7th European Conference on Industrial Engineering and Operations Management
Augsburg, Germany, July 16-18, 2024
Publisher: IEOM Society International, USA DOI: 10.46254/EU07.20240008
Published: July 16, 2024

Integrating Trust into TAM to Examine Consumers' Behavior Intention toward Driverless Cars

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Abstract

In recent years, with the advent of the intelligence era, all kinds of technologies have been introduced, and many of them are artificial intelligence-based technologies combined with extensive data analysis and decision-making. Traditional automobiles have also reached a milestone in transforming into driverless cars. To understand consumers' intentions to adopt driverless cars, this study collected data from potential users with driving experience through physical and online questionnaires, with a valid sample size of 457. The four dimensions derived from the technology acceptance model (TAM), including "perceived usefulness," "perceived ease of use," "attitude toward driverless cars," and "acceptance intention of driverless cars," were combined with trust to examine their casual effects toward driverless cars. The results show that consumers' evaluation of driverless cars depends on whether or not the functional features of the vehicle can satisfy their practical needs, which means that consumers' attitude toward the vehicle's practicality can influence their acceptance or even their intentions to adopt the driverless cars. In addition, trust in the product is a significant factor affecting consumers' decision to choose a driverless car. Therefore, automobile manufacturers still need to design vehicle functions from the consumers' standpoints to meet their needs and achieve achievement.

Keywords
Driverless vehicles, artificial intelligence, technology acceptance model, trust, attitude

1. Introduction
With the advent of the age of intelligence, the research and development of driverless vehicles, or self-driving cars, has seen a significant investment from both the traditional automobile industry and technology-based companies. Driver assistance in the form of driverless vehicle systems, fully autonomous vehicles, and alternative transportation services such as Uber are in the news today. A range of technology companies, automotive suppliers, startups, and academic organizations are leading the technical efforts to develop the systems necessary to make transportation more responsive and ultimately innovative, safer products and ease of operation for all consumers.

With the advancement of transmission and sensing technologies, routing planning, vehicle control, and innovations around autonomous and highly automated vehicle development, vehicles are increasingly being produced in the form of active safety. Advanced Driver Assistance Systems (ADAS), for example, where LiDAR (Light Detection and Ranging), high-precision mapping, and AI (Artificial Intelligence) computing are the key components of the final products. The high technological threshold makes it difficult for individual manufacturers to develop their products, so they choose to utilize the complementary nature of the technology to ally. Currently, the driverless car industry consists of vehicle component suppliers, technology companies, chip manufacturers, and networking companies, etc., combining the technologies of each to create a future industry chain. According to McKinsey and Company, the global market for ADAS, the primary system for driverless cars, is expected to reach US$20 billion to US$30 billion by 2020. In the future, the annual growth potential is expected to be maintained at 20% to 30%, and by 2025, the value is estimated to reach US$200 billion (Bender et al. 2017. Boston Consulting Group (BCG) predicts that the size of the driverless car market will reach US$42 billion in 2025 and will double to US$77 billion in 2035 (KPMG 2019). Therefore, the driverless car has the value of a future star for the industry. Thus, it is a critical issue that needs to be investigated by the government and the automotive industry.

Meanwhile, according to the World Health Organization, as many as 1.19 million people worldwide die in 2021 from all types of traffic accidents, and it is estimated that the number of deaths due to traffic accidents will reach 2.2 million by 2030, an increase of 183%. (World Health Organization 2023). In the United States, 33,000 people die in traffic accidents each year. It is predicted that driverless vehicles will have the potential to dramatically reduce the incidence of traffic accidents, allowing lives to be saved. According to the Eno Center for Transportation, if the number of unmanned vehicles on North American roads reaches 90% of the nation's vehicle fleet, the number of traffic accidents is expected to drop from 6 million to 1.3 million, a reduction of 78.3%. The number of traffic accidents is expected to drop from 6 million to 1.3 million, a decrease of 78.3%, and the number of fatalities nationwide is expected to fall from 30,000 to 11,000, a reduction of 66% (Lewis et al. 2017). In traffic accidents caused by human negligence, driverless vehicles can significantly improve road safety by preventing behaviors such as drunk and dangerous driving and avoiding the regret caused by human mistakes. Driverless cars are considered an essential technology for reducing deaths caused by human negligence (Kyriakidis et al. 2015). Driverless cars are considered one of the key innovators in the next technological revolution since the extensive data networks and smartphone revolution, and along with drones and the Internet of Things, they are considered a key area for future research (NHTSA 2013). As Google's self-driving car and Tesla have become one of the top issues in mass communications, governments have begun to develop strategies to deal with the potential impact of driverless cars on the traditional automotive industry (Anania et al. 2018; Schoettle and Sivak 2015).

Since Davis (1989) proposed the Technology Acceptance Model (TAM), it has been used to explain the reasons for users' behavior toward technology products. Studies have found the essential concepts of the model and have been confirmed in the acceptance studies of different innovative technology products: namely users' perceived usefulness and perceived ease of use of IT products have positive and direct impact on the adoption intention of the products, and the phenomenon that perceived ease of use positively influences perceived usefulness is prevalent in various innovative technologies.

Furthermore, driverless cars are seen as innovative products in the technological revolution. However, the main barrier to adoption is the lack of public trust (Kaur and Rampersad 2018). Various studies have shown that user trust varies in unmanned driving since the primary concern for producers and researchers is how people trust the technology (Abraham et al. 2016). Trust plays a crucial role in unmanned vehicles, where users' lives are in the hands of the vehicle's intelligence system. Trust is an abstract concept with many definitions. Therefore, we rely on the definition of trust of Mayer et al. (1995) and the analogy of Lee and See (2004) to allow for a sense of trust in direct interpersonal connections and trust in the machinery vehicles. Trust is built on the possibility of observing a system's behavior and performance, understanding its intended use, and understanding how it makes decisions. Deutsch (1960) defines trust as the trustor's confidence in the trustee's abilities. Scanzoni (1979) defines cognitive effect as trust is the trustor's willingness to take a risk in the belief that they will receive a satisfactory outcome from the trusted person. The trustor's trustworthiness of the trustee depends on the trustee's personality traits, relevant abilities, and other conditions. Trust should be included not only in trusting human beings but also in transportation machinery vehicles. In the traditional automobile, human beings control the cars. Thus, trust is only at the mechanical level; however, the emergence of AI in unmanned vehicles will lead to cars transporting people in the future. Therefore, trust also plays a critical role in the context of the driverless car. Driverless cars are regarded as critical initiators in the future technological revolution, resulting in the understanding that consumers' willingness to use them is a critical issue in the popularization of innovative technologies.

From a practical point of view, previous studies have been conducted in a single aspect, and the empirical arguments have been too weak. Given this, the present study is motivated by the need to bridge this gap. Therefore, since driverless cars are high-tech products, this study will apply the technology acceptance model to explore consumers' intention to adopt driverless cars and apply the concepts of trust theory to investigate the impact of the product characteristics of driverless cars on consumers' cognition. In other words, this study aims to integrate the TAM and trust, combine the different aspects, and propose a model to effectively explore consumers' intention towards the adoption of driverless cars. The conclusions of this study are intended to provide insights and recommendations for policy-making and market development by relevant industries, R&D organizations, and government agencies.

2. Literature Review

2.1 Driverless Vehicles

A driverless car, also known as an autonomous or self-driving car, can be an intelligent vehicle capable of following instructions and operating independently without a driver (Benenson et al. 2008; Paden et al. 2016). It is a type of intelligent vehicle that is unmanned through computerized artificial intelligence. It can also be defined as "those key control functions that are performed without direct input from the driver in at least some aspects (e.g., cornering, acceleration, or braking)" (NHTSA 2013). Relying on big data, GPS, and radar sensing to work together, automotive computers automatically operate the vehicle, sensing the surrounding terrain and navigating autonomously without human intervention. The history of driverless vehicles can be traced back to 1925 A.D. The first "unmanned" car, the American Wonder, was designed by the American company Houdini Radio Control. The car was equipped with a radio receiver, which received radio signals from the rear vehicle. The signals received were decoded and then used to control the car's throttle, brake, and steering wheel through an electric motor, just like a sizeable remote-controlled toy car. The American Wonder was successfully developed and presented in New York, then traveled from Broadway through the congested rush hour to Fifth Avenue.

There are various classes of driverless vehicles, and various classification systems exist, namely SAE International standards, National Highway Traffic Safety Administration (NHTSA) standards, and German Federal Highway Institute standards of BASt. These systems have various levels, from fully manual to fully automated (Kyriakidis et al. 2015). Generally speaking, the current industry definition of a driverless car is based on the Society of Automotive Engineers (SAE) J3016 standard, which is divided into six levels of evaluation from 0 to 5 according to the degree of automation of the vehicle (SAE 2014):

Level 0: Fully manual. The driver must keep track of all the mechanical functions of the vehicle, including lights, alarms, etc.

Class 1: Driver-operated vehicles. Vehicles equipped with active safety devices such as anti-lock brakes (ABS), electronic vehicle control (EVC), and a driver's control system (DCR) are available to intervene in the vehicle in case of emergency.

Level 2: The driver can no longer control the vehicle completely. The vehicle's computer can automatically intervene in driving conditions on a normalized basis, reducing the need for and preventing the driver from driver fatigue. For example, Active Cruise Control (ACC) actively keeps the vehicle at a safe distance and warns the driver of lane departure; automatic braking system (AEB) with integrated blind-spot detection for timely braking; a new system that allows the driver to stop when the vehicle is moving out of its lane.

Level 3: The vehicle computer is capable of controlling the vehicle to follow previous ones automatically, and the driver can be free from control for a short time, but the driver still needs to follow the vehicle at all times and prepare to control the vehicle in case the vehicle computer detects an emergency that cannot be handled.

Class 4: The driver can make the vehicle fully automatic when the environment permits, usually without human intervention after starting. The driver can drive the vehicle without the need for any other assistance. Vehicles can turn, accelerate, brake, and maneuver according to established roads such as highways or pavement markings. The driver no longer needs to be ready to control the vehicle at any time, and the vehicle can turn itself around and move the steering wheel to stop when it reaches its destination.

Level 5: The driver can control the vehicle from anywhere without having to be in the vehicle. This level of functionality enables the vehicle to start remotely. In this sense, vehicles can execute driver commands and pay attention to road conditions and essential vehicle safety features, including unoccupied car, so the driverless car can make its own decisions.

2.2 The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) describes the reasons for users' behavior in the use of technology products or acceptance behavior. It was proposed by Fred Davis in his doctoral dissertation in 1986, and is based on Ajzen and Fishbein's (1980) theory of reasoned action to evolve a behavioral model of IT acceptance. The purpose of the model is to explain the acceptance of technology products, to develop a set of effective behavioral patterns, and to examine the extent to which various factors influence users in their IT acceptance behaviors. In order to understand the extent to which the acceptance intentions of technology users are influenced by external factors, which in turn affect the utilization of technology products, this model contributes a theoretical basis for evaluating or measuring the factors that influence users' acceptance of technology. TAM, as shown in Figure 1, introduced two antecedents of technology acceptance, namely perceived usefulness and perceived ease of use. It is also suggested that user behavioral intention will be affected by the degree of use of technology products. The model derives user attitudes and behavioral intentions from perceived usefulness and perceived ease of use, which are affected by external variables. TAM describes the acceptance of technology using only a few simple concepts, which is consistent with the simplicity of the theory and is very suitable for research on related topics.

Several academic studies have used the TAM for empirical purposes and concluded that there are three key points: (1) user behavioral intention can be reasonably predicted to technology use behavior; (2) user behavioral intention is primarily influenced by perceived usefulness; and (3) users’ attitude toward using technology is influenced by perceived ease of use and usefulness. In practice, the TAM can explain the attitude and behavior intention of IT. When a new technology product is introduced, this model is also used to examine the critical factors of user acceptance of the technology. In many cases, external factors may also be introduced to understand better and explain user acceptance of the technology product for better performance.

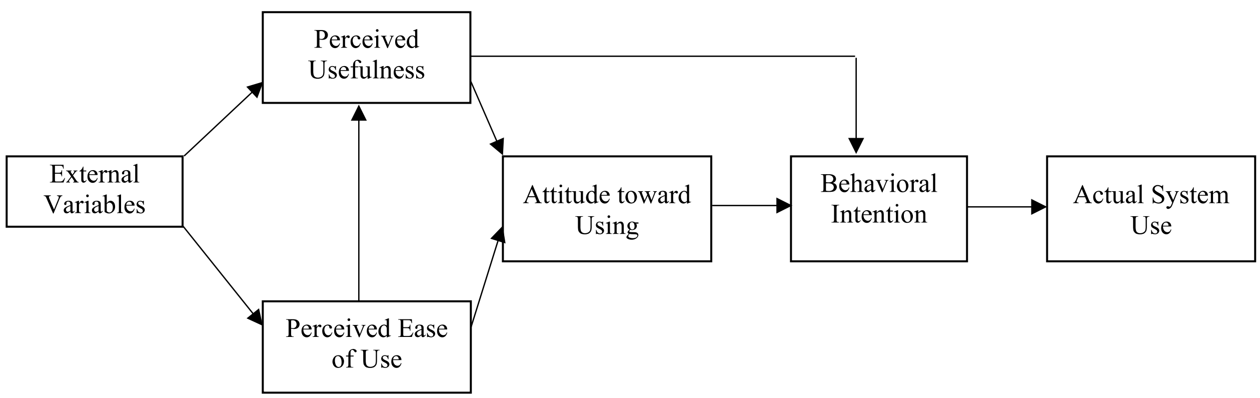

Figure 1. The Technology Acceptance Model

2.3 Trust Beliefs

Trust can be defined as a person's willingness to place themselves in a vulnerable position, subjectively, with positive expectations of results and futurity (Mayer et al. 1995). Such a definition can be interpreted as the beliefs of integrity, competence, and kindness. Competence implies having the skills and knowledge to accomplish the task; integrity implies a commitment to accomplishing the task; and kindness implies being fully trusted by the person who trusts them; in other words, service providers must have the competence, knowledge, and skills to accomplish the task of the service delivery and to maintain their commitment to the users (Gefen et al. 2003).

Luhmann (1979) argued that the essence of trust can be seen as a social lubricant that enables cooperation between individuals and maintains the functioning of social order. Trust can be manifested on many levels, individually, between people, between people and organizations, and between people and the whole system. Many studies have explored the factors that influence trust in different contexts, such as e-commerce (e.g., Bhattacherjee 2002; Gefen et al. 2003; Jarvenpaa et al. 2000), Internet banking (e.g., Kesharwani and Singh Bisht 2012), consumer behavior (e.g., McKnight et al. 2002, 2004), and social networking sites (e.g., Liu et al. 2018).

In the context of this present study, driverless car manufacturers need to be mindful of consumers’ interests, as users build trust in the companies' abilities and commitments to avoid potential problems. In a study of innovative social networking services (SNSs), Chang et al. (2017) concluded that the trust SNSs place in their users involves technological and interpersonal trust. Technology trust means that technology functions must be able to fulfill the technological tasks assigned to them by users and provide appropriate feedback and assistance to users through continued operational accuracy. Accordingly, the characteristics of technological trust represent functionality, trustworthiness, and usefulness. In terms of interpersonal trust, service providers should maintain a good reputation for integrity, competence, and kindness to increase user trust. Meanwhile, many sociologists believe that modern society would not exist without trust. Establishing trust is crucial and necessary for the credibility of the trustees (Barber 1983; Buskens 2002; Macy and Skvoretz 1998).

Therefore, this study integrates the abovementioned definitions of the terms related to trust. The operational definition is “the consumer's belief in the quality and assurance of product quality of the firms in the exchange process when purchasing a driverless vehicle.” This is an internalized belief that one party has goodwill toward the other party.

3. Hypothesis Development

This study focuses on consumer acceptance of driverless cars. Since unmanned vehicles are a new technology product that has not been entirely popularized, the basic framework is suitable for applying the technology acceptance model in this exploratory research. Driverless cars are essentially a kind of Information Technology (IT), therefore, the concepts in the behavior intention of a driverless car can be interpreted by the TAM (Davis et al. 1989). TAM is a classic and long-standing model for explaining technology-user relationships, and it has been proven to be a perfect model for many scholars in the literature on IT acceptance in a wide variety of countries (Straub et al. 1997). Even in the earliest literature on IT acceptance, the TAM was only used for the work-related part of the study. However, the theory can be well applied in various non-organizational contexts.

As Gefen et al. (2003) mentioned, TAM can also be practically applied to e-commerce to explain the relationship between the variables. The ease of use for users operating a technological product not only interferes with the user's attitude towards the product but also affects the user's perception of the product's usefulness to him/her. Pituch and Lee's (2006) study on the adoption of online learning systems; Bruner II and Kumar's (2005) study on the adoption of smartphones; and Tung et al.'s (2006) study on the adoption of electronic logistics information systems in the medical industry all confirm the relationship between perceived ease of use and perceived usefulness. Therefore, this study proposes the following hypothesis:

H1: Consumer’s perceived ease of use has a positive effect on perceived usefulness of driverless cars

Davis (1989) defines perceived usefulness as the tendency of users to believe that using a particular information system will directly or indirectly improve their performance or optimize the effectiveness of their work with less effort. In other words, the easier the advantages brought by a new technology can be grasped by the users, the better the acceptance attitude of the users towards the new technology. Stoel and Lee's (2003) study on the adoption of online courses; Shih's (2004) study on the adoption of online shopping, and Bruner II and Kumar's (2005) study on the adoption of smartphones all confirm the relationship between perceived ease of use and acceptance attitudes. Therefore, this study intends to formulate the hypothesis that.

H2: Consumer’s perceived ease of use has a positive effect on attitude towards driverless cars

Driverless car dealers need to commit customers to their products. Ganesan (1994) points out that this kind of trust relationship exists between buyers and sellers, and the interaction between them during the transaction is mainly based on the impression that the dealers deliver to the consumers with the brand's image. When car dealers commit to designing driverless cars that are easy and fast to operate, the car's ease of operation will allow them to successfully capture the trust of consumers. On the other hand, a car that is tricky to operate shows that the carmaker does not understand what consumers want. Thus, users' trust in a driverless car is affected by the perceived ease of use. Therefore, the following hypothesis is proposed:

H3: Consumer’s perceived ease of use has a positive effect on trust

Davis (1989) defines perceived usefulness as the tendency of users to believe that the use of a particular information system will, directly or indirectly, improve their performance or optimize the effectiveness of their work with less effort. In other words, when a product is perceived by users as being practical, their attitudes toward the technology will be positively affected. Fu et al.’s (2006) study on the adoption of an online tax payment system, Gallego et al.'s

(2008) study on the adoption of open source computer software, and Chang and Tung's (2008) study on the adoption of an online learning website all confirm the relationship between perceived usefulness and attitude towards the objects. Therefore, this study proposes the following hypothesis:

H4: Consumer's perceived usefulness has a positive effect on the attitude towards driverless cars

Trust in a driverless car is enhanced by its perceived usefulness (Kaur and Rampersad 2018). The usefulness of a driverless car relies on two aspects: the practicality of the car's technological features, such as the intelligent functions of auto-braking, auto-stopping, and auto-following in the active safety equipment; and the humanized service behind the technology (Reichheld and Schefter 2000). Secondly, the humanized service behind the technology so as "technology comes from human nature." In this vein, the benefits that can be derived from intelligent vehicles in the future are the links to current relevant industries, such as the practical applications of technology itself, for example, the integration of medical monitoring of vital signs such as pulse and respiration. In addition, the benefits related to the future, such as the automated arrival at the vehicle's destination, so that individuals can close their eyes and rest inside the vehicle without having to physically drive it. In terms of long-term benefits, the user's perceived level of trust should be enhanced by the usefulness of the vehicle, and considerable benefits can be gained through interaction with the vehicle. Thus, a company that cares about its customers and is competent is more likely to achieve its business objectives under such circumstances (Gefen et al. 2003). In order to measure the task-technology fit (TTF), Goodhue and Thompson (1995) proposed eight factors, which discussed the relationship between the rate of proper functioning of the technology and the user's trust in the technology. They suggest that individual work performance is positively and significantly affected by IT. Users who believe that a high rate of proper functioning of the automotive technology will enhance their work performance naturally believe that the technology is trustworthy. Thus, the following hypothesis is also proposed:

H5: Consumer's perceived usefulness has a positive effect on trust in the adoption of driverless cars

The relationship between an individual and a vehicle is such that when a user believes (s)he can trust the vehicle is using, he/she will naturally perceive the vehicle as being beneficial. Kankanhalli et al. (2005) argue that there is a strong sense of trust between people. A positive intention to share knowledge will naturally arise when trusting others to provide and utilize knowledge through databases. Senge's study shows that trust increases employees' willingness to share knowledge (Senge 1997). Previous studies have also found a positive and significant relationship between trust and attitude (Jarvenpaa et al. 2000; Gefen et al. 2003; Wu and Chen 2005). Therefore, the following hypothesis is proposed:

H6: Consumer trust has a positive effect on attitude towards driverless cars

The trust of the buyer is a crucial prerequisite in business and the same scenario in the vehicle selection process. Trust helps minimize the complications customers may encounter when purchasing a driverless car. Trust is the subjective belief that the car dealer may be prepared for any adverse consequences, including illegal or improper use of the personal data. This means that the more trust a customer has in a car dealer, the more his/her intention to use the car increases. In the context of driverless cars, it indicated that when sitting behind the wheels of an autonomous vehicle, users may find a loss of "choice and control" (Glancy 2012). The handling control will be transferred to the car within the self-driving cars' closing space, including driving, road status, driving conditions, and monitor computer data transmissions (Kaur and Rampersad 2018). Thus, the more trust in driverless cars, the more acceptance intention a driver would have. Thus, the following hypothesis is proposed.

H7: Consumer trust has a positive effect on the acceptance intention of driverless cars

A user's impression of the vehicle's operation will affect his/her acceptance attitude, which will affect their adoption behavior (Ajzen and Fishbein 1980). In other words, as long as the user is attracted by the vehicle, e.g., perceived usefulness and perceived ease of use, the user's acceptance attitude towards the driverless vehicle will increase, affecting the individual intention to adopt the vehicle (Davis et al. 1989). O'Cass and Fenech's (2003) study on the adoption of online retail shopping, Arruda-Filho et al.'s (2010) study on the adoption of smartphones, and Pillai et al.'s (2024) study on the adoption of online learning systems all confirmed the relationship between acceptance attitudes and purchase intention. Therefore, this study also proposes the following hypothesis:

H8: Consumer's attitude towards driverless cars has a positive effect on acceptance intention

3. Research Model and the Methodology

3.1 Research model

Based on the literature and hypotheses discussed in the previous section, this study proposed the research model shown in Figure 2. For validating the research model, an empirical survey-based strategy is employed to collect the data, especially for the respondents who have purchased a driverless car or have an intention to purchase one shortly.

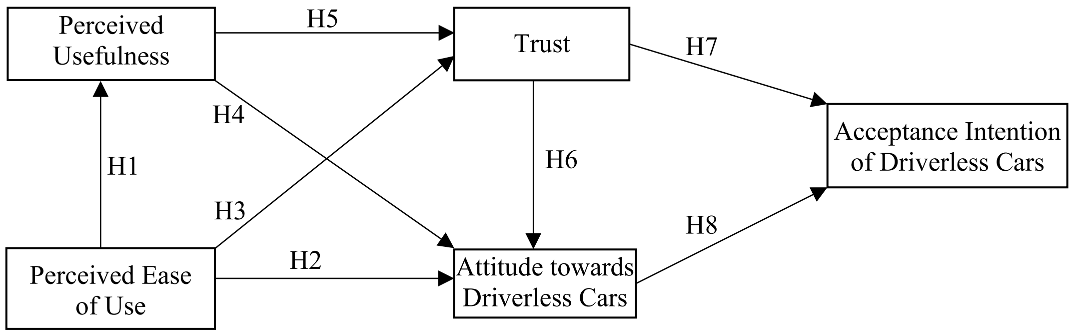

Figure 2. The research model of this study

3.2 Research Method

In this study, the questionnaire was distributed in a convenient sampling method, and the data collection was the quantitative method designed to understand the effect of driving experiences or purchase intention on the adoption of driverless vehicles to facilitate statistical analysis and make specific recommendations to academicians and practitioners.

3.3 Operational Definitions

The operational definitions for each construct are summarized in Table 1. Most of the definitions of each of the structural operators were adopted from previous studies and modified to fit with the context of this study

Table 1. Definition of each organization's operation type

Construct	Operational Definition
Perceived ease of use	The extent to which consumers can use unmanned vehicles with ease.
Perceived usefulness	The extent to which consumers can improve their work efficiency effectively.
Trust	The extent to which driverless car providers are trustworthy for consumers.
Attitude towards driverless cars	The degree to which consumer sentiment will be intended, positive or negative.
Acceptance Intention of driverless cars	The extent to which the consumers are willing to buy a driverless car.

3.4 Scale Administration

In this study, automobile drivers were invited to pre-test the questionnaire. According to their comments, the items were revised to enhance the face validity and content reliability of this questionnaire. The researchers invite users to complete the questionnaire on social media, e.g., FB, IG, Line…and so on. The data from all the users' completed questionnaires were stored in Google's online survey website. In addition, this study also used the snowballing method to transfer the questionnaire-filling link to the acquaintance's family and friends and ask them to forward the website to the friends and relatives to allow more people to fill in the questionnaire (Simon and Burstein 1985). The items for measuring perceived ease of use and perceived usefulness were adapted from those of Davis (1989) and Venkatesh and Davis (2000) with 3 items. The items measuring attitudes towards driverless cars were adapted from Taylor and Todd (1995) with 3 items. The items measuring perceived trust were adapted from those of Lankton and McKnight (2011) with 3 items. Finally, the items for measuring the acceptance intention of driverless cars were adapted from

Lin and Lu's (2011) study. The measurement items were measured on a Likert 7-point scale from strongly disagree (=1) to strongly agree (=7)).

4. Results

4.1 The Profile of the Respondents

At the end of data collection, a total of 460 questionnaires were obtained, and after deducting 3 invalid questionnaires with incomplete answers, 457 valid questionnaires were collected in total. SPSS18.0 and smartPLS were used to analyze the data. The results showed that most of the respondents are male, accounting for 52.5% of the total; more than half of the respondents are under 30 years of age, accounting for 63.5% of the total; students are the leading occupational group, accounting for 26% of the total; most of the respondents are educated with a university degree, accounting for 52.3% of the total; and most of the respondents with a monthly income of less than NTD 20,000 and N.T.D. 20,001~30,000, accounting for 31.7% and 34.8% of the total respectively. Consumers with less than 5 years of driving experience accounted for the most, accounting for more than half of the total, at 55.8%. This demographic result indicates that consumers are mostly young and have a college degree.

4.2 Reliability and Correlation Analysis

The mean, standard deviation, Cronbach's alpha, and correlation coefficients of all the dimensions are summarized in Table 2. According to Nunnally (1978), Cronbach's alpha coefficient value above the threshold 0.70 indicates high internal consistency within the scale. Cronbach's alpha for each construct is from 0.802 to 0.912, demonstrating that all constructs have a high level of international consistency. Table 2 also shows the results of the correlation analysis. Moreover, the correlation coefficients of all the dimensions can be seen to reach the significant level of $p < 0.05$, and the cognitive usefulness and the adoption of the unmanned car are the most highly correlated.

Table 2. Descriptive statistics, Cronbach's alpha, and correlation coefficients

Construct	Mean	S.D.	1	2	3	4	5
1. Perceived usefulness	5.74	1.27	(0.907)				
2. Perceived ease of use	5.64	1.14	0.79	(0.891)			
3. Attitude towards D.C.	5.66	1.03	0.75	0.76	(0.802)		
4. Trust	5.55	1.28	0.76	0.78	0.76	(0.912)	
5. Acceptance intention of D.C.	5.63	1.23	0.76	0.75	0.73	0.80	(0.904)

Note: 1. n=457; 2. All correlation coefficients are significant at $p < 0.05$; 3. The diagonal values represent Cronbach's alpha coefficient.

4.3 Structural Equation Modeling

4.3.1 Measurement model

A measurement model aims to use observed variables to construct latent variables. In other words, the observed variables reflect the relationship with the latent variables. Since latent variables are challenging to measure concretely, they must be indirectly inferred by computing the observed variables (Diamantopoulos and Siguaw 2000). Therefore, the analysis of measurement models is mainly based on confirmatory factor analysis (CFA) to test the reliability, discriminant validity, and convergent validity of each construct (Bagozzi 1993). We used the value of 0.5 as the threshold for factor loading assessment (Hair et al. 2006). Consequently, the composite reliability (CR) of each construct is greater than the recommended value of 0.6 (Fornell and Larcker 1981). In addition, the factor loadings for all of the items demonstrated that they were all above the threshold of 0.5.

The criterion for determining the convergent validity is its average variance extracted (AVE) value must be greater than 0.50 (Fornell and Larcker 1981). The result showed all of the AVEs of constructs are larger than the value of 0.50. In addition, discriminant validity can be done by comparing the AVE and the squared values of the correlation coefficients of pairwise variables. The criterion was that the AVE value should be greater than the squared values of the correlation coefficients (Fornell and Larcker 1981). The results showed that the AVE value for each construct was more significant than all of the square values of the correlation coefficient between itself and other constructs.

Therefore, it showed that the scale used in this study had good convergent and discriminant validity. The results are shown in Table 3.

Table 3. Properties of the variables in this study

Construct	**Standardized factor loading**	**t-value**	**Composite reliability**	**Average variance extracted (AVE)**
Perceived usefulness			0.94	0.84
PU1	0.91	88.61***		
PU2	0.94	114.93***		
PU3	0.90	64.18***		
Perceived Ease of Use			0.93	0.82
PE1	0.87	51.28***		
PE2	0.93	86.07***		
PE3	0.92	88.48***		
Attitude			0.93	0.81
AU1	0.91	79.88***		
AU2	0.88	68.26***		
AU3	0.91	81.83***		
trust			0.94	0.85
CC1	0.91	79.69***		
CC2	0.93	107.62***		
CC3	0.92	96.75***		
Adoption of Ideas			0.94	0.84
UI1	0.88	54.02***		
UI2	0.94	109.67***		
UI3	0.92	91.33***		

Note: 1. Combination Reliability (CR) = $(\Sigma\lambda i)^2$ / [$(\Sigma\lambda i)^2$ + (Σεi)]; 2. Average Variation Extraction (AVE) = ($\Sigma\lambda i^2$) / [($\Sigma\lambda i^2$) + (Σεi)] where $(\Sigma\lambda i)^2$ = the square of the sum of the standardized factor loadings of the observed variables for a single structure, ($\Sigma\lambda i^2$) = sum of squares of standardized factor loadings for each observed variable in a single structure, (Σεi) = sum of the measurement errors of the observed variables of a single structure = $\Sigma(1-\lambda i)^2$

4.3.2 Structural model analysis

The result of the structural model is summarized in Figure 3. Overall, all 8 paths exhibited significance at the $p < 0.05$ level, supporting the proposed model strongly. The results showed that perceived ease of use significantly and positively affects perceived usefulness ($\beta = 0.79$, $t = 30.56$, $p < 0.001$) and explains 62% of the variance with perceived usefulness. In addition, perceived usefulness (β=0.38, t=6.46, p<0.001) and perceived ease of use (β=0.48, t=8.70, p<0.001) have significant and positive effects on trust, especially perceived ease of use has a more significant effect on trust. Perceived usefulness and perceived ease of use explained 67% of the variance with trust. It means that new technologies may not be easy to use; thus, perceived ease of use is much more important than perceived usefulness, and the easier a product is to use, the more consumers will trust it.

In terms of attitude toward driverless cars, the three antecedents, namely perceived usefulness (β=0.30, t=5.64, p<0.001), perceived ease of use (β=0.34, t=6.61, p<0.001), and trust (β=0.30, t=6.27, p<0.001) all affected attitude towards driverless cars, totally explained 75% of the variance with attitude. In particular, perceived ease of use has the most significant effect. Finally, regarding acceptance intention of driverless cars, trust (β=0.49, t=9.43, p<0.001) and attitude (β=0.40, t=7.91, p<0.001), both have positive and significant effects on consumers' acceptance intention for driverless cars, and trust has the most significant effect on acceptance intention. Attitude and trust explained 70% of the variance with acceptance intention.

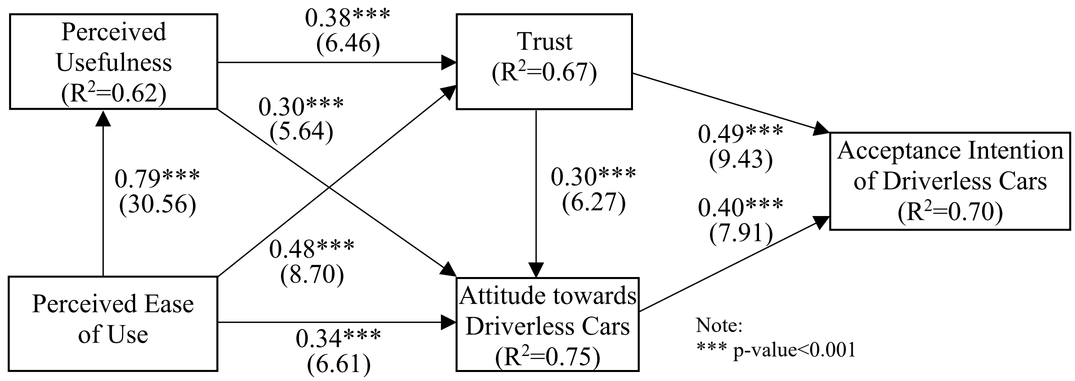

Figure 3. Results of the structural equation model analysis

5. Conclusion and Recommendations

The main aim of this study is to examine consumers' intention to accept (purchase) driverless cars. Based on the relevant literature, the TAM, trust beliefs perspectives. The analysis uses linear structural equation modeling to examine the hypotheses. The results showed that the empirical data proved all the hypotheses. We then discuss the findings and make arguments for the implications as follows.

5.1 Conclusions

The results of this study show that the “perceived ease of use” has a positive and significant effect on “perceived usefulness.” For driverless vehicles, the perceived usefulness is positively affected if the vehicle is easier to use, more skillful, and better than traditional driving, and the perceived usefulness is positively affected if consumers perceive that the use of unmanned vehicles meets their needs in life and transportation.

The results of this study also show that the factors “perceived usefulness” and “perceived ease of use” of technology acceptance patterns have a positive and significant relationship with “trust,” with “perceived ease of use” having a more significant effect. In other words, the easier it is for consumers to use a driverless car, the more positively it affects consumer trust. Based on the expectation that if car manufacturers design and manufacture cars without human drivers, the more skillful consumers are in controlling the car, and the better they are at driving than traditional driving modes, the more positive impact on consumer trust will be realized.

In addition, the results of this study show that “perceived usefulness,” “perceived ease of use,” and "trust" are all positively and significantly related to the “attitude towards driverless cars,” with “perceived ease of use” having a more significant effect. In other words, the easier it is for consumers to use a vehicle, the more positively it affects their attitude towards it. When the vehicle is more accessible for consumers to maneuver and better than the traditional driving mode, it will positively affect consumers’ attitude to accept. Perceived usefulness indicates that consumers perceive the use of unmanned vehicles for transportation as a cost-effective alternative to more traditional and unchanging modes of transportation, such as mass transit and self-driving. Instead of driving alone, they only need to start the car and input the traffic information to reach the destination, allowing them to spend time without driving the car alone. With the elimination of the need to drive, consumers find it easier to maneuver and are positively receptive to using a driverless car.

The result of the survey is similar to Davis et al. (1989), who suggest that people's “behavioral intentions” positively influence “information system adoption” in the technology acceptance model. The findings also show that “trust” and “attitude towards driverless cars” have a positive and significant impact on “acceptance intention of driverless cars.” Among them, “trust” has a more significant effect. In other words, the higher the level of trust, the more positive the impact on the consumer's intention to accept (purchase). This means that the more trust consumers have, the more they will be willing to visit the car dealer’s showroom to purchase the product and even recommend the products they trust to their friends and relatives if the car dealer keeps its promise to consumers. In sum, consumers’ perceived usefulness and perceived ease of use of driverless cars will lead to trust in the product, which leads to the intention to accept it. Meanwhile, the attitude towards driverless cars also influences consumers' specific behaviors regarding their willingness to adopt.

5.2 Academic and Practical Implications

Regarding academic implications, driverless vehicles are a relatively emerging research topic. While the technology acceptance model has considerable explanatory power for new technology products, the use of new technology products still relies heavily on trust beliefs from consumers. In addition to the TAM, this study also integrates the perspective of consumer trust to study the emerging issue of driverless vehicles, which is a different perspective from the previous study on the adoption of unmanned vehicles and hopes to shed more light on the research in this type of new technology and provide a reference for future researchers. It is hoped that this will improve the academic research on this new technology and be one of the references for future researchers on related issues.

Regarding practical implications, introducing driverless vehicles on the road is a brand-new driving mode, and the degree of acceptance by the general public has yet to be elaborated. According to this study, the ease of operation of driverless vehicles is positively correlated with consumer acceptance, and vehicle manufacturers are urged to improve the simplicity of the vehicle's function control and make the vehicle's functions more straightforward to use. It is also recommended that the relevant government departments focus on the future development trend of the automobile industry, assess the feasibility of the future, and propose relevant supporting policies to assist automobile manufacturers to a considerable extent so that the domestic automobile industry can safely transform and continue to maintain a high degree of competitiveness in the face of international competition. Once the transformation is successful, it will undoubtedly be a booster for the automobile industry, making it more convenient for the public to travel more quickly and safely in the future. On the one hand, stimulating domestic consumption, on the other hand, and not fearing falling behind in international competition creates a 3-win situation for the public, the industry, and the country.

5.3 Research Limitations and Recommendations

Regarding the research limitations, several factors still affect the intention to adopt driverless cars. Studies may include other influential factors into the trust-TAM model to improve the explaining power to predict the acceptance intention of driverless cars. Second, due to the unsettled situation, this questionnaire did not differentiate between the respondents in the survey process. Since the questionnaire was distributed snowballing, the identity of the collected respondents was more concentrated on specific groups. Third, it is recommended that future researchers may expand the sample size to compare the differences between the ones who have or have not yet used driverless vehicles in the intended explaining variables.

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