
13b. less traffic congestion	1.000	0.897
13c. less traffic accidents	1.000	0.918
13d. reduce occupation of public spaces	1.000	0.899
14b. reserved parking space clash	1.000	0.802
14c. underlying driverless technologies are immature	1.000	0.898
14d. relevant regulations and policies are blank	1.000	0.887
14e. urban infrastructures are not ready	1.000	0.848
14f. higher selling price	1.000	0.834
14g. hacking the vehicle’s computer systems, software error or hardware error or data privacy disclosure (location and personal phone number)	1.000	0.886
14h. deterioration of driving skills	1.000	0.700
15a. I like driving by myself	1.000	0.860
15c. I care about control feeling	1.000	0.844
15d. I am used to driving by myself	1.000	0.835
16a. I would like to try new technology	1.000	0.872
16b. I know lots of information about new technology	1.000	0.939
16c. I expect new technology comes up	1.000	0.922

Extraction Method: Principal Component Analysis.

Table 4.14 Selected SPSS Text Output for Factor Analysis (2)

Total Variance Explained							
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	17.14	48.96	48.96	17.14	48.96	48.96	9.24
2	4.30	12.29	61.25	4.30	12.29	61.25	8.26
3	2.47	7.05	68.30	2.47	7.05	68.30	13.99
4	2.16	6.16	74.46	2.16	6.16	74.46	8.49
5	1.15	3.28	77.74	1.15	3.28	77.74	11.35
6	0.94	2.70	80.44	0.94	2.70	80.44	6.74
7	0.81	2.31	82.75	0.81	2.31	82.75	10.76
8	0.69	1.97	84.71	0.69	1.97	84.71	12.14
9	0.54	1.56	86.27	0.54	1.56	86.27	11.44

The nine factors are rotated using Promax method to yield orthogonal, interpretable factors. In Table 4.15, the factor structure for the remaining 35 items is very well defined, that is, all variables have higher loadings only on a single factor and present a clean structure of nine distinct groups of variables. Although the variable of 16c did not perform very well as its factor loading is higher than 1, the evidence from previous studies (Jensen et al., 2014; Lu et al., 2005) illustrates that this factor can be used to measure the contrast personal innovativeness in the car context. So far, the nine constructs are formed and entitled as attitude toward driverless cars (2a, 2b, 2c), intention to use (3a, 3b, 3c, 4c), perceived travel efficiency (10a, 10b, 10c), perceived helpfulness (11a, 11b, 11c, 11d), perceived enjoyment (12a, 12b, 12c, 12d), perceived societal benefits (13a, 13b, 13c, 13d), customers' concerns (14b, 14c, 14d, 14e, 14f, 14g, 14h), incumbent system habit (15a, 15c, 15d), and personal innovativeness (16a, 16b, 16c) individually.

Table 4.15 Rotated Factor-Loading Matrix (2)

	Component								
	1	2	3	4	5	6	7	8	9
2a. using driverless cars would be a good idea				0.992					
2b. using driverless cars would be a wise idea				0.972					
2c. using driverless cars would be pleasant experience				0.859					
3a. assuming I had access to a driverless car now, I intend to use it					0.768				
3c. If driverless cars are available on mass market within 1 year, I intend to use it					0.869				
4c. If driverless cars are available on mass market in the next 5-10 years, I intend to use it					0.718				
I predict that I would buy an AV in the next 5-10 years					0.941				
10a. entertainment								0.859	
10b. dealing with important things								0.749	
10c. socializing								0.893	
11a. benefit for individuals without driving licenses		0.950							
11b. benefit for drivers who are lack of driving experiences		0.889							
11c. benefit for the older or disabled people		0.762							
11d. after drinking alcohol, taking medicines		0.808							

12a. free of drivers' hands									0.715
12b. mental relax, especially suitable for long journey									0.771
12c. enjoy private space									0.535
12d. speed change smoothly									0.465
13a. lower vehicle emissions, protect the environment			0.778						
13b. less traffic congestion			0.831						
13c. less traffic accidents			0.961						
13d. reduce occupation of public spaces			0.978						
14b. reserved parking space clash	0.899								
14c. underlying driverless technologies are immature	0.954								
14d. relevant regulations and policies are blank	0.959								
14e. urban infrastructures are not ready	0.912								
14f. higher selling price	0.878								
14g. hacking the vehicle’s computer systems, software error or hardware error or data privacy disclosure (location and personal phone number)	0.927								
14h. deterioration of driving skills	0.762								
15a. I like driving by myself						0.935			
15c. I care about control feeling						0.782			
15d. I am used to driving by myself						0.993			
16a. I would like to try new technology							0.767		

16b. I know lots of information about new technology							0.898		
16c. I expect new technology comes up							1.014		

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 8 iterations.

4.2.4 Data Examination

This section aims to detect data-related problems, viewed as a fundamental preparation for use of the data in SEM. If data failed to go through the following tests (e.g. outlier test, multicollinearity test, and common method bias test), it may generate model-fit problems or unconceivable results, and it will be impossible to assess and evaluate the proposed hypotheses and the conceptual model. Therefore, to ensure the data's usability, validity and reliability without any potential issues, a series of data screening procedures are conducted prior to testing the proposed hypotheses of the framework.

4.2.4.1 Outlier Test

Outliers refers to 'observations with a unique combination of characteristics identifiable as distinctly different from the other observations' (Hair et al., 2010). In other words, outliers represent cases that differ from the main trend of data (Field, 2013). Outliers shown as unusually high or low value among a group of values on a variable can generate the observation that they stand out from the others (Hair et al., 2010). It is imperative to examine the data for the presence of outliers and identify the characteristic of outliers, which ones are problematic and which are not. Three types of outliers are identified based on the number of variables considered, including univariate outlier, bivariate outliers, and multivariate outliers. Univariate and bivariate outliers are derived from single and paired variables respectively, while multivariable outliers are involved more than two variables (Hair et al., 2010). Generally, detecting outliers can be made easily through a standardized format or drawing a scatterplot to observe the range of distributions for paired variables (Hair et al., 2010). Due to the complicated multivariate analyses, the bivariate methods become inadequate; this issue addressed by the Mahalanobis measure. It defined as a method that measures the distance of each observation in multidimensional space from the mean centre of all observations (Hair et al., 2010). Higher values represent observations are far away from the general distribution of observations and vice versa. The conservative level of significance could be 1% (i.e., $p<0.001$) as the threshold value for designation as an outlier (Hair et al., 2010). Table 4.16 below shows the multivariate outliers were calculated via Mahalanbis distance.

The highlighted cases represented influential outliers (the significance level is $p<0.001$), that is the correlations between the variables for these responses (14 cases) are significantly different when compare to the rest of dataset. However, the limitation of this method is that the larger the sample size (more than 200), the easier it is to achieve the significance results due to small deviations from normality. Hair et al. (2010) further claim that the better way to deal with outliers is retain them if no evidence can prove that they are truly aberrant and not representative of any observations in the populations. In the same vein, Alves and Nascimento (2002) insist that outliers should be retained because outliers may simply exist as extreme values in a probability distribution of a random variable that is natural and common. In other words, outliers do not really exist in Likert-scales, that means answering at the extreme value (1 or 7) is not really representative of outlier behaviour (Gaskin, 2018). In line with these, there is no evidence that can prove that the 14 observations are truly aberrant and not representative of any observations of the population. Thus, the identified outliers should be kept as they belong to a segment of the population and valuable to ensure generalizability to the entire population. Especially, the problematic outliers can be accommodated in the subsequent multivariate analysis in a manner which does not distort the analysis (Hair et al., 2010).

Table 4.16 Analysis of Outliers

Observation number	Mahalanobis d-squared	Significance	Observation number	Mahalanobis d-squared	Significance
72	70.602	0.000	460	20.227	0.042
4	52.789	0.000	181	20.219	0.042
462	44.327	0.000	13	20.143	0.043
15	44.236	0.000	178	19.998	0.045
372	40.731	0.000	54	19.647	0.050
2	40.645	0.000	68	19.605	0.051
3	40.645	0.000	461	19.525	0.052
166	39.608	0.000	203	19.279	0.056
1	39.417	0.000	195	19.201	0.058
240	38.683	0.000	135	19.03	0.061
131	36.483	0.000	171	18.996	0.061
62	35.156	0.000	123	18.993	0.061
338	34.824	0.000	75	18.82	0.064
199	33.239	0.000	94	18.771	0.065
49	31.855	0.001	430	18.675	0.067
162	31.448	0.001	211	18.551	0.070
299	30.448	0.001	44	18.495	0.071
77	29.44	0.002	158	18.33	0.074
249	29.156	0.002	7	18.235	0.076
395	28.62	0.003	376	18.034	0.081
14	28.331	0.003	111	17.804	0.086

Table 4.16 Analysis of Outliers

Observation number	Mahalanobis d-squared	Significance	Observation number	Mahalanobis d-squared	Significance
29	27.912	0.003	294	17.753	0.087
48	27.851	0.003	43	17.647	0.090
10	27.787	0.003	104	17.642	0.090
56	27.616	0.004	28	17.509	0.094
354	27.12	0.004	73	17.45	0.095
306	25.728	0.007	159	17.174	0.103
45	25.31	0.008	257	17.098	0.105
5	25.257	0.008	31	17.018	0.107
101	24.787	0.010	20	17.004	0.108
11	24.341	0.011	326	16.886	0.111
78	24.109	0.012	26	16.877	0.112
145	24.1	0.012	91	16.679	0.118
23	23.867	0.013	106	16.659	0.118
8	22.417	0.021	222	16.621	0.120
12	22.2	0.023	81	16.467	0.125
107	22.137	0.023	431	16.438	0.126
42	21.703	0.027	36	16.368	0.128
63	21.401	0.029	367	16.29	0.131
383	21.362	0.030	288	16.253	0.132
6	21.28	0.031	35	15.914	0.144
113	21.264	0.031	9	15.824	0.148
86	21.23	0.031	400	15.787	0.149
141	21.165	0.032	309	15.726	0.152
231	21.026	0.033	140	15.721	0.152
340	20.972	0.034	57	15.709	0.152
382	20.818	0.035	30	15.552	0.159
437	20.636	0.037	21	15.466	0.162
391	20.495	0.039	71	15.26	0.171
24	20.475	0.039	258	15.218	0.173

4.2.5 Demographic Information of the Respondents

556 participants participated in online survey, while 63 participants were unengaged as evidenced by giving the exact same response for every single item. Therefore, 493 valid samples were collected that represented 88.60% of responding rate. Male and female were adopted an equal portion of the sample, of which 50.7% were male and 49.3% were female. Their ages were mainly within the groups of 18-25 (37.5%) and 26-35 (30.6%), therefore, 1/3 of participants were belong to the Generation Z cohort. Majority of them have heard of self-driving cars before. In terms of education, 78.7% of the respondents were educated with bachelor’s degree. More than half of the

participants were full time staff (58.6%), and full-time students dominated 28% with the rest were part-time staffs, unemployed, retired, and part-time students. 31.8% of the participants have salary over 4,500 up to 9,000 rmb. A total of 69.4% had driving experience before. Approximately, 30% of the participants mentioned that their driving frequency was a few times a year and 31% were in possession of a manual driving car. And 36.8% expressed their preferred driverless vehicles would be driverless private cars. This is shown in Table 4.17.

Table 4.17 Demographics and Driving Details on Respondents (N=493)

Category	Variable	Frequency	Percentage (%)
Gender			
	male	250	50.7
	female	243	49.3
Age			
	18-25	185	37.5
	26-35	151	30.6
	36-45	78	15.8
	46-55	66	13.4
	56-65	12	2.4
	66 and over	1	0.2
Heard of AVs before			
	Yes	456	92.5
	No	37	7.5
Education			
	Elementary-school school	4	0.8
	Middle-school diploma	10	2.0
	High-school diploma	30	6.1
	University degree	388	78.7
	Others	61	12.4
Current level of employment			
	Full-time staff	289	58.6
	Part-time staff	27	5.5
	Unemployed	22	4.5
	Retirement	14	2.8
	Full-time student	138	28.0
	Part-time student	3	0.6
Monthly salary			
	Below 1,500 rmb	104	21.1
	Over 1,500 up to 4,500 rmb	137	27.8
	Over 4,500 up to 9,000 rmb	157	31.8
	Over 9,000 up to 35,000 rmb	65	13.2
	Over 35,000 up to 55,000 rmb	9	1.8

Table 4.17 Demographics and Driving Details on Respondents (N=493)

Category	Variable	Frequency	Percentage (%)
	Over 55,000 up to 80,000 rmb	6	1.2
	Over 80,000 rmb	15	3.0
Driving experience			
	Yes	342	69.4
	No	151	30.6
Driving frequency			
	A few times in a year	145	29.41
	Several times in a month	90	18.26
	Several times in a week	111	22.52
	Several times on each day	97	19.68
	About once a day	50	10.14
Automated features of own car			
	Manual control	153	31.0
	Function-specific automation	86	17.4
	Combined function automation	80	16.2
	Limited self-driving automation	52	10.5
	Do not know	122	24.7
Preferred driverless cars type			
	Automated bus	182	36.8
	Automated private car	249	50.5
	Automated taxi	62	12.6

4.2.6 Developing the Overall Measurement Model

4.2.6.1 Confirmatory Factor Analysis

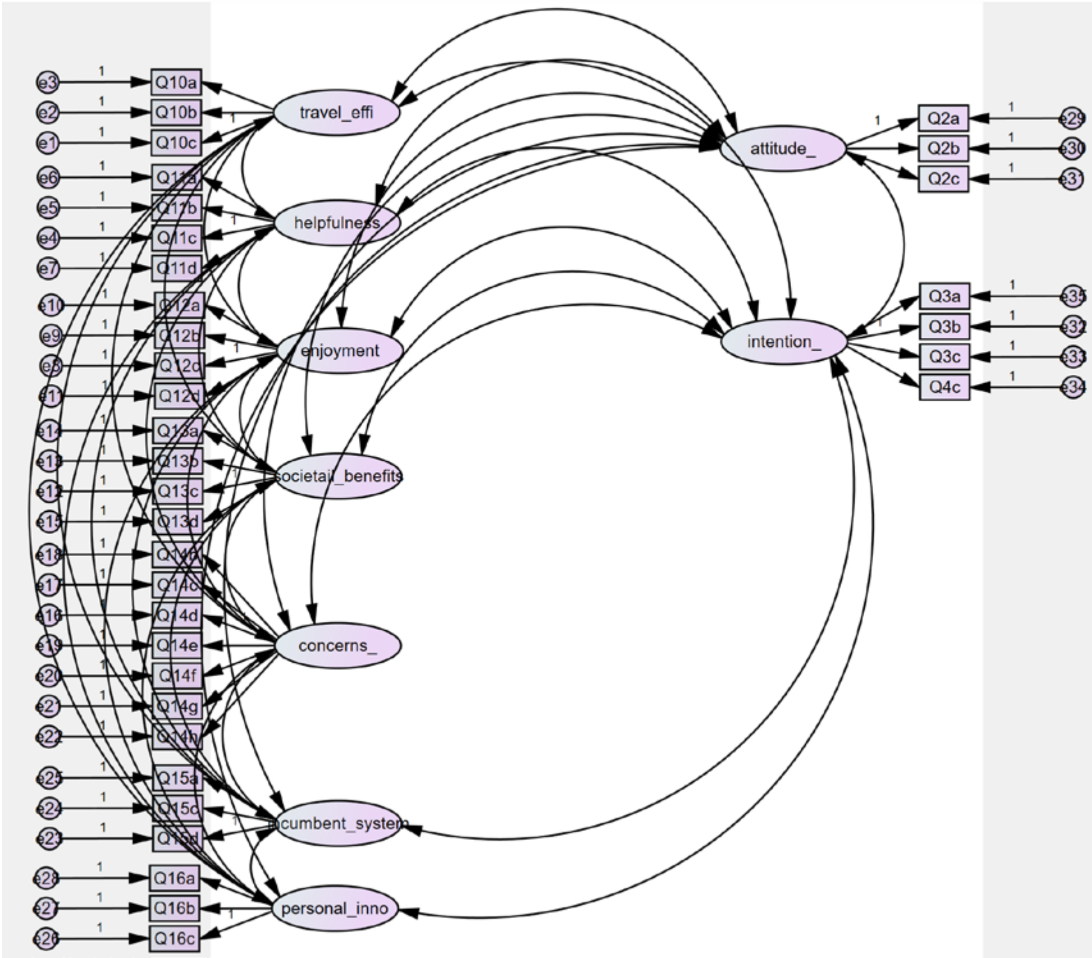
Perceived travel efficiency, perceived enjoyment, perceived helpfulness and perceived societal benefits are proposed as antecedents of attitude towards driverless cars. Meanwhile, perceived travel efficiency, perceived enjoyment, customers’ concerns and attitude are presented as predictors of intention to use driverless cars, along with moderators of incumbent system habit and personal innovativeness that are supposed to impact on the causalities between dependent and independent variables. The hypothesized causalities have been developed based on the relevant theories and extant literature as described in Chapter 2. The process of designing a good construct measure for each construct has been conducted in Chapter 3, the formed measurement scale for each construct has passed construct reliability and validity tests.

Confirmatory factor analysis (CFA) should be used to test the measurement model firstly as CFA statistics can present how well a theoretical specification of the factors matches the actual data (Hair et al., 2010), with adequate reliability and validity tests. It is an imperative premise to test the structural model (SEM) by using the same sample. Thus, the purpose of conducting CFA is twofold: (1) to specify how measured variables logically and systematically represent constructs involved in a theoretical model, and (2) to decide if the measurement theory can combine with a structural theory to fully specify a SEM model (Hair et al., 2010). Once the specified model is estimated, model fit needs to be assessed by using different types of measures to reflect the model's ability to represent the data. The chi-square (x^2) is the fundamental statistical measure to test differences between the observed and estimated covariance matrices (Hair et al., 2010), while the x^2 likelihood ratio statistic is sensitive, especially when the sample size is large and a large number of constraints are involved (Levesque, Zuehlke, Stanek & Ryan, 2004). Normally, the researcher should look for a relatively small x^2 value and it should be non-significant in a well-fitting model Kim & Kim, 2010). The present study also used some basic indices such as goodness-of-fit index (GFI), adjusted goodness of fit index (AGFI) and badness-of-fit measures, including SRMR and RMSEA.

In this stage, each latent construct is included in the measurement model, along with the measured indicator variables that are assigned to latent constructs. The primary advantage of using this way to estimate correlations is that the result demonstrates an estimate of what the correlation would be in the absence of measurement error (Kim & Kim, 2010). Amos Graphics is used to perform a confirmatory factor analysis to relate the variables to the underlying factors. The process and results of the CFA are presented in the following sections.

The total of 493 observed samples was used for full model measurement check in this research. A visual diagram depicting the measurement model is shown in Figure 4.4.It represents a nine-construct measurement model with 35 indicators associated with corresponding constructs and correlational relationships between constructs.

Figure 4.4 Full Measurement Model



The x^2 test of full measurement model yields a statistic of 1311.785 with the value equal to 2.503, which is well within the recommended level between 2 to 5 (Hair et al., 2010). In terms of goodness-of-fit indices, GFI=0.864, NFI=0.921, CFI=0.951, and FLI=0.944 are higher than the threshold level of 0.90 (Hair et al., 2010). The values of RMSEA and SRMR are 0.055 and 0.042 individually which are between 0.03 to 0.08 (Hair et al., 2010). Apparently, all indices indicate good fit as their values are within the recommended criteria. While there is still some room for further improvement, the results of the model fit shown in Table 4.18.

Table 4.18 Results of Model Fit

	Recommended Criteria	Results
Normal chi-square (x^2/df)	Between 2 to 5	2.503
GFI	>0.90, close to 1	0.864
NFI	>0.90, close to 1	0.921
CFI	>0.90, close to 1	0.951
TLI (NNFI)	>0.90, close to 1	0.944
RMSEA	Between 0.03 to 0.08	0.055
SRMR	Between 0.03 to 0.08	0.042

In addition, reviewed results of unstandardized and standardised maximum likelihood parameter estimates that shown in Table 4.19, all the parameter estimates are statistically significant and substantively meaningful.

Table 4.19 Selected Amos Text Output for Full Measurement Model

Regression Weights			**Unstandardised Estimate**	**S.E.**	**C.R.**	**P**	**Standardised Estimate**
Q10c	<---	Travel efficiency	1				0.897
Q10b	<---	Travel efficiency	0.939	0.032	29.312	***	0.889
Q10a	<---	Travel efficiency	0.992	0.032	31.25	***	0.916
Q11c	<---	helpfulness	1				0.818
Q11b	<---	helpfulness	1.143	0.048	23.967	***	0.895
Q11a	<---	helpfulness	1.265	0.054	23.268	***	0.876
Q11d	<---	helpfulness	1.22	0.059	20.747	***	0.809
Q12c	<---	enjoyment	1				0.941
Q12b	<---	enjoyment	0.953	0.029	33.315	***	0.884
Q12a	<---	enjoyment	0.959	0.031	30.767	***	0.860
Q12d	<---	enjoyment	0.918	0.026	35.744	***	0.905
Q13c	<---	Societal benefits	1				0.896
Q13b	<---	Societal benefits	1.015	0.031	32.837	***	0.927
Q13a	<---	Societal benefits	0.939	0.033	28.32	***	0.870
Q13d	<---	Societal benefits	0.969	0.033	29.512	***	0.886

Table 4.19 Selected Amos Text Output for Full Measurement Model

Regression Weights			Unstandardised Estimate	S.E.	C.R.	P	Standardised Estimate
Q14d	<---	Concerns	1				0.872
Q14c	<---	Concerns	0.97	0.037	26.055	***	0.864
Q14b	<---	Concerns	0.863	0.043	19.884	***	0.739
Q14e	<---	Concerns	0.953	0.038	24.764	***	0.841
Q14f	<---	Concerns	0.938	0.041	22.933	***	0.806
Q14g	<---	Concerns	1.013	0.04	25.482	***	0.854
Q14h	<---	Concerns	0.787	0.053	14.879	***	0.603
Q15d	<---	Incumbent system habit	1				0.856
Q15c	<---	Incumbent system habit	0.915	0.04	23.116	***	0.850
Q15a	<---	Incumbent system habit	1.016	0.042	24.453	***	0.896
Q16c	<---	Personal innovativeness	1				0.901
Q16b	<---	Personal innovativeness	1.019	0.031	32.834	***	0.940
Q16a	<---	Personal innovativeness	1.009	0.038	26.497	***	0.845
Q2a	<---	Attitude	1				0.889
Q2b	<---	Attitude	1.105	0.037	30.187	***	0.924
Q2c	<---	Attitude	0.992	0.039	25.487	***	0.844
Q3b	<---	Intention to use	1				0.808
Q3c	<---	Intention to use	0.894	0.041	21.707	***	0.851
Q4c	<---	Intention to use	0.874	0.048	18.332	***	0.751
Q3a	<---	Intention to use	1.037	0.048	21.817	***	0.855

The following step is to identify the area that can be improved to increase the model fit based on the results of MI (see Table 4.20). MI relates to the covariances that provide important diagnostic information and suggestions for remedy discrepancies between the proposed and estimated model (Gaskin, 2017). Normally, the appropriate way to improve the model fit via the tool of modification indices is to covary error terms that belong to the same factor, rather than covary error terms with observed or latent variables, or with other error terms generated from different factors (Gaskin, 2017). In addition, the largest modification indices should be dealt with first. Consistent with this, value of the covariances between item 14f and item 14g (err20<->err21; MI=66.691) is the largest MI compared with the others. As item 14f and item 14g are used to measure a same construct-customers' concerns, it is reasonable to covary err20 and err21 and re-test the model fit. In other words, the overall x^2 value of the measurement model can be reduced by 66.691.

Table 4.20 Amos Text Output for Measurement Model: Modification Indices and Parameter Change Statistics

Covariances:			M.I.	Par Change
e33	<-->	e34	32.141	0.263
e32	<-->	e35	31.27	0.288
e22	<-->	Incumbent system habit	26.868	0.373
e20	<-->	e21	66.691	0.264
e18	<-->	e21	25.283	-0.182
e17	<-->	e20	31.599	-0.168
e17	<-->	e18	41.357	0.215
e16	<-->	e20	22.288	-0.141
e16	<-->	e17	57.83	0.192
e12	<-->	e14	26.245	-0.158
Variances **Regression Weights**			**M.I.**	**Par Change**
Q14h	<---	Incumbent system habit	23.597	0.227
Q14h	<---	Q15a	21.353	0.181
Q14g	<---	Q14f	21.228	0.12
Q14f	<---	Q3a	20.024	0.103

4.2.6.2 Respecification of the Full Measurement Model

The modified model structure is presented in Figure 4.5. The overall model is 1232.716, with value of presents 2.357, which is lower than 5.0 as the suggested level by Hair et al. (2010). The assessment of goodness-of-fit statistics generates the following results (see Table 4.21), GFI=0.872, NFI=0.925, CFI=0.956, and TLI=0.949 are closer or higher than the threshold value of 0.90 (Hair et al., 2010). Also, the values of RMSEA and SRMR, are 0.052 and 0.043 individually. Both values fall within the scale of 0.03 to 0.08 (Hair et al., 2010). Comparing the generated model fit among two measurement models, the current model indicates a better model fit with lower value of x^2, with relatively higher level of GOF indices and lower level of badness-of-fit, except for a slightly higher value of SRMR. Because the modification is minor, the theoretical integrity of a measurement model is not severely damaged and the research can proceed using the predetermined model and data.

Figure 4.5 Re-specified Full Measurement Model

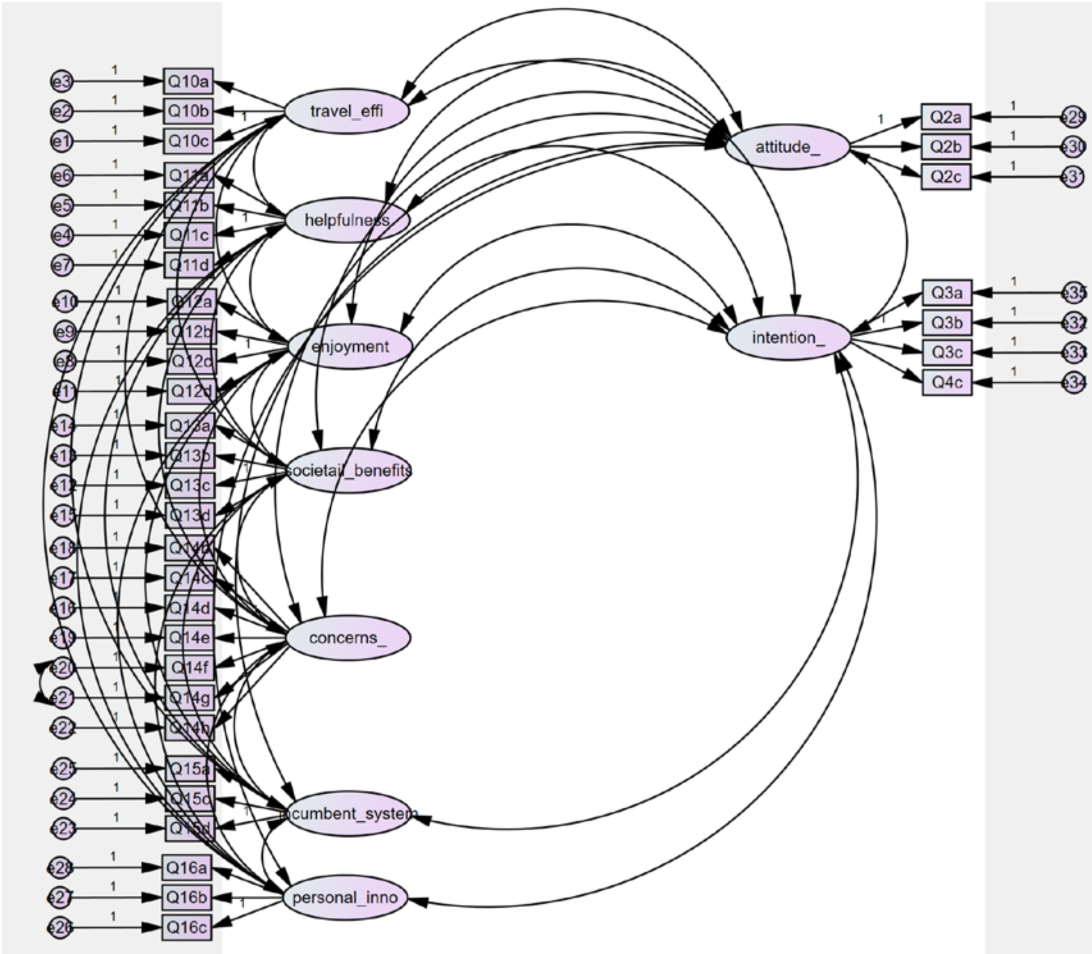


Table 4.21 Results of Model Fit after Modification

	Recommended Criteria	**Results**
Normal chi-square (x^2/df)	Between 2 to 5	2.357
GFI	>0.90, close to 1	0.872
NFI	>0.90, close to 1	0.925
CFI	>0.90, close to 1	0.956
TLI (NNFI)	>0.90, close to 1	0.949
RMSEA	Between 0.03 to 0.08	0.052
SRMR	Between 0.03 to 0.08	0.0434

Reviewing the results of unstandardized and standardised maximum likelihood parameter estimates in Table 4.22, all the parameter estimates are statistically significant and substantively meaningful.

Table 4.22 Selected Amos Text Output for Full Model

Regression Weight			Unstandardised Estimate	S.E.	C.R.	P	Standardised Estimate
Q10c	<---	Travel efficiency	1				0.897
Q10b	<---	Travel efficiency	0.939	0.032	29.312	***	0.889
Q10a	<---	Travel efficiency	0.992	0.032	31.248	***	0.916
Q11c	<---	Perceived helpfulness	1				0.818
Q11b	<---	Perceived helpfulness	1.143	0.048	23.966	***	0.895
Q11a	<---	Perceived helpfulness	1.265	0.054	23.267	***	0.876
Q11d	<---	Perceived helpfulness	1.22	0.059	20.75	***	0.809
Q12c	<---	perceived enjoyment	1.043	0.034	30.77	***	0.941
Q12b	<---	perceived enjoyment	0.994	0.037	27.093	***	0.884
Q12a	<---	perceived enjoyment	1				0.86
Q12d	<---	perceived enjoyment	0.957	0.034	28.368	***	0.905
Q13c	<---	Societal benefits	1				0.896
Q13b	<---	Societal benefits	1.015	0.031	32.836	***	0.927
Q13a	<---	Societal benefits	0.939	0.033	28.32	***	0.87
Q13d	<---	Societal benefits	0.969	0.033	29.513	***	0.886
Q14d	<---	concerns_	1				0.89
Q14c	<---	concerns_	0.977	0.034	28.462	***	0.888
Q14b	<---	concerns_	0.863	0.041	20.935	***	0.754
Q14e	<---	concerns_	0.917	0.037	24.66	***	0.827
Q14f	<---	concerns_	0.867	0.041	21.161	***	0.76
Q14g	<---	concerns_	0.951	0.039	24.166	***	0.819
Q14h	<---	concerns_	0.757	0.052	14.661	***	0.592
Q15d	<---	Incumbent system habit	1				0.856
Q15c	<---	Incumbent system habit	0.915	0.04	23.119	***	0.85
Q15a	<---	Incumbent system habit	1.016	0.042	24.453	***	0.896
Q16c	<---	Personal innovativeness	1				0.901
Q16b	<---	Personal innovativeness	1.019	0.031	32.835	***	0.94
Q16a	<---	Personal innovativeness	1.009	0.038	26.502	***	0.845
Q2a	<---	Attitude	1				0.889
Q2b	<---	Attitude	1.105	0.037	30.19	***	0.924
Q2c	<---	Attitude	0.992	0.039	25.487	***	0.843
Q3b	<---	Intention to use	1				0.808
Q3c	<---	Intention to use	0.893	0.041	21.709	***	0.851
Q4c	<---	Intention to use	0.874	0.048	18.327	***	0.75

Table 4.22 Selected Amos Text Output for Full Model

Regression Weight			Unstandardised Estimate	S.E.	C.R.	P	Standardised Estimate
Q3a	<---	Intention to use	1.037	0.047	21.833	***	0.855

4.2.6.3 Reliability Analysis for the Full Measurement Model

It is necessary to conduct construct validity and reliability tests when doing a CFA, which is a prior conditional requirement before moving to the next stage to test a causal model.

Reliability refers to a measure of the degree to which a set of indicators of a latent construct is internally consistent based on how highly interrelated the indicators are with each other (Hair et al., 2010). In other words, it is used to measure the extent to which the adopted indicators all measure the same construct. An important measure is being used to assess the reliability coefficient among the entire scale, called Cronbach's alpha (α) with an agreed value in the range of 0.70 to 0.80 (Field, 2013; Hair et al., 2010). As a complementary measurement of reliability, construct reliability (CR) and the average variance extracted (AVE) can be used as a means of testing construct reliability. This is a critical step to make sure variables are qualified to go through validity tests.

Construct reliability (CR) is advocated as a useful measurement to assess measured variables internal consistency, which is often used in conjunction with SEM models (Hair et al., 2010). CR is computed from the squared sum of factor loadings (L_i) for each construct and the sum of the error variance terms for a construct (e_i), the formula shown as:

$$CR = \frac{(\sum_{i=1}^{n} L_i)^2}{(\sum_{i=1}^{n} L_i)^2 + (\sum_{i=1}^{n} e_i)}$$

The value of reliability estimate is 0.70 or higher suggests good reliability, reliability between 0.60 and 0.70 may be acceptable as prerequisite to ensure other indictors of a model's construct validity are good (Hair et al., 2010).

The average variance extracted (AVE) is calculated as the mean variance extracted for the items loadings on a construct (Hair et al., 2010). In other words, it is the average percentage of variation explained among the items of a construct. The formula of calculating AVE bases on standardised loading:

$$\text{AVE} = \frac{\sum_{i=1}^{n} L_i^2}{n}$$

L_i: Represents the standardized factor loading;

i: Represents the number of items

So, AVE is calculated as the total of all squared standardized factor loadings divided by the number of items (Hair et al., 2010). An AVE of 0.5 or above is a sign of adequate convergence, and vice versa (Hair et al., 2010). Table 4.23 shows all constructs have acceptable values for Cronbach's Alpha within the range from 0.887 to 0.941 that is greater than the threshold of 0.70 (Hair et al., 2010). Values of AVE with range from 0.643 to 0.811 and CR ranging from 0.889 to 0.934 exceeding the minimum threshold of 0.70 as well (Hair et al., 2010). Thus, the measurement items used in this study converged on their proposed latent factors and demonstrated internal consistency. Table 4.13 demonstrated the results of the reliability and validity of all constructs.

Table 4.23 Reliability and Convergent Validity

Variables	Factor loadings	Composite reliability	AVE	Cronbach's Alpha
Attitude		0.916	0.785	0.913
ATT1	0.89			
ATT2	0.92			
ATT3	0.84			
Perceived Travel efficiency		0.928	0.811	0.927
TE1	0.92			
TE2	0.89			
TE3	0.90			
Perceived helpfulness		0.912	0.723	0.909
PH1	0.88			
PH2	0.90			
PH3	0.82			
PH4	0.81			
Perceived enjoyment		0.943	0.806	0.941
PE1	0.86			
PE2	0.88			
PE3	0.94			
PE4	0.91			
Societal benefits		0.941	0.801	0.941
SB1	0.87			
SB2	0.927			

Table 4.23 Reliability and Convergent Validity

Variables	Factor loadings	Composite reliability	AVE	Cronbach's Alpha
SB3	0.896			
SB4	0.886			
Concerns		0.926	0.643	0.919
CON1	0.739			
CON2	0.864			
CON3	0.872			
CON4	0.841			
CON5	0.806			
CON6	0.854			
CON7	0.603			
Incumbent system habit		0.901	0.753	0.900
INC1	0.896			
INC2	0.85			
INC3	0.856			
Personal innovativeness		0.924	0.803	0.920
PI1	0.845			
PI2	0.94			
PI3	0.901			
Intention to use		0.889	0.668	0.887
INT1	0.855			
INT2	0.808			
INT3	0.851			
INT4	0.751			

ATT, attitude; TE, Perceived travel efficiency; PH, perceived helpfulness; PE, perceived enjoyment; SB, societal benefits; CON, concerns; INC, incumbent system habit; PI, personal innovativeness; INT, intention to use; AVE=Average Variance Extracted.

4.2.6.4 Validity Analysis for the Full Measurement Model

There are three types of validity estimates that are commonly used in social science research, including face or content validity, convergent validity, and discriminant validity (Hair et al., 2010).

Face or content validity represents a same thing that refers to the extent to which the content of the item is consistent with the construct definition (Hair et al., 2010) that based upon the logical link between the questions and objectives of the study (Kumar, 2014). Greater the link implies higher the face validity of the instrument. The limitation of this type of judgement is that it is highly based upon subjective logic, solely decided by the researcher's judgement (Hair et al., 2010). In order to reduce the subjective evaluation of the measurement adopted in this research, the constructs are measured by multi-item scales and assessed in extant studies in the relevant marketing areas with adequate reliability and validity. Face validity of new explored constructs was also assessed via the pilot study with feedbacks from the respondents and academia in the field.

Convergent validity: convergent validity is used to assess whether or not 'the items that are indicators of a specific construct that converge or share a high proportion of variance in common' (Hair et al., 2010). The size of the factor loading is a commonly used measurement to assess convergent validity, high loadings on a factor would indicate that they converge on a common point, and vice versa (Hair et al., 2010). At a minimum, all factor loadings should be statistically significant, and have standardized loading estimates above 0.50 at least, and ideally 0.70 or higher (Hair et al., 2010).

In addition, construct validity as an alternative reliability estimate is often used in conjunction with SEM models, with value of 0.70 or higher suggests good reliability (Hair et al., 2010). Additionally, AVE as a strict measure of convergent validity is treated as a conservative measure more than CR (Malhotra & Briks, 2007). The rationale is that the range of AVE is from 0 to 1, adequately convergent valid measures should contain less than 50% error variance that means the value of AVE should be 0.5 or above that (Hair et al., 2010). The results of CR and AVE for measuring the convergent validity among item measures are shown in the Table 4.23 above. Each factor has an adequate amount of convergent validity as the value of CR and AVE are all above the threshold level of 0.70 that indicate the measures all consistently represent the same latent construct.

Discriminant validity: discriminate validity refers to the extent to which a construct is truly distinct from other constructs (Hair et al., 2010). High discriminant validity implies that a construct is unique and reflects more facets other measures do not (Hair et al., 2010). To assess discriminant validity, the techniques proposed by Chin (1998) and Hair et al. (2010) were used. First, a matrix of correlations between constructs with reflective measures was developed. In this mode, the square root of the AVE of each construct on the diagonal is greater than the correlations between each construct and other constructs that are off the diagonal (see Table 4.24). Second, discriminant validity was assessed by adopting Fornell-Larcker criteria (Fornell & Larcker, 1981). Fornell and Larcker (1981) explained the cross-loading criterion is that the loading of each indicator should be higher than all cross-loadings. That is, the value of AVE should be greater than all correlations between each pair of constructs (Chin, 1998; Oliveira, Thomas, Baptista & Campos, 2016). For rigorous results, Hair et al. (2010) proposed that AVE value should be greater than the Maximum Shared Squared Variance (MSV). Table 4.24 shows that the values of AVE for each construct are larger than that of MSV, thus there is no concern about discriminate validity.

Table 4.24 Results of AVE, MSV, and Cross-loadings of Each Factor

	AVE	MSV	ATT	TE	PH	PE	SB	CON	INC	PI	INT
ATT	0.785	0.659	**0.886**								
TE	0.811	0.656	0.568	**0.901**							
PH	0.723	0.450	0.430	0.671	**0.850**						
PE	0.806	0.656	0.622	0.810	0.671	**0.898**					
SB	0.801	0.643	0.592	0.757	0.596	0.802	**0.895**				
CON	0.643	0.168	0.224	0.295	0.137	0.321	0.270	**0.802**			
INC	0.753	0.127	0.004	0.171	0.049	0.144	0.158	0.294	**0.868**		
PI	0.803	0.428	0.505	0.637	0.483	0.654	0.620	0.410	0.356	**0.896**	
INT	0.668	0.659	0.812	0.664	0.536	0.734	0.678	0.178	0.005	0.552	**0.817**

Notes: ATT, attitude; TE, Perceived travel efficiency; PH, perceived helpfulness; PE, perceived enjoyment; SB, societal benefits; CON, concerns; INC, incumbent system habit; PI, personal innovativeness; INT, intention to use.

Subsequently, multicollinearity must be assessed as the model contains more than one independent variables. If there is a strong correlation between two or more predictors that means their measurement scales overlap and may represent the same variable (Hair et al., 2010). Multicollinearity can have detrimental effects on the predict ability of regression model, and can also influence the estimation of the regression coefficients and their statistical significance test (Hair et al., 2010). This study adopted two most commonly used multicollinearity diagnostic measures-namely tolerance and the variance inflation factor (VIF).

The former refers to the amount of variability of the selected independent variable not explained by the other independent variables, the VIF used to measure whether a predictor has a strong linear relationship with the other predictor(s) (Field, 2013). Hair et al. (2010) proposed that a value of the tolerance larger than 0.10 and a value of VIF less than 5 or 3 could be the ideal cut-off threshold to measure multicollinearity. On the other hand, Hair et al. (2010) address the emergence of multicollinearity that is unavoidable in consumer response data.

In this study, the diagnostic result of multicollinearity shown in Table 4.25. Intention to use driverless cars was treated as a dependent variable and other variables were identified as independent variables. The values of tolerance for each independent variable were above the threshold level of 0.10, and the values of corresponding VIF below to the cut-off level of 5. Therefore, no multicollinearity concern exists across those variables. Overall, the results from different analysing methods provided a strong empirical support for the discriminate validity of the constructs in the research model.

Table 4.25 Result of Collinearity Test

	Collinearity Statistics	
Variables	**Tolerance**	**VIF**
Travel efficiency	.342	2.922
Perceived helpfulness	.545	1.833
Perceived enjoyment	.278	3.600
Societal benefits	.368	2.714
Concerns	.801	1.248
Personal innovativeness	.472	2.117
Incumbent system habit	.815	1.226
Attitude	.592	1.689

a. Dependent Variable: Intention to use AVs

So far, the face and content validity for each construct was assessed and accepted based on the justifications that presented above. The proposed constructs' convergent validity and discriminate validity also assessed through a series of statistical measures with adequate validity. It means the formed instrument scales for measuring each construct are reliable and trustworthy.

4.2.6.5 Common Method Bias

Common method bias (CMB) refers to variance that is generated due to the form of measurement at different levels of abstraction, such as the content of specific items, scale type, and response format (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). In other words, such bias are generated due to something external to the measures. This is a potential problem in behavioural research and viewed as one of the main sources of measurement error that threatens the validity of the relationships between measures (Podsakoff et al., 2003). In the marketing study, the most common way that generates method bias is that participants try to maintain consistency between their cognition and attitudes, that is, participants would have a desire to show consistent and rational responses (Podsakoff et al., 2003). In addition, participants may tend to respond to questions more as a result of their social acceptability than their true feelings, or effected by personal philosophy, recent mood, layout of the questionnaire, written style of the statements, translation quality, a single method (e.g. online survey), a same scale format (e.g. Likert scales) etc. (Podsakoff et al., 2003). The generated response bias will either inflate or deflate responses to some extent (Gaskin, 2017).

In order to control the influence of common method biases that hide behind this research, the researcher paid extra attention on the questionnaire itself. For example, the translation of specific wording and statements were checked to make sure participants are able to understand them easily; adopted different format to display Seven-Likert scale (e.g. round circles and check marks) to avoid participants getting bored with questions; changed question order which may contain logical flow inside of them in order to diminish participants' motivation to use prior responses to answer subsequent questions; ensured the respondents' answers to be anonymous, and assured respondents to answer questions as honestly as possible.

Furthermore, two tests of the potential threat of CMB were conducted. First, Harman's single factor test was adopted using principle components factor analysis (Podsakoff et al., 2003). The method constrains the number of factors extracted in EFA to be just one, then examining the unrotated factor solution. Nine factors emerged in the results, the largest variance accounted for by a single factor is 41.47% which is less than 50%, which suggests CMB does not affect the result (see Table 4.26). Second, a single factor test was conducted by adding a common latent factor (CLF) to capture the common variance among all observed variables in the model (Podsakoff et al., 2003). The result of comparing the standardised regression weights from this model to the standardised regression weights of a model without the CLF shows that there was no CMB concern in the research data as the amount of differences below the threshold value of 0.20 (Gaskin, 2017) (see Table 4.27). Figure 4.6 depicted the measurement model with CLF.

Table 4.26 Results of Harman's Single Factor Test

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	14.515	41.472	41.472	14.515	41.472	41.472
2	4.788	13.680	55.152			
3	2.457	7.021	62.172			
4	1.979	5.655	67.827			
5	1.291	3.689	71.516			
6	1.104	3.155	74.671			
7	.886	2.532	77.204			
8	.762	2.177	79.381			
9	.709	2.025	81.406			
10	.625	1.787	83.192			
11	.534	1.525	84.717			
12	.438	1.252	85.969			
13	.364	1.040	87.009			
14	.332	.948	87.956			
15	.320	.914	88.870			
16	.306	.874	89.744			
17	.293	.836	90.580			
18	.271	.774	91.354			
19	.268	.765	92.119			
20	.260	.742	92.862			
21	.243	.694	93.556			
22	.232	.662	94.218			
23	.225	.643	94.862			
24	.204	.583	95.444			
25	.199	.569	96.013			
26	.188	.536	96.550			
27	.180	.514	97.063			
28	.162	.463	97.526			
29	.158	.451	97.978			
30	.141	.403	98.381			
31	.128	.366	98.747			
32	.122	.350	99.097			
33	.117	.333	99.430			
34	.110	.313	99.743			
35	.090	.257	100.000			

Extraction Method: Principal Component Analysis.

Figure 4.6 Measurement Model with CLF (Unconstrained Model)

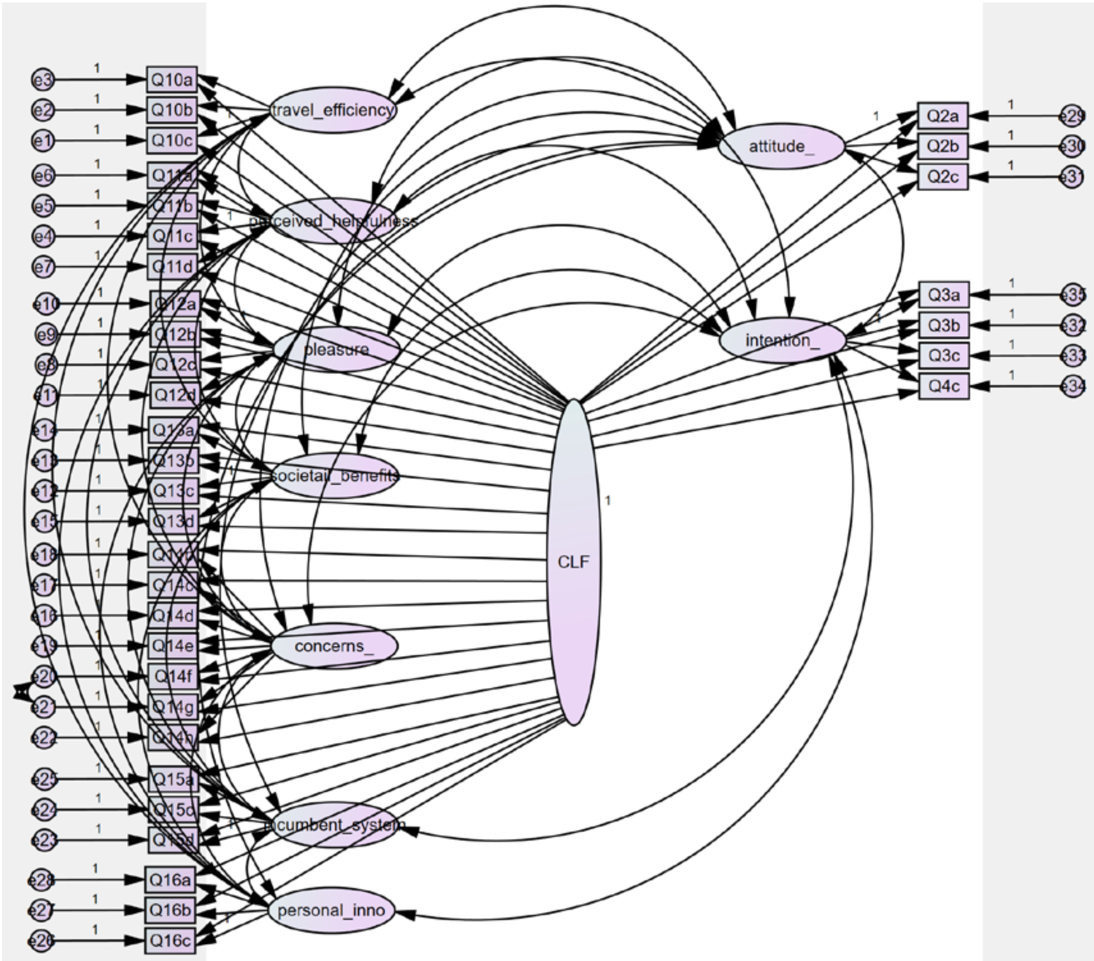


Table 4.27 Result of Standardised Regression Weights with/without CLF

Standardized Regression Weights: (with CLF)				**Standardized Regression Weights: (No CLF)**				
			Estimate				Estimate	Delta <0.20
Q10c	<---	Travel efficiency	0.835	Q10c	<---	Travel efficiency	0.897	0.062
Q10b	<---	Travel efficiency	0.756	Q10b	<---	Travel efficiency	0.889	0.133
Q10a	<---	Travel efficiency	0.817	Q10a	<---	Travel efficiency	0.916	0.099
Q11c	<---	Perceived helpfulness	0.742	Q11c	<---	Perceived helpfulness	0.818	0.076
Q11b	<---	Perceived helpfulness	0.825	Q11b	<---	Perceived helpfulness	0.895	0.07
Q11a	<---	Perceived helpfulness	0.873	Q11a	<---	Perceived helpfulness	0.876	0.003

Table 4.27 Result of Standardised Regression Weights with/without CLF

Standardized Regression Weights: (with CLF)				Standardized Regression Weights: (No CLF)				
			Estimate				Estimate	Delta <0.20
Q11d	<---	Perceived helpfulness	0.797	Q11d	<---	Perceived helpfulness	0.809	0.012
Q12c	<---	enjoyment	0.843	Q12c	<---	enjoyment	0.941	0.098
Q12b	<---	enjoyment	0.757	Q12b	<---	enjoyment	0.884	0.127
Q12a	<---	enjoyment	0.786	Q12a	<---	enjoyment	0.86	0.074
Q12d	<---	enjoyment	0.741	Q12d	<---	enjoyment	0.905	0.164
Q13c	<---	Societal benefits	0.832	Q13c	<---	Societal benefits	0.896	0.064
Q13b	<---	Societal benefits	0.859	Q13b	<---	Societal benefits	0.927	0.068
Q13a	<---	Societal benefits	0.808	Q13a	<---	Societal benefits	0.87	0.062
Q13d	<---	Societal benefits	0.83	Q13d	<---	Societal benefits	0.886	0.056
Q14d	<---	Concerns	0.798	Q14d	<---	concerns_	0.89	0.092
Q14c	<---	Concerns	0.801	Q14c	<---	concerns_	0.888	0.087
Q14b	<---	Concerns	0.718	Q14b	<---	concerns_	0.754	0.036
Q14e	<---	Concerns	0.735	Q14e	<---	concerns_	0.827	0.092
Q14f	<---	Concerns	0.638	Q14f	<---	concerns_	0.76	0.122
Q14g	<---	Concerns	0.701	Q14g	<---	concerns_	0.819	0.118
Q14h	<---	Concerns	0.585	Q14h	<---	concerns_	0.592	0.007
Q15d	<---	Incumbent system habit	0.87	Q15d	<---	Incumbent system habit	0.856	-0.014
Q15c	<---	Incumbent system habit	0.826	Q15c	<---	Incumbent system habit	0.85	0.024
Q15a	<---	Incumbent system habit	0.881	Q15a	<---	Incumbent system habit	0.896	0.015
Q16c	<---	Personal innovativeness	0.782	Q16c	<---	Personal innovativeness	0.901	0.119
Q16b	<---	Personal innovativeness	0.84	Q16b	<---	Personal innovativeness	0.94	0.1
Q16a	<---	Personal innovativeness	0.76	Q16a	<---	Personal innovativeness	0.845	0.085
Q2a	<---	Attitude	0.837	Q2a	<---	Attitude	0.889	0.052
Q2b	<---	Attitude	0.9	Q2b	<---	Attitude	0.924	0.024

Table 4.27 Result of Standardised Regression Weights with/without CLF

Standardized Regression Weights: (with CLF)				**Standardized Regression Weights: (No CLF)**				
			Estimate				Estimate	Delta <0.20
Q2c	<---	Attitude	0.746	Q2c	<---	Attitude	0.843	0.097
Q3b	<---	Intention to use	0.891	Q3b	<---	Intention to use	0.808	-0.083
Q3c	<---	Intention to use	0.687	Q3c	<---	Intention to use	0.851	0.164
Q4c	<---	Intention to use	0.618	Q4c	<---	Intention to use	0.75	0.132
Q3a	<---	Intention to use	0.819	Q3a	<---	Intention to use	0.855	0.036
Q10a	<---	CLF	0.412					
Q10b	<---	CLF	0.471					
Q10c	<---	CLF	0.348					
Q11a	<---	CLF	0.182					
Q11b	<---	CLF	0.352					
Q11c	<---	CLF	0.348					
Q11d	<---	CLF	0.174					
Q12a	<---	CLF	0.359					
Q12b	<---	CLF	0.456					
Q12c	<---	CLF	0.425					
Q12d	<---	CLF	0.529					
Q13a	<---	CLF	0.324					
Q13b	<---	CLF	0.345					
Q13c	<---	CLF	0.33					
Q13d	<---	CLF	0.313					
Q14b	<---	CLF	0.255					
Q14c	<---	CLF	0.387					
Q14d	<---	CLF	0.393					
Q14e	<---	CLF	0.375					
Q14f	<---	CLF	0.424					
Q14g	<---	CLF	0.428					
Q14h	<---	CLF	0.154					
Q15a	<---	CLF	0.136					
Q15c	<---	CLF	0.234					
Q15d	<---	CLF	0.034					
Q16a	<---	CLF	0.369					
Q16b	<---	CLF	0.426					
Q16c	<---	CLF	0.448					
Q2a	<---	CLF	0.289					
Q2b	<---	CLF	0.259					
Q2c	<---	CLF	0.405					
Q3a	<---	CLF	0.263					
Q3b	<---	CLF	0.066					
Q3c	<---	CLF	0.569					
Q4c	<---	CLF	0.452					

Once descriptive analysis and exploratory factor analysis (EFA) were completed using SPSS, the impact of generated factors on customers' attitude toward driverless cars and intention to use was then analysed via AMOS. Reliability and validity tests were also conducted via CFA. The measurement model confirmed that the measured variables appropriately represent constructs that are not measured directly. Thereafter, the next step is to fully specify a SEM model, thereof, the relationships among measured variables and latent constructs can be measured. Then, the proposed theoretical model will be assessed.

4.2.7 Developing the Structural Equation Model (SEM)

4.2.7.1 Structural Evaluation of the Model

Based on the results of the established measurement model, the proposed structural model is also to be tested via Amos. The path analysis is not only used to examine the proposed relationships between intention to use driverless cars and its antecedents (perceived travel efficiency, perceived helpfulness, perceived enjoyment, perceived societal benefits, concerns, and attitude toward driverless cars) but also the hypothesised moderating factors (incumbent system habit and personal innovativeness). As a prerequisite requirement, the factor score for each latent factor was calculated. It is computed based on the factor loadings of all variables on the factor. It can increase the reliability of the measurement through multivariate measurement. Afterwards, the direct influencers on intention to use driverless cars are examined. The value of x^2/df is 2.207 that less than the threshold value of 5.0 (Hair et al., 2010). The indices of goodness-of-fit, GFI=0.998, NFI=0.998, CFI=0.999, TLI=0.927, which are higher than 0.80 and closer to the suggested value of 1 (Hair et al., 2010). The badness-of-fit indices RMSEA and SRMR also perform well, the value of SRMR is lower than the suggested value of 0.03 but still can be accepted in the condition that the value of CFI is above 0.92 (Hair et al., 2010). All shown in Table 4.28.

Table 4.28 Model Fit of the Proposed Structural Model

	Recommended Criteria	**Results**
Normal chi-square (x^2/df)	Between 2 to 5	2.207
GFI	>0.90, close to 1	0.998
NFI	>0.90, close to 1	0.998
CFI	>0.90, close to 1	0.998

TLI (NNFI)	>0.90, close to 1	0.927
RMSEA	Between 0.03 to 0.08	0.050
SRMR	Between 0.03 to 0.08	0.003

After reviewing the results of parameter estimates for each proposed relationship between variables, all the parameter estimates have been found to be statistically significant (Table 4.29).

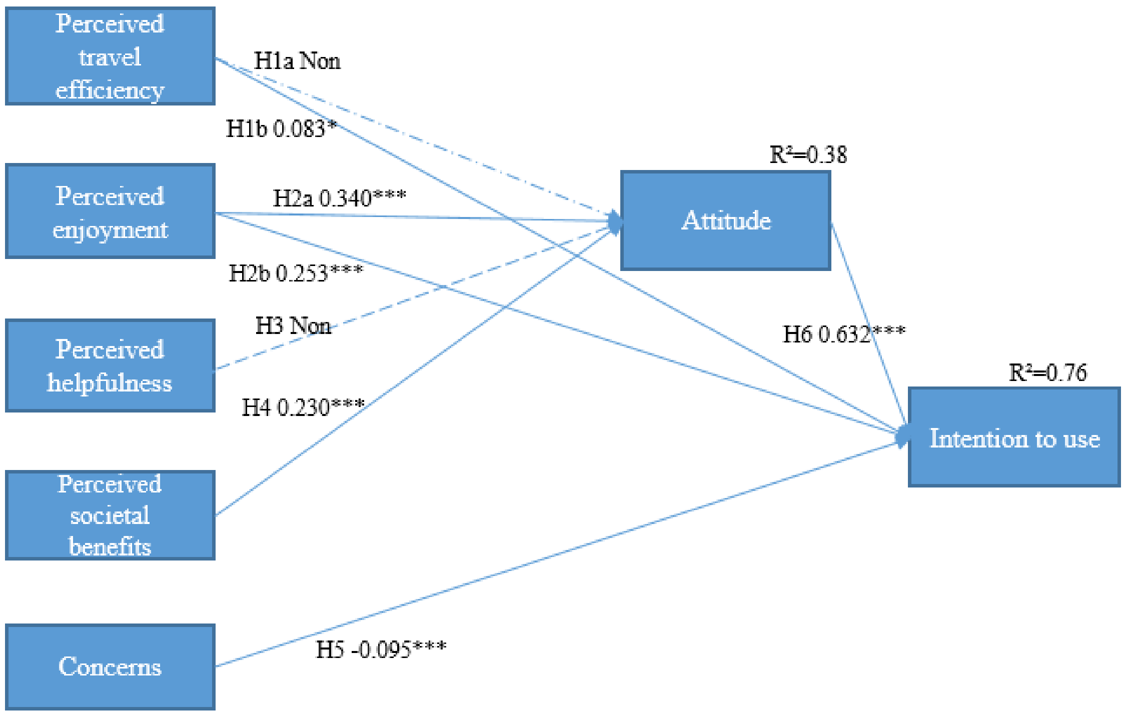
Table 4.29 Selected Amos Text Output for Proposed Structural Model

Regression Weights			Unstandardized Estimate	S.E.	C.R.	P	Standardized Estimate
attitude_	<---	travel efficiency	0.132	0.068	1.93	0.054	0.124
attitude_	<---	helpfulness	-0.067	0.052	-1.272	0.203	-0.063
attitude_	<---	enjoyment	0.365	0.074	4.963	***	0.34
attitude_	<---	societal benefits	0.225	0.061	3.699	***	0.23
attitude_	<---	gender	-0.002	0.095	-0.016	0.987	-0.001
attitude_	<---	age	0.122	0.041	2.943	0.003	0.11
attitude_	<---	education	0.061	0.078	0.778	0.436	0.028
attitude_	<---	experience	0.056	0.105	0.531	0.595	0.02
intention_	<---	attitude_	0.743	0.033	22.757	***	0.632
intention_	<---	concerns_	-0.14	0.033	-4.227	***	-0.095
intention_	<---	travel efficiency	0.105	0.046	2.294	0.022	0.083
intention_	<---	enjoyment	0.319	0.048	6.621	***	0.253
intention_	<---	gender	0.141	0.07	2.026	0.043	0.047
intention_	<---	age	0.039	0.03	1.294	0.196	0.03
intention_	<---	education	-0.09	0.057	-1.569	0.117	-0.035
intention_	<---	experience	-0.027	0.077	-0.352	0.725	-0.008

Note: *** Significant at p<0.001; **Significant at p<0.01; * Significant at p<0.05

The path coefficients are depicted in Figure 4.7, with the results of proposed hypotheses from H1a to H6. The constructs for intention to use produced an R^2 of 0.76, indicating that more than half of the intention to use driverless cars could be explained by perceived travel efficiency, perceived enjoyment, concerns and attitude towards driverless cars. In addition, perceived enjoyment and perceived societal benefits contributed 38% of explained variance (R^2) for attitude. This empirical evidence strongly confirms the explanatory power of this model. The results of the proposed hypotheses are shown in Table 4.30 below.

Figure 4.7 Results of Path Analysis (I)



Note: *** Significant at p<0.001; **Significant at p<0.01; * Significant at p<0.05

——————→Supported Hypothesis

------------------→Non Supported Hypothesis

R^2=Squared Multiple Correlations

Table 4.30 Results of Hypotheses Test (H1 to H6)

Hypotheses	Path coefficients	Significance Level	Supported?
H1a: Perceived travel efficiency positively influences the attitude toward self-driving cars	0.124	P=0.054	No
H1b: Perceived travel efficiency positively influences the intention to use self-driving cars	0.083*	P=0.022	Yes
H2a: Perceived enjoyment positively influences the attitude toward self-driving cars	0.340***	***	Yes
H2b: Perceived enjoyment positively influences the intention to use self-driving cars	0.253***	***	Yes
H3: Perceived helpfulness positively influences the attitude toward self-driving cars	-0.063	P=0.203	No
H4: Perceived societal benefits positively influence the attitude toward self-driving cars	0.230***	***	Yes
H5: Concerns negatively influence the intention to use self-driving cars	-0.095***	***	Yes
H6: Attitude positively influences the intention to use self-driving cars	0.632***	***	Yes

Note: *** Significant at $p<0.001$; **Significant at $p<0.01$; * Significant at $p<0.05$

$R^2=0.38$ (Attitude toward self-driving cars); $R^2=0.76$ (Intention to use self-driving cars)

Two out of eight hypotheses are accepted among the identified variables. The coefficient estimates for the path from perceived travel efficiency toward attitude to driverless cars is not significant ($ß=0.124$, $p>0.05$), thus H1a should be rejected. The positive relationship between perceived travel efficiency and intention to use driverless cars is statistically significant ($ß=0.083$, $p<0.05$), supporting H1b. H2a and H2b are accepted, confirming the significant role of perceived enjoyment on customers' attitude toward driverless cars (ß=0.340, p<0.001), and their intention to use driverless cars (ß=0.253, p<0.001). This finding confirmed the previous statement of that IT products which provide consumers "fun, fantasy, arousal, sensory and enjoyment" experience can stimulate their purchases (Hirschman & Holbrook, 1982), along with the confirmed motivating role of perceived travel efficiency on user intention to use driverless cars that reflected consumer purchasing behaviours either encouraged by a need for achieving hedonic experience or for instrumental benefits (Batra & Ahtola, 1991). The positive relationship between perceived helpfulness and attitude toward driverless cars fails (ß=-0.063, p>0.05), thus rejected H3. H4 is supported (ß=0.230, p<0.001), that is, perceived societal benefits has a positive impact on user attitude toward driverless cars. These findings are consistent with extant finding that consumers are likely to focus on personal benefits more than societal benefits (Zmud et al., 2016) as the influencing power of perceived societal benefits on attitude is weaker than that of perceived enjoyment did in the model. The negative influence of consumers' concerns about driverless cars on their behavioural intention is confirmed (ß=-0.095, p<0.001), thus H5 is accepted. It corroborates previous findings that customers' concern toward self-driving cars is the main barrier to restrict their intention to use, such as technological challenges, regulation challenges with laws and insurance issues, and ethical challenges (Bjørner, 2017). H6 is supported by a significant positive relationship between attitude and intention to use driverless cars (ß=0.632, p<0.001). Unsurprisingly, individuals' attitude has a strong impact on their behavioural intention regardless of the type of products or services. This echoes with extant research conducted by Payre et al. (2014), that users' intention to use a fully automated vehicle can be predicted by their attitudes.

To sum up, the significant predictors of consumers' intention to use driverless cars are identified. The accepted hypotheses confirmed that hedonic motivation, utilitarian motivation, individual awareness of social responsibility, and attitude towards driverless cars have positive influences on their behavioural intention to use self-driving cars. Among the confirmed motivators, hedonic variable is the most powerful indicator of positive attitude towards driverless cars among other determinants, and also has a direct influence on consumer behavioural intention to use. Multi-featured customers' concerns about driverless cars are confirmed as a second important indicator that negatively influence consumers' intention to use driverless cars.

4.2.7.2 Moderation Effects of Individual Difference Variables

Hypotheses from H7a to H7h are hypothesised to exhibit moderating effects of incumbent system habit on the determinants as well as the consequences of individual perceptions about driverless cars; hypotheses from H8a to H8h are hypothesised to exhibit moderating effects of personal innovativeness on the determinants as well as the consequences of individual perceptions about driverless cars.

1) Embedded personal innovativeness in the conceptual model

The SEM used to conduct moderation test indicates the observed X^2 for this model is 31(=5.162) which is slightly higher than the recommended value of 5.0 (Hair et al., 2010). The goodness-of-fit indices of GFI=0.993, NFI=0.993, CFI=0.995, TLI (NNFI)=0.877 are above the suggested guideline of 0.9 (Hair et al., 2010). The value of RMSEA is 0.09 that slightly higher than the threshold of 0.08 (Hair et al., 2010), while Browne and Cudeck (1992) state that the value of RMSEA within the range from 0.08 and 0.1 is still acceptable but represents a mediocre fit. The value of SRMR is 0.012 and below the lower bound of 0.03 (Hair et al., 2010); it still can be viewed as a good fit as this value less than the threshold of 0.05 that proposed by Byrne (2016) (see Table 4.31).

Table 4.31 Model Fit (Personal Innovativeness within the Initial Model)

	Recommended Criteria	**Results**
Normal chi-square (x^2/df)	Between 2 to 5	5.162
GFI	>0.90, close to 1	0.993
NFI	>0.90, close to 1	0.993
CFI	>0.90, close to 1	0.995
TLI (NNFI)	>0.90, close to 1	0.877
RMSEA	Between 0.03 to 0.08	0.090
SRMR	Between 0.03 to 0.08	0.012

According to the results of moderation test regarding personal innovativeness (shown in Table 4.32), its moderating effects were not confirmed. This is because the parameter for each proposed relationship between variables presented a non-significant value (see highlighted numbers). Therefore, the hypothesised moderating role of personal innovativeness and its corresponding hypotheses (H8a to H8h) were rejected.

Table 4.32 Selected Amos Text Output for Moderator Test (Personal Innovativeness)

Regression Weights			Unstandardized Estimate	S.E.	C.R.	P	Standardized Estimate
attitude_	<---	Travel efficiency	0.104	0.069	1.518	0.129	0.097
attitude_	<---	Helpfulness	-0.071	0.052	-1.36	0.174	-0.067
attitude_	<---	Enjoyment	0.335	0.074	4.536	***	0.312
attitude_	<---	Societal benefits	0.205	0.062	3.303	***	0.209
attitude_	<---	Personal innovativeness	0.185	0.069	2.685	0.007	0.125
attitude_	<---	Enjoyment_x_ personal innovativeness	-0.074	0.083	-0.892	0.372	-0.079
attitude_	<---	Societal benefits_x_ personal innovativeness	0.077	0.084	0.923	0.356	0.081
intention_	<---	Attitude	0.749	0.033	22.801	***	0.636
intention_	<---	Concerns	-0.145	0.034	-4.249	***	-0.098
intention_	<---	Travel efficiency	0.099	0.047	2.133	0.033	0.079
intention_	<---	Enjoyment	0.304	0.049	6.215	***	0.24
intention_	<---	Personal innovativeness	0.03	0.051	0.584	0.559	0.017
intention_	<---	Travel efficiency_x_ personal innovativeness	-0.017	0.054	-0.323	0.747	-0.015
intention_	<---	Attitude_x_personal innovativeness	-0.045	0.037	-1.225	0.221	-0.037
intention_	<---	Enjoyment_x_personal innovativeness	0.073	0.058	1.258	0.208	0.066
intention_	<---	Concerns_x_personal innovativeness	-0.029	0.022	-1.303	0.192	-0.031

2) Embedded incumbent system habit in the conceptual model

The SEM used to conduct moderation test indicates the observed X^2 for this model is 22.37 (=4.476) which is less than the higher bound of 5.0 (Hair et al., 2010). The goodness-of-fit indices of GFI=0.995, NFI=0.995 and CFI=0.996 are above the suggested guideline of 0.9 (Hair et al., 2010), excepting TLI (NNFI)=0.894 is slightly lower than the guideline. The value of RMSEA is 0.084 that still represents a mediocre fit (0.08<RMSEA<0.1) as suggested by Browne and Cudeck (1992). The value of SRMR is 0.012 also less than the threshold of 0.05 proposed by Byrne (2016). Thus, the indices of badness-of-fit present the values of RMSEA as 0.080, and 0.012 for SRMR which are resident in the acceptable level and reflect a good model fit (see Table 4.33).

Table 4.33 Model Fit (Incumbent System Habit within the Initial Model)

	Recommended Criteria	**Results**
Normal chi-square (x^2/df)	Between 2 to 5	4.476
GFI	>0.90, close to 1	0.995
NFI	>0.90, close to 1	0.995
CFI	>0.90, close to 1	0.996
TLI (NNFI)	>0.90, close to 1	0.894
RMSEA	Between 0.03 to 0.08	0.084
SRMR	Between 0.03 to 0.08	0.012

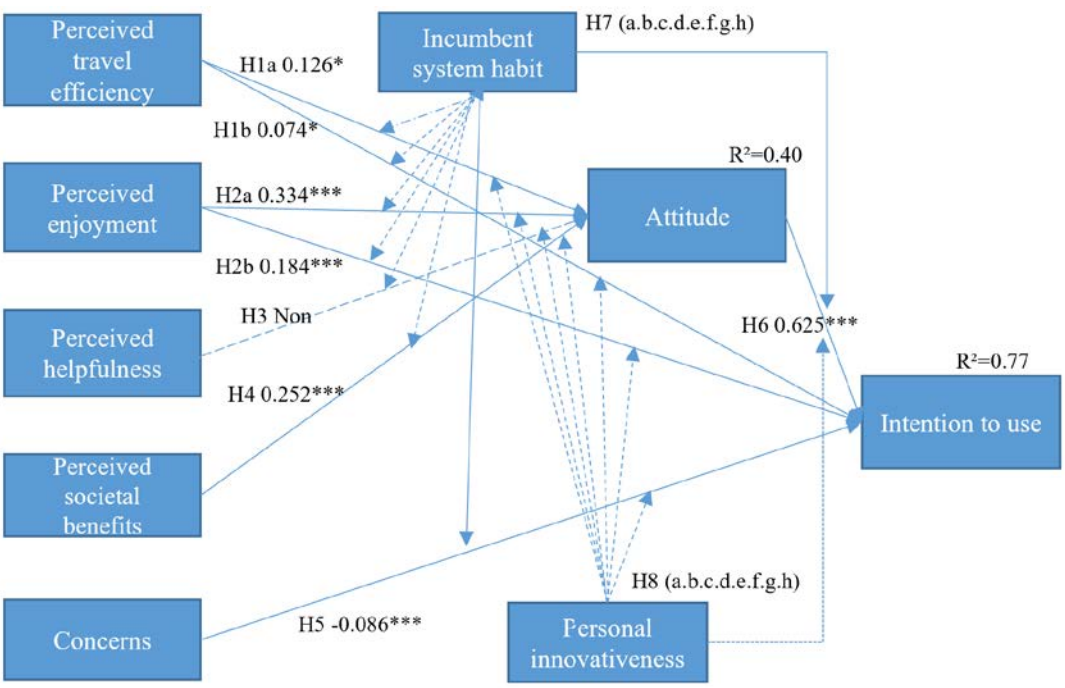
According to the results of moderation test for incumbent system habit (shown in Table 4.34), the parameter for proposed moderating relationship between variables presented significant values (see highlighted numbers). Thus, the results confirmed the moderator role of incumbent system habit in the study of driverless cars acceptance. This factor dampens the positive relationships between perceived enjoyment and attitude toward driverless cars (H7c), and the positive relationship between attitude and intention to use (H7g). Conversely, it strengthens the negative relationship between concerns toward driverless cars and intention to use (H7h).

Table 4.34 Selected Text Output for Moderator Test (Incumbent System Habit)

Regression Weights			Unstandardized Estimate	S.E.	C.R.	P	Standardized Estimate
attitude_	<---	Travel efficiency	0.135	0.067	2.001	0.045	0.126
attitude_	<---	Helpfulness	-0.075	0.051	-1.47	0.141	-0.071
attitude_	<---	Enjoyment	0.359	0.073	4.947	***	0.334
attitude_	<---	Societal benefits	0.247	0.06	4.1	***	0.252
attitude_	<---	Incumbent system habit	-0.139	0.037	-3.738	***	-0.138
attitude_	<---	Enjoyment_x_incumbent system habit	-0.137	0.08	-1.711	0.087	-0.149
attitude_	<---	Societal benenfit_x_incumbent system habit	0.093	0.084	1.109	0.267	0.097
intention_	<---	Attitude	0.736	0.033	22.5	***	0.625
intention_	<---	Concerns	-0.126	0.035	-3.649	***	-0.086
intention_	<---	Travel efficiency	0.093	0.047	1.957	0.05	0.074
intention_	<---	Enjoyment	0.233	0.053	4.396	***	0.184
intention_	<---	Enjoyment_x_incumbent system habit	0.052	0.065	0.794	0.427	0.048
intention_	<---	Concerns_x_incumbent system habit	-0.055	0.023	-2.36	0.018	-0.054
intention_	<---	Incumbent system habit	-0.057	0.028	-2.024	0.043	-0.048
intention_	<---	Attitude_x_incumbent system habit	-0.106	0.035	-2.98	0.003	-0.089
intention_	<---	Travel efficiency_x_incumbent system habit	-0.062	0.051	-1.21	0.226	-0.056

After testing the hypothesised moderators, the statistical evidence confirmed the moderating role of incumbent system habit in the study of driverless cars acceptance. The proposed conceptual model was re-specified (shown in Figure 4.8). After integrating the moderating factor into the initial model, the conceptual model reached a value of 40% in explaining attitude toward driverless cars and 70% of the variance in customers' intention to use. It illustrates that to explicate the role of an individual trait variable-individual incumbent system habit in driverless cars acceptance can further our understanding of the underlying rationale that behind consumer behaviours. Additionally, the results indicate that the parameter estimate for each proposed relationship between variables are slightly lower if compared with that of the initial model. Although the positive effect of perceived travel efficiency on customers' attitude toward driverless cars was significant (ß=0.126, $p<0.05$) in this situation, it should be rejected. The reason is that have a third variable, that is, a moderator, which can help researchers to understand the direction and/or strength of the relations between an independent and a dependent variable (Baron & Kenny, 1986). Thus, a confirmed relationship between variables is the premise to assess the influences of moderators. Based on this evidence, H1a can be rejected.

Figure 4.8 Results of Path Analysis (II)



Note: *** Significant at $p<0.001$; **Significant at $p<0.01$; * Significant at $p<0.05$

——————→Supported Hypothesis

-------------------->Non Supported Hypothesis

R^2=Squared Multiple Correlations

Additionally, in order to precisely explicate the moderating role of incumbent system habit in driverless cars acceptance, the researcher evaluated the results of unstandardised and standardised maximum likelihood parameter estimates (see Table 4.35). Two groups of moderating hypotheses are confirmed with statistically significant results. The verified interactions are plotted in Figure 4.9 and Figure 4.10.

Table 4.35 Selected Amos Text Output for Moderator Test

Regression Weights			Unstandardised Estimate	S.E.	C.R.	P	Standardised Estimate
attitude_	<---	Perceived enjoyment	0.359	0.073	4.947	***	0.334
attitude_	<---	Societal benefits	0.247	0.06	4.1	***	0.252
attitude_	<---	Incumbent system habit	-0.139	0.037	-3.738	***	-0.138
attitude_	<---	Enjoyment_x_ incumbent system habit	-0.137	0.08	-1.711	0.087	-0.149
attitude_	<---	Societal benenfit_x_incumbent system habit	0.093	0.084	1.109	0.267	0.097
intention_	<---	Attitude	0.748	0.032	23.126	***	0.635
intention_	<---	Concerns	-0.125	0.035	-3.597	***	-0.085
intention_	<---	Travel efficiency	0.118	0.045	2.622	0.009	0.094
intention_	<---	Concerns_x_incumbent system habit	-0.054	0.023	-2.301	0.021	-0.053
intention_	<---	Incumbent system habit	-0.052	0.028	-1.834	0.067	-0.044
intention_	<---	Attitude_x_incumbent system habit	-0.095	0.035	-2.712	0.007	-0.08

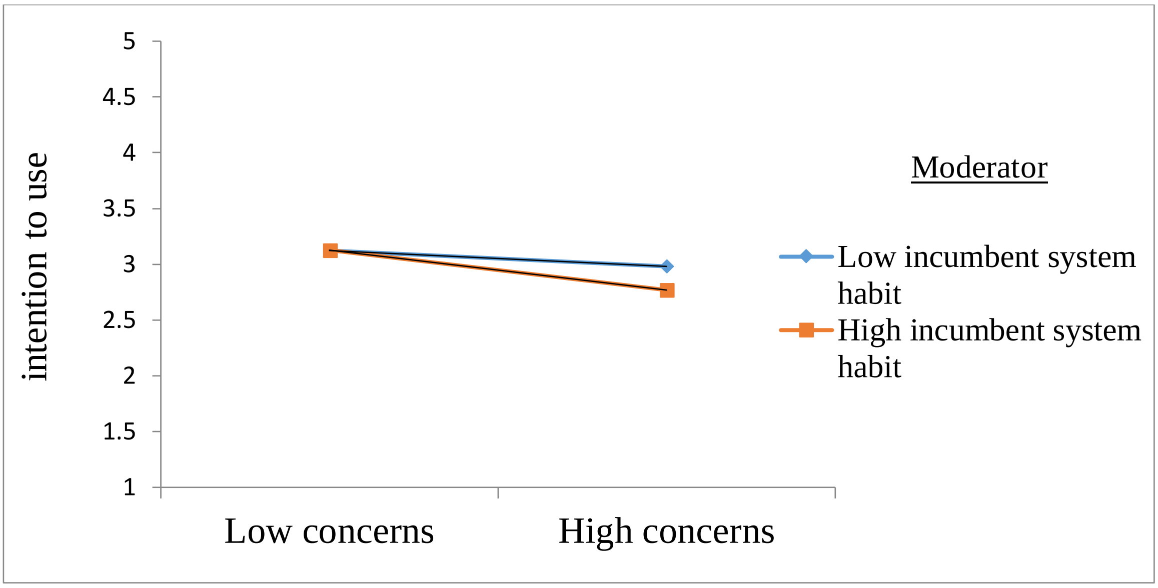
In order to compare an individual's level of incumbent system habit on driverless cars acceptance, 493 respondents were grouped into High incumbent system habit group and Low incumbent system habit group. The sum of the measurement scale for incumbent system habit was calculated based upon individuals' response level of three measurement items (15a、15c and 15d) for the variable of incumbent system habit.

The median of incumbent system habit is 16, then the respondent whose summative scale for incumbent system habit less than 16 were coded as 1; hence, the rest of values were coded as 2. By doing so, 259 respondents were groups as 1 and 234 respondents grouped as 2 regarding respondents' incumbent system habit.

1) **Incumbent system habit moderates the relationship between concerns and intention to use driverless cars (H7g)**

The results shown that incumbent system habit strengthens the negative relationship between concerns and intention to use, meaning that for customers who have stronger preference for incumbent automobile vehicles (e.g., traditional manual driving vehicles), concerns about driverless cars impact more heavily on intention to use than for others with lower incumbent system habit toward incumbent automobile vehicles (see **Figure 4.9**).

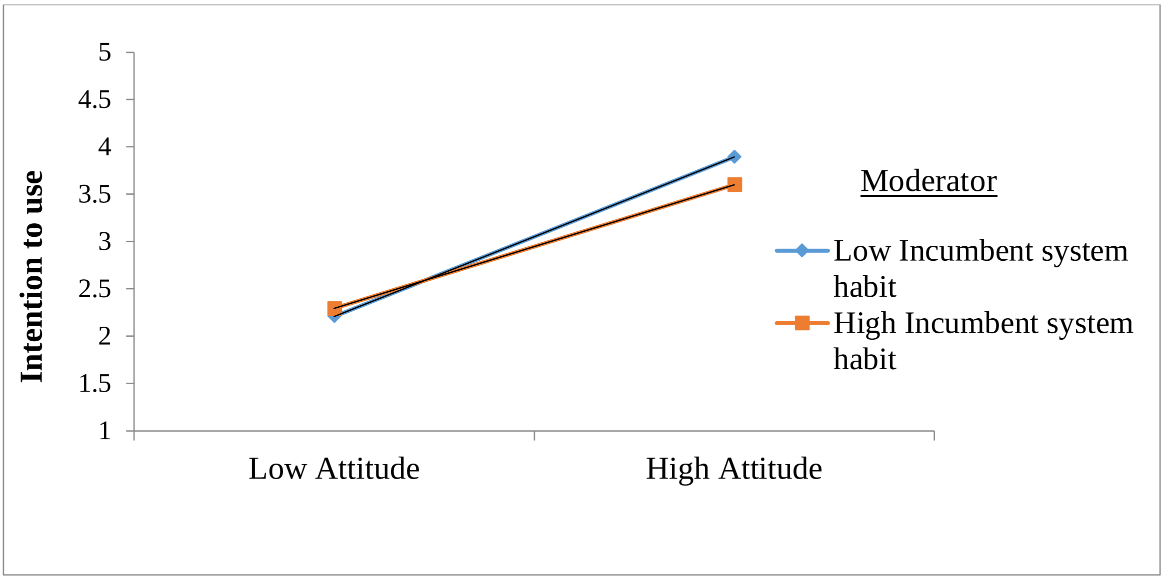
Figure 4.9 Moderation Effect of Incumbent System Habit on the Relationship between User Concerns and Intention to Use



2) **Incumbent system habit moderates the relationship between attitude and intention to use driverless cars (H7h)**

The results shown that incumbent system habit dampens the positive relationship between attitude and intention to use driverless cars, which implies that for individuals with stronger incumbent system habit toward traditional automobile vehicles, attitude towards driverless cars has a lesser influence on intention to use than for people who have low incumbent system habit (see **Figure 4.10**).

Figure 4.10 Moderation Effect of Incumbent System Habit on the Relationship between Attitude and Intention to Use



4.2.7.3 Mediation Effect of Attitude

To test the mediating effect, three series of conditions need to be satisfied: 1) the independent variable (perceived enjoyment) must have a significant effect on the mediator (attitude towards driverless cars), 2)independent variables (perceived enjoyment) must have a significant effect on the dependent variable (intention to use driverless cars), 3) the mediator (attitude towards driverless cars) must have a significant effect on the dependent variables (intention to use driverless cars) (Baron & Kenny, 1986). Based upon the archived results from Table 4.30, three conditions are satisfied, therefore, the mediating test is applied on the perceived enjoyment-attitude-intention to use. Thus, the research hypothesized that:

Attitude mediates the positive relationship between perceived enjoyment and intention to use driverless cars (H9b)

The parameter for the path between perceived enjoyment and attitude is named as A, and the path between attitude and intention to use driverless cars is named as B. The indirect effect or A*B is the measure of the amount of mediation (Kenny, 2018). In Table 4.36 below, the value of A*B is equal to 0.269 at $p<0.01$level, implying attitude mediates the relationship between perceived enjoyment and intention to use. Therefore, the direct relationship between perceived enjoyment and intention to use is better explained through the mediator of attitude towards driverless cars

Table 4.36 Moderation Effect of Attitude

Parameter	Estimate	Lower	Upper	P
A * B	.269	.170	.363	.001

The result of mediating test approved that attitude towards driverless cars have a mediating infuence on the positive path between perceived enjoyment and intention to use. This is also in line with the findings from Kim et al., (2009) and Yang and Yoo (2004) who verified the mediating role of attitude in the technology acceptance across different contexts. Table 4.37 presented that attitude towards driverless cars is partialy mediate the relationship between percieved enjoyment and intention to use, in which the direct effect of perceived enjoyment on intention to use reduced but still significant. Therefore, this research supported the mediating role of attitude in explaining technology acceptance, which confirmed its role in belief-behavioural linkage.

Table 4.37 Mediation Effect of Attitude

Mediator	Direct without Mediator	Direct with Mediator	Indirect	Mediation type observed
Perceived enjoyment -Attitude- Intention to use	0.531***	0.253***	0.214***	Partial

4.2.7.3 Socio-demographic Variables

Socio-demographic variables' effects on the consumer attitude and intention to use self-driving cars are assessed, shown in Table 4.36. The findings disclosed that age and gender have significant influences on consumer attitude and intention to use respectively in the context of self-driving cars, although the influence of gender is rather marginal. The other mentioned socio-demographic variables, education and driving experience, did not show any significant impact on user attitude and intention to use. This is congruency with the finding from Zmud et al. (2016) who indicate educational attainment was not a significant factor.

Table 4.36 Socio-Demographic Variables

	Attitude	*Intention to use*

Control variables		
Age	0.110**	0.030
Gender	-0.001	0.047*
Education	0.028	-0.035
Driving experience	0.020	-0.008

Note: *** Significant at p<0.001; **Significant at p<0.01; * Significant at p<0.05

Meanwhile, the multi-group difference test was conducted to assess if confirmed relationships between variables performed differently among age and gender. Therefore, the dataset is split along values of two grouping variables, that is, the young and the old, male and female. In terms of age, participants who are age between 18 to 25 years old are coded as 1, representing the young group who are also belong to Generation Z cohort. The rest samples are coded as 2 that represents the senior who are age above 25 years, also viewed as previous generations. The result revealed that with 90% confidence (p=0.079) the positive relationship between perceived enjoyment and attitude toward self-driving cars is stronger for customers age above 25 years old than the young (see Table 4.37). In other words, senior customers are more appreciative of the enjoyable and comfortable benefits of riding in driverless cars, such as free up own hands, a mental break, relaxing and relieving stress, and enjoying private space. This is consistent with the finding that users' preference towards innovative transport systems increase with age (Delle Site et al., 2011).

Table 4.37 Multi-Group Difference Test among Age

Hypotheses	Standardised estimate		Significance level
	The young	The older	
Perceived enjoyment → Attitude	0.225*(P=0.016)	0.488***	p=0.079

Note: *** Significant at p<0.001; **Significant at p<0.01; * Significant at p<0.05

In terms of gender, the results go against conventional wisdom as males and females do not hold different perceptions toward driverless cars, while previous studies noticed that male and female sometimes have different opinions on technology acceptance in general (KPMG, 2013). Regarding driverless cars, males and females also express different behavioural intention to use (Payre et al., 2014; Zmud et al., 2016). Men usually express higher tendencies to use driverless cars that is manifested through them having fewer concerns with driverless cars and thinking this technology is safer (Casley et al., 2013), while women associate higher levels of worry regards driverless cars (Hohenberger et al., 2016; Kyriakidis et al., 2015). The non-significantly gender differences in terms of intention to use driverless cars could be explained by examining customers' affective reactions toward these vehicles. As customers' affective responses (e.g. anxiety and pleasure) toward driverless cars can overcome gender differences (Hohenberger et al., 2016).

So far, all proposed hypotheses are tested and evaluated that contribute to the formation of driverless cars acceptance model. Comparing with the pre-designed conceptual model that was depicted basing upon the narrative data from Study 1, the confirmed conceptual model demonstrates detailed relationships between variables and the rationale behind user intention to use driverless cars. The latter model confirmed the positive impacts of user perceived travel efficiency and perceived enjoyment on user intention to use, while the perceived helpfulness is not verified as a significant factor in driverless cars acceptance. In addition, user attitude towards driverless cars is confirmed as the most significant predictor of intention to use, which is impacted by perceived enjoyment and perceived societal benefits. This echoes the rationale of belief-attitude-intention that is behind consumer behaviours. In addition, user attitude towards driverless cars also play a mediator role among the relationship between perceived enjoyment and intention to use. User concerns regarding driverless cars indeed have negative influences on intention to use. The moderating role of incumbent system habit is also confirmed, which moderates two paths among variables. Unfortunately, another personal trait variable-personal innovativeness-is not verified as a moderator in the study of driverless cars acceptance.

4.3 Chapter Summary

This chapter reported the procedure of understanding customers' attitude and their intentions to use driverless cars through a sequential mixed method. The public thoughts about driverless cars were collected via the interviews in Study 1 that explored the core themes which plausibly have significant influences on driverless cars acceptance. The process of proposing hypotheses and forming the conceptual model were presented, followed by a series of statistical analyses with aims to test and explore causal relationships among variables (i.e. perceived travel efficiency, perceived helpfulness, perceived enjoyment, perceived societal benefits, concerns, attitude towards driverless cars, and intention to use), moderator and mediator effects and group differences.

The measurement model and structural equation model were evaluated with good model fit individually. The final confirmed conceptual model explains a high ($R^2 = 0.38$) of the variance associated with customers' attitude toward driverless cars by its determinants, including perceived enjoyment and perceived societal benefits. The constructs of travel efficiency, perceived enjoyment, concerns and attitude contributed 76% ($R^2 = 0.76$) of explained variance for intention to use driverless cars. Therefore, the designed conceptual model of this study can demonstrate substantial information about customers' perceptions and intention to use toward driverless cars as well as elaborates the rationale behind their behaviours.

The results proved the consistent relationship between attitude and intention to use in the context of technology acceptance (ß=0.632, p<0.001). Among identified five predictors, perceived enjoyment was evaluated as the most important variable influencing consumer attitude (ß=0.340, p<0.001) and intention to use driverless cars (ß=0.253, p<0.001). The second significant predictor of attitude was identified as perceived societal benefits ((ß=0.230, p<0.001). On the other side, the variable of concerns toward driverless cars was verified as a significant negative predictor that restricts users' intention to use driverless cars (β=-0.095, p<0.001). Incumbent system habit was verified as a moderator within the mode. User attitude towards driverless cars has a mediating impact on the relationship between perceived enjoyment and intention to use. Age and gender also have significant influences on attitude and intention to use respectively.

In the next chapter, precise discussions and assessments of the final results are presented that also synergy with previous studies and literature review in the study of technology acceptance. The contributions of this research are described afterwards from theoretical and practical perspectives. In addition, the limitations of this research are provided with aims to provide suggestions for future research to update the knowledge about consumer behavioural intention towards automated transport systems, also assess the applicability of the proposed research model and new designed measurement scales for explored variables.

Chapter 5 Discussion and Conclusions

5.0 Overview of Chapter

The purpose of this chapter is to discuss the research findings, which were generated from a series of proposed hypotheses and the confirmed theoretical conceptual model that was presented in Chapter 4. The critical evaluations of each finding are based on the results generated from the structural equation modelling (SEM), and are synthesised with the existing literature on the study of technology acceptance (section 5.1). Plausible reasons can explain the distinctive findings achieved in this study, as well as the results found in previous studies. Subsequently, description is provided of the main contributions of this research, which comprise two parts, the theoretical implications (section 5.2) and the practical contributions (section 5.3). Then, the overall limitations of this study are pointed (section 5.4), and some recommendations are made for future research in the context of user acceptance of advanced automobile vehicles (section 5.5).

Before closing the chapter, the research questions and objectives outlined in Chapter 1 are reviewed, with the purpose of describing the systematic and logical research procedure that enabled this research to be accomplished successfully (section 5.6 and section 5.7). The chapter closes with a brief summary (section 5.8).

In sum, the major aim of this study was to understand customers' perceptions and attitudes towards driverless cars, and to explore and evaluate the significant factors that influence their intention to use such vehicles. By integrating new factors (explored in conjunction with conventional TRA-oriented theories), the researcher proposed a new conceptual model that explained how customers' perceptions impact upon their acceptance of driverless cars. The results show that attitudes, perceived enjoyment and perceived travel efficiency positively influence the degree of acceptance of driverless cars, whilst customers' concerns have a significantly negative influence on their intention to use such vehicles. In addition, the factors of perceived enjoyment and perceived societal benefits positively influence customers' attitudes towards driverless cars. Moreover, incumbent system habit acted as a moderator in the model by impacting two groups of relationships: 1) the negative relationship between concerns and intention to use, and 2) the positive relationship between attitude and intention to use driverless cars. The findings also disclosed that customers aged over 25 appreciated the enjoyable and comfortable aspects of driverless cars more than those aged between 18 and 25. In contrast, customers' educational background and driving experience were not significant.

5.1 Influential Factors

The factors that were explored and verified as playing a significant role in the acceptance of driverless cars are discussed in the following sections: enablers (section 5.1.1), barriers (section 5.1.2), and individual variables (section 5.1.3). The discussion parts are synthesised with the previous literature review (Chapter 2).

5.1.1 Enablers

Attitude

In the domain of technology acceptance in general, and the context of driverless cars in particular, a strong positive relationship has been found between attitude and intention to use. Both perceived enjoyment and perceived societal benefits are antecedents of existing attitudes towards driverless cars. This is consistent with the study by Payre et al. (2014), which suggested that in order to boost consumers' intention to use driverless cars, one should improve their attitudes towards driverless cars, because this factor was the main predictor of their intention to use such vehicles. This finding is also in line with Zmud et al. (2016), according to whom attitudes often have a greater impact on technology adoption than socio-demographic variables. In addition, such findings are congruent with the rationale of the TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which suggests that individual behaviour is normally based on pre-existing attitudes and behavioural intentions, and thus the strength of individuals' beliefs about the outcomes of their behaviour will impact upon their attitudes. There is no doubt that the impact of attitude on intention to use is vital and remains consistent across various contexts.

Perceived enjoyment

This research has demonstrated the significant predictive power of perceived enjoyment in user attitudes and intention to use driverless cars. This means that out of all the factors explored in this study, the hedonic feature of driverless cars is the most effective motivating factor in appealing to potential customers. This not only satisfies the need to consider affective factors on user intention to use, such as comfort and emotional response (e.g., pleasure and anxiety), given that these appear important in the acceptance of driverless cars (Hohenberger et al., 2016; Hulse et al., 2018; Merat & de Waard, 2014), it also extends our knowledge about the hedonic motivator in the study of technology acceptance in a different context. Moreover, it provides support for the effect of perceived enjoyment on the adoption of driverless cars that was emphasised by Bjørner (2017). It also echoes with the findings of Hirschman and Holbrook (1982), who argued that consumers evaluate a new IT product either to solve a problem or to seek 'fun, fantasy, arousal, sensory stimulation, and enjoyment'. This has been confirmed in various contexts in the study of technology acceptance, for example, the use of mobile applications (Ding & Chai, 2015), the acceptance of web-based information systems (Yi & Hwang, 2003), and consumers' online retail shopping behaviours (Childers et al., 2001). As regards driverless cars, existing studies (Buckley et al., 2018; Zmud et al., 2016) describe the hedonic benefits of using such vehicles, such as freeing up the driver' hands, feeling relaxed, and a sensation that is enjoyable, fun and interesting. Kyriakidis et al. (2015) also mentioned that customers largely expect the use of driverless cars to be enjoyable and comfortable.

Perceived societal benefits

The findings of this study advance the research on technology acceptance by identifying perceived societal benefits as a predictor of user attitude towards driverless cars. This factor has not been evaluated properly in previous studies of the acceptance of driverless cars, although other studies have noticed it as a potential positive side-effect in consumer behaviour. The findings of this study provide evidence to support the idea that customers who care about the public consequences of their purchasing or consuming behaviours also find environmentally friendly products appealing (K.-H. Lee & Shin, 2010; Webster Jr, 1975), and therefore, this factor should also affect their attitudes towards driverless cars. As regards this research, the findings from Study 1 are consistent with those of previous studies (Bjørner, 2017; Casley et al., 2013; KPMG, 2013), which mentioned that potential autonomous cars have to have a positive impact on the environment, such as less traffic congestion, a reduction in the amount of CO_2 emitted into the atmosphere, scaled down parking lots (especially in in urban areas), and the creation of a new transportation ecosystem. In contrast with existing studies, the confirmed positive influence of perceived societal benefits on customers' attitudes towards driverless cars gives a new insight into technology acceptance.

Perceived travel efficiency

The findings of this study reveal the significant influence of perceived travel efficiency on user intention to use driverless cars, demonstrating the primary role of utilitarian factors in technology acceptance. This is also in line with the rationale of the TAM (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), according to which perceived usefulness directly impacts on the intention to use information systems and technology. In addition, perceived travel efficiency being a significant determinant of driverless car acceptance is congruent with Haboucha et al. (2017), who argued that driverless cars can provide efficiency benefits, enabling drivers to free up time to do something else.

Interestingly, however, this factor was found not to affect user attitudes towards driverless cars. This finding is similar to that of Kaur and Rampersad (2018), who found that out of the various benefits offered by driverless cars, such as allowing drivers to do other things while inside the vehicle, only mobility benefits had a correlation with global trust. This is probably due to the primacy of other considerations that users have regarding the use of driverless cars, such as how safe they believe autonomous driving technology is, the cost of driverless cars, and how comfortable customers are with the current legal structure regarding the use of driverless cars (Casley et al., 2013). Once customers see driverless cars as safe and are satisfied with the relevant regulations/laws and with the cost of such car, their focus may switch to secondary influences, including how the productivity and efficiency of driverless cars can benefit them in daily lives (e.g., through improved mobility for the young, elderly and disabled; reduced driving pressures, and allowing drivers to carry out other tasks), and what environmental benefits such vehicles can offer. A greater importance associated with these, secondary influences may then affect their decision to use driverless vehicles, but thus far, the effect of perceived travel efficiency on customer attitudes towards such vehicles is less influential. Given that driverless cars are not actually available yet on the market, it is difficult for customers to picture these benefits. For the benefits to be realised, the public needs to actually use autonomous driving systems and interact with driverless cars.

5.1.2 Barriers

This research has identified the main barriers to customers' intention to use driverless cars, which consist of five types of concern, including a deterioration in driving skills, the financial costs associated with driverless cars, technological issues, laggard regulations and laws regarding driverless cars, hacking and privacy issues. The exploration of these concerns has added new knowledge to the technology acceptance literature in the context of driverless cars.

Previous studies (Casley et al., 2013; Kaur & Rampersad, 2018) emphasised the lack of public trust as a major barrier to the adoption of new technology, resulting in extensive research into the antecedents of trust. However, not all perceived issues are relevant to trust of the technology—these issues are complex, and include "aesthetic, emotional and sensory responses to driving, as well as patterns of kinship, sociability, habitation and work" (Sheller, 2004), and "relaxed awareness" (Edensor, 2003). Bearing this in mind, in this study, the concerns explored originally derived from potential customers' perceptions. Out of the different types of concerns, user concern about a deterioration in driving skills is a new barrier to the acceptance of driverless cars. Additionally, this is the first study to assess and verify the reliability and validity of new measurement scales for a new construct of concerns in the context of driverless cars.

Deterioration in driving skills

Customer concern about a deterioration in driving skills was mentioned by the participants in Study 1, and verified as one of the barriers restricting customers' intention to use driverless cars. This is because customers' sense of control (e.g., decision making) will decrease as they use driverless cars. A similar issue was noticed in studies on the acceptance of advanced driving assistance systems (Van Der Laan et al., 1997). With partial autonomous driving systems, the customer is still recognised as the true driver, with the capability to control the vehicle and conduct common tasks, such as parking. However, with autonomous driving systems, it is assumed that drivers will not have to be responsible for driving, and that their role will switch from that of drivers to that of passengers, without any requirement to intervene in the driving process. As a result of this, their driving capabilities will deteriorate as time passes. This concern could become sufficiently acute as to cause some people to reject driverless cars altogether. Individual difference variables (e.g., a sense of control and incumbent system habit) are also factors in this respect.

Additionally, as suggested by Payre et al. (2014), this concern may be exacerbated by social influences, since those drivers who use advanced autonomous driving systems may be judged by others to have poor driving skills. In the highest level of automation in particular, drivers would not even have to supervise the driving process, and no human intervention would be needed (Payre et al., 2014), implying that no driving skills would be required. From this point of view, future research should consider the effects of social norms in explaining customers' behavioural intentions towards driverless cars.

Financial cost of driverless cars

The financial cost of driverless cars was discussed by the participants in Study 1, some of whom stated that it would be unlikely that they would be able to afford driverless cars, because new technology is expensive when it is first introduced to the market. In addition, car insurance would be higher than in the case of manually driven cars or semi-autonomous cars. In the same vein, Fagnant and Kockelman (2015) suggested that the initial costs would most likely be unaffordable, which would itself constitute a barrier to implementation and mass market penetration. Zmud et al. (2016) also studied the factor of willingness to pay, and noticed that few participants would be willing to pay significantly above the average price of a new conventional vehicle in order to own a driverless car. Therefore, the author suggested that the market demand for driverless cars may be weak for the time being. Buckley et al. (2018) also found that the majority of the respondents would not be able to afford the extra cost associated with being an early adopter.

Technological issues

Autonomous driving technology is still in its infancy, and the technological challenges are therefore manifold, including the performance of the navigation systems, disputes over the use of reserved parking spaces, difficulties in predicting different types of situations and weather conditions, and mismatched infrastructure changes in both urban and highway environments. Interestingly, however, some participants mentioned increased safety as one of the greatest benefits of using driverless cars, since human error is considered to be the main cause of highway collisions (Payre et al., 2014), especially in adequate attentiveness, distractions and speeding, which have been found to be contributory factors (Fagnant & Kockelman, 2015). Conversely, some participants had lower confidence in autonomous driving technologies and were concerned about their safety aspects. The issue of confidence and concern are probably related to the personal trait of sensation-seeking, which refers to the tendency to want to experience novel, varied, complex and intense sensations and the willingness to take risks for the sake of such experiences (Zuckerman, 1994). Therefore, further research could examine whether individuals with greater sensation-seeking tendencies would seek to experience advanced autonomous driving more proactively, and would have fewer safety concerns, than those with lower sensation-seeking tendencies.

Laggard regulations and laws

Specific laws and regulations regarding the use of driverless cars do not currently exist, and previous studies have identified this situation as being similar to the regulatory challenges within the fields of legislation and insurance (Fagnant & Kockelman, 2015), traffic legislation (Casley et al., 2013), and licensing and testing standards (Fagnant & Kockelman, 2015). Such concerns are viewed as normal in the issue of acceptance of driverless cars, because technological innovation often develops more quickly than legal or regulatory systems: new technology opens up new possibilities and regulators rush in afterwards to establish relevant rules (KPMG, 2013). To date, there are no national licensing or testing standards available in the automobile industry, and liability details remain undefined (Fagnant & Kockelman, 2015). Payre et al. (2014) pointed out that the boundaries between being a passenger and being a driver are blurred, and therefore it is expected that customers will be unclear about their rights and responsibilities when using driverless cars. Their study also found that potential customers were not clear about their legal responsibility in the evet that they had to use the driverless technology because their ability to drive was impaired (Payre et al., 2014). This factor would be more important still in the case of the highest level of automation, because users would not have to monitor the driving process, which implies that they would take no responsibility for the vehicle during the whole journey.

Hacking and privacy issues

These concerns revolve around the danger of someone or some entity hacking the vehicle's computer systems, as well as software errors, hardware errors, and the disclosure of private information (e.g., location and phone number). These, can also be seen as ethical issues; for example, GPS tracking (Bjørner, 2017), disclosure of personal information, targeted surveillance and mass surveillance (Kaur & Rampersad, 2018), all of which are closely related to global trust (Buckley et al., 2018).

Obviously, customer concerns regarding driverless cars are multidimensional, and are not just related to the actual product or driving *per se* (Pearce, 2017). Therefore, future studies could attempt to explore and verify any undisclosed issues that significantly restrict customers' behavioural intentions towards driverless cars from a different user perspective, such as a sociological standpoint. Nonetheless, those barriers that have already been identified provide a vast amount of information that can be helpful to automobile manufacturers and marketing managers in shaping strategies for launching their products in the mass market.

5.1.3 Individual Difference Variables

This research advances the marketing literature by offering explanations of how individual difference variables affect the formation of perceptions about driverless cars, and the subsequent role they play in determining the degree of acceptance of driverless cars. Previous studies have noted some potential effects of personal traits on user acceptance of driverless cars (but without empirical evidence to prove their assumptions), such as, personal innovativeness (Payre et al., 2014), incumbent system habit (Polites & Karahanna, 2012), social norms (e.g., influence of family/friends/strangers), and self-confidence and sense of control (Buckley et al., 2018).

Two types of personal characteristic factors were examined in this research: personal innovativeness and individual incumbent system habit, both of which emerged from the interviews (section 4.1). These two variables were hypothesised as moderators in the model of user acceptance of driverless cars, and were assumed to have an influence both on the antecedents of user attitudes and on their consequences, namely, user intention to use driverless cars. The results of this study confirmed the moderating effects of incumbent system habit on user acceptance of driverless cars. Firstly, incumbent system habit strengthens the negative relationship between concerns and the intention to use driverless cars. Secondly, incumbent system habit dampens the positive relationship between attitude and the intention to use driverless cars. These findings are consistent with those of Polites and Karahanna (2012), who noticed that a strong incumbent system habit can have a negative impact on the intention to use new information systems. From the status quo bias perspective, the stronger an individual's preference for an incumbent automobile vehicle (e.g., traditional manual driving), the higher the bias that the person will have against a new alternative (e.g., autonomous driving); hence, less willingness to use driverless cars. Therefore, individuals' incumbent system habits do indeed have a significant association with customers' receptivity to driverless cars, with the relationship between such habits and intention to use being a negative one.

Unfortunately, the hypothesised moderating role of personal innovativeness was not confirmed in this study. The influence of socio-demographic variables on the degree of acceptance of driverless cars was also explored, with different findings in respect to age and gender when compared to previous studies. Nevertheless, due to varying study objectives and differences between cultures and demographics, it is acceptable to have different results regarding the impact of individual traits and socio-demographic variables on user perceptions and adoption across countries and studies (Bjørner, 2017).

Incumbent system habit

In the context of driverless cars, incumbent system habit refers to consumers' usage of the incumbent system (i.e., traditional automobile vehicles), which has become an automatic response for obtaining specific instrumental goals (Polites & Karahanna, 2012). This psychological variable is viewed as a subconscious source of resistance, and is assumed to serve as an inhibitor to new system acceptance (i.e., driverless cars) (Polites & Karahanna, 2012). Based on the literature on status quo bias and habit, incumbent system habit is viewed as a driving force behind deliberate inertia (Polites & Karahanna, 2012; Wang, Wang, & Lin, 2018). Individual inertia represents a psychological factor that reflects consumers' propensity to continue using an incumbent product rather than seek or switch to alternative actions (Samuelson & Zeckhauser, 1988).

Therefore, the mechanism through which incumbent system habit impacts on the degree of acceptance of driverless cars can be explained through the theory of status quo bias and habit (Kim & Kankanhalli, 2009; Samuelson & Zeckhauser, 1988).

Regarding driverless cars, customers probably assess the values, benefits and costs of incumbent automobile vehicles (i.e., the status quo) against a new system—driverless cars—and evaluate the risks involved in switching products. Thus, consumers knowingly and deliberately choose inertia in making the decision to continue using the status quo automobile vehicles (Schwarz, 2012). Previous findings have illustrated that the stronger an individual's incumbent system habit is (in relation to incumbent automobile vehicles), the higher the bias that that person will have against a new system (driverless cars); hence, less willingness to use driverless cars. The findings of this study reveal that incumbent system habit is indeed a potential source of resistance to adopting a new technology.

In the area of advanced autonomous driving, the available technology is able to directly control all the driving tasks, and essentially takes over the traditional role of the drivers (Payre et al., 2014). Drivers may therefore think that they are not real drivers anymore, especially those who have a strong incumbent system habit (e.g., they are used to driving) and consider the physical sensation of driving (e.g., steering and navigating) important. As a result, they may typically buy a car with a driving style that resembles their own (Philippe et al., 2009). Therefore, delegating driving may lower their feeling of control and negatively affect their driving experience. Such findings shed further light on the paradox between positive perceptions of driverless cars (e.g., perceived enjoyment) and a weak intention to use. Thus, whether the positive features of driverless cars can facilitate their implementation depends on the extent of the potential user's incumbent system habit.

Technology Innovativeness

Interest in technology was mentioned by the participants in this study and has been evaluated in previous research as having a positive influence on the intention to use driverless cars (Buckley et al., 2018; Payre et al., 2014; Schoettle & Sivak, 2014b). However, this study generated different findings. One would think that an interest in technology would increase the intention to use driverless cars, but the number of issues that remain unresolved is large, and the various concerns that exist probably restrict technophiles' interest in driving a driverless car. These concerns, as mentioned before, include the nascence of autonomous driving technology, hacking and privacy issues, unaffordability, etc. Once these concerns have been resolved, technophiles might very likely be more receptive to using driverless cars than others. In addition, due to varying objectives and differences between cultures and demographics, it is common to have different results regarding the impact of individual traits and socio-demographic variables on user perceptions and adoption across countries and studies (Bjørner, 2017).

<u>Socio-Demographic Variables</u>

Driving experience, education level and gender as socio-demographic factors did not significantly influence consumers' intention to use driverless cars in this study, with the exception of age. This is in line with the findings of Zmud et al. (2016) and Rödel et al. (2014), who found that education and driving frequency had no influence on consumer acceptance of driverless cars. On the other hand, the positive relationship between perceived enjoyment and attitude towards driverless cars was weaker for younger customers than those aged above 25. In other words, the hedonic benefits of using driverless cars may not be attractive enough for the young, while older customers have higher expectations of receiving an enjoyable and comfortable experience from using driverless cars. Similarly, Wood (2013) found that older consumers strongly agreed that the use of driverless cars would be a good idea and a pleasant experience. This was particularly true for customers aged between 26 and 35 (Wood, 2013). Another study showed that individuals' preference for autonomous driving systems increases with age (Delle Site et al., 2011).

A plausible reason behind this phenomenon could be that customers aged over 25 have a more intensive pace of life, with a higher workload and levels of stress. In such situations, the hedonic benefits of driverless cars would be more appealing, because these customers could take a mental break, relax, enjoy a private space, or do other things while driving. This is consistent with the findings of Nordhoff et al. (2016), who mentioned that driverless cars provide a multidimensional vehicle space that can be adjusted to fit user preferences. For example, stressed employees could take a yoga vehicle that would allow them a moment to breathe, take a step back from their hectic lives, and regain motivation (Nordhoff et al., 2016). Another reason could be that daily commuters who have to spend a significant amount of time on the road tend to have a greater appreciation of the benefits of driverless cars (Haboucha et al., 2017), especially in the case of individuals with longer commutes, since they would appreciate the ability to use the time to relax, be entertained, or take a nap.

Age

Young customers aged between 18 and 25 (Generation Z) behave differently—compared to older generations—due to their unique characteristics, such as an interest in innovation and a desire for security (Wood, 2013), frugality and an interest in saving, negligible brand loyalty, and caring more about the experience (Schlossberg, 2016). Indeed, after analysing the seven Likert-scale measurements of concerns, the participants from the Generation Z cohort were found to be very concerned about 'disputes over the use of reserved parking space' and the 'high selling price of driverless cars', while being moderately concerned about using autonomous driving technologies that are still in their infancy, as well as the lack of relevant regulations and policies, hacking and privacy issues. For young customers, these concerns are plausibly the main block to accepting driverless cars. Thus, once these key issues have been resolved, so that customers see driverless cars as safe and are satisfied with the relevant laws and the selling price, it can be expected that they will pay greater attention to the benefits of using driverless cars, such as a hands-free and comfortable experience, and improved productivity. This can be assessed through group interviews in future studies to further understand the opinions regarding driverless cars amongst young people.

Gender

In terms of gender, the influence of attitude on the intention to use driverless cars did not differ between the male and female participants. This contrasts with the findings of previous studies, which found that females were more cautious and conservative than males, and had less desire to use and buy driverless cars (Payre et al., 2014; Schoettle & Sivak, 2014b). This may be because the emotions (e.g., pleasure or anxiety) that are associated with driverless cars can negate gender differences in relation to the acceptance of driverless cars (Hohenberger et al., 2016). Another plausible explanation may be that although women tend to express higher levels of concern towards technology than men, that tendency is not universal and may not be applicable in the context of driverless cars (Davidson & Freudenburg, 1996).

5.2 Theoretical Implication

There are huge expectations from the public regarding driverless vehicles, which—as a relatively new technology—constitute one of the key elements of the next technological revolution. The self-driving evolution could reshape our roads, our cities and our lives (Kaur & Rampersad, 2018; KPMG, 2013). However, the realisation of these benefits is dependent on the widespread adoption of driverless cars and their penetration of the mass market. There is no doubt that user intention to use driverless cars is crucial in this regard. Therefore, this research has focused on exploring the major influencing factors in the context of acceptance of driverless cars. The findings of this study contribute to the relevant literature in a number of ways.

Firstly, this research extends the boundaries of TRA-oriented theories in the literature on technology acceptance in the context of driverless cars by considering unique contextual influences on customers' thoughts. This aligns with Osswald et al. (2012), who suggested that it is necessary to take contextual characteristics into account when applying an original cognition-oriented model to the car context. Although most studies extend the TAM, UTAUT or other models of technology acceptance to the study of acceptance of driverless cars, such contextual factors have not been covered by them (Adell, 2010; Madigan et al., 2016). For example, the performance of a driverless car is determined by the relevant programmed software, which implies that the user may be placed in a potentially risky situation if the system fails; hence, users' safety concerns may have a potential influence on the extent of their acceptance of driverless cars. Therefore, the researcher applied a reworked version of the TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) to the context of driverless cars, and integrated explored contextual variables into the model, which extracted potential customers' perceptions of driverless cars. The developed model explains 76 per cent of the variance in the intention to use driverless cars, which outperforms previous studies that were based either on the TAM or on the UTAUT.

Secondly, this research responds to a demand for a more in-depth study of the significant determinants of user intention in relation to driverless cars by taking account of potential factors that are frequently mentioned by other researchers. For example, the sense of comfort in using automatic driving systems (Delle Site et al., 2011), hedonic motivation (Venkatesh et al., 2012), the characteristics of autonomous driving technologies (Madigan et al., 2016), and individual difference variables (e.g.

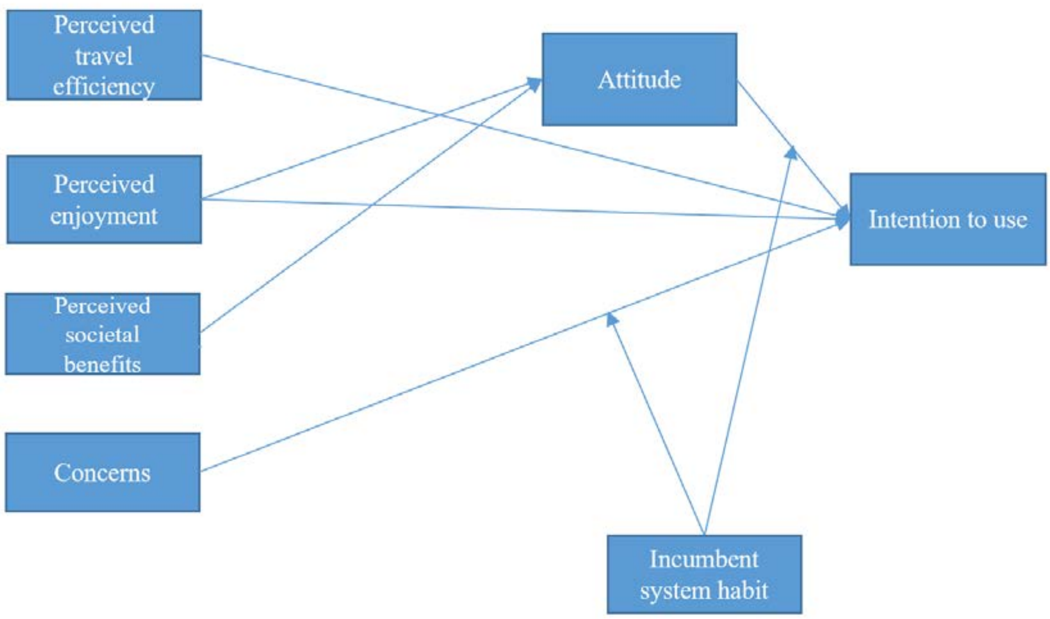
incumbent system habit and personal innovativeness) (Polites & Karahanna, 2012; Payre et al., 2014). Bearing these factors in mind, this research synthesises the significant factors that have been explored with previously categorised constructs derived from the literature on marketing, sociology, consumer psychology, and status quo bias and habit to explain the mechanisms through which these factors operate in influencing driverless cars acceptance.

More specifically, this research uses the theory of status quo bias to extend the habit perspective, and hypothesises that the construct of incumbent system habit (i.e., the status quo) has influences on new system (i.e., driverless cars) acceptance, since it represents a subconscious source of inertia. This research examined how deeply ingrained habitual behaviour towards an incumbent system (i.e., traditional automobile vehicles) affects customers' intention to use a new system (i.e., driverless cars) through its moderator role within the conceptual model. Thus, the research expands the theoretical explanation of the belief–attitude–intention–behaviour rationale to include a subconscious construct–incumbent system habit. Based on the theoretical perspective of status quo bias and habit, the research indicates that individual incumbent system habit strengthens the negative relationship between concerns and the intention to use driverless cars, which implies that for customers who have a stronger incumbent system habit towards traditional automobile vehicles (i.e., the status quo), concerns about driverless cars impact more heavily on the intention to use than in the case of those with a less pronounced incumbent system habit. This variable also dampens the positive relationship between attitude and intention to use driverless cars, which indicates that for customers with a stronger incumbent system habit towards traditional automobile vehicles, the user attitude towards driverless cars has less of an influence on their intention to use such vehicles than in the case of customers who have a less pronounced incumbent system habit. This is consistent with the findings of Polites and Karahanna (2012), who posited that a strong incumbent system habit may have a negative impact on new system acceptance. In other words, the extent of an individual decision maker's bias towards maintaining the status quo (i.e., habitual use of traditional automobile vehicles) does indeed influence new system acceptance (i.e., acceptance of driverless cars).

Furthermore, this research reveals that the motivators of the intention to use driverless cars include the user's attitude towards driverless cars, the perceived enjoyment, and the perceived travel efficiency. Unsurprisingly, users' concerns about driverless cars directly restrict their intention to use. The factors of perceived enjoyment and perceived societal benefits are positive predictors of user attitude towards driverless cars. The mediating role of user attitude towards driverless cars is confirmed, since it affects the relationship between perceived enjoyment and intention to use. Meanwhile, age has been noticed as a factor in the relationship between perceived enjoyment and attitude towards driverless cars. Specifically, customers from older generations (aged above 25) have higher expectations of benefits—in terms of enjoyment and comfort—from using driverless cars (e.g., a mental rest, relaxation, and enjoyment of private space) than those from the younger generation (aged between 18 and 25).

Based on the above discussions regarding the role of each factor in the theoretical model of driverless car acceptance, the core driving factors behind the intention to use driverless cars are verified. Figure 5.1 shows an overview of this proposed model. The factors included in this figure are briefly described below.

Figure 5.1 Driverless Car Acceptance Model



Perceived travel efficiency is defined as the degree to which a person believes that self-driving cars can allow the user to extend activities or secondary tasks. This factor has a positive influence on the intention to use.

Perceived enjoyment is a hedonic concept that captures consumers' emotional reaction to travelling in driverless cars. It is defined as the degree to which an individual believes that using a driverless car will bring hedonic feelings, and has a positive influence on user attitude and the intention to use driverless cars.

Perceived societal benefits is defined as the degree to which an individual believes that the adoption of driverless cars can generate a series of societal benefits.

Attitude is defined as one's personal reaction to a target behaviour, and it can be used to predict behavioural intention (Fishbein & Ajzen, 1975). In the context of driverless cars, user attitude towards driverless cars is defined as an individual's overall affective reaction upon using a driverless car (Osswald et al., 2012). It not only has a positive influence on the intention to use, it also mediates the positive relationship between perceived enjoyment and the intention to use.

Concerns refer to issues related to driverless cars that potentially concern customers, such as a deterioration in driving skills, the financial cost of driverless cars, technological issues, laggard regulations and laws, hacking and privacy breaches. These have a negative influence on the intention to use driverless cars.

Incumbent system habit is a subconscious source of inertia that reflect consumers' habitual behaviour in relation to the use of conventional automobile vehicles (i.e., the status quo), whereby consumers tend to stick to that product even when there are better alternatives available (i.e., driverless cars) (Murray and Häubl, 2007). Thus, the variable of incumbent system habit is assumed to affect the degree of acceptance of driverless cars, and is confirmed as a moderator within the model via two paths: 1) by dampening the positive relationship between attitude and the intention to use, and 2) by strengthening the negative relationship between concerns and the intention to use.

Thirdly, this study not only proposes new constructs in the context of driverless car acceptance, it also describes operational measures for these constructs that can be used in future studies. This was achieved through the adoption of a mixed-methods approach to investigating potential customers' thoughts and intention to use driverless cars by taking customers' perspectives into account, and by designing measurement items for each latent variable. Perceived travel efficiency as a cognitive factor is described as the extent to which a person believes that driverless cars can improve the performance of users, measured against three factors. The construct of perceived helpfulness—the extent to which a person believes that using a driverless car will be convenient for mobility—is measured against four items. Perceived societal benefits—identified as a person's belief or expectation that driverless cars can generate a series of societal benefits—are measured against four items. Incumbent system habit as a subconscious source of inertia refers to consumers' habitual in relation to the use of a conventional automobile vehicle (i.e., the status quo), and is measured against three items. In addition, the researcher tailored measurement scales borrowed from previous studies in the marketing field for other constructs. These measurement scales have passed reliability and validity tests. This demonstrates that a qualitative study can facilitate quantitative research and vice versa (Blaxter et al., 2010).

5.3 Practical Implications

Both enablers and barriers that affect the widespread adoption of driverless cars and their mass market penetration have been meaningfully verified for all the relevant stakeholders in the automobile market: automobile manufacturers, marketing managers, policy-makers and governmental bodies. These stakeholders should work together to tackle the barriers that have been created as a result of various user concerns regarding driverless cars, such as technological issues, laggard regulations and laws, hacking and privacy issues, unaffordability and other vehicle-related expenses, and the deterioration in driving skills. They also need to work hard to meet the benefits expected of driverless cars, including commuting, time economy, freeing up drivers' hands, the ability to do other things whilst commuting, reduced carbon emissions, traffic congestion relief, and improved mobility. In addition, this research recommends that marketing managers should tailor their strategies to attract customers aged between 18 and 25 (Generation Z) and those aged above 25 (older generations), since these age cohorts have different perceptions regarding driverless cars. Detailed suggestions are presented below.

Initially, the results of this study verified that users' belief of enjoying the experience of using a driverless car is the most significant motivating factor in relation to user attitude and the intention to use driverless cars. Thus, marketing managers should emphasise (e.g., in promotional material) how users can achieve the enjoyable effects of a driverless car, for example through reduced pressure when parking, the opportunity to do something fun during a long journey, resting/relaxing, enjoying a private space to take a nap, etc. Highlighting this type of benefit would offset, to some extent, user anxiety-related responses towards driverless cars (Hohenberger et al., 2016).

This type of benefit appeals particularly to customers over the age of 25, because this age group typically comprises daily commuters who spend a considerable amount of time commuting, or have an intense lifestyle (e.g., a high workload, no private time, high levels of mental stress). In addition, it would be useful to publicise the fact that users of driverless cars can use their time effectively for other secondary tasks, for example taking care of children in the back seat, checking emails or replying to telephone messages.

Furthermore, the researcher suggests that automobile manufacturers should strive to realise the societal benefits of driverless cars (e.g., reduced fuel consumption and carbon emissions, decreased traffic congestion, fewer parking problems, freeing up social time, fewer traffic accidents, and sustainable transportation), because these can have a positive effect on user attitude. Such societal benefits would be appreciated by customers who care about consumer behaviour and have a strong sense of social responsibility. To sum up, marketing managers and advocates should put more effort into publicising the various benefits of driverless cars in order to boost their appeal to customers, and possibly even offset customers' concerns regarding driverless cars.

It is important to stress that resolving user concerns regarding driverless cars is imperative. Users are typically concerned about technological issues and the safety of driverless cars, for example the performance of driverless cars in different conditions (e.g., in heavy rain, in the event of changed road layouts, and in complex urban transportation systems). Therefore, it would be helpful to provide an option that would allow the user—in extreme or urgent situations—to easily switch the self-driving mode off and intervene in the driving process. This would appeal to customers who enjoy cars and driving, as well as to those who desire control of the car and do not want to relinquish their role as driver. Another promising strategy (for driverless cars without driver responsibility) would be to design solutions to keep drivers in the control loop during automation, especially in closed environments or in built up areas (e.g., platooning in long tunnels), and also to develop co-piloting systems to help human drivers instead of replacing them (Kyriakidis et al., 2017). This could be a compromise to appease contradistinctions between users' hedonic expectations of driverless cars and drivers' obligation to monitor the road and take responsibility for driving. If necessary, a driver licensing programme could be considered to ensure that the driver understands how to operate a driverless car safely. Although drivers may not be required to intervene in the operation of driverless cars, it could be a prerequisite to learn some fundamental knowledge about their operating systems, their limitations, and how to resume control of a driverless car in certain conditions.

The legal situation is complex because there are no clear regulations and laws relevant to owning or using driverless cars. Therefore, policy-makers and governmental bodies should clearly define and clarify the conditions for using driverless cars, and balance the obligations between users and automobile manufacturers in order to deal with any unprecedented issues that could surface with the use of driverless cars. As regards hacking and privacy issues, managers of research and development (R&D) departments should lead their teams to work on methods of preventing hacking and minimising customers' privacy concerns; approaches such as encryption, anonymisation, minimisation of personal information, and regular destruction of data would be useful in protecting personal information and guarding against privacy risks.

To deal with users' concerns regarding cost, marketing managers could conduct surveys or interview individuals who already have semi-autonomous cars or who use manual cars in order to ascertain the price that users are willing to pay to purchase a driverless car. This information could help automobile manufacturers find a suitable balance between profitability and a price that potential customers find reasonable. This would improve the prospects of driverless cars penetrating the mass market. Meanwhile, strategies for the improvement of transportation systems could be borrowed to develop the market for driverless cars as well. Good examples of such strategies are the Chinese government's provision of subsidies for each electric vehicle to encourage their greater usage, and the granting of free licence plates to electric vehicle buyers (Charles, 2017). By using such schemes, local and central governments can raise customers' level of acceptance of driverless cars, and thus their willingness to buy these vehicles.

Meanwhile, automobile manufacturers should improve their design strategy by taking customers’ preferences into account, such as individual preferred speeds, acceleration profiles and headway distance, and interior décor. This can ensure that customer-oriented needs are met. As mentioned above, automobile manufacturers should also consider retaining the option of allowing drivers to easily switch from the autonomous mode to manual driving in certain conditions, rather than eliminating the pleasure of driving totally.

Last but not least, marketing managers should make sure that they use appropriate social media and communication channels, such as the broadcast media, websites, social media (e.g., Facebook, Twitter,YouTube), and automobile-related talk shows, to publicise the potential benefits of autonomous vehicles and advanced driving technology. This would be an appropriate way to proactively discuss and address concerns about driverless cars, and enhance public trust in autonomous driving technology.

In summary, all of the aforementioned perceived benefits of driverless cars will be highly advantageous when such vehicles become ready for sale, but only if user concerns have been resolved.

5.4 Limitations

One of the major limitations of this research was the adoption of the non-probability sampling method to collect the data. This inevitably limited the possibility of generalising the findings, since the samples could not be representative of all potential customers in the mass market. However, the use of non-probability sampling, especially convenience sampling, in this research was consistent with previous studies in the domain of technology acceptance, including the acceptance of driverless cars. In addition, Creswell (2014) argued that in many cases only a convenient sample is appropriate, because the researcher has to use naturally formed groups, such as volunteers. Moreover, this strategy is time-saving, and ensures that it easy to increase the sample size. By adopting non-probably sampling, a total of 493 participants were involved in the quantitative study (Study 2), which is sufficient for conducting a multivariable analysis and for ensuring the accuracy of the results and their generalisability (Kumar, 2014).

Another limitation of this research was the sample used; individuals who are interested in driverless cars or have positive personal attitudes towards driverless cars were more likely to take the online survey, while those with less of an interest in this topic were less likely to participate. This potentially restricted the stability of the model and the generalisability of the results. In addition, Nordhoff et al. (2016) pointed out that studies based on respondents who have no real or concrete user experience with driverless cars can generate research bias. This was also addressed by Fraedrich and Lenz (2014), who acknowledged the considerable methodological difficulties they encountered in surveying public opinion towards driverless cars, since autonomous vehicles were not well known or clearly definable for the respondents (Fraedrich & Lenz, 2014). Therefore, future studies should take into consideration the perceptions of users with experience in using autonomous driving technology, so that research bias can be minimised.

Another limitation concerns questionnaire itself, in which one of the items used to measure perceived usefulness was problematic (Q11c was a double-barrelled question). This is defined as a question that asks about more than one construct in a single survey question (Olson, 2008). Q11c was used to measure how strongly the participant agreed or disagreed with the statement "using driverless cars would benefit the elderly or the disabled". An issue arises when a respondent agrees that driverless cars can benefit the elderly but they do not think that such vehicles would benefit the disabled (or vice versa). Such a dilemma can confuse the participant, making them more likely to skip question, which would lead to analytic problems (Olson, 2008). Therefore, this question should be replaced with a series of single-barrelled questions, and the construct validity should be rechecked.

Unavoidably, surveys can be limited by the participants' ability to understand the meaning of driverless cars, because the products are not yet available in the mass market. Participants can imagine driverless cars in differing ways, even though the definition of driverless cars has been provided to them. In such circumstances, customers may tend to over-evaluate or under-value driverless cars, since they have had no real interaction with these systems (Schade & Schlag, 2003), which in turn would affect the validity of the results. Therefore, it might be useful to use videos to better explain the meaning of driverless cars and facilitate participants' understanding, thus enabling them to visualise driverless cars.

Notably, the generalisability of this research was affected by the cultural context, since the study was conducted in China. Future studies should replicate this research and assess the conceptual model in different cultural contexts, so that a better understanding of the multiple interacting variables covered by this research can be provided.

5.5 Recommendations for Future Research

This research offers many valuable insights into the drivers behind user acceptance of autonomous vehicles, and provides ample opportunities for future research. Firstly, the proposed conceptual model is in essence based on the belief–attitude–intention behaviour rationale, with core factors extracted from the interviews, which as an approach agrees with Nordhoff et al. (2016) who argued that the perception of driverless cars can be multidimensional and is associated with various factors. Therefore, the researcher believes that there are some unexplored factors that could potentially influence user acceptance of driverless cars.

This research has disclosed certain potential paradoxes: the perceived benefits of driverless cars (such as a more pleasurable experience, reduced driver workload and freeing up drivers' hands) could increase concerns about a deterioration in driving skills. This complexity probably applies to other factors as well, such as social influence (Venkatesh et al., 2003). It is possible that drivers may be sensitive to others' judgement (e.g., their friends, colleagues or neighbours) if they adopted driverless cars, because they may think that they will be considered to have poor driving skills. This dilemma also applies to user acceptance of advanced driving assistance systems (Van Der Laan et al., 1997). Therefore, individuals' willingness to accept or adopt driverless cars may also be determined by social pressure (Bagozzi & Lee, 2002). On the other hand, social influence may motivate user intention to use driverless cars, such as friend and family expectations (Madigan et al., 2016). Previous research has disclosed that if driverless cars were adopted by friends and neighbours, individuals would likely feel a degree of social pressure that would induce them to also purchase one (Bansal et al. , 2016). A plausible explanation for this is that owing a driverless car would be associated with social status (Nordhoff et al., 2016). Therefore, in future studies it would be worthwhile to investigate social influence on user intention to use driverless cars.

Apart from incumbent system habit, other personal trait variables that have not been covered by this research probably also affect the degree of acceptance of driverless cars through their moderating effect on the relationship between user perceptions and the intention to use. For example, an individual's sense of control, which implies that some drivers may want to control their car manually whilst others may be pleased to allow automatic systems to take over the driver's role (Stanton & Young, 2000). It would therefore be useful to consider this personal trait variable, since it could help identify individuals who are likely to remain active supervisors of the driving process, even though the physical role of the driver in autonomous driving is different, because it is important to make sure the driver is comfortable with the degree of control transfer given to the autonomous driving system (Stanton & Young, 2000). From a practical point of view, the findings would help marketing managers to personalise their advertisements and increase the adoption of driverless cars.

Additionally, this research did not find gender differences in the relation to user acceptance of driverless cars, which is in contrast to existing studies. Normally, men have a higher tendency to be willing to use driverless cars, since they have fewer concerns regarding driverless cars (Kyriakidis et al., 2017), while Hohenberger et al. (2016) noticed that affective responses towards driverless cars, such as anxiety or pleasure, can be used to explain gender differences in relation to the willingness to use them. Therefore, further studies could examine the emotional variables that underlie user behavioural intention towards driverless cars, and address any gender differences, which seems crucial for the widespread adoption of driverless cars. Age is another important demographic variable that has been found to influence user attitude towards driverless cars in the present research. A group difference test was conducted amongst two age groups: those aged between 18 and 25, and those aged above 25. The findings revealed that individuals from the latter group appreciated the enjoyable benefits of driverless cars more than the former group. However, previous research has revealed that older adults are less likely than younger adults to use technology in general, and older women tend to be more anxious about driverless cars than younger women (Czaja et al., 2006; Millard-Ball, 2016). This was corroborated by Bansal et al. (2016), who found that older individuals display less willingness to pay for driverless cars, probably because they are concerned about having to learn how to use the new vehicles, and they do not trust autonomous driving technology. Conversely, some findings revealed that the oldest (aged above 60) and the youngest (aged between 21and 34) groups expressed the most willingness to buy driverless cars (Schoettle & Sivak, 2014b). To clarify this complex finding, the researcher suggests examining differences amongst more age groups (e.g., 26- to-35-year-olds, 36-to-45-year-olds, and those aged over 46). In addition, there is another socio-demographic variable that should be considered in future studies, namely income, because the present study found that people have with higher incomes and with lower incomes expressed different concerns about driverless cars (Begg, 2014). Taking account of the aforementioned factors in future research would undoubtedly yield interesting and meaningful results.

Moreover, this research confirmed the direct significant influence of perceived enjoyment on user attitude and the intention to use driverless cars, while Bjørner (2017) indicated that the hedonic feeling of using driverless cars is complex and must be explored within various contexts. In the same vein, Payre et al. (2014) mentioned that perceived enjoyment would increase user intention to use driverless cars in the beginning, but that in the long run users may get bored and less inclined to use driverless cars. Therefore, future research should investigate how hedonic perceptions vary between contexts (e.g., different levels of autonomy, different speeds/road conditions/ driving distances, and different numbers of passengers). These findings would help designers and developers maximise the benefit features of driverless cars and attract more potential customers.

Fourthly, the factor of perceived helpfulness explored in this study, which refers to the extent to which a person believes that using a driverless car will be convenient for mobility, was identified as a type of micro-behavioural benefit, and has been mentioned frequently by participants in previous studies, since they thought that driverless cars could enhance mobility for the young, the elderly, the disabled, and those who were interested in using driverless cars but were not fit to drive themselves (Bjørner, 2017; Kaur & Rampersad, 2018; Payre et al., 2014). The hypothesised positive influence of perceived helpfulness on user attitude was, however, rejected in this study. A plausible explanation for this is that the participants who were involved in Study 2 were not representative of customers from these groups (e.g., the aged and the disabled), and therefore the information collected did not express the true perceptions of those groups towards driverless cars. Few studies have focused on users from these groups, resulting in a paucity of empirical evidence examining the impact of perceived helpfulness on user intention to use driverless cars. In the same vein, Kaur and Rampersad (2018) suggested that future studies should actually survey users from particular groups to ascertain their views on driverless cars, rather than make assumptions about their views.

Fifthly, a previous study examined how drivers and passengers place different values on travel time depending on how efficient they perceive their use of the travel time is (e.g., for working, taking a nap, or other meaningful activities), which would influence their intention to use driverless cars and willingness to pay (Bansal et al., 2016). However, this research did not include relevant questions to distinguish the participants as drivers or passengers. Therefore, future research could ask questions about individuals' views depending on whether they were travelling as drivers or as passengers, which would also be crucial for devising personalised marketing strategies.

In addition, there is a new psychological factor that has not received sufficient examination in studies of user acceptance of driverless cars. This factor—motion sickness—is known as a human factor issue and refers to self-driving carsickness (Nordhoff et al., 2016). Motion sickness is more frequently experienced by passengers than by drivers (Reason & Brand, 1975). Previous findings have disclosed that self-driving carsickness can negatively influence driverless car acceptance, since drivers essentially turn into passengers (Nordhoff et al., 2016). Similarly, Diels and Bos (2016) noticed that motion sickness symptoms are likely have a negative impact on safety and user acceptance of driverless cars. However, this research did not touch on this human factor at all, since no one mentioned it in the interviews study. It would therefore be interesting to add a question about carsickness in the questionnaire and investigate whether individual motion sickness has a significant influence on driverless car acceptance.

Last but not least, eight factual questions were included in the first part of the questionnaire that related to previous experience with cars (for example, how often the respondents had used cars, to what extant their cars had automated systems, if they had heard of driverless cars previously and what type of driverless car they would like to use, etc.). Nordhoff et al. (2016) verified that the corresponding answers to those questions reflect sociodemographic characteristics, and proposed that experience or familiarity with automation is likely to influence acceptance of driverless cars.

Kyriakidis et al. (2015) also noted that individuals who currently used adaptive cruise control in their vehicles were more likely to buy driverless cars. However, the present researcher did not examine whether the answers to those questions had any influence on user acceptance of driverless cars. Therefore, further studies could take vehicle automation experience into account to investigate whether this factor has any influence on user acceptance of driverless cars.

5.6 Summary of the Thesis

The goal of this research was to understand customers' attitudes towards, and intention to use, driverless cars by identifying the main predictors and assessing the exact extent of each influencing factor on user acceptance. The researcher conducted two studies in sequential order, starting with the interviews study (N=13), which aimed to elicit core themes that expressed customers' perspectives towards driverless cars, and then condensed these as key constructs, including perceived travel efficiency, perceived enjoyment, perceived helpfulness, perceived societal benefits, attitude, concerns, personal traits, and socio-demographic variables. A quantitative survey (N=493) was then conducted to investigate the relationships between these variables and how they affect user acceptance of driverless cars. A theoretical conceptual model was proposed by incorporating these determinants into the TRA model; it relied on the rationale of belief—attitude—intention—behaviour. The proposed conceptual model explained 76 per cent of the variances in the intention to use driverless cars based on attitude, perceived enjoyment, concerns, perceived travel efficiency and perceived societal benefits. Notably, the findings also confirmed the moderating role of incumbent system habit in the acceptance of driverless cars. Firstly, incumbent system habit strengthens the negative relationship between customer concerns and the intention to use. Secondly, incumbent system habit dampens the positive relationship between attitude and the intention to use driverless cars. In addition, the findings also revealed differences in perceptions between customers aged between 18 and 25 (Generation Z) and those aged above 25 (older generations). The research offers additional explanations with which to understand user acceptance of driverless cars.

The proposed model has also shed light on areas for future research. The researcher suggests that in order to understand customers' intention to use driverless cars, scholars should conduct more integrative and multidisciplinary studies by focusing on different age groups, capturing more personal traits, and considering other potential factors, such as social influence and motion sickness. The findings have also generated some practical implications that can help automobile manufacturers and marketing managers to better understand the opportunities and challenges in introducing driverless cars to the mass market, thus ensuring that their precious resources will be correctly utilised and their marketing strategies will target the right customers.

5.7 Reviewed Research Questions and Objectives

Two objectives were developed after identifying the research gaps in the research on the acceptance of driverless cars. In this section, the research objectives are reviewed, with a brief description of how the researcher accomplished them.

Objective 1: To understand customers' perspectives towards driverless cars and whether they would like to use driverless cars.

Sub-question 1: What do potential customers think about driverless cars?

Sub-question 2: What are the potential factors that influence customers' intention to use driverless cars?

The researcher reviewed the literature in the fields of marketing, sociology, consumer psychology, and status quo bias and habit in the context of technology acceptance, as well as existing studies concerning driverless cars. The main factors that could potentially have a significant influence on the intention to use driverless cars were then identified. Widely adopted theories (e.g., the TAM and the UTAUT) in the study of technology acceptance and driverless car acceptance were also evaluated. These theories developed out of the TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which uses a long-standing rationale to explain consumer behaviour, namely, the belief—attitude—intention—behaviour causality. In this study of driverless car acceptance, influential factors were classified as enablers, barriers, and individual difference variables (personal trait variables and socio-demographic variables).

Enablers consisted of users' positive perceptions towards driverless cars. The construct of perceived travel efficiency was used to describe the extent to which a person believed that driverless cars could allow users to extend activities or undertake alternative tasks. Perceived helpfulness was used to describe the extent to which a person believed that using a driverless car would be convenient for mobility, including for old and disabled individuals. Perceived societal benefits referred to a person's belief or expectation that the adoption of driverless cars would generate a series of societal benefits, such as reducing the number of accidents caused by human errors and increasing traffic flow efficiency. Perceived enjoyment was a hedonic concept that captured consumers' emotional reactions to riding in driverless cars, such as enjoyment, relaxation, and the feeling of safety. User attitude towards driverless cars was defined as one's personal attitude towards the use of driverless cars, and could be used to predict the intention to use (Fishbein & Ajzen, 1975).

Customers also articulated their concerns about driverless cars, and these were viewed as barriers or critical challenges to the development and deployment of driverless cars. The findings further revealed that many challenges pertaining to the interaction between human drivers and automated systems have yet to be resolved (Kyriakidis et al., 2015). The principal concerns that were explored related to technological issues, hacking and privacy issues, laggard regulations and laws (e.g., the role of human drivers in the event of an emergency), financial cost, and a possible deterioration in driving skills. The potential influences of individual difference variables (e.g., incumbent system habit, age and gender) have also been discussed in this research. By this time, the pre-categorised variables had provided sufficient guidance for the researcher to analyse the narrative data via a template analysis and the formation of a conceptual model.

Subsequently, an interview study was conducted (see section 4.1) with the aim of revealing what customers thought about driverless cars and eliciting the potential factors that could influence their intention to use autonomous vehicles. By doing so, sub-questions 1 and 2 were answered. The researcher then adopted a template analysis strategy to sort the narrative data and extract the key themes that reflected individual expectations and concerns about driverless cars, and to synthesise these with the knowledge derived from the literature. Six core constructs were generated: perceived travel efficiency; perceived enjoyment; perceived helpfulness; perceived societal benefits; user attitude towards driverless cars; and concerns; and two individual difference variables—personal innovativeness and incumbent system habit—were also identified. The findings revealed that the majority of the participants wanted to wait until autonomous driving technology was more mature (e.g., in order to be sure that it would perform well in different weather conditions). They also wanted to see clearer regulations and policies regarding driverless cars. Moreover, they were concerned about the affordability of autonomous vehicles and other car-related expenses, such as insurance. Furthermore, they expressed the wish to read reviews about such vehicles from more 'technology-savvy' users who have experienced riding in a driverless car. They also described their preferred scenarios for using driverless cars, such as a closed geofenced area (e.g., a campus or an airport), segregated lanes designed exclusively for authorised driverless cars, and drivers still being able to take over the controls if necessary.

Objective 2: To explore and evaluate the significant factors that influence customers' attitude towards and their intention to use driverless cars, and to what extent these predictors impact on customers' acceptance.

Sub-question 3: What are the significant factors that influence consumers' intention to use driverless cars?

Sub-question 4: How do the key factors influence customers' intention to use driverless cars, and to what extent do the significant factors impact on the intention to use?

A quantitative study (see section 4.2) was conducted with the aim of exploring the significant determinants of user intention to use driverless cars, and explicating the exact extent of influential power that they have on intention to use. The mechanism behind user intention to use driverless cars was also spelled out. A series of hypotheses were proposed based on the fundamental cognition-oriented theory—TRA. Factors that reflected user perceptions about driverless cars were hypothesised as antecedents of attitudes towards driverless cars. A utilitarian factor (perceived travel efficiency) and a hedonic factor (perceived enjoyment), along with user attitude, were hypothesised as having a positive influence on user intention to use. Conversely, the construct that reflected user concerns about driverless cars was hypothesised as a negative predictor of the intention to use. The individual difference variables (i.e., incumbent system habit and personal innovativeness) were hypothesised as exhibiting moderating effects on the antecedents as well as on the consequence of user attitudes towards driverless cars.

These hypotheses were assessed through structural equation modelling, which verified that user intention to use driverless cars is significantly influenced by users' attitudes towards driverless cars, perceived enjoyment, users' concerns, and perceived travel efficiency (in descending order). User attitude towards driverless cars is positively impacted by perceived enjoyment and perceived societal benefits. User concerns about driverless cars (perceived technological issues, regulation and policy issues, hacking and privacy issues, and a possible deterioration in driving skills) have a significant negative influence on the intention to use such vehicles. In other words, these are the barriers to the widespread adoption of driverless cars. The moderating effects of incumbent system habit on user perceptions towards driverless cars and intention to use have been confirmed. Incumbent system habit not only restricts the positive relationship between attitude and intention to use, it also strengthens the negative relationship between concerns and intention to use.

The influences of the socio-demographic variables (i.e., age and gender) on user attitude and intention to use were also explored, although the influence of gender was rather marginal. As regards age, the results revealed that the positive effect of perceived enjoyment on attitude was significantly greater amongst customers aged above 25 than amongst the young aged between 18 and 25 (Generation Z). The results of the proposed hypotheses have been discussed in detail in this in chapter, along with a summary of the research contributions. So far, research objective 2 has been accomplished and sub-questions 3 and 4 have been answered.

To sum up, this study accomplished the two proposed research objectives listed in Chapter 1 by strictly following the three-step approach (section 1.3), and by answering the four sub-questions that were components of the main research question—What are the significant factors influencing consumer acceptance of driverless cars? The findings are rich in meaning in that they not only add new knowledge to the existing consumer marketing literature in the domain of technology acceptance, but they also provide plenty of practical implications for the various stakeholders involved in driverless car development, such as automotive manufacturers, marketing managers in the automobile retailing market, and policymakers.

5.8 Chapter Summary

This chapter has discussed the findings of this research based on the confirmed hypotheses and the proposed theoretical model. Each factor has been discussed sufficiently and critically with evidence from existing studies and from the review of the literature on marketing, sociology, consumer psychology, and status quo bias and habit. Therefore, the entire study presents a large amount of knowledge to explain user intention to use driverless cars. Meanwhile, the theoretical and practical implications described so precisely go beyond driverless cars. This chapter has also reviewed the proposed research objectives and four sub-questions, and in doing so the process of conducting Study 1 and Study 2 has also been presented, which strictly followed a three-steps approach and the strategy of a mixed-methods.

The research's original contributions are summarised as:

1. Proposing a new theoretical model to investigate user intention to use driverless cars by integrating the explored factors into the TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which extend the boundary condition of such cognition-oriented theories to a new context.
2. Answering a demand to explore the significant predictors of user intention to use driverless cars by taking potential customers' perspectives into account. The verified significant factors include (in descending order), user attitude towards driverless cars, perceived enjoyment, user concerns, and perceived travel efficiency. Perceived enjoyment and perceived societal benefits are significant predictors of user attitudes towards driverless cars. Age has a strong effect on attitude.
3. Exploring the significant construct of incumbent system habit in relation to driverless car acceptance by verifying its moderating impact on the relationship between user perceptions about driverless cars and the intention to use. The findings demonstrate that the stronger an individual's incumbent system habit is (in relation to an incumbent automobile vehicle), the higher the bias that that the person will have against driverless cars; hence, less willingness to use driverless cars.
4. Adopting a mixed-methods strategy to conduct this research, and creating measurement scales for new explored constructs, which can be used in future studies in the context of driverless cars.

The limitations of this research have already been outlined, as have suggestions for new directions in future studies, which will allow user behavioural intentions towards driverless cars and other car-related technology to be explored further.

Appendices

Appendix A-Interview schedule

Thank you for coming here today. I am conducting a research of understanding customers' attitude toward self-driving cars and intention to use it. I have a few questions would like to ask you, please feel free to let me know your answer.

A driverless car is defined as (Payre et al., 2014):

A driverless car is a vehicle which can drive autonomously in the condition of fully automated mode without the intervention from the driver. It is able to master the speed, headways, and braking of the vehicle and designed to be used by all kind of customers.

1. Have you heard of driverless cars before?
    - Yes
    - No
2. What do you think of driverless cars?
3. Do you think you would use it in the next couple of years once the product is available on the mass market?

    Yes, I do

    No. I don't
4. Can you describe the reason?
    - Why you are intent to use a driverless car?
    - What do you expect from a driverless car?

Or

- Why you are not intent to use a driverless car?
- Is anything you concerned about driverless cars?

This is all the questions I would like to ask you. Thank you so much for your participation. If you have any questions would like to ask me, please feel free to send me an e-email: Ruihan.zhang@northumbria.ac.uk.

Thanks again!

Appendix B-Consent Form

Consent Form

Faculty of Business and Law
Informed Consent Form for research participants

Title of Study:	Understanding customers' attitude and intention to use automated vehicles
Person(s) conducting the research:	Ruihan Zhang
Programme of study:	Business and Management PGR
Address of the researcher for correspondence:	Room E, Flat 110, Manor Bank Pandon Bank Newcastle Upon Tyne United Kingdom NE1 2JA
Telephone:	07762311676
E-mail:	ruihan.zhang@northumbria.ac.uk
Description of the broad nature of the research:	This research is part of my doctoral study. The research is for academic purpose only and not for commercial purpose. The purpose of this research work is to understand potential customers' attitude toward self-driving cars and intention to use it. This research begins with a qualitative interview for exploring critical factors that may significantly influence customers' attitude in terms of automated vehicles, and following up with a quantitative study to collect a large sample so that the researcher can generalise results to a population. This research will contribute on creating an innovative research model to explain and predict customer's behaviour toward adopting a new technology-driverless cars. The findings generated from this research

	also can help R&D managers in car manufacturing and marketing managers in a retail market.
Description of the involvement expected of participants including the broad nature of questions to be answered or events to be observed or activities to be undertaken, and the expected time commitment:	1. Participation in this survey is voluntary without coercion or under any pressure. 2. Participants can withdraw their permission at any time, and are encouraged to be honest as possible with their answers. 3. Participants can access the information and are able to contact with the researcher at any time. 4. The expected interview time is an hour for each participant. 5. The questionnaire will be posted on a Chinese market research survey website for 3 weeks.
Description of how the data you provide will be securely stored and/or destroyed upon completion of the project.	1. To protect participants' right to anonymity and confidentiality, a coding system will be adopted to identify the participants instead of using their real name or personal ID. 2. The data will be password-protected and only can be assessed by a researcher. 3. Hard copy of the questionnaire is not required. Electronic records will be stored in logical files structures and indexed using logical file. 4. The expected time of storing the data is approximate the length of completion of project adds to 5 years. 5. Arrangements for the archiving of electronic materials will be made within the Business and Law Faculty.

Information obtained in this study, including this consent form, will be kept strictly confidential (i.e. will not be passed to others) and anonymous (i.e. individuals and organisations will not be identified *unless this is expressly excluded in the details given above*).

Data obtained through this research may be reproduced and published in a variety of forms and for a variety of audiences related to the broad nature of the research detailed above. It will not be used for purposes other than those outlined above without your permission.

Participation is entirely voluntary and participants may withdraw at any time.

By signing this consent form, you are indicating that you fully understand the above information and agree to participate in this study on the basis of the above information.

Participant's signature: **Date:**

Student's signature: **Date:**

Appendix C-Participant Debrief

Participant code:

PARTICIPANT DEBRIEF

Name of Researcher: Ruihan Zhang

Name of Supervisor (if relevant): Dr Gendao Li

Project Title: Understanding customers' attitude and intention to use driverless cars

1. What was the purpose of the project?

The present study aims to understand customers' attitude toward driverless cars and intention to use it. The use of driverless cars would be the upcoming trend in road transportation and improve quality of life. While few studies deeply investigate the potential factors that influence customer acceptance of driverless cars from customers' perspectives. The researcher expected to fill in this research gap by using a sequential mixed-method to detect key factors (e.g. cognitive factors and emotional factor) and verify their relationships. Thus, the collected data will be analysed by statistical methods via AMOS and SPSS to guarantee high quality of results. The proposed conceptual model will expand the TAM-typed framework in the literature of human-technology interactions. Additionally, the results of this study will help marketing managers to optimize their marketing strategies and effectively use their marketing resources.

2. How will I find out about the results?

The data will be analysed approximately 3 weeks after taking part of the interview. The final study will be completed on 30/04/2019. The researcher will email you a general summary of the results if you would like to know.

3. If I change my mind and wish to withdraw the information I have provided, how do I do this?

If you wish to withdraw your data then please email the researcher named in the information sheet within 1 month of taking part and given me the code number that was allocated to you (this can be found on your debrief sheet). After this time it might not be possible to withdraw your data as it could already have been analysed.

The data collected in this study may also be published in scientific journals or presented at conferences. Information and data gathered during this research study will only be available to the research team identified in the information sheet. Should the research be presented or published in any form, all data will be anonymous (i.e. your personal information or data will not be identifiable).

All information and data gathered during this research will be stored in line with the Data Protection Act and will be destroyed 60 months (the length of completion of the research adds to 5 years) following the conclusion of the study. If the research is published in a scientific journal it may be kept for longer before being destroyed. During that time the data may be used by members of the research team only for purposes appropriate to the research question, but at no point will your personal information or data be revealed. Insurance companies and employers will not be given any individual's personal information, nor any data provided by them, and nor will we allow access to the police, security services, social services, relatives or lawyers, unless forced to do so by the courts.

If you wish to receive feedback about the findings of this research study then please contact the researcher at Ruihan.zhang@northumbria.ac.uk

This study and its protocol have received full ethical approval from Faculty of Business and Law Research Ethics Committee. If you require confirmation of this, or if you have any concerns or worries concerning this research, or if you wish to register a complaint, please contact the Chair of this Committee:hyemi.shin@northumbria.ac.uk, stating the title of the research project and the name of the researcher.

Thanks again for your participation.

Appendix D-Translation of Interviews

Coded data is highlight and the corresponding codes are listed in the next column.

Profile	Data	Initial Codes
M1:	I won't accept driverless cars because safety issues are what I am really concerned about. Also, I may not trust its navigation system because such autonomous driving technology requires high-quality specialised maps to support. However, as far as I know, these maps are not available yet. Also, artificial intelligence (AI) still need some time to improve its accuracy and self-learning capability. These should be technological obstacles for the widespread use of driverless cars. Well, price of a driverless car is another factor I am concerned about. The car would be so expensive when it is first released on the automobile market and probably targets only rich people…umm, car insurance may also increase. Also, the liability issue and drivers' responsibility in traffic accidents will be a problem, I don't know when the government will release new regulations and laws to clarify these disputes. I am also concerned about the deterioration of my driving skills. It's not a good thing that people highly reply on driverless cars. While, if there are some subsidies for customers who purchase driverless cars, I think I would go for it. Um, at least it will be a new experience and benefit us. Driverless cars could make our day more productive, potentially saving travel time, good for environment, reduce the carbon footprint to some extent. In my opinion, the implementation of driverless cars probably starts from ride-sharing industry or freight transport, then move to the mass market for personal use. It would save parking areas and free some public spaces; also, the driverless cars would bring more comfort and convenient experience to users. I feel like it would be very beneficial for the older generation who are	Safety concern Navigation system Technological issues/obstacles High-quality specialise maps Accuracy Self-learning capability Costs Insurance Liability issue Drivers' responsibility Regulations Policies Deterioration of driving skills New experience Productive Save travel time Good for environment Reduce the need for Parking Comfort and convenience experience Good for the elder, disabled people Impaired driving

	over 70 years old and not permitted to drive a car anymore, driverless cars can take them to anywhere without bothering someone else. Also, individuals who are interested in impaired driving (drunk, taking medication, or feeling tired) could benefit from driverless cars.	
M2:	It's a good technology but I may not consider using it in such earlier stage. I don't trust machine or programmed systems. Well, no matter how advance it is. I know, it sounds like anti-technology, but I enjoy driving. I especially enjoy the feeling of control, no matter how popular driverless cars may become in the automobile market…I still prefer manual driving. Umm, I know driverless cars will be very beneficial and useful. For example, smoother speed adjustment and a comfortable experience, drivers can do other things while riding, and saving lots of time on the road.	Safety concern Not trust Programmed System Anti-technology Enjoy driving Feeling of control Useful Comfortable experience Saving time
M3:	I do not accept driverless cars because they are unsafe. The autonomous driving technology is unreliable, especially in unforeseeable conditions. As a passenger, I will feel unsafe as well. I have so many years driving experience so far, if I were allowed to sit in the 'driver' position but did not have an authority to control the car... that makes me uncomfortable and distressed…I am care about the feeling of control, the car's safety equipment and safety systems when I decided to buy a new car… although use of a driverless car is a good idea but I don't think I would like it. However, if driverless cars available in certain scenarios or for a particular purpose, I would like to have a try. For example, the pre-designed areas and a short trip. Um, I am not sure what kind of benefits I can get from it, but at least I can relax in my seat and no one interrupt me.	Safety concern Technological issues/obstacles Used to driving by self Uncomfortable and distressed Sense of control A good idea Relax/no interruption

M4:	In my opinion, the autonomous driving technology is still in its infancy. Lots of works need to be done to resolve technological issues, such as accurately distinguishing obstacles. In addition, current road infrastructure may need to reconstruct and change for autonomous cars to function optimally. Regulation challenges and policy issues need to be solved as well. So, the implementation of driverless cars is the big project for governments. However, in certain conditions I would like to use a driverless car. For example, the car permits me to intervene in certain conditions, riding in a designed area or a closed environment (e.g. campus, airport).	Technological issues Regulations Policies Designed area Closed environment Road infrastructure
M5:	Personally, I trust autonomous driving technology as the embedded systems are pre-designed and tested. It would be super easy to go anywhere by using a driverless car as I just need to provide destination or navigation information to the system then can relax in my seat. It sounds cool. Also, people don't need to attend the driving test anymore…or maybe there is another kind of driving licence that need to be obtained before we could use driverless cars, but it would be much easier to pass. As you know, passing the driving test is a hard challenge and attending driving lessons is tough and time-consuming. However, autonomous cars controlled by computer systems, imply a potential threat from hacking. If the driving system got a virus or shut down while driving, or is targeted by terrorism, what should I do? In addition, once driverless cars are implemented widely that means users' privacy information (e.g. home address, mobile number and individual travel route) will be monitored via GPS or other advanced information systems embedded in the car. I mean, it is hard to say if our privacy data and personal information will be protected by automobile companies or mobile carriers. If they get access to my data and use it for other purposes, how would I know that?... um, I don't think using	Reliable computer systems Mobility Relax Cool Threat from hacking Virus Technological issues Privacy issue

	driverless cars will encounter serious privacy issues if compared with a concern about hacking. Because that will break down the autonomous driving systems and endanger my life. That's what I am really concerned about.	
M6:	I think using a driverless car for daily commute would be a good idea as it could save lots of time. Assuming some special roads will be designed for driverless cars, implying an upscale road infrastructure is coming soon. By doing so, traffic congestion will be reduced. I don't think drivers need to monitor the system all the time, so I will be free to do other things while riding, for example, taking a nap, especially during the mid-day because I'm used to taking a nap at certain times. Thus, I would expect the interior are quite comfortable, such as, equipped with adjustable seats that can fold down flat, embedded in voice-control system and WiFi available. In addition, I will have lots of transportation methods to choose, such as riding a bike, walking, driving, or using a driverless car which all depend on my mood and my outdoor purpose.	Daily commute Good idea Saving time Road infrastructure Traffic congestion Do other things while driving Take a nap Comfortable Adjustable seats Voice-control systems WiFi Transportation methods
M7:	I would like to wait for a while before deciding whether or not to use a driverless car, although I have high expectations toward this advanced technology. As I know, there still has lots of challenges need to be resolved by automobile manufactures. I would recommend autonomous driving technology adopted by trucks firstly because lower safety concern. Of course, this advanced technology sounds so good. I do think it can bring different experience to users. I think driverless cars should be user-friendly, no driving pressure, and allow the drivers to chat with friends, replying emails etc. Those sounds pretty cool and fun. Especially useful to reduce the phenomenon of drunk driving. Also, it can help	Wait for a while High expectations Challenges Safety concern Different experience User-friendly No driving pressure Do other things while driving Cool and fun Useful Impaired driving

	customers who are do not have driving licenses or inexperienced to drive by themselves.	No driving licenses Inexperienced drivers
F1:	Um…I am a little bit concern about driverless cars. For example, if the driverless car couldn't react immediately in emergency situations, what can I do in that situation? Probably the underlying technology is still in its infancy and need more time to develop. Also, if the software system of the driverless car got some problems, and I wasn't aware of it when I riding in the car, I cannot image the result… that's a big hazard…also, I am not sure if I can take over the controls whenever I want? Well, I still admit that driverless cars can provide some benefits to users. If I am riding in a driverless car, well, I can play my phone, watch a show online and do whatever I want. Also, it is so convenient for me to go anywhere by simply inputting the destination details in the navigation system.	concern Technological issues Benefits Take control back Do other things while driving Convenience
F2:	I think driverless cars will become to the best option for female customers or female drivers. In my opinion, driving a car on the road is not hard, parking is the hardest task to me. Navigation system should be one of the basic functions installed into driverless cars, I think autonomous cars may have very high-quality 3D map in its software so it will operate more accurate if I am riding in a driverless car, well, I can play my phone, watch a show online and do whatever I want. Also, it is so convenient for me to go anywhere… if driverless cars can be implemented widely, I believe that would reduce the amount of car emission, save resources, mitigate traffic congestion, reduce the needs of parking space in urban areas, freeing scarce land for other purposes, such as expanding landscaping, public areas and social uses.	Assisted users to parking Navigation system High-quality specialise maps Good for environment Save resources Reduce the need for parking Social responsibility Willingness to try new things Open-mind

	I think people's awareness of social responsibilities (e.g. protect environment) are facilitated than before, also the government encourage citizens to use environment-friendly products, such as, electric motor car, and provide preferential policies to users. The similar subsidies may be launched by the government again to increase the implementation of driverless cars and achieve good societal results. Um. I think people have more open minds toward new technology than few years before, and willing to try new things, especially the younger generations. I am quite concerned about the safety, so I would like to wait for a while and see the reviews and comments from customers who are technology savvy and have tried an autonomous car. Also, I will consider the price of autonomous cars, if it is too expensive and out of my budget by a lot, then I will not consider to buy one; I am not sure if driverless cars are more suitable to drive in highways rather than in city roads. In the current transportation situation of our country, it sounds impossible for autonomous cars to drive in urban city as the traffic situation is so complicated.	Younger generations Safety concern Wait for a while Costs Limited conditions
F3:	I will buy a driverless car if it available on the mass market now. Because I do not trust my own driving skill even though I have passed the driving test and got a driving license, I lack driving experiences. Um, such cars would be very beneficial if the traffic is bad or the parking area is too tiny, these are big challenges for me. If I could have a driverless car in the near future, it would be a dream come true and relieve my driving pressure as I am always nervous when driving. So you know I have high expectations for driverless cars, especially autonomous reversing system…I can take care of my kid during the journey rather than split my attentions to drive a car, or I can read a magazine, text my friends, reply to a mail or do other things. The driving condition would be quiet, comfortable, and smooth. Well, the price of a driverless car is another factor I may be	Not trust own driving skills Inexperienced drivers Convenience Relief driving pressure Doing other things while driving Costs Safety concern Liability Regulation issue

	concerned with, If the price is extraordinarily high then I will not go for it. On the other hand, I am also concerned about safety. Imagine that driverless cars and normal vehicles using one driveway on highways or city roads, no one can guarantee driverless cars will always perform very well and perfect. How a car can react in unforeseen edge cases? Like raining day and heavily snowing day. Additionally, if traffic police closed the road, how to notify an autonomous car in advance? Another concern is about liability if an autonomous car is involved in a traffic accident, who should take the responsibility in this case? The regulations for autonomous cars are still blank.	
F4:	I prefer to wait for a while rather than to be a first person to try driverless cars. Actually, I have experienced being taken on an autonomous electric metro in Japan few years ago but didn't have any intuitive feeling. Umm… I still prefer to drive a car by myself even the car have some autonomous features, for example, adaptive cruise control and lane keeping system. I would say I'm quite conservative, it will take some time for me to accept driverless. Well, I think I have some safety concerns toward autonomous driving technology and other underlying technologies, such as artificial intelligence. Many people say that AI still isn't able to function properly in chaotic city roads. I am not an expert so...I don't know, I just don't trust this technology currently. Also, I would worry about my personal privacy if someone hack the system and track users' information, then my home address and my daily route will be disclosed for other purposes. One more point I would like to address is that, as I know a driverless car use radar or wireless communication technique to sense its surrounding environment, but how it works in underground	Wait for a while Driver driving by self Conservative Safety concern Technological issues Not trust Privacy issue Hacking Limited conditions

	parking areas. Especially in my city-Chongqing. More than half of parking areas locate in underground.	
F5:	Of course, I will accept driverless cars but I don't think I would like to buy one. I think driverless cars would be more popular among female customers as it can enhance their mobility and help them to drive easier and safer. As I know various driver assistance systems are already available in the market, like autonomous valet parking system that can help drivers to park cars into smaller parking spaces and reduce their parking frustrations. Did you notice that Cadillac Super Cruise TM and Audi advanced car all use female super models as their spokesperson? See, their potential targeted customers are female. I think riding in a driverless car can also allow people to conduct business, for example, a team can arrange a business meeting in the car while the car drives itself to their destination. It can save everyone's time and makes work more efficient. I don't think I have any concerns about liability, well, I mean, who should take a responsibility for crash or traffic accidents when riding in a driverless car. Traffic polices can check automobile data record and surround cameras installed in the car, right? Well, I also don't have privacy concern, if a third party or the government tracking my personal information, there is nothing I can do. So…it's not what I am concerned about. But if the car's software system is hacked by someone that would be horrible…umm. It's not on my priority list anyway. I think users may highly rely on driverless cars gradually and forgot how to drive cars. If I decide to buy a new car, I will consider the performance of the car and my feeling of operation, umm…the control feeling as well. That's why I	Assisted users Enhanced mobility Saving time Improve work efficiency Do not have privacy concern Hacking Deterioration of driving skill Feeling of control feeling Regulations and policies Incumbent system habit Without driving license

	decided to buy a SUV as my first car. Additionally, driverless cars have different brands and their own software systems I think, even they are just slightly different. Also, it is necessary to set single standards or same rules for autonomous vehicles manufactures cross the nations. Personally, I think I am so optimistic and will not worry about too much. If I were my sister, she would choose a driverless car without thinking because she doesn't like to take public transport and without a valid driving licence.	
F6:	I will not consider using a driverless car at current stage. Because AI technology is still in its learning process, no one knows how long it will take. Driving a car without human intervention sounds marvellous but it is limited in specific conditions and emergency situations. Such as bad weather, unforeseen cases etc. How an autonomous car can react under this situation and protect me? I don't know. If the price of driverless cars is quite high, well, I am definitely not going to use it. If the price drop down and is widely used by others, I may consider buying one and chose a popular brand, the one that has a good reputation. Also, I don't know what kind of power source will be used by driverless cars, gasoline-powered or electric drive. If driverless cars still categorised as a type of gasoline-powered vehicle that would be convenient for users to find a petrol station. However, if driverless cars use electric that will be difficult for users to charge cars as it would be a huge project to build charging stations widely, not just in cities also the rural areas, while enlarging petrol stations is relatively easier. But imagine if one day I am riding in a driverless car, I will have more time to do other things, such as reading a book, taking a nap, or just relax. Also, I don't like small talk with drivers, I think lots of people have the same feeling like me, right? So using driverless cars would allow me to have a	Technological issue Limited conditions Cost Power source Infrastructure Doing other things while driving Limited conditions Safety concern Prefer driving by self Elder and disabled people

	private space. Also, in this autonomous mode, I don't need to monitor the roadway. Um, it sounds pretty good. But honest speaking, I don't think driverless cars can be used in all situations, especially in urban environment and congestion roads, that will be safer to drive a car by myself. At least I am placing my life in my own hands rather than a machine. On the other hand, the elderly and disabled people can benefit from autonomous cars as that can drive them go anywhere, very comfortable and convenient. When I am getting older, another 20 years maybe, and the autonomous driving technology should be developed more maturely, I may consider buying one.	

Appendix E- Questionnaire for Pilot Study (English Version)

Questionnaire

Thank you very much for agreeing to participant in this survey. The purpose of this research work is to understand customers' attitude intention to use automated vehicles (AVs). The whole questionnaire contains three parts and will takes you approximately 10 minutes to complete.

The information provided by you in this questionnaire will be used for research purpose only and not for commercial purpose. The results generated by this study will contribute to the literature in the human-technology interactions studies. You will also get some knowledge about automated vehicles through this survey.

You participated in this survey voluntarily without coercion or under any pressure.

You can withdraw your permission at any time, and are encouraged to be honest as possible with your answers.

Your right to anonymity and confidentiality will be protected during the whole process of data collection.

You can access the information and are able to contact with the researcher at any time.

If you are understanding the above statements, please click the right box shown in the follows:

- I am totally understanding above statements and agree to join in this survey
- I do not want to join in this survey

Thank you so much!

Part 1

Please reading the following statements carefully. Select the most closed description that can reflect how strongly you agree or disagree with each statement.

1=Strongly disagree

2=Disagree

3=Somewhat Disagree

4=Neither disagree nor agree

5=Somewhat agree

6=Agree

7=Strongly agree

1. **Have you heard of AVs before?**
   - o Yes
   - o No
2. **How do you think of AVs?**
   a. Using autonomous cars would be a good idea
   b. Using autonomous cars would a wise idea
   c. Using autonomous cars would be pleasant experience
3. **If AVs available in the mass market, would you use it as a daily vehicle?**
   a. Assuming I had access to the automated vehicle, I intend to use it
   b. If AVs are available on mass market within 1 year, I intend to use it
   c. If AVs are available on mass market in the next 5-10 years, I intend to use it
4. **If AVs available in the mass market, would you purchase it?**
   a. I intend to buy an AV now
   b. I plan to buy an AV within 1 year
   c. I predict that I would buy an AV in the next 5-10 years

5. **Do you have a car?**
   a. Yes
   b. No

6. How often you normally drive a car?

a. Several times in a month
b. Several times in a week
c. Several times on each day
d. Several times a day

7. Whether or not your car involved in autonomous driving functions, for example automatic steering control, automatic lane keeping, or automatic parking.

a. Yes
b. No
c. I don't know
d. I am not own a car

8. Do you want what type of vehicles use autonomous driving technology firstly?

a. automated bus
b. automated private car
c. automated taxi

Part 2

How strongly you disagree or agree with the following statements? (1=strongly disagree----7=strongly agree)

10. Time efficiency

Using AVs would allow me to use time…

a. For entertainment (e.g. sending messages、watching video and reading books)
b. Dealing with important things (e.g. replying business emails)
c. Socializing (e.g. chatting with friends, replying to texts on WeChat/Weibo)

11. Benefit for certain customers

Using AVs would benefit for…

a. Individuals without driving licenses
b. Drivers who are lack of driving experiences
c. The older or disabled people

d. After drinking alcohol, taking medicines

12. Enjoyable experience

a. Using AVs can free up drivers' hands
b. Users can enjoy a break mentally, especially in a long journey
c. Users can enjoy private space
d. Users can enjoy speed change smoothly

13. Sustainable social development

Using AVs would…

a. Lower vehicle emissions, protect the environment and improve sustainable environment
b. Less traffic congestion
c. Less traffic accidents
d. Reduce occupation of public spaces (e.g. public parking place)

14. Concerns

To what extent you will concern about the following statements? (1=extremely low； 2=moderately low； 3=somewhat low； 4=not sure； 5=somewhat high； 6=moderately high； 7=extremely high)

a. Navigation inaccurate, unable to find passenger(s)' location or destination
b. Reserved parking space clash
c. Underlying driverless technologies are immature
d. Relevant regulations and policies are blank
e. Urban infrastructures are not ready
f. Higher selling price
g. Hacking the vehicle's computer systems, software error or hardware error or data privacy disclosure (location and personal phone number)
h. Deterioration of driving skills

15. Incumbent system habit

How strongly you disagree or agree with the following statements? (1=strongly disagree----7=strongly agree)

a. I like driving by myself

b. I care about cars' safety performance when I buy a car
c. I care about control feeling
d. I am used to driving by myself

16. **Personal Innovativeness** (1=strongly disagree----7=strongly agree)

a. I like to experiment with new technologies
b. It is important for me to follow technological development
c. I expect new technologies to come out
d. I always buy new technology products, although they are expensive

Part 3:

17. Please select your gender

a. Male
b. Female

18. Please select your age groups

a. 18-25
b. 26-35
c. 36-45
d. 46-55
e. 56-65
f. 66 and above

19. Please select your education background

a. Elementary-school diploma
b. Middle-school diploma
c. High-school diploma
d. University degree diploma
e. Others

20. Please select your employment status

a. Full time staff
b. Part time staff
c. Unemployed

d. Retirement
e. Student

21. Please select your monthly salary (before tax)

a. Below 1，500 rmb
b. Above 1，500-4，500 rmb
c. Above 4，500-9，000 rmb
d. Above 9，000 -35，000 rmb
e. Above 35，000-55，000 rmb
f. 55，000 to 80，000 rmb
g. Above 80，000 rmb

Thank you very much for your time to complete this questionnaire!

Appendix F-Questionnaire for Pilot Study (Chinese Version)

无人驾驶车调查问卷

您好！此份问卷旨在调查大众对无人驾驶车的看法以及接受程度。您需要完成三部分简短的问卷来表达您的看法和态度，总共约用时 10 分钟。

此问卷不会涉及任何风险。同时，此次研讨论的目的将有助于日后的学术研究。我们也希望您可以从中获取对于无人驾驶车的进一步了解。所有数据将以不记名的方式收集与保存，并将受到严格的保密。此数据仅作为学术研究所用。最后收集到的数据仅以整体的方式出现在学术期刊上。

此次研究纯属自愿参与，您有权随时终止并退出问卷测试，不会产生任何负面后果。您也可以拒绝回答任何不愿意回答的问题。

- o 我完全清楚以上所述内容并同意参与此次研究
- o 我不愿意参与此次研究

无人驾驶车被定义为： 车辆可以全程自行控制全部驾驶功能，包括驾驶，刹车和提速等。可供高速公路驾驶，市区内驾驶，以及自主停车等功能。用户可以自行输入目的地或者导航信息。行驶全程如遇紧急状况，用户可以接管车辆驾驶权。

第一部分

请回答以下问题，选出您认为最合适的回答。

1=非常不同意
2=不同意
3=不太同意
4=不确定
5=有点同意
6=同意
7=非常同意

1. 您是否听过无人驾驶汽车?
- o 有
- o 没有

2. 你对无人驾驶车的态度是什么?
- a. 使用无人驾驶车是一个好想法
- b. 使用无人驾驶车是明智之举
- c. 使用无人驾驶车将会是一种愉悦的体验

3. 假设无人驾驶车已经面世，可以购买。您有多大可能使用它作为日常出行工具?
- a. 如果我现在可以使用无人驾驶车，我打算使用它
- b. 如果无人驾驶车一年内上市了，我会使用它
- c. 如果未来 5-10 年可以使用无人驾驶车，我会使用它

4. 如果无人驾驶车已经面试，您购买的可能性有多大?
- a. 我想现在就购买一辆无人驾驶车
- b. 我计划一年内购买一辆无人驾驶车
- c. 我预计在未来 5-10 年内购买一辆无人驾驶车

5. 您是否有车
- a. 是
- b. 否

6. 您开车的频率为多少?
- a. 每月多次
- b. 每周多次
- c. 每日多次
- d. 每日多次

7. 您现在驾驶的车是否有任何自动化功能，例如自动方向盘控制，自动车道保持，或者自动停车系统?
- a. 有
- b. 没有

c. 不知道
d. 没有车

8. 您最希望哪类车种应该先采用无人驾驶技术?

a. 公交车
b. 私家车
c. 出租车

第二部分

您对无人驾驶车具有下列优势的认同程度如何?

1-非常不同意-----7-非常同意

10.有效利用乘车时间

a. 休闲娱乐 （例如：发短信、看视频、看书等）
b. 不耽误手边的紧急事情（例如：回复工作邮件等）
c. 有助于社交 （例如：微信聊天、玩微博等）

11. 有助于特定群体使用

a. 无驾照者
b. 开车经验不足的司机
c. 老人或残疾人等特殊群体
d. 饮酒，服用药物之后

12 享受乘车乐趣

a. 解放司机双手
b. 精神放松，特别是长途出行
c. 独享个人空间，不被打扰，无需与司机交谈
d. 匀速行驶，变速流畅

13 有助于社会的可持续发展

a. 减少废气排放，保护环境, 促进环境可持续发展
b. 减少道路拥堵
c. 减少交通事故的发生
d. 减少公共设施占用（例如：停车位）

14. 您有多担忧下列情况的发生?

1=担忧程度很低
2=担忧程度比较低
3=担忧程度低
4=不确定
5=担忧程度高
6=担忧程度比较高
7=非常担忧

a. 系统定位可能不准确，无法找到乘客所在地或者目标地
b. 预定目的停车位冲突
c. 无人驾驶车涉及的技术，还未完全成熟
d. 与无人驾驶相关的法律、法规存在空白
e. 配套城市道路设施不完善
f. 车辆售价会很高
g. 黑客入侵、车辆系统（软件、硬件）被损害或者用户个人信息泄露（例如：住址、手机号码等）
h. 开车技能退化

15 个人习惯以喜好

根据你个人的偏好，你赞同以下的描述吗？

1-非常不赞同----7 非常赞同

a. 喜欢自己开车的感觉，手握方向盘，踩油， 有运动感
b. 在意车辆的安全性能
c. 享受开车的驾驭感
d. 习惯自己开车

16 个人特性

a. 乐于尝试新的科技
b. 对新科技了解得多
c. 期待新科技的面世
d. 经常购买新上市的科技产品，即便价格较高

第三部分

17. 请选择您的性别

o 男
o 女

18. 请选择您的年龄阶段

a. 18-25 岁
b. 26-35 岁
c. 36-45 岁
d. 46-55 岁
e. 56-65 岁
f. 66 岁以上

19. 请选择您的受教育程度（以最高学历为准）

a. 小学程度
b. 中学程度
c. 高中程度
d. 大学程度

e. 其他

20. 请说明您目前的就业状况

a. 全职员工
b. 兼职员工
c. 目前待业
d. 退休
e. 学生

21. 请选择您的税前月收入水平

a. 低于 1，500 人民币
b. 超过 1，500 至 4，500 人民币
c. 超过 4，500 至 9，000 人民币
d. 超过 9，000 至 35，000 人民币
e. 超过 35，000 至 55，000 人民币
f. 超过 55，000 至 80，000 人民币
g. 超过 80，000 人民币

感谢您的参与!

Appendix G-Questionnaire for Study 2 (English Version)

Questionnaire

Thank you very much for agreeing to participant in this survey. The purpose of this research work is to understand customers' attitude intention to use driverless cars. The whole questionnaire contains three parts and will takes you approximately 5-8 minutes to complete.

The information provided by you in this questionnaire will be used for research purpose only and not for commercial purpose. The results generated by this study will contribute to the literature in the human-technology interactions studies. You will also get some knowledge about automated vehicles through this survey.

You participated in this survey voluntarily without coercion or under any pressure.

You can withdraw your permission at any time, and are encouraged to be honest as possible with your answers.

Your right to anonymity and confidentiality will be protected during the whole process of data collection.

You can access the information and are able to contact with the researcher at any time.

If you are understanding the above statements, please click the right box shown in the follows:

- o I am totally understand above statements and agree to join in this survey
- o I do not want to join in this survey

Thank you so much!

Part 1:

1. **Have you heard of driverless cars before?**
   - o Yes
   - o No
2. **How do you think of driverless cars? (1=strongly disagree----7=strongly agree)**
   a. Using driverless cars would be a good idea
   b. Using driverless cars would be a wise idea
   c. Using driverless cars would be pleasant experience
3. **Would you like to use driverless cars? (1=strongly disagree----7=strongly agree)**
   a. Assuming I had access to the driverless cars, I intend to use it
   b. If driverless cars are available on mass market within 1 year, I intend to use it
   c. If driverless cars are available on mass market in the next 5-10 years, I intend to use it
4. **If driverless cars available in the mass market, how likely you will buy one? (1=strongly disagree----7=strongly agree)**
   a. I intend to buy a driverless car now
   b. I plan to buy a driverless car within 1 year
   c. I predict that I would buy a driverless car in the next 5-10 years
5. **Do you have driving experience?**
   - o Yes
   - o No
6. **If driven a car by yourself, how often you will drive it?**
   a. A few times in a year
   b. Several times in a month
   c. Several times in a week
   d. Several times on each day
   e. About once a day
7. **To what extent that your own car involved in autonomous driving technologies?**
   a. Manual control
   b. Function-specific automation
   c. Combined function automation
   d. Limited self-driving automation
   e. Do not know
8. **What type of automated vehicles you would like to use?**

a. Automated bus
b. Automated private car
c. Automated taxi

Part 2:

How strongly you disagree or agree with the following statements? (1=strongly disagree----7=strongly agree)

10. Time efficiency

Using driverless cars would allow me to use time…

a. For entertainment
b. Dealing with important things
c. Socializing (e.g. chatting with friends, replying to texts on WeChat/Weibo)

11. Benefit for certain customers

Using driverless cars would benefit for…

a. Individuals without driving licenses
b. Drivers who are lack of driving experiences
c. The older or disabled people
d. After drinking alcohol, taking medicines

12. Enjoyable experience

a. Using driverless cars can free up drivers' hands
b. Users can enjoy a break mentally, especially in a long journey
c. Users can enjoy private space
d. Users can enjoy speed change smoothly

13. Sustainable social development

Using driverless cars would…

a. Lower vehicle emissions, protect the environment
b. Less traffic congestion
c. Less traffic accidents
d. Reduce occupation of public spaces (e.g. public parking place)

14. Concerns

To what extent you will concern about the following statements? (1=extremely low； 2=moderately low； 3=somewhat low； 4=not sure； 5=somewhat high； 6=moderately high； 7=extremely high)

a. Navigation inaccurate, unable to find passenger(s)' location or destination
b. Reserved parking space clash
c. Underlying driverless technologies are immature
d. Relevant regulations and policies are blank
e. Urban infrastructures are not ready
f. Higher selling price
g. Hacking the vehicle’s computer systems, software error or hardware error or data privacy disclosure (location and personal phone number)
h. Deterioration of driving skills

15. Incumbent system habit

How strongly you disagree or agree with the following statements? (1=strongly disagree----7=strongly agree)

a. I like driving by myself
b. I care about cars' safety performance when I buy a car
c. I care about control feeling
d. I am used to driving by myself

16. Personal Innovativeness (1=strongly disagree----7=strongly agree)

a. I would like to try new technology
b. I know lots of information about new technology
c. I expect new technologies comes up
d. I always buy new technology products, although they are expensive

Part 3:

17. Please select your gender

a. Male
b. Female

18. Please select your age groups

a. 18-25
b. 26-35
c. 36-45
d. 46-55
e. 56-65
f. 66 and above

19. Please select your education background

a. Elementary-school diploma

b. Middle-school diploma

c. High-school diploma

d. University degree diploma

e. Others

20. Please select your employment status

a. Full time staff
b. Part time staff
c. Unemployed
d. Retirement
e. Full time student
f. Part time student

21. Please select your monthly salary (before tax)

a. Below 1，500 rmb
b. Above 1，500-4，500 rmb
c. Above 4，500-9，000 rmb
d. Above 9，000 -35，000 rmb
e. Above 35，000-55，000 rmb
f. 55，000 to 80，000 rmb
g. Above 80，000 rmb

Thank you very much for your time to complete this questionnaire!

Appendix H-Questionnaire for Study 2 (Chinese Version)

无人驾驶车调查问卷

您好！此份问卷旨在调查大众对无人驾驶车的看法以及接受程度。您需要完成三部分简短的问卷来表达您的看法和态度，总共约用时 10 分钟。

此问卷不会涉及任何风险。同时，此次研讨论的目的将有助于日后的学术研究。我们也希望您可以从中获取对于无人驾驶车的进一步了解。所有数据将以不记名的方式收集与保存，并将受到严格的保密。此数据仅作为学术研究所用。最后收集到的数据仅以整体的方式出现在学术期刊上。

此次研究纯属自愿参与，您有权随时终止并退出问卷测试，不会产生任何负面后果。您也可以拒绝回答任何不愿意回答的问题。

- o 我完全清楚以上所述内容并同意参与此次研究
- o 我不愿意参与此次研究

无人驾驶车被定义为： 车辆可以全程自行控制全部驾驶功能，包括驾驶，刹车和提速等。可供高速公路驾驶，市区内驾驶，以及自主停车等功能。用户可以自行输入目的地或者导航信息。行驶全程中如遇紧急状况，用户可以接管车辆驾驶权。

第一部分

1. 您是否听过无人驾驶汽车?

- o 有
- o 没有

2. 您对无人驾驶车持有什么样的态度?

1-非常不同意-----7-非常同意

a. 使用无人驾驶车是一个好想法

b. 使用无人驾驶车是明智之举

c. 使用无人驾驶车将会是一种愉悦的体验

3. 使用意向

1-非常不同意-----7-非常同意

a. 如果我现在可以使用无人驾驶车，我打算使用它

b. 如果无人驾驶车一年内上市了，我会使用它

c. 如果未来 5-10 年可以使用无人驾驶车，我会使用它

4. 如果无人驾驶车已经面世，您购买的可能性有多大?

1- 非常不同意-----7-非常同意

  a. 我想现在就购买一辆无人驾驶车

  b. 我计划一年内购买一辆无人驾驶车

  c. 我预计在未来 5-10 年内购买一辆无人驾驶车

5. 您是否有驾车经历

a. 是

b. 否

6. 如果您自己驾车，您开车的频率为多少?

a. 每年几次

b. 每月多次

c. 每周多次

d. 每日多次

e. 每日一次

7. 您现有的车， 涉及自动化的程度有多少?

a. 完全手动驾驶

b. 辅助驾驶 （例如预警提示功能，前撞预警、盲点检测等）

c. 部分自动驾驶 （例如车道保持辅助、自适应巡航）

d. 有条件自动驾驶 （例如自动加速、自动刹车、自动转向）

e. 不清楚

8. 您最希望乘坐什么样的无人驾驶车?

a. 公交车

b. 私家车

c. 出租车

第二部分

您对无人驾驶车具有下列优势的认同程度如何?

1-非常不同意-----7-非常同意

10. 有效利用乘车时间

a. 休闲娱乐 （例如：看视频、休息等）

b. 随时处理紧急事情（例如：回复工作邮件等）

c. 社交 （例如：微信聊天、玩微博等）

11. 有益于下列群体使用

a. 无驾照者

b. 开车经验不足的司机

c. 老人或残疾人等特殊群体

d. 饮酒，服用药物后

12. 享受乘车乐趣

a. 解放司机双手

b. 精神放松，尤其适合长途出行

c. 可以独享个人空间，不被打扰

d. 行驶匀速，变速流畅

13. 有助于社会的可持续发展

a. 减少废气排放，保护环境

b. 减少道路拥堵

c. 减少交通事故

d. 减少公共设施占用（例如：公共停车位）

14. 担忧

您对下列情况发生的担忧程度如何？

（1=担忧程度很低；2=担忧程度比较低；3=担忧程度低；4=不确定；5=担忧程度高；6=担忧程度比较高；7=非常担忧）

a. 系统定位可能不准确，无法找到乘客所在地或目的地

b. 预定目的地停车位冲突

c. 无人驾驶车涉及的技术，还未完全成熟

d. 与无人驾驶相关的法律、法规存在空白

e. 配套城市道路设施不完善

f. 车辆售价高

g. 黑客入侵，车辆系统（软件、硬件）被损害或者用户信息泄露（例如：住址、手机号码等）

h. 开车技能退化

15. 个人习惯及喜好

a. 我喜欢自己开车，手握方向盘，踩油门

b. 我买车时注重车子的安全性能

c. 我注重自己对车子的操控

d. 我习惯自己开车

16. 个人特性

a. 我乐于尝试新的科技
b. 我注重对新科技的了解
c. 我期待新科技的面世
d. 我喜欢购买新上市的科技产品，即便价格较高

第三部分

17. 请选择您的性别

a. 男
b. 女

18. 请选择您的年龄阶段

a. 18-25 岁
b. 26-35 岁
c. 36-45 岁
d. 46-55 岁
e. 56-65 岁
f. 66 岁以上

19. 请选择您受教育的程度

a. 小学程度
b. 中学程度
c. 高中程度
d. 大学程度
e. 其他

20. 请说明您目前的就业状况

a. 全职员工
b. 兼职员工

c. 待业

d. 退休

e. 在校学生

f. 在职学生

21. 请选择您的月收入水平 (税前)

a. 低于 1，500 人民币

b. 超过 1，500 至 4，500 人民币

c. 超过 4，500 至 9，000 人民币

d. 超过 9，000 至 35，000 人民币

e. 超过 35，000 至 55，000 人民币

f. 超过 55，000 至 80，000 人民币

g. 超过 80，000 人民币

感谢您的参与!

Appendix-I Different Model Fit Indices for Goodness-of-Fit across Different Model

Statistical variables	Explanations	Ranges	Fit indices	Sources
x^2	Chi-square (x^2) is the degree of freedom that represents the amount of mathematical information available to estimate model parameters. A good model fit would provide an insignificant result with *p-value* larger than 0.05. Once a *p-value* for the x^2 test to be small (statistically significant) that implies problems with the fit.		<0.05	Hair et al. (2010)
	Normed chi-square (x^2/df) is a ratio of x^2 to the degree of freedom for a model.		Ratio on the order of 3:1 better fit	Hair et al. (2010)
GFI	Goodness-of-fit (GFI) is calculated for measure the proportion of variance that is accounted for by the estimated population covariance.	0 -1	>0.90 good fit >0.95	Tabachnick and Fidell (2014) Miles et al. (1994)
NFI	Normed fit index (NFI) is one of the incremental fit indices. It is a ratio of the difference in the x^2 value for the null model.	0-1	>0.90 good fit	Hair et al. (2010)
CFI	Comparative fit index (CFI) is an improved version of NFI	0-1	>0.90 good fit	Hair et al. (2010)

TLI	Tucker-Lewis index (TLI) is similar to the NFI. It used to compare the normed chi-square values for the null and specified model and taking account of model complexity.		>0.90 good fit	Hair et al. (2010)
RMSEA	Root mean square error of approximation (RMSEA) is used to illustrate how well a model fits a population, not just the sample used for estimation.		0.05<RMSEA<0.08 good fit <0.05 good fit 0.05<RMSEA<0.08 reasonable fit 0.08<<0.10 mediocre fit >0.10 poor fit <0.06 0.05< RMSEA <0.08	Hair et al. (2010) Browne and Cudeck (1992) Hu, Bentler, and Kano (1992) Chen, Curran, Bollen, Kirby, and Paxton (2008)
SRMR	Standardized root mean residual (SRMR) is the index of badness-of-fit measure. High values are indicative of poor fit.	0-1	<0.05 <0.1 acceptable fit <0.08 acceptable fit	Byrne (2016) Hair et al. (2010) Hu et al. (1992)

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