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CONSUMER ACCEPTANCE OF AUTONOMOUS VEHICLES: A PROPOSITION TO EXTEND THE TECHNOLOGY ACCEPTANCE MODEL

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Danışman: Doç. Dr. Taşkın DİRSEHAN

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TEZ ONAY BELGESİ

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İstanbul, 2019

CONSUMER ACCEPTANCE OF AUTONOMOUS VEHICLES: A PROPOSITION TO EXTEND THE TECHNOLOGY ACCEPTANCE MODEL

ABSTRACT

Technology develops rapidly and presents new innovations every day. Some of them become lost or even acquire bad reputations, as the people or the environment may not be ready to accept it. Maybe the virtually indestructible and artificially intelligent supercar Kitt in the TV Serie Knight Rider cannot be seen on the streets yet, but the latest developments regarding autonomous vehicles have drawn the attention of tech-savvy individuals and marketers. Although there are discussions about this technology's potential problems, technology also provides many benefits that make this change inevitable. Therefore, this study aims to investigate how people would react to autonomous vehicle technology.Technology Acceptance Model (TAM) with new dimensions added used in the study to analyze people if they are ready or not for nondriver vehicles, autonomous vehicles. In the study hypothesis, Knowledge and Individual Innovativeness leads to Trust towards autonomous vehicle technology and Trust leads to the behavioral intention to use autonomous vehicle are accepted. So people trust technology with new features and trust leads people to use autonomous vehicles. But hypotheses age and education Level leads to the behavioral intention to use autonomous vehicle are rejected. The survey shows that people with any education from any age may use new technology, autonomous vehicles in the future.

Key Words

Autonomous Vehicles, Sustainability, Technology Acceptance Model (TAM), Individual Innovativeness, Trust in Technology

OTONOM ARAÇLARA YÖNELİK TÜKETİCİ KABULÜ: TEKNOLOJİ KABUL MODELİNE BİR GENİŞLETME ÖNERİSİ

ÖZET

Teknoloji hızla gelişiyor ve her gün yenilikler sunuyor. Yeni teknolojilerin bazıları kaybolmakta veya hatta kötü ünler kazanmakta çünkü insanlar veya çevrebunu kabul etmeye hazır olmayabilir. Belki de Kara Şimşek televizyon dizisindeki yok edilemez ve üstün yapay zekalı süper araba Kitt sokaklarda görülmüyor, fakat otonom araçlarla ilgili en son gelişmeler teknoloji meraklısı bireylerin ve pazarlamacıların dikkatini çekmektedir. Bu teknolojinin potansiyel sorunları hakkında tartışmalar olsa da, teknoloji de bu değişikliği kaçınılmaz kılan birçok fayda sağlamaktadır. Bu nedenle, bu çalışma insanların otonom araç teknolojisine nasıl tepki vereceğini araştırmayı amaçlamaktadır. Araştırmada sürücüsüz, otonom araçlar için hazır olup olmadıkların analizi için yeni boyutların eklendiği Teknoloji Kabul Modeli (TAM) kullanılmıştır. Araştırmada bilgi sahibi olmanın ve bireysel yenilikçilik seviyesinin otonom araç kullanımına güveni sağladığı hipotezi ve insanların duyduğu güven ile de otonom araç kullanma yönünde davranış gösterdiği hipotezi kabul edilmiştir. Fakat yaş ve eğitim seviyesi yüksekliğinin otonom araç kullanımına önderlik ettiği hipotezleri reddedilmiştir. Anket göstermiştir ki her yaştan ve her eğitim seviyesinde kişiler yeni teknolojiyi, otonom araçları kullanabilmektedirler.

Anahtar Kelimeler

Otonom Araçlar, Sürdürülebilirlik, Teknoloji Kabul Modeli (TAM), Bireysel Yenilikçilik, Teknolojiye Güven

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LIST OF ABBREVIATIONS

ACC	Adaptive Cruise Control
AI	Artificial Intelligence
AV	Autonomous Vehicles
AVL	Anstalt für Verbrennungskraftmaschinen (İçten Yanmalı Motorlar Enstitüsü)
ATT	Attitude Toward Use
IDT	Innovation Diffusion Theory
IT	Information Technology
LISP	LISt Processing
GDP	Gross Domestic Product
GPS	The Global Positioning System
MM	Motivational Model
MPCU	Model of PC Utilization
NHTSA	National Highway Traffic Safety Administration
OECD	Organisation for Economic Co-operation and Development
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
SAE	Society of Automotive Engineers
SCT	Social Cognitive Theory
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TTF	Task-Technology Fit
USA	United States of America
UTAM	Updated Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
VMT	Vehicle Miles Traveled
WHO	World Health Organization

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INTRODUCTION

Every year more than 1 million and 250 thousand people are killed on the motorways (Mariano, 2018) and nearly 50 million people are seriously impacted by road traffic injuries. A lot of social and economic losses occur after these traffic accidents. All over the world, Europe and Central Asia, North America, etc. everywhere have the same problem. Causes of death in 15-49 years old in 2016 traffic accident is ninth place over top thirty all over the world (Ritchie and Roser, 2018). After cardiovascular diseases and cancers, the other seven factors are closer. The population of the world increasing, people live longer, life quality improves but causes of death all over the world changes but the cause of death from traffic accident always a big problem.

Road traffic accidents cost in many countries three percent of their Gross Domestic Product (WHO, 2018). Not only the economic benefits of reducing traffic accident but also there are social benefits. Drivers are the leading cause of critical pre-crash events. 94% drivers, 2% vehicles, 2% environment, 2% unknown (Singh, 2015). Recognition and decision error are the leading causes of these events. Recognition 41%, decision error 33%, performance 11%, non-performance 7% and other 8%. Drivers don't pay attention so miss something which is really important, drives too fast for the condition or do something illegal or fail to figure out where the other people in close environment move.

The aim is to reduce drivers cause of traffic crashes. Recognition and decision errors totally %74 of drivers cause of the accident. What if, there are no recognition and decision errors in traffic and Artificial Intelligence (AI) make the recognition environment and decide what to do next according to traffic rules instead of drivers. Instead of two eyes and two ears, there are many sensors to see and hear the environment, the Global Positioning System (GPS) perceive better than a human being. The idea of nondriver vehicles getting more mature every year that is called Autonomous Vehicles (AV).

Nondriver vehicles which called autonomous vehicles considered very promising and seem to improve the service of the public transport system in the very near future. Autonomous vehicle watch every street, everybody, the very gap on the road and street, every time all day long. It's completely covered recognition problem or paying attention problem. At the back of the vehicle, Artificial Intelligence uses algorithms to make the right decision, all possibilities (Schneider, 2017). So, will people accept this technology instead of driving

themselves habitude. How close people riding autonomous vehicles. In light of this explanation above, the aim of this study is analyzing the factors affecting autonomous vehicle usage according to the Technology Acceptance Model. Technology Acceptance Model (TAM) is one of the most acknowledged models designed to explain the acceptance and the usage of the technology by individuals.

In the thesis with the TAM model Theory of Reasoned Action (TRA), which is one of the most essential and respected theories on estimating human behavior with attitude toward behavior and subjective normcore is described. They are interconnected consequently related TRA to the individual's attitudes toward technology and developed TAM by defining two new constructs: Perceived Usefulness and Perceived Ease of Use are examined. It is found in the model is that PEOU affects PU as well because the user perceives a system more useful when it is perceived as more easier to use.

The Technology Acceptance Model (TAM) was used as a research framework in which findings contribute to technology acceptance research by demonstrating the suitability of the TAM to explain the intention to use technology among people tend autonomous vehicle use. Within this purpose, the first section of the thesis clarifies the concepts concerning the subject within the literature. This is followed by the Research Design Method section in which information will be provided about the data collection analysis period research purpose and objectives, model, variables, hypothesis. Then conclusive research findings and the last two sections are the theoretical and practical contributions of the study will be discussed.

To figure out how people would react to new technologies, are they ready to accept artificial intelligence (AI), machine learning. Each generation of robotics get a higher level and also get fewer mistakes. It isn't realized that machine learning began to used around so industry 4.0, its vision of near-total automation. The main purpose behind the rise of industrial robots is said to be a desire to reduce or eliminate dull, dangerous and dirty jobs. But other important aim included the need for permanency of quality. The industry is getting improved that involves using technology to return human value would be the next generation. So autonomous cars will carry human mostly which empower people to realize the basic human urge to express themselves that machines require what we call the human touch (Østergaard, 2017). So are people ready for the future?

The survey is used for research, Google survey link was sent to respondents which were over eighteen years old and 391 people joined the survey. In the survey, the first part asked demographic characteristics like age, gender, location, education and also earning a salary for a year. In the first part, Individual Innovativeness has investigated and asked to find out Resistance to Change. Then it is searched Opinion Leading and Openness to Experience of the respondents and Risk Taking approach. Second Part of the survey searched Trust by technical competence, situation management and system transparency. Then in the survey investigated Technology Acceptance Model with questions are related to Behavioral Intention, Perceived Usefulness and Perceived Ease of Use. Lastly, the survey asked questions about Sustainability and Hazardous Situations in traffic. The variables that have been measured are Resistance to Change, Opinion Leading, Openness to Experience, Risk Taking, Behavioral Intention, Perceived Usefulness, Perceived Ease of Use, Trust, System Transparency, Technical Competence, Situation Management, Experience, and Sustainability.

Regarding the variables included in the survey, same scaling technique (5 Point Likert Scale) is preferred while preparing the questionnaire, so that several measuring tests such as factor analysis could be applied. Though only independent variables subject to the trust and individual innovativeness are included in the factor analysis. Subsequently, correlation and regression analysis are performed to interpret the effects of each factor. Finally, socio-demographic differences are determined by variance analysis. So the results are shown in the third part of the thesis, which is Conclusive Research Findings, implications included.

I. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

1.1. Background of the Autonomous Vehicles

1.1.1. Background of the Autonomous Vehicles in the World

Technology changes our lives every day by providing us with new inventions; in 2011, Hannover Fair labeled this new era: Industry 4.0. This collective term encompasses many innovations such as automation systems, data exchanges, internet of things, cyber-physical systems, production technologies, etc. (Rojko, 2017). Among these technologies, autonomous vehicles are discussed widely due to the latest test drive news surrounding Google's self-driving car tests (Gibbs, 2014) or Tesla's self-driving car crash (CBSNews, 2018). The technology is clearly still in the development process, but the social and environmental aspects of this technology should be investigated as well. It is important to figure out how cars drive itself.

Before half a century John McCarthy, as considered the father of Artificial Intelligence, told his colleagues that a machine would learn like a child and his paper about such as mathematical logic, neural nets, and game playing was published in 1956 by the Princeton University Press (Rajaraman, 2014). The use of robots has been on the rise since the 1960s, so first introduced as part of what technologists call Industry 3.0 which called programmable logic for advanced manufacturing. Robots used especially for the car industry, where they were used primarily as a welding robot to put car bodies together (Østergaard, 2017). Artificial Intelligence (AI) need programming. It was used Assembly language for all programming in 1956, but after one year, in 1957 the first high-level programming language, FORTRAN was developed by John Backus at IBM. Fortran programming language was used for calculations (Rajaraman, 2014). It should have written that Alan Mathison Turing, British scientist is the father of AI, a pioneer in computer science. During World War II, he developed a machine that helped break the German Enigma code and also laid the groundwork for modern computing and theorized about artificial intelligence (Bowen, 2013).

According to SAE (Society of Automotive Engineers), autonomous vehicle technology is examined in five levels from no automation to full automation (SAE, 2014). Even though there are vehicles with partial automation are on the streets, it is still unknown how people would accept fully autonomous vehicles.

This study intends to understand the acceptance of fully autonomous vehicles in accordance with earlier studies and design an extended model by considering the trust level, past experience and personality traits of the public. The sustainability of autonomous vehicles is an essential subject, as it affects our lives environmentally and socially; thus, this factor should be discussed when investigating the acceptance by people.

Autonomous vehicles are started and stopped from the office. Vehicles use an array of sensors to see what around them that allow self-driving to navigate safely. There is no steering wheel and no dashboard. The driverless bus in Stockholm goes 20 km per hour until 2018. If somebody jumps in front of the vehicle either it slows down or stops completely (https://easymile.com/ez10-driverless-shuttles-hit-the-streets-of-stockholm/). One new risk that autonomous vehicles may bring is the possibility of system failure. However, after being tested for many years under many different conditions, the probability is very low. Although there are some concerns about privacy and security, engineers can develop new technologies for both physical and software security. Newman (2016) states that autonomous vehicle technology may save 300,000 lives per decade in addition to increasing our mobility (Newman, 2016).

Another autonomous vehicle scenario involves shared vehicles and reduced employment. Since this technology does not require a driver, new ownership patterns could arise, which could change transportation methods. Taxi or truck drivers may not be needed to drive but instead, be present for emergency or safety purposes.

City IT systems advance and big data getting involved closer and the basic tasks within a municipality such as street lighting and tourist information, are gradually becoming automated smart navigation systems, which continuously monitor the roads and can transmit their data to a municipal traffic control centre, helping to provide real-time information on accidents, traffic jams or rescue services' mission and the once futuristic concept of a smart city starts to evolve into reality (Morrissey, 2018).

Litman (2014) reports that incremental costs are still uncertain, but are estimated to be high since the existing technologies cost hundreds of dollars. However, the additional cost could be covered by reduced energy consumption and insurance savings (Litman,2014).

- **Sustainability:** Autonomous vehicle technology has several advantages on sustainability
    - increasing energy efficiency and environmental benefits such as optimizing road and parking lot capacity,
    - decreasing traffic congestion and fewer accidents or incidents,
    - autonomous vehicle technology helps to reduce air pollution and fuel consumptions by decreasing the time spent in traffic that Shadidi and Stone report,
    - travel cost reduction that Wadud et al. (2016) investigates while higher highway speeds, increased features, travel cost reduction and new user groups cause an increase in energy consumption, eco-driving, platooning, congestion mitigation, de-emphasized performance, improved crash avoidance, vehicle right-sizing, changed mobility services and infrastructure footprint result in great decrease in total energy consumption.

- **Shared Autonomous Vehicle:** The investigation (Fagnant and Kockelman, 2014) shows that shared autonomous vehicle system would decrease the number of self-owned private travels and achieves more travels which result in less traffic congestion, lower Vehicle-Miles Traveled (VMT). Reducing waiting time plus less environmental harm since older and more polluting vehicles will be renewed sooner as a result of faster vehicle turnover. Similarly, Liang et al. (2016) developed a model to explore the effect of AV on transportation activity and found out that it can reduce travel costs and achieve much more trips. Zhang et al. (2019) report that SAV system may eliminate a great percentage of parking demand. Ride-sharing is one of the existing alternative travel method preferred by many people for some time because of its benefits like cost-reduction, environmental friendliness and being a

substitute for a self-owned vehicle. Zhang et al. (2019) say that ridesharing via shared autonomous vehicle offers several advantages like decrease in car ownership, less parking space need, lower GHG emissions and also promises higher customer satisfaction. Yet, in possible future scenarios, some people still do not prefer sharing an autonomous vehicle because of psychological safety concerns.

Table 1.1 Potential Benefits and Costs of Autonomous Vehicles

Benefits	Problems
• *REDUCING DRIVER'S STRESS;* Reduce the stress of driving and allow motorists to rest and work while traveling. • *REDUCING DRIVER'S COSTS;* Reduce the costs of paid drivers for taxis and commercial transport. • *MOBILITY FOR NONDRIVERS;* Provide independent mobility for nondrivers, and therefore reduce the need for motorists to chauffeur non-drivers, and to subsidize public transit. • *INCREASING SAFETY;* May reduce many common accident risks and therefore crash costs and insurance premiums. May reduce high-risk driving, such as when impaired. • *INCREASING ROAD CAPACITY AND REDUCING COSTS;* May allow platooning (vehicle groups	• *INCREASING COSTS;* Requires additional vehicle equipment, services and maintenance, and possibly roadway infrastructure. • *SOME ADDITIONAL RISKS;* May introduce new risks, such as system failures, be less safe under certain conditions, and encourage road users to take additional risks (offsetting behavior). • *SOME SECURITY AND PRIVACY CONCERNS;* May be used for criminal and terrorist activities (such as bomb delivery), vulnerable to information abuse (hacking), and features such as GPS tracking and data sharing may raise privacy concerns. • *INDUCING VEHICLE TRAVEL AND INCREASING EXTERNAL COSTS;* By increasing travel convenience and

traveling close together), narrower lanes and reduced intersection stop, reducing congestion and roadway costs. • *EFFICIENCY FOR PARKING AND REDUCING COSTS;* Can drop off passengers and find a parking space, increasing motorist convenience and reducing total parking costs. • *INCREASE FUEL EFFICIENCY AND REDUCE POLLUTION;* May increase fuel efficiency and reduce pollution emissions. • *MAY SUPPORT VEHICLE SHARING;* Could facilitate carsharing (vehicle rental services that substitute for personal vehicle ownership), which can provide various savings.	affordability, autonomous vehicles may induce additional vehicle travel, increasing external costs of parking, crashes, and pollution. • *SOCIAL EQULITY CONCERNS;* May have unfair impacts, for example, by reducing other modes' convenience and safety. • *REDUCED EMPLOYMENT AND BUSINESS ACTIVITY;* Jobs for drivers should decline, and there may be less demand for vehicle repairs due to reduced crash rates. • *MISPLACED PLANNING EMPHASIS;* Focusing on autonomous vehicle solutions may discourage communities from implementing conventional but cost-effective transport projects such as pedestrian and transit improvements, pricing reforms and other demand management strategies.

Source: Litman, T. (2015). Autonomous Vehicle Implementation Predictions: Implications for Transport Planning, Victoria Transport Policy Institute.

It is seen in Table 1.1 that there are a lot of benefits and costs of autonomous vehicles. Benefits are no drivers and more safety but it increases cost and additional risks so it will be calculated as a perceived value will be benefits minus costs and will be considered deeply. It seems that costs getting decrease every year as big data and smart mobility improve.

- **Rest and Work:** Litman (2015) points out that being able to focus on a busyness instead of driving is quite tempting for people and they do not feel any responsibility on driving task anymore. Similarly, a driving simulator study (Shen and Neyens, 2014) shows that the drivers' response poorly to the critical situations with the automated system and it becomes worse if they engage with another business.

- **Implementation Predictions:** One of most substantial matters is whether the consumers are willing to pay for the technology and if yes, what would be the amount they are willing to pay and is the worth of this useful technology would be affordable for them. Daziano et al. (2016) report that the people are willing to pay 3500 USD for partial automation and 4900 USD for full automation and as a solution offering flexible autonomy models for different needs and preferences is recommended. Fortunately, to download the autopilot system of Tesla would be available for 3500 USD. Their research shows the knowledgeable consumers are more interested in this technology and willing to pay greater amounts.

An international questionnaire (Kyriakidis et al., 2015) shows that people enjoy manual driving more nevertheless they appreciate the AV (Autonomous Vehicles) technology. People who spend more time driving or has a vehicle with partial autonomy such as ACC (Adaptive Cruise Control) tend to buy an AV or willing to pay more for advanced technology.

Research (Harper et al., 2016) shows that the VMT (Vehicle Miles Traveled) will increase for the non-drivers, elderly people (those over 65) and the people with medical conditions that restrict traveling thanks to the development of fully autonomous vehicle technology.

Continental Automotive Group (Sommer, 2013) research held in Germany, China, Japan, and the US reports that autonomous vehicles are appreciated to be a useful advancement yet considered to be unreliable in functioning. Concordantly the policies across states of the US are inconsistent due to liability, security and privacy concerns (Fagnant and Kockelman, 2015).

Winston and Mannering (2014) argue that the public authority has a lack of repair or investment on durable material used for the infrastructure due to the absence of improvement budget. But the private sector will create a leapfrog with autonomous vehicle technology and improve the public highway performance through minimizing traffic congestions caused by rush hours, accidents and incidents, parking, narrow lanes, the insufficient number of lanes, road capacity, route planning, and signaling systems (Winston and Manning, 2014). Additionally, it will help to reduce the costs such as the time spent on highways, incidents, vehicle repairs, operating costs, maintenance cost and speed, damages on bridges and pavements caused by truck weight and the total weight on the road in rush hours.

Table 1.2 Autonomous Vehicle Implementation Stages

Stage	Notes
Level 0	No Automation
Level 2 – Limited automation (steering, braking, and lane guidance)	This is the current state of the art, available on some new vehicles.
Coordinated platooning	Currently technically feasible but requires vehicle-to-vehicle communications capability, and dedicated lanes to maximize safety and mobility benefits.
Level 3 – Restricted self-driving	Currently being tested. Google experimental cars have driven hundreds of thousands of miles in the self-drive mode under restricted conditions.
Level 5 – Self-driving in all conditions	Requires more technological development.
Nowadays being tested. Google testing cars have driven hundreds of thousands of kilometers in the driverless mode under restricted conditions.	Regulations and developing performance standards for autonomous vehicles have started in some States. Driverless vehicles must meet to legally operate on public roads.
Requires more technological development.	Several companies predict commercial sales of “driverless cars” between 2018 and 2020, although their capabilities and prices are not specified.

Regulations and developing performance standards for autonomous vehicles have started in some States. Driverless vehicles must meet to legally operate on public roads	Will depend on performance, prices and consumer acceptance. New technologies usually require several years to build market acceptance.
Autonomous vehicles become a major portion of vehicle fleets.	As the portion of new vehicles with autonomous driving capability increases, their portion of the total vehicle fleet will increase over a few decades.
Autonomous vehicles become a major portion of vehicle travel.	Newer vehicles tend to be driven more than average, so new technologies tend to represent a larger portion of vehicle travel then the vehicle fleet.
Market saturation.	Everybody who wants an autonomous vehicle has one.
Universal	All vehicles operate autonomously.

Source: Autonomous Vehicle Implementation Stages (NHTSA 2013)

SAE (The Society of Automobile Engineers) defines the stages of development of the autonomous vehicle technology in 6 levels. While level 1 means no automation, level 3 indicates restricted self-driving and level 5 means full automation in all conditions. Accordingly, Table 1.2 shows the implementation stages of the autonomous vehicles and its projections to our everyday lives.

"We must develop a comprehensive and globally shared view of how technology is affecting our lives and reshaping our economic, social, cultural, and human environments. There has never been a time of greater promise, or greater peril." Klaus Schwab, founder, and executive chairman, World Economic Forum.

1.1.2. Background of the Autonomous Vehicles in Turkey

AVL Turkey Director Umut Genç commented in an interview that the most important benefits of the autonomous vehicles regarding sustainability will be their increased fuel efficiency and reduced pollution, thanks to the effective use of resources. The autonomous vehicles will provide efficient parking and increase road capacity. The drivers will be free of traffic stress, and non-drivers will be able to own vehicles as well. However, while people will be saving time and energy, it is also possible costs of transportation will increase due to the additional travel. Kaenel (2016) reports that autonomous vehicles will reduce fuel consumption and are also expected to ease traffic congestion (Kaenel, 2016).

In Turkey, there is not much company developing new technologies for vehicles and they are mainly focused on electric cars. Therefore most of the technology is imported from foreign countries. Nevertheless, Bozkurt, who is a former engineer in Research and Development department of İstanbul Ulaşım A.Ş. states that railway systems are handled differently since they are quite suitable for autonomous systems thanks to their signalization infrastructure and deterministic behavior. He also mentioned that in Istanbul, most of the subway trains already are at level 2 and level 3. For example, in Yenikapı–Hacıosman line, the tram driver only controls the doors unless there is an emergency situation. Because a subway construction has already high costs, new technology systems and automation costs seem to be rather reasonable. Therefore the management usually prefers to invest in the best technology vehicles and devices. As a result, new lines to be opened soon in İstanbul will be autonomous at level4. Another advantage of autonomous vehicles in public transportation is being able to control the arrival/departure times, which are important for passengers, especially in a big crowded city alike İstanbul.

1.2. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is one of the most acknowledged models designed to explain the acceptance and the usage of the technology by individuals. The ancestor of TAM is considered as Ajzen and Fishbein's Theory of Reasoned Action (TRA), which is one of the most essential and respected theories on estimating human behavior with Attitude Toward Behaviour and Subjective Normcore constructs. Davis related TRA to the

individual's attitudes toward technology and developed TAM by defining two new constructs: Perceived Usefulness and Perceived Ease of Use (Davis, 1989).

Technology Acceptance Model (TAM) is designed by Davis in 1989. Derived theoretical background from TRA, TAM explains the structure of technology acceptance by showing the relationship between constructs as illustrated in Figure 1.1.

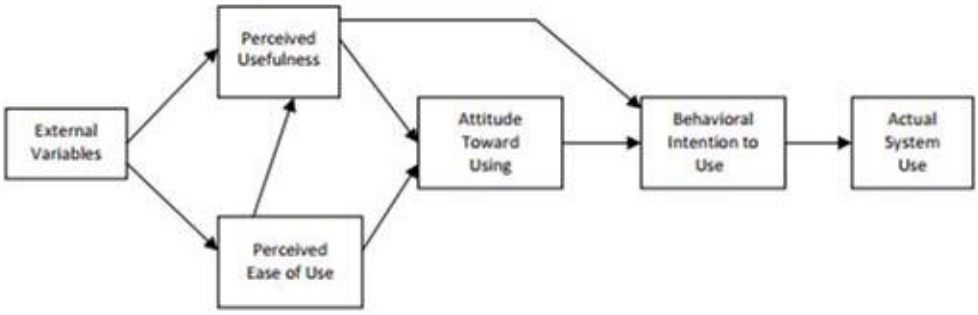


Figure 1.1 Technology Acceptance Model (TAM)

Source: Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13.

The two core constructs of TAM are perceived ease of use and perceived usefulness. Davis defines Perceived Usefulness as

"the degree to which a person believes that using a particular system would enhance his or her job performance"

and Perceived Ease of Use as

"the degree to which a person believes that using a particular system would be free of effort". A remarkable point about the model is that PEOU affects PU as well because the user perceives a system more useful when it is perceived as easier to use (Davis, 1989).

In the context of the Technology Acceptance Model, the following hypotheses are proposed:

H1: Perceived Ease of Use leads to the Behavioral Intention to use an autonomous vehicle.

H2: Perceived Usefulness leads to the Behavioral Intention to use an autonomous vehicle.

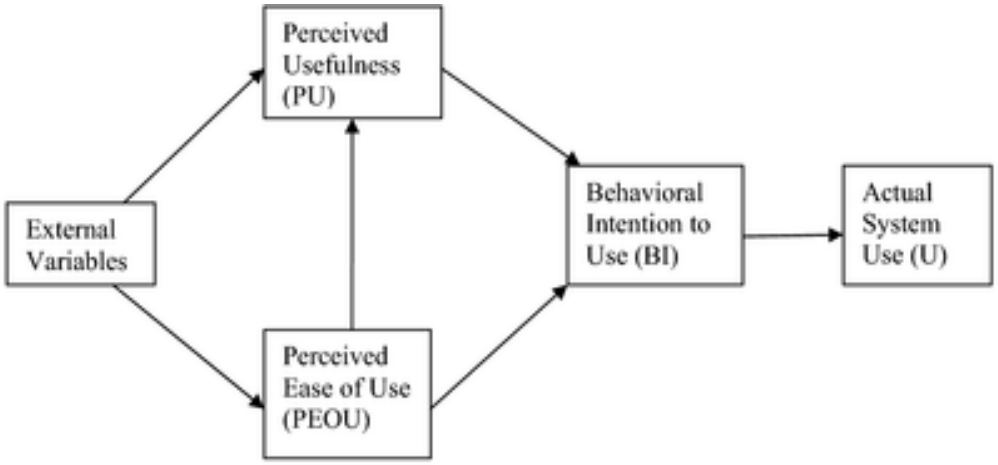


Figure 1.2 Updated TechnologyAcceptance Model (UTAM)

Source: Venkatesh, V., and Davis F. D., (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Manage Management Science*, 46(2).

As illustrated in Figure 1.2 external variables, perceived usefulness (PU) and perceived ease of use (PEOU), behavioral intention to use(BI) to actual system use (U) are Updated Technology Acceptance Model (UTAM).

There are two types of variables that need to be controlled that are internal variables and external variables. Internal variables typically consist of the variables being manipulated and measured. External variables are factors outside the scope.

Later, Venkatesh and Davis (2000) removed the Attitude toward use (ATT) according to their longitudinal study and introduced the factors (Subjective Norm moderated by Experience, Image, Job Relevance, Output Quality, Result Demonstrability) that are explaining Perceived Usefulness, so that the TAM2 model would provide guidance in organizational decisions. External variables suggested in the first TAM Model is explained and defined as determinants of Perceived Usefulness and Perceived Ease of Use in TAM2 and TAM3 Models. Finally, Venkatesh and Bala (2008) developed TAM3 by proposing the determinants (Computer Self-efficacy, Perceptions of External Control, Computer Anxiety,

Computer Playfulness, Perceived Enjoyment, Objective Usability) of Perceived Ease of Use, in order to guide managers for their interventions of IT adoption and use.

This study will investigate the TAM model in the domain of autonomous vehicle technology and analyze if perceived usefulness and perceived ease of use lead to behavioral intention.

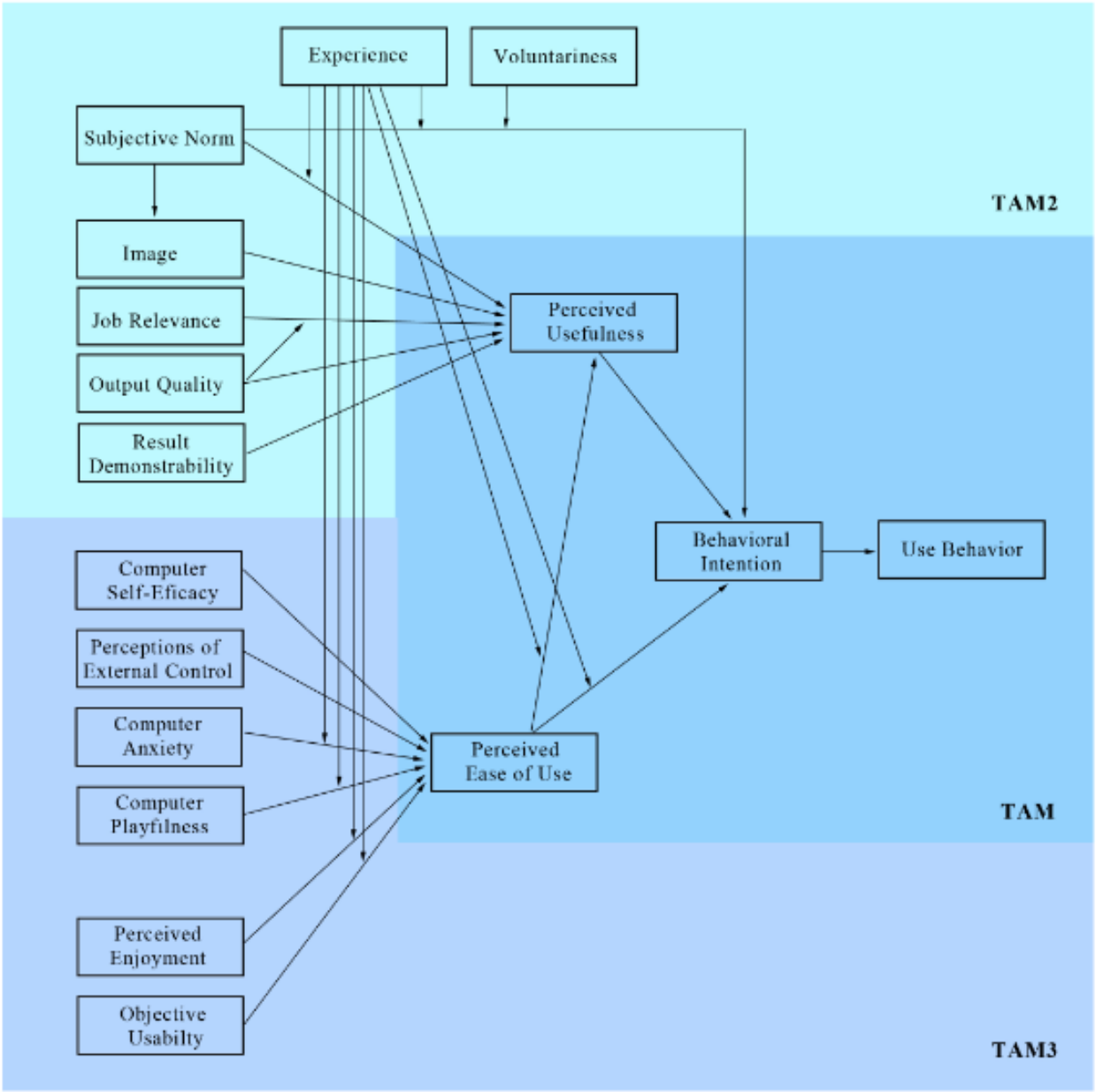


Figure 1.3. TAM Models(Illustrated by the Researcher)

As illustrated in Figure 1.3 by the researcher, as we compare Technology Acceptance Models (TAM), we would say that TAM2, TAM3 is an addition of the TAM. It was developed by Venkatesh and Davis (2000) due to the limitations of the TAM in terms of illustrative power (R^2). The wish for the TAM2 was to keep the original TAM set upexact and "include additional key determinants of TAM's perceived usefulness and usage intention constructs and to understand how the effect of these determinants changed with increasing users' experience over time with the target system" (Venkatesh and Davis, 2000). The reason is that TAM2 only focused on the determinants of TAM's perceived usefulness and usage intention constructs, TAM3 by Venkatesh and Bala (2008) added the determinants of TAM's perceived ease of use and usage intention set up for sturdiness. Therefore, TAM3 presented a fulfill nomological network of the determinants of users' Information Technology System espousal (Venkatesh and Bala, 2008). Venkatesh et al. (2003) added four key determinants in the UTAUT model and there were performance expectancy, effort expectancy, social influence, and facilitation conditions as well as four key moderators which are gender, age, voluntariness and experience. TAM2 and TAM3 didn't look carefully direct effects which might show new relationships as well as important factors. Technology Acceptance Model (TAM2) by Venkatesh and Davis (2000), TAM3 by Venkatesh and Bala (2008) and UTAUTby Venkatesh et al. (2003) were not chosen since the situation was for products in the market. Davis, Bagozzi and Warshaw (1989) explained that social norms scales had a very poor psychometric standpoint, and might not apply any power on consumers' behavior intention, while individual usage was voluntary.

Table 1.3 Summary of Technology Acceptance Models Usage in Literature by Time

Article	Author	Year	Model	Added Variables	Implementation Area
A Conceptual And Operational Definition Of Personal Innovativeness In The Domain Of Information Technology	Ritu Agarwal, Jayesh Prasad	1998		Personal Innovativeness	Information Technology
Why Don'T Men Ever Stop To Ask For Directions? Gender, Social Influence, And Their Role In Technology Acceptance And Usage Behavior	Viswanath Venkatesh, Michael G. Morris	2000	TAM	Genders	New Software System In The Workplace
Predicting E-Services Adoption: A Perceived Risk Facets Perspective	Mauricio S. Feathermana, Paul A. Pavlou	2003	TAM	Perceived Risk	E-Services
User Acceptance Of Information Technology: Toward A Unified View	Viswanath Venkatesh, Michael G. Morris, Gordon B. Davis, Fred D. Davis	2003	UTAUT		Information Technology
Trust And Tam In Online Shopping: An Integrated Model	David Gefen, Elena Karahanna, Detmar W. Straub	2003	TAM	Trust	Online Shopping
The Utilization Of E-Government Services: Citizen Trust, Innovation And Acceptance Factors	Lemuria Carter & France Bélanger	2005	TAM	Diffusion of Innovation theory, Trust	E-Government Services
Personal Innovativeness, Social Influences And Adoption Of Wireless Internet Services Via Mobile Technology	June Lu, James E. Yao, Chun-Sheng Yu	2005	TAM	Social Influences, and Personal Innovativeness	Mobile Technology
Organizational Adoption Of Enterprise Resource Planning Systems	Onur Kerimoğlu	2006	TAM		Erp Usage
Understanding The Role Of Individual Innovativeness In The Acceptance Of It-Based Innovations: Comparative Analyses Of Models And Measures	Mun Y. Yi, Kirk D. Fiedler, Jae S. Park	2006		Individual Innovativeness	Information Technology
User Acceptance Of Context-Aware Services: Self-Efficacy, User Innovativeness And Perceived Sensitivity On Contextual Pressure	O. Kwon, K. Choi, and M. Kim	2007	TAM	Personal Innovativeness, Self-Efficacy, Perceived Sensitivity	Context-aware Services

Table 1.3 Summary of Technology Acceptance Models Usage in Literature by Time (continued)

Article	Author	Year	Model	Added Variables	Implementation Area
The Determinants Of Radical Versus Incremental Mobile Service Innovation Adoption: Model Development And Testing At Low Versus High Consumer Involvement Levels	Uygur Gümüslü	2010			Mobile Service
Analysis Of Erp Usage With the Technology Acceptance Model	Didem Pasaoglu	2011	TAM		Erp Usage
Evaluation Of Project Management Systems With Tam3	Pol Irgav	2011	TAM3		Project Management Systems
Analyzing The Factors Affecting Enterprise Resource Planning Systems Usage Via Extended Technology Acceptance Model	Hale Kaġmer Erdem	2011	TAM		Erp Usage
User Acceptance Of Agile Information Systems: A Model And Empirical Test	Weiyin Hong, James Y.L. Thong, Lewis C. Chasalow, and Gurpreet Dhillon	2011	UTAUT	Personal Innovativeness	Information Systems
Augmenting The Technology Acceptance Model With Trust: Commercial Drivers' Attitudes Towards	Mahtab Ghazizadeh, Yiyun Peng, John D. Lee, Linda Ng Boyle	2012	TAM	Trust	Commercial Drivers
Consumer Acceptance And Use Of Information Technology: Extending The Unified Theory Of Acceptance And Use Of Tech.	Viswanath Venkatesh, James Y. L. Thong, Xin Xu	2012	UTAUT 2		Information Technology
Predicting Information Technology Adoption In Small Businesses: An Extension Of The Technology Acceptance Model	Thomas P. Hayes, Jr.	2012	TAM		Information Technology Adoption In Small Businesses

Table 1.3 Summary of Technology Acceptance Models Usage in Literature by Time (continued)

Article	Author	Year	Model	Added Variables	Implementation Area
Toward An Understanding Of Acceptance Of Electronic Performance Support Systems: What Drives Users' Perceptions Regarding Usefulness And Ease Of Use?	Evren Şumuer	2012	TAM		Electronic Performance Support Systems
Exploring The Adoption Of A Virtual Reality Simulation	Mary Fagan, Carol Kilmon, Vivek Pandey	2012	TAM	Personal Innovativeness	Virtual Reality Simulation in Nursing Education
An Integrated Adoption Model For E-Books In A Mobile Environment: Evidence From South Korea	Sungjoon Lee	2012	TAM	Individual Innovativeness, Risk, Innovation Resistance	E-Books
An Analysis Of The Factors That Affect The Technology Acceptance Of The White Collar Employees	Ali Sercan Kocagöncü	2013	TAM		White Collar Employees
Consumers' Acceptance And Use Of Information And Communications Technology: A Utaut And Flow-Based Theoretical Model	Saleh Alwahaishi1, Václav Snášel	2013	UTAUT		Communications Technology
Effects Of Trust And Perceived Risk On User Acceptance Of A New Technology Service	Ji-Hwan Lee	2013	TAM	Trust, Perceived Risk	New Technology Service
Taking "Fun And Games" Seriously: Proposing The Hedonic-Motivation System Adoption Model	Paul Benjamin Lowry, James Eric Gaskin, Bryan Hammer, Tom L. Roberts	2013	TAM	Cognitive Absorption	Hedonic-motivation systems
The Effects Of Individual Innovativeness On Users' Adoption Of Internet Content Filtering Software And Attitudes Toward Children'S Internet Use	Chang-Hyun Jin	2013		Innovativeness	Internet content filtering software

Table 1.3 Summary of Technology Acceptance Models Usage in Literature by Time (continued)

Article	Author	Year	Model	Added Variables	Implementation Area
Factors Influencing Smartphone Use And Dependency In South Korea	Namkee Park, Yong-Chan Kim, Hae Young Shon, Hongjin Shim	2013	TAM		Smartphone Use
Factors For Information Technology Acceptance Willingness And Adoption In Logistics Industry From Supply Chain Perspectives	Tsan-Hwan Lin And I-Ching Lin	2014	TAM		Logistics Industry
The Influence Of Social A1Aversion And Institution- Based Trust On Computer Self- Efficacy, Computer Anxiety And Antecedents To It Use	Elizabeth White Baker, Jason Bennett Thatcher, Michael Gundlach, D. Harrison McKnight	2014	TAM	Personal Innovativeness, Trust, Computer Anxiety, Computer Self-Efficacy, Social Aversion	Information Technology
Revising Tam For Hedonic Location-Based Social Networks: The Influence Of Tam, Perceived Enjoyment, Innovativeness And Extraversion	Mariëlle E. Bouwman, Piet A.M. Kommers and Alexander J.A.M. van Deursen	2014	TAM	Perceived Enjoyment, Innovativeness and Extraversion	Mobile Services
An Analysis Of Intention To Use In Innovative Product Development Model Through Tam Model	Min-Wei Hsu	2015	TAM		Innovative Product Development
Investigating The Importance Of Trust On Adopting An Autonomous Vehicle	Jong Kyu Choi & Yong Gu Ji	2015	TAM	Trust	Autonomous Vehicles
Consumer Acceptance Of A Revolutionary Technology-Driven Product: The Role Of Adoption In The Industrial Design Development	Jungkun Park, Frances Gunn, YoungHee Lee, Scott Shim	2015	UTAUT Task-Technology Fit (TTF)	Consumer Innovativeness	Revolutionary Technology-Driven Product

Table 1.3 Summary of Technology Acceptance Models Usage in Literature by Time (continued)

Article	Author	Year	Model	Added Variables	Implementation Area
Determinants Of Iranian Agricultural Consultants' Intentions Toward Precision Agriculture: Integrating Innovativeness To The Technology Acceptance Model	Somayeh Tohidyan Far, Kurosh Rezaei-Moghaddam	2015	TAM	Individual Innovativeness, Attitude of Confidence	Agricultural Systems
Airline Passengers' Continuance Intention Towards Online Checkin Services: The Role Of Personal Innovativeness And Subjective Knowledge	Zhibin Lin, Raffaele Filieri	2015	TAM	Personal Innovativeness and Subjective Knowledge	Airline Industry
The Effects Of Technology Innovativeness And System Exposure On Student Acceptance Of E-Textbooks	Madison N. Ngafeeson, Jun Sun	2015	TAM	Technology Innovativeness, Technology Exposure	E-Books
Modeling Consumers' Adoption Intentions Of Remote Mobile Payments In The United Kingdom: Extending Utaut With Innovativeness, Risk, And Trust	Emma L. Slade, Yogesh K. Dwivedi, Niall C. Piercy, and Michael D. Williams	2015	UTAUT	Innovativeness, Risk, and Trust	Mobile Services
Investigating Cross-Cultural Differences In Trust Levels Of Automotive Automation	Valarie A.Yerdon, Tiffani A. Marlowe, William G. Volante, Shuling Li And P. A. Hancock	2016	-	Trust	Autonomous Vehicles
How And Why Do Men And Women Differ In Their Willingness To Use Automated Cars? The Influence Of Emotions Across Different Age Groups	Christoph Hohenberger, Matthias Spörrle, Isabell M. Welpe	2016		Genders	Autonomous Vehicles

Table 1.3 Summary of Technology Acceptance Models Usage in Literature by Time (continued)

Article	Author	Year	Model	Added Variables	Implementation Area
Antecedent Variables Of Intentions To Use An Autonomous Shuttle: Moving Beyond Tam And TPB	L. Moták, E. Neuville, P. Chambres, F. Marmoiton, F. Monéger, F. Coutarele, M. Izaut	2017	TAM		Autonomous Vehicles
Expectation And Experience: Passenger Acceptance Of Autonomous Public Transportation Vehicles	Eden, G., Nanchen, B., Ramseyer, R., Evéquoz, F.	2017		Expectation And Experience	Autonomous Vehicles
Not Fearless, But Self-Enhanced: The Effects Of Anxiety On The Willingness To Use Autonomous Cars Depend On Individual Levels Of Self-Enhancement	Christoph Hohenberger, Matthias Spörrle, Isabell M.Welpe	2017		Anxiety	Autonomous Vehicles
Towards An Understanding Of The Travel Behavior Impact Of Autonomous Vehicles	Johanna P. Zmud, Ipek N. Sener	2017		Sustainability	Autonomous Vehicles
Investigation Of Instructional Technology Acceptance And Individual Innovativeness Of Academicians	Fatma Akgün	2017	TAM	Individual ınnovativeness	Education
An Empirical Investigation On Consumers' Intentions Towards Autonomous Driving	Ilias Panagiotopoulos George Dimitrakopoulo	2018	TAM	Trust	Autonomous Vehicles
Acceptance Of Autonomous Vehicles In Suburban Public Transport	Henning Hinderer, Jonas Stegmüller, Jannick Schmidt, Jessica Sommer, Jennifer Lucke	2018	TAM		Autonomous Vehicles
Consumer Innovativeness And Intentioned Autonomous Car Adoption	Thomas Leicht, Anis Chtourou, Kamel Ben Youssef	2018	TAM	Consumer innovativeness	Autonomous Vehicles

Table 1.3 Summary of Technology Acceptance Models Usage in Literature by Time (continued)

Article	Author	Year	Model	Added Variables	Implementation Area
Influencing Factors On Social Acceptance Of Autonomous Vehicles And Policy Implications	Jihye Lee, Hyungsik Chang, Young Il Park	2018		usefulness, reliability and legality	Autonomous Vehicles
How Trust Can Drive Forward The User Acceptance To The Technology? In-Vehicle Technology For Autonomous Vehicle	Nadia Adnan, Shahrina Md Nordin, Mohamad Ariff Bin Bahruddin, Murad Ali	2018		Trust	Autonomous Vehicles
Perceptions Of Autonomous Vehicles: Relationships With Road Users, Risk, Gender And Age	Lynn M. Hulse, Hui Xie, Edwin R. Galea	2018		Risk, Gender, Age	Autonomous Vehicles
Parents' Perspectives On Using Autonomous Vehicles To Enhance Children's Mobility	Yi-Ching Lee, Jessica H. Mirman	2018		Parenting	Autonomous Vehicles
Uncovering Early Adopter'S Perceptions And Purchase Intentions Of Automated Vehicles: Insights From Early Adopters Of ElectricVehicles In California	Rosaria M. Berliner, Scott Hardman, Gil Tal	2018		Experience	Autonomous Vehicles
What Drives People To Accept Automated Vehicles? Findings From A Field Experiment	Zhigang Xu, Kaifan Zhang, Haigen Min, Zhen Wang, Xiangmo Zhao, Peng Liu	2018	TAM	Trust	Autonomous Vehicles
Exploring The Impact Of Optimum Stimulation Level On Individual Perceptions Of It Innovations: A Trait Hierarchical Model Perspective	Rui Gu, Zhenhui (Jack) Jiang, Lih-Bin Oh, Kanliang Wang	2018	TAM,	Optimum Stimulation Level Theory, Personal Innovativeness	Information Technology
The Influence Of Feelings While Driving Regular Cars On The Perception And Acceptance Of Self-Driving Cars	Martina Raue, Lisa A. D'Ambrosio, Carley Ward, Chaiwoo Lee, Claire Jacquillat, Joseph F. Coughlin	2019		Affect heuristic	Autonomous Vehicles

Table 1.3 Summary of Technology Acceptance Models Usage in Literature by Time (continued)

Article	Author	Year	Model	Added Variables	Implementation Area
The Roles Of Initial Trust And Perceived Risk In Public's Acceptance Of Automated Vehicles	Tingru Zhang, Da Tao, Xingda Qu, Xiaoyan Zhang, Rui Linb, Wei Zhang	2019	TAM	Risk, Trust	Autonomous Vehicles

Table 1.3 shows the summary of TAM usage in Literature by time. As can be seen in the table, individual innovativeness, or named as personal innovativeness in some studies, frequently used as a complementary variable with the TAM model. Trust is another variable preferred frequently to explain acceptance together with TAM. Additionally, we can interpret the table as, autonomous vehicle acceptance is one of the popular implementation areas in the last years, while for example, ERP Usage was more popular in the past.

TAM model has been criticized frequently for not providing applicable guidance for organizations (Lee et al., 2003). Although TAM2 and TAM3 models present a deeper understanding of the factors for technology acceptance, still the model is not fully capable to explain how the Intention of Use is determined for various technological innovations. For this reason, several analyses are conducted and extended models are proposed for project management systems (Irgav, 2011), supply chain relationships (Lin and Lin, 2014), new product development (Hsu, 2015; Park et al., 2015), small business implementation (Hayes, 2012), electronic performance support systems (Şumuer, 2012), enterprise resource planning system (Paşaoğlu, 2011; Erdem, 2011).Gümüşlü (2010) proposes extended TAM model for adoption of mobile service innovation by adding new variables such as consumer innovativeness, perceived risk and perceived value.

It is researched that how new technological and other advancements spread throughout societies and cultures, from the first usage of the technology to large acceptance. The diffusion of innovations theory seeks to explain how and why new ideas and practices are

adopted, in the time potentially spread out over long periods. Innovations are communicated to different parts of society and how quickly diffusion occurs (LaMorte, 2018).

Innovation Diffusion Theory (IDT) suggested by Rogers (1995) is often investigated together with TAM to explain adoption in intention and adoption aspects. Similarly, the Unified Theory of Acceptance and Use of Technology (UTAUT) is developed by comparing and combining eight models: the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), Combined TAM and TPB, Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT) and Social Cognitive Theory (SCT) (Venkatesh, et al., 2003).

UTAUT model is presented as a unified theory, however, it was basically explaining the acceptance of employee technology and UTAUT2 was developed in the context of consumer use (Venkatesh, Thong and Xu, 2012). What is remarkable about these two models differently than TAM is that individual differences like age, gender and experience are also taken into account for their moderating effects. Bagozzi (2007) considering, UTAUT might be a powerful model due to its parsimonious structure and higher explanatory power (R^2) but the model did not investigate direct effects which might reveal new relationships as well as important factors from the study which were left out by categorizing under the existing predictors only.

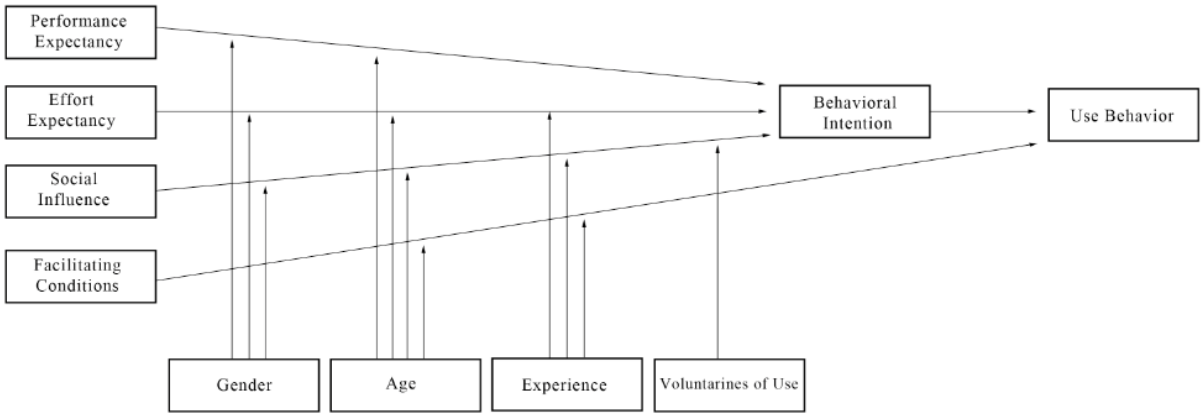


Figure 1.4. UTAUT Model(Illustrated by the Researcher)

As illustrated in Figure 1.4by the ResearcherUTAUT is an extended version from TAM2 and TAM3 is an extended version of TAM2 that includes social influence, therefore they will not be used in this study based on the social norm.TAM2, TAM3, and UTAUT use moderators. Additionally, TAM2, TAM3, and UTAUT did not include direct relations studies. Therefore, TAM2, TAM3, and UTAUT were not favorable to study the intentions of people about autonomous vehicles.

Table 1.4 Unified Theory of Acceptance and Use of Technology (UTAUT)

1	The Theory of Reasoned Action (TRA)
2	Technology Acceptance Model (TAM)
3	Motivational Model (MM)
4	Theory of Planned Behavior (TPB)
5	Combined TAM and TPB
6	Model of PC Utilization (MPCU)
7	Innovation Diffusion Theory (IDT)
8	Social Cognitive Theory (SCT)

Source: Venkatesh, V., Morris, M.G., Davis, F.D., and Davis, G.B. (2003). User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly, 27.

It is seen in Table 1.4 that The Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), Combined TAM and TPB, Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), Social Cognitive Theory (SCT) are listed in eight lines that show Unified Theory of Acceptance and Use of Technology (UTAUT).

1.3. Individual Innovativeness

Prior empirical studies tried to explain the determinants and mechanisms of users' adoption decisions on the basis of the technology acceptance model (TAM) (Venkatesh and Davis, 2000) with the condemnation that the adoption process influences successful use of particular technology systems (Liao, Palvia and Chen, 2009). The TAM was based on to apply to any field of human-computer interactions (Davis et al., 1989) that widely used as the theoretical basis for many empirical studies of user technology acceptance and has some conduced to understanding users' acceptance of choosing new technology like autonomous vehicles (Venkatesh and Davis, 2000). The TAM defend that two beliefs which are Perceived Usefulness (PU) and Perceived Ease of Use (PEU) to determine technology acceptance and are the main background of behavioral intentions to use comfortable and safe technology.

Individual innovativeness scale is developed to understand and measure the behavior of individuals with the focus of "willingness to change" (Hurt et al., 1977), which is explained later as innovation diffusion theory.

The diffusion of innovation research in disciplines such as education, sociology, communication, agriculture, marketing, and information technology, etc (Agarwal, Sambamurthy and Stair, 2000). An innovation defined as an idea, practice or object that is perceived as new by an individual or another unit of acceptance. Diffusion described as the process by which an innovation corresponds through certain channels over time among the members of a social system (Rogers, 1995). As far as it is understood innovation diffusion theory (IDT) determines that the potential users make decisions to assimilate or denial an innovation based on beliefs that they form about the innovation (Agarwal, 2000).

Innovation Diffusion Theory (IDT) includes five significant innovation characteristics: relative advantage, compatibility, complexity, and trialability and observability as illustrated in Figure 1.5.

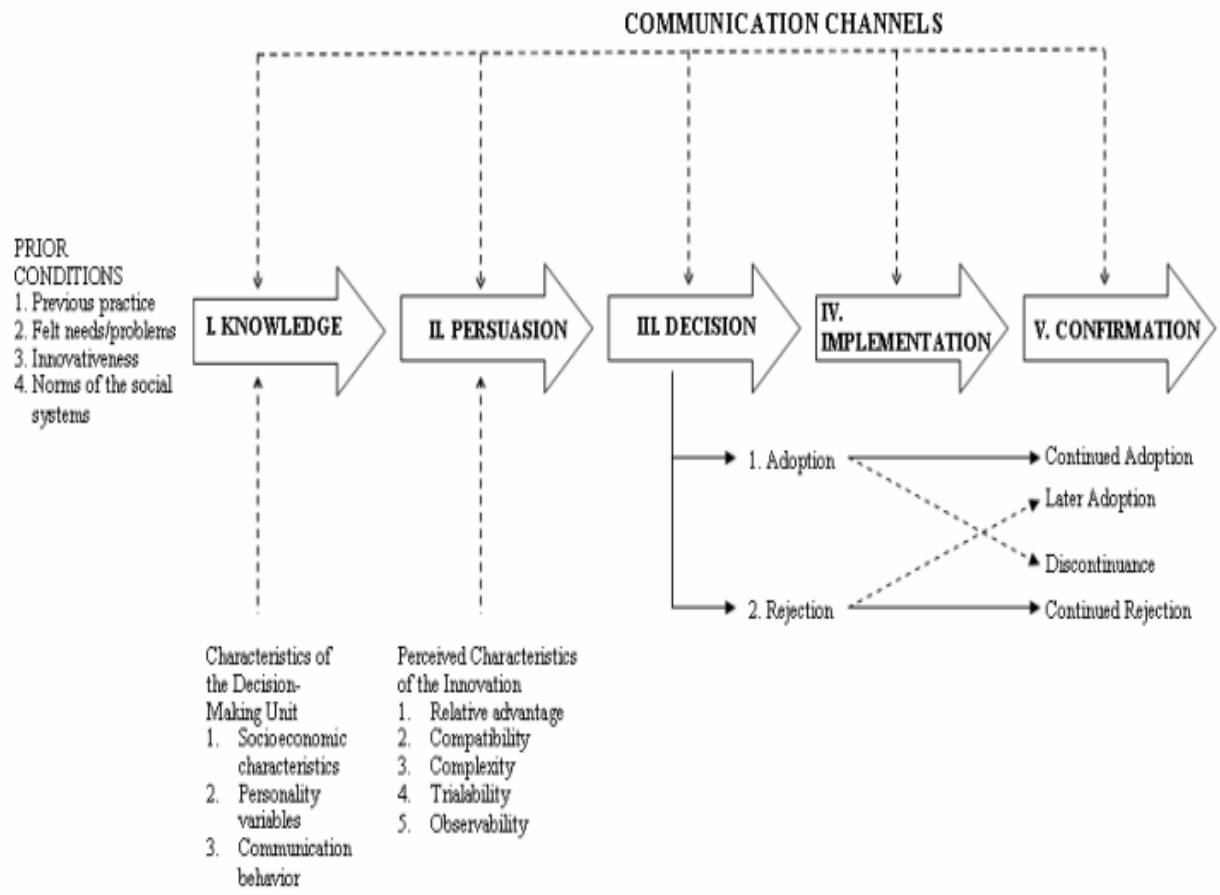


Figure 1.5A Model of Five Stages in the Innovation-Decision Process

Source: Rogers, E.M. (2003). Diffusion of Innovations (5th ed.). *New York: Free Press.*

The Oslo Manual of OECD (2005) describes innovation as "the implementation of a new or significantly improved product (good or service), process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations."Individuals and organizations differ in accepting and adopting an innovation. An analysis reveals that personal innovativeness is another determinant to predict technology acceptance (Kocagöncü, 2013).

Rogers (2003) stated that in the society, people demonstrate different responses to innovation depending on their personality traits and divides individual innovativeness into five different categories from earliest to latest: innovators, early adopters, early majority, late

majority, and laggards. Rogers (2003) explains the characteristics of people in this group as follows;

• Innovators- the risk takers willing to take the initiative and time to try something new. This question may be asked ‘‘What is it?’’

• Early Adopters - tend to be respected group leaders, the individuals essential to adoption by the whole group. This question may be asked ‘‘What problem will it potentially solve?’’

• Early Majority - the careful, safe, deliberate individuals unwilling to risk time or other resources. This question may be asked ‘‘What problem will it solve now?’’

• Late Majority - those suspect of or resistant to change. Hard to move without significant influence. This question may be asked ‘‘Does it work?’’

• Laggards - these are those who are consistent or even adamant in resisting change. The pressure needed to force change. This question may be asked ‘‘Do I have to use this thing?’’

According to the study of Kılıçer and Odabaşı (2010), the individual innovativeness scale is adapted to Turkish and its validity and reliability are confirmed.

This study will investigate the individual innovativeness scale in autonomous vehicle domain and analyze if it leads to behavioral intention to use, together with perceived ease of use and perceived usefulness. Hypothesis four, five and six listed below as;

H4: Individual Innovativeness leads to the behavioral intention to use an autonomous vehicle
H5: Individual Innovativeness leads to perceived ease of use in autonomous vehicle usage
H6: Individual Innovativeness leads to perceived usefulness in autonomous vehicle usage

1.4. Trust in Autonomous Vehicles

Trust is one of the most important determinants regarding technology acceptance, as suggested in earlier studies. (Gefen and Straub, 2000; Gefen, Karahanna, and Straub, 2003). Lee and Song (2013) studied the relationship between trust and perceived risk as two constructs of the UTAUT model. Feathermann and Pavlou (2003) propose to add perceived risk as a variable to TAM. In the same vein, many studies have been shown the remarkable effect of trust on the acceptance of automation shaping people's reliance on the system and intention to use it (Lee and Moray, 1992, 1994; Gefen, Karahanna, and Straub, 2003; Pavlou, 2003; Lee and See, 2004; Carter and Bélanger, 2005; Parasuraman, Sheridan and Wickens, 2008).

Trust is a major determinant to be added as a new construct to the TAM for AV technology as suggested by many corresponding types of research (Ghazizadeh et al., 2012; Gefen et al., 2003). However, the frameworks of the models are varying about the dimensions of trust and its influence on the other constructs in the autonomous vehicle domain.

Lee and Moray (1994) explained that trust in automation should surpass operators' self-confidence to be preferred over manual control. Banks and Stanton (2015) specified that in order to build trust in AV, drivers should fully understand the system behavior through the interface to avoid stressful situations since experience has an influence over the trust.

Considering the importance of trust, another study pointed out that drivers trust AV more when it is anthropomorphized with humanlike features such as name, gender, and voice (Waytz, Heafner and Epley, 2014). An experiment (Stormont, 2008) indicated that trust towards an autonomous system is still not enough in hazardous situations unless human interference becomes impossible. This study will investigate if Trust leads to behavioral intention to use an autonomous vehicle, together with the TAM model and individual innovativeness scale.

So, accordingly, the hypotheses listed below:

H8: Trust leads to the behavioral intention to use an autonomous vehicle

H9: Trust leads to perceived ease of use in autonomous vehicle usage

H10: Trust leads to perceived usefulness in autonomous vehicle usage

1.5. Experience and Knowledge About Autonomous Vehicles

Experience is suggested as a moderator in TAM3 model for the factors of both perceived ease of use and perceived usefulness (Venkatesh and Bala, 2008). However, these factors are applicable to information technology and organizational developments. Therefore many researchers investigated the effects of experience in several paths in different domains.

Noh et. al (2016) studied the impact of experience and knowledge towards personal innovativeness in an education technology context. Wang and Arnett (2016) suggest that knowledge increases innovativeness. Schweisfurth and Raasch (2018) also report that knowledge is positively related to individual innovativeness by increasing the absorptive capacity of an individual regarding a technological solution. Sanin et al. (2019) studied the experiential knowledge to understand the decision-making process for the Internet of Things and Cyber-Physical Systems. Research about train driving proposes two-level human driving experience to optimize the usefulness of the vehicle (Huang et. al, 2017)

H11: Experience leads to the behavioral intention to use an autonomous vehicle
H12: Experience leads to the individual innovativeness in autonomous vehicle domain

1.6. Socio-demographic Differences Regarding Technology

According to Venkatesh and Morris (2000), perceived usefulness is a strong determinant in technology usage decisions of men, yet perceived ease of use and subjective norm are more effective for women.

H16: Gender leads to Behavioral Intention to use an autonomous vehicle.

The study of Ipsos MORI (2014) shows that men younger people find driverless cars more important, while KPMG (2013) indicates that women are more willing to use a driverless car. Payre et al (2014) report that men are interested in buying or using an autonomous vehicle more than women but in case of being impaired or having a disability to

drive then the difference between two genders vanishes. Gold et al, 2015 reports that older drivers have higher trust and intention to use towards AV. Another research indicates that men, people with a higher level of education, people living in highly populated places are more likely to accept autonomous vehicles (Liljamo et. al, 2018; Hudson et. al, 2019). Liu et. al, additionally suggests that willingness to pay for an autonomous vehicle increases for young, highly educated people and for higher income level (2019).

H17: Age leads to Behavioral Intention to use an autonomous vehicle.

H18: Education Level leads to the Behavioral Intention to use an autonomous vehicle.

H20: Income Level leads to the Behavioral Intention to use an autonomous vehicle

Additionally, parents vary in accepting an autonomous vehicle considering the safety of their children (Lee and Mirman, 2018). Another research also suggests that technology acceptance is different for married and unmarried people (Wang, 2013)

H19: Marital Status leads to Behavioral Intention to use an autonomous vehicle.

Depending on a culture's level of context, whether individualism or collectivism prevails, the driver's level of trust in autonomous vehicles is influenced by the style of communication (Yerdon et al, 2016). This study will investigate the differences in behavioral intention to use autonomous vehicle considering the socio-demographic variables such as age, gender, education, etc.

II.RESEARCH DESIGN AND METHODOLOGY

Finding out things you did not know with a systematic way, more academic interpretation is that research involves finding out about things that may be no-one else knew either. It can be said advancing the frontiers of knowledge (Walliman, 2011). The aim of this research is to discuss the importance of technology which makes life easier. According to scientist lifestyle in the future will be more closely with artificial intelligence, robotics, and autonomous systems. Autonomous vehicles have multiple benefits, are Turkish citizens ready for a future that is asked 58 questions to 391 people on the survey. Investigating the user acceptance of autonomous vehicles to contribute to sustainability in the chapters.

2.1. Research Purpose And Objectives

The objective of this study is to analyze the factors of autonomous vehicle usage according to the technology acceptance model. In consonance with the results of literature view, the research includes perceived ease of use, perceived usefulness and behavioral intention as the base structure of TAM model and investigates experience, trust and individual innovativeness as new constructs. The study also investigates the correlation between these determinants to reach a more comprehensive understanding of consumer acceptance. Since autonomous vehicle technology will cause major changes in our lives inevitably, it is important to understand the attitudes and the factors shaping the attitudes and behavior to shape the development of this technology accordingly.

2.2. Conceptual Model of the Study

The diffusion of innovations theory begins with innovators that are experienced people who want to be the first to try the innovation. They are adventurous and interested in new ideas. These people are very willing to take risks and are often the first to develop new ideas.

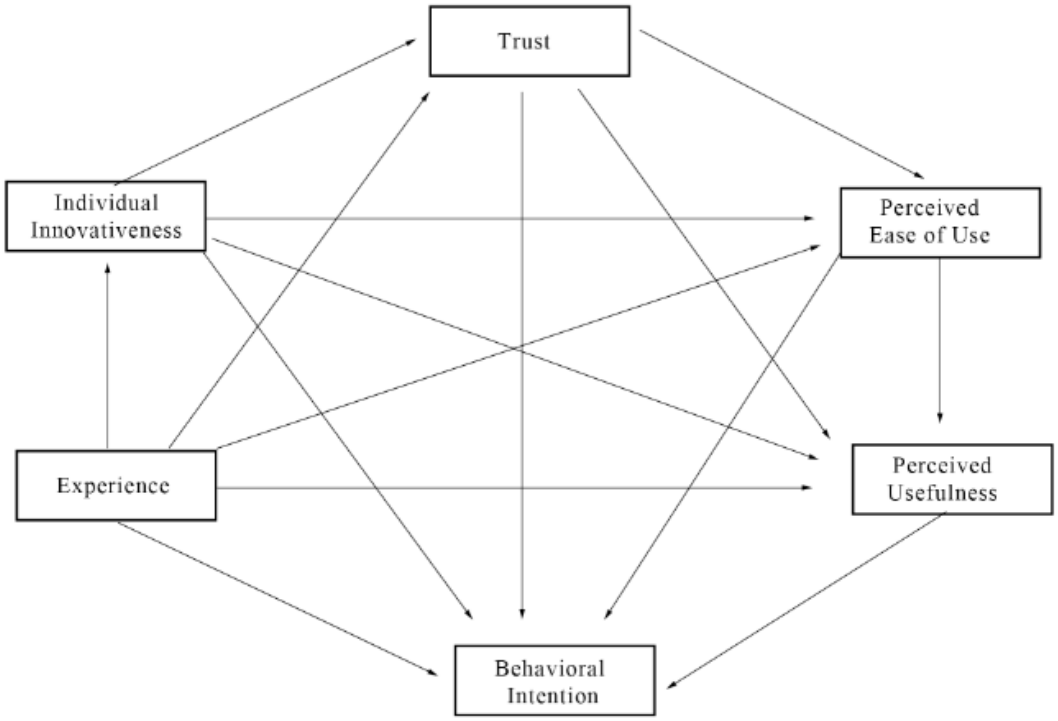


Figure 2.1 Conceptual Model of the Study

Conceptual model of the study as illustrated in Figure 2.1 begins with experience. Experience is shaped by knowledge and past experiences and goes to individual innovativeness, trust, perceived ease of use, perceived usefulness and behavioral intention. Individual innovativeness is built by resistance to change, opinion-leading, openness to experience and risk-taking. Individual innovativeness is suggested to affect trust, perceived usefulness, perceived ease of use and behavioral intention. System transparency, technical competence and situation management determines trust and trust goes to perceived ease of use, perceived usefulness, and behavioral intention. Finally, as derived from the original TAM model, perceived ease of use and perceived usefulness lead to behavioral intention and perceived ease of use also goes to perceived usefulness.

2.3. Variables of the Study

Table 2.1 Variables Used in the Survey

Model	Constructs	Item No	Statement	Source
Individual Innovativeness	Resistance to Change	RC1	I am generally cautious about accepting new ideas.	Hurt, H. T., Joseph, K., & Cook, C. D. (1977). Scales for the measurement of innovativeness. Human Communication Research, 4, 58-65.
		RC2	I am suspicious of new inventions and new ways of thinking	
		RC3	I rarely trust new ideas until I can see whether the vast majority of people around me accept them.	
		RC4	I am aware that I am usually one of the last people in my group to accept something new.	
		RC5	I am reluctant about adopting new ways of doing things until I see them working for people around me.	
		RC6	I tend to feel that the old way of living and doing things is the best way.	
		RC7	I must see other people using new innovations before I will consider them.	
		RC8	I often find myself skeptical of new ideas.	
	Opinion Leading	OL1	My peers often ask me for advice or information.	
		OL2	I feel that I am an influential member of my peer group.	
		OL3	I consider myself to be creative and original in my thinking and behavior.	
		OL4	I am an inventive kind of person.	
		OL5	I enjoy taking part in the leadership responsibilities of the group I belong to.	
	Openness to Experience	OE1	I enjoy trying new ideas.	
		OE2	I seek out new ways to do things.	
		OE3	I frequently improvise methods for solving a problem when an answer is not apparent.	
		OE4	I find it stimulating to be original in my thinking and behavior	
		OE5	I am receptive to new ideas.	
	Risk Taking	RT1	I am challenged by ambiguities and unsolved problems	
		RT2	I am challenged by unanswered questions	

Technology Acceptance Model	Behavioral Intention	BI1	I intend to use an autonomous vehicle in the future.	Venkatesh & Bala, 2008, Technology Acceptance Model 3 and a Research Agenda on Interventions
		BI2	I expect that I would use an autonomous vehicle in the future.	
		BI3	I plan to use an autonomous vehicle in the future.	
	Perceived Usefulness	PU1	Using autonomous vehicle improves my performance in my job.	
		PU2	Using an autonomous vehicle in my job increases my productivity.	
		PU3	Using autonomous vehicle enhances my effectiveness in my job.	
		PU4	I find the autonomous vehicle to be useful in my job.	
	Perceived Ease of Use	PEOU1	I find the autonomous vehicle would be easy to use.	
		PEOU2	I would find it easy to get an autonomous vehicle to do what I want to do.	
		PEOU3	My interaction with the autonomous vehicle would be clear and understandable.	
		PEOU4	Interacting with an autonomous vehicle would not require a lot of my mental effort.	
	Trust	TRU1	Autonomous vehicle is dependable.	Jong Kyu Choi & Yong Gu Ji, 2015, Investigating the Importance of Trust on Adopting an Autonomous Vehicle
		TRU2	The autonomous vehicle is reliable.	
		TRU3	Overall, I can trust an autonomous vehicle.	
	Experience	EXP1	I drive a vehicle regularly	Developed by the Researcher
		EXP2*	I use public transportation	
		EXP3	I drive a vehicle with intelligent driving assistance systems	
		EXP4	I have knowledge about autonomous vehicles	
		EXP5	I have knowledge about the experiments with autonomous vehicles	
		EXP6	I had an accident while driving a vehicle	
		EXP7	I had an accident as a passenger	
	Sustainability	SUS1	I believe that autonomous vehicles will decrease traffic accidents	Developed by the Researcher
		SUS2	I believe that autonomous vehicles will decrease environmental pollution	
		SUS3	I believe that autonomous vehicles will support fuel efficiency	

* reversed question

Variables used in the survey is seen inTable 2.1that the questionnaire includes the questions about Individual Innovativeness (Resistance to Change, Opinion Leading, Openness to Experience, Risk Taking); Technology Acceptance Model (Behavioral Intention, Perceived Usefulness, Perceived Ease of Use); Trust, Experience, Sustainability.

2.4. The hypothesis of the Study

This study aims to investigate how people would react to autonomous vehicle technology. The hypotheses are separated into segments in the study. The segments contain, hypothesizes that measure the relationships and influences of independent variables on the dependent variable through regression analysis.

- **H1:** Perceived Ease of Use leads to the Behavioral Intention to use an autonomous vehicle.
- **H2:** Perceived Usefulness leads to the Behavioral Intention to use an autonomous vehicle.
- **H3**Perceived Ease of Use leads to Perceived Usefulness to use an autonomous vehicle.
- **H4**: Individual Innovativeness leads to the behavioral intention to use an autonomous vehicle
- **H5**: Individual Innovativeness leads to perceived ease of use in autonomous vehicle usage
- **H6**: Individual Innovativeness leads to perceived usefulness in autonomous vehicle usage
- **H7:** Individual Innovativeness leads to trust in an autonomous vehicle
- **H8:** Trust leads to the behavioral intention to use an autonomous vehicle
- **H9:** Trust leads to perceived ease of use in autonomous vehicle usage
- **H10:** Trust leads to perceived usefulness in autonomous vehicle usage
- **H11:** Experience leads to the behavioral intention to use an autonomous vehicle

- **H12:** Experience leads to the individual innovativeness in autonomous vehicle domain
- **H13:** Experience leads to trust in an autonomous vehicle
- **H14:** Experience leads to perceived ease of use in autonomous vehicle usage
- **H15:** Experience leads to perceived usefulness in autonomous vehicle usage
- **H16:** Gender leads to Behavioral Intention to use an autonomous vehicle.
- **H17:** Age leads to Behavioral Intention to use an autonomous vehicle.
- **H18:** Education Level leads to the Behavioral Intention to use an autonomous vehicle.
- **H19:** Marital Status leads to the Behavioral Intention to use an autonomous vehicle.
- **H20:** Income Level leads to the Behavioral Intention to use an autonomous vehicle

The survey starts by investigating individual innovativeness as a personality trait that could lead to the acceptance of autonomous vehicle technology. Since Technology Acceptance Model is the base of the suggested model of the research, we investigated the thoughts about two main constructs: Perceived Usefulness and Perceived Ease of Use. Another essential factor in understanding the acceptance of autonomous vehicle technology is Trust. Sustainability, in order to measure the future predictions of the respondents, some potential environmental effects of autonomous vehicle technology is also included in the survey.

2.5. Research Method

There are research methods which are the tools and techniques for doing research for a specific subject. The term of research is generally used liberally for any kind of investigation that is intended to uncover interesting or new facts. Research methods are a range of tools that are used for different types of inquiry, just as a variety of tools which are used for doing any

kind of jobs. In all cases, for example in this master thesis, it is necessary to know what the correct tools are for doing the job and how to use them to best effect (Walliman, 2011).

The term methodology refers to the overall approaches and perspectives to the research process as a whole and is concerned with the following main issues (Collis and Hussey, 2003):

- Why you collected certain data
- What data you collected
- Where you collected it
- How you collected it
- How you analyzed it

A research method refers only to the various specific tools or ways data can be collected and analyzed, e.g. a questionnaire; interview checklist; data analysis software, etc.

It is known that there are numerous types of research design that are appropriate for the different types of research projects. It is chosen that which design to apply depends on the nature of the problems related by the research aims. Each type of research design has a range of research methods that are commonly used to collect and analyze the type of data that is generated by the investigations (Walliman, 2011). Classifications of Marketing Research Designs firstly separated into two arms as Exploratory Research Design and Conclusive Research Design. Then, Conclusive Research Design separates into two arms as Descriptive Research and Causal Research. Descriptive Research separates into the other two arms which are Cross-Sectional Design and Longitudinal Design. Cross-Sectional Design also breaks into two as Single cross-sectional Design Multiple cross-sectional Design (Malhotra and Birks, 2007).In the study Single, Cross-Sectional has done.

2.6. Data Collection Method

The survey is used for research. Google online survey is chosen.

Advantages of the online survey:

- Collecting data does not have cost
- When respondents input their own data it is automatically stored electronically and available immediately, automation and real-time access makes easier researches
- Less time needed for respondents
- Convenience for respondents, the survey may be answered anywhere and anytime even start a survey at one time, stop, and complete it later
- Respondents may be more willing to share personal information because they're not disclosing it directly to another person. Interviewers can also influence responses in some cases
- To start this tool it is only needed Google account
- Survey forms can be sent by email, or by the link via social networks or any other means

.

Disadvantages of the online survey:

- It is necessary to have internet
- Security is important, the password is needed to protect data
- Limited sampling and respondent availability
- Possible cooperation problems
- No interviewer, so a trained interviewer may be clarified and probe some unclear questions
- Limitation of 40 sheets

Google survey link was sent to respondents who were over eighteen years old and 391 people joined the survey. In the survey, the same scaling technique (5 Point Likert Scale) is preferred while preparing the questionnaire. The questionnaire has added to the Appendix.

2.7.Research Sample Design

The example design refers to the estimation technique used to calculate the plans and methods to be followed and sample statistics in selecting the sample from the target population. These statistics are estimates used to reveal population parameters (Kabir, 2016: 170). Sample design refers to the plans and methods to be followed in selecting a sample from the target population and the estimation technique formula for computing the sample statistics. It can be said for the sampling design process, there are of five steps; describe the target population, determining the sampling frame, selecting a sampling technique, determining the sample size and executing the sampling process (Malhotra, 2007).

These statistics are the estimates used to infer the population parameters. Includes sample design The target population for the research systematically describes the size of the sample and sampling techniques for qualitative research and quantitative research. There are 391 people in this survey.

A target population is an entire group that holds the characteristics which information is desired and the conclusion is made for developing the theory (Kabir, 2016: 171). In this study citizens from Turkey are chosen, there is 11 different sample's area of residence. Research is limited within the geographical borders and in both qualitative and quantitative researches example of this population. The aim of this research is to find the factors leading to autonomous vehicle usage according to the technology acceptance model.

For the survey, Convenience Sampling has used over eighteen years old people and mostly the Marmara Region is the target area.

Cochran (1963) developed an equation to determine the sample size for large populations (Israel, 2009; Dirsehan, 2010). The following equation indicates 385 people for this study with a 95% confidence level and ±5% precision as shown with the following calculation:

$$n = \frac{z^2 pq}{e^2} = \frac{(1.96)^2 (0.5)(0.5)}{(0.05)^2}$$

≈ 385 People (approximately)

In the survey only non-probability sampling techniques used as-as illustrated in Figure 2.7 that the study for both qualitative and quantitative research. Convenience sampling and snowball sampling has been used basically.

Asking questions is a clear method of collecting both quantitative and qualitative information from people. Questionnaires are a suitable way of collecting quantitative data but can also be used for qualitative data. This method of collecting data is usually called a survey. The questions need to be short and simple to follow. There are basically two question types:

- Closed format questions. The answer will be chosen from a set of given answers. These tend to be quick to answer, easy to code and require no special writing skills from the respondent.
- Open format questions. He/she is free to answer in his / her own content and style. These give freedom of expression and let people writing any type of answers.

III. CONCLUSIVE RESEARCH FINDINGS

3.1.Pre-Conclusive Research:Expert Opinions

In Turkey there is not enough knowledge about Autonomous Vehicles (AV) so, to improve validity expert knowledge and opinions will be useful for the theoretical frame.

Interview with the general manager of the Turkish company improving autonomous vehicle technology (27 June 2018): AVL (Anstalt für Verbrennungskraftmaschinen) Turkey is developing vehicle technologies for popular manufacturers. They provide software support for abroad especially in Germany, England, America. Some projects they are working on are changing lane automatically on the motorway, automatic parking via the key when the driver is in or out of the vehicle. Vehicle tests related to these programs are done abroad. They plan to test in the highway with their own demo tools, but it may take 1-2 years to implement this plan. There are projects that are currently in the idea evaluation stage about public transport. Autonomous vehicles are expected to have great advantages in terms of fuel economy. The software will increase energy efficiency because its decision making is completely logical. The tests so far seem positive.

The potential for public transport is particularly high. Retrofit is possible in public transport. Autonomous systems can be used to prevent accidents and for fuel economy. For example, level 2 security systems can be added. The development of technology and city infrastructure for autonomous vehicle technology is a more important criterion than legal infrastructure. We've got time ahead of level 4 or 5. Even one in a thousand error is unacceptable. Technology needs to reach a level of error in a million. People may cause more likely to crash, but it is unacceptable for an autonomous system to be acceptable to people. These data must be available in order to determine the laws or regulations for insurance. So technology is a bigger factor than law. For autonomous vehicle technology to reach level 4-5, there are 5-6 years ahead of us. When technology reaches those levels, the legal infrastructure will be ready.

There are 3 important criteria for the acceptance of autonomous vehicles: Safety, Reliability, and Comfort. The most important criterion among them is security. Successful overtaking and need to maintain vehicle distance. It has to prevent accidents. For example, it is very important that we trust that it can take us to Sarıyer when we want. For this, the city

infrastructure should be ready. We're uploading a city map to the vehicles, but these maps need to be accurate and up-to-date, or the vehicle can't go on its own. Another important criterion for autonomous vehicles is to increase the perception of comfort for people. During the journey, people should be able to read books, drink their coffee, not have to deal with the road. (Level 4 is able to intervene in case of an emergency, the system at level 5 is absolutely unmanned and does not even need to be inside the vehicle.) But there is more time for level 5.

Prices are of course important for autonomous vehicles to arrive. Expensive vehicle models slowing down when the closing distance to the vehicle ahead is at level 3.The characteristics that determine people accepting autonomous instruments can be education, economy, gender, and age. Young people want to see the technologies they see in science fiction.Especially in our country, the young population will be more likely to accept autonomous tools. Our demographics are much more convenient than other countries, yet our country will be 2-3 years late because our country infrastructure is not ready for this. For autonomous vehicles, the United States is very ambitious, and countries with strong car brands like Germany will go ahead. It is very important that the public policies are appropriate and the infrastructure is ready. We will develop more cautiously in Turkey.

Vehicle sharing will increase, but not as high as mentioned. At least in Turkey, sharing family, friends remain as limited to the immediate surroundings. We don't want to give our private car to a stranger. But acquiring common cars with peer friends may occur as a new purchase or rental models but will not be among foreigners. But taxi or shuttle cars can be shared. (about using autonomous vehicles for people without drivers license such as school services, children's transportation, etc.) Level 4-5 will come very far. Level 4 still requires human intervention in emergencies. Therefore, it will be necessary to have a license for a long time and to have an adult in the vehicle. Autonomous vehicles, unfortunately, will adversely affect unemployment. However, the transition to autonomous vehicles will be slow, as the vehicles will need to have a driver even at Level 4, and the law will not allow driverless vehicles, especially for emergencies. During this time, the education of some of them may increase in other areas, but in general, it will be difficult.

Autonomous instruments have many advantages in terms of sustainability. Reduction of losses in both life and property by preventing accidents, fuel economy, etc. In fact, some of the current autonomous vehicle technologies are particularly well suited to public transport. Only if the level 1-2 emergency braking systems are applied to the buses are very serious

gains. Hospital costs, insurance and damage losses, workforce damage, etc. Metrobuses are also suitable for level 3-4 since they are not involved in car traffic. I don't really know why it hasn't been done so far, but I believe it will be done soon.

3.2. Descriptive Analysis of Respondents

Descriptive Analysis of Respondents aims to provide a better understanding of the respondent's characteristics, demographics, and orientation.

3.2.1. Demographic and Socioeconomic Characteristics of Respondents

The total sample size of 391 people, mostly consists of male respondents as similar to most of the vehicle technology enthusiasts and the driver population. The majority of the sample group is male although the convenience sampling technique is preferred, there were no equal respondents for genders because the level of interest in the subject of the research was lower for women. 60.1% of the sample is male and 39.9% is female as illustrated in Figure 3.1a.

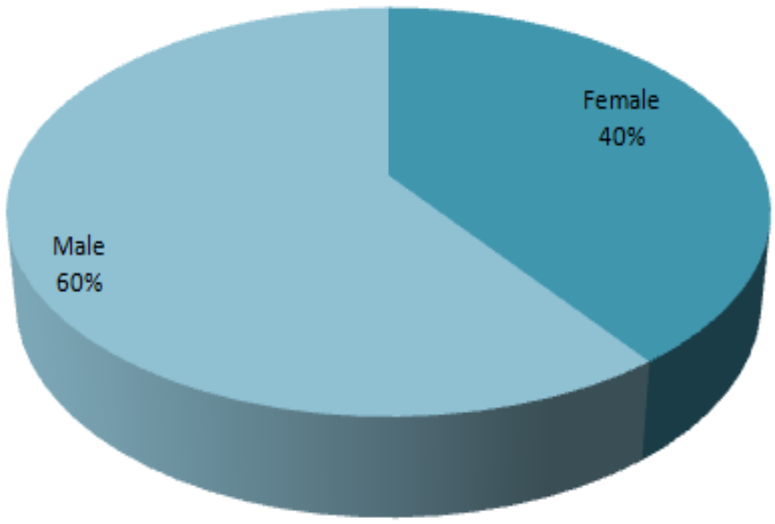
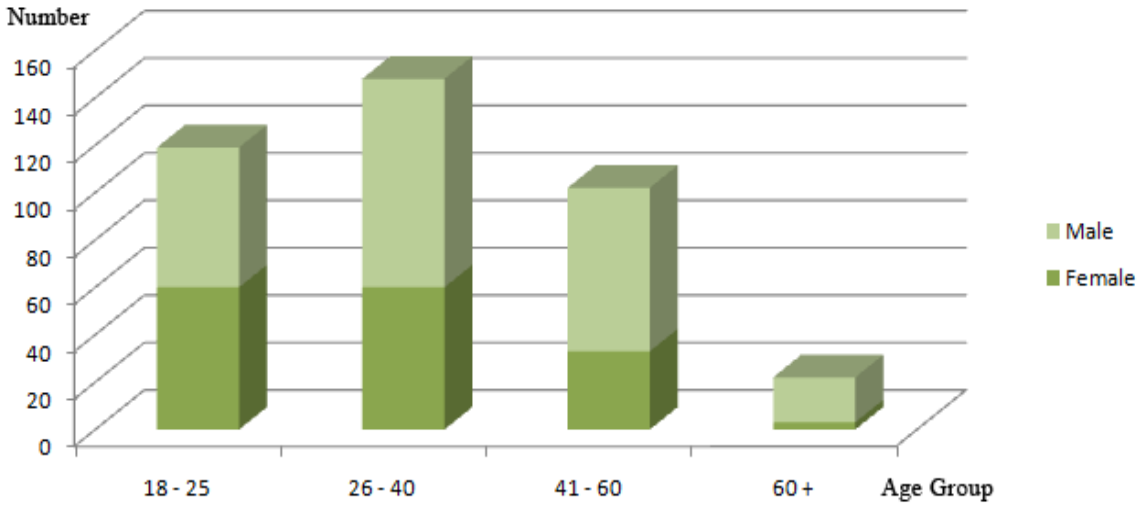


Figure 3.1a Sample's Gender Distribution

As illustrated in Figure 3.1b for both genders, the age group of 26-40 is the majority which equals to 37,9% in total as more than a third of the whole sample group. The second largest age group is 18 - 25 which is 30.4% of the total, followed by the age group of 41 – 60 as 26,1% of the respondents.

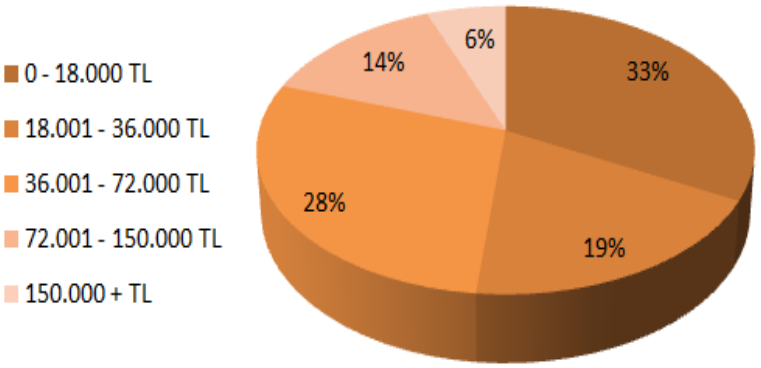


	18 - 25	26 - 40	41 - 60	60 +	Total
Female	60	60	33	3	156
Male	59	88	69	19	235
Total	119	148	102	22	391

Figure 3.1b Sample's Age Distribution

An individual is expected to reach a particular age and income level based on his/her seniority at work in order to own a vehicle and therefore develops a consistent and valid opinion towards the autonomous vehicle. In this regard, our sample group represents a good combination of certain demographic characteristics.

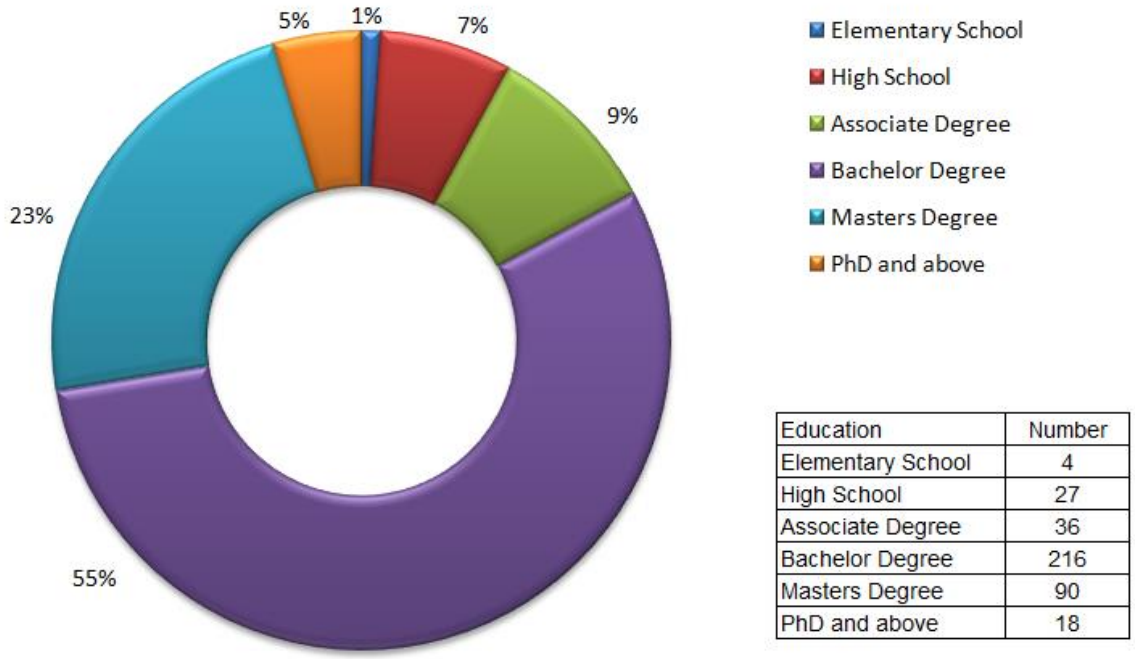
As illustrated in Figure 3.2 the percentages of different income level categories of the respondents. Since vehicle ownership, the features of the owned vehicle may change according to the income level, it is expected the individuals to have different perceptions and opinions about autonomous vehicles.



Income	Number
0 - 18.000 TL	128
18.001 - 36.000 TL	74
36.001 - 72.000 TL	112
72.001 - 150.000 TL	54
150.000 + TL	23

Figure 3.2 Sample's Annual Income Level

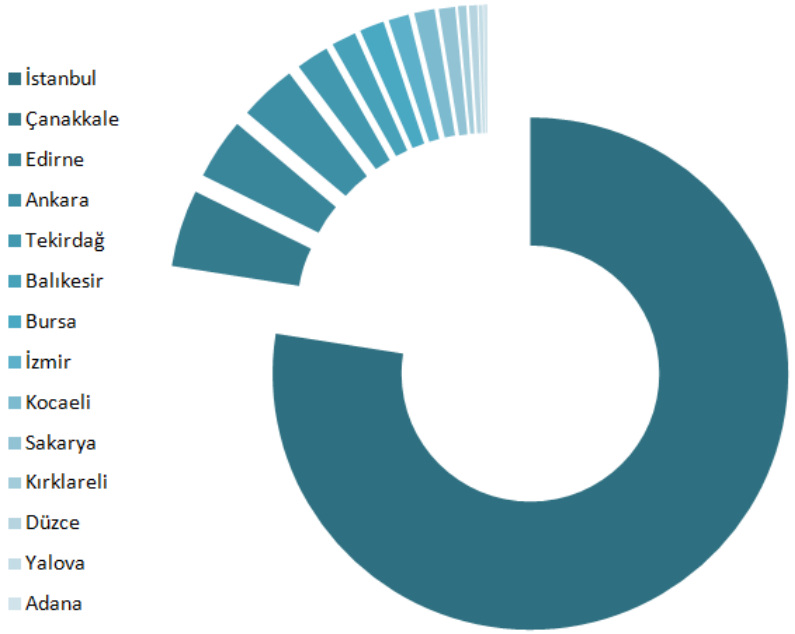
The survey additionally asked the education level, because the higher the education level gets a better understanding of technology could be developed by individuals. This may lead to individual innovativeness, trust and acceptance levels. As illustrated in Figure 3.3 the Sample's level of education. 83% of the respondents have at least a bachelor degree accordingly.



Education	Number
Elementary School	4
High School	27
Associate Degree	36
Bachelor Degree	216
Masters Degree	90
PhD and above	18

Figure 3.3 Sample's Level of Education

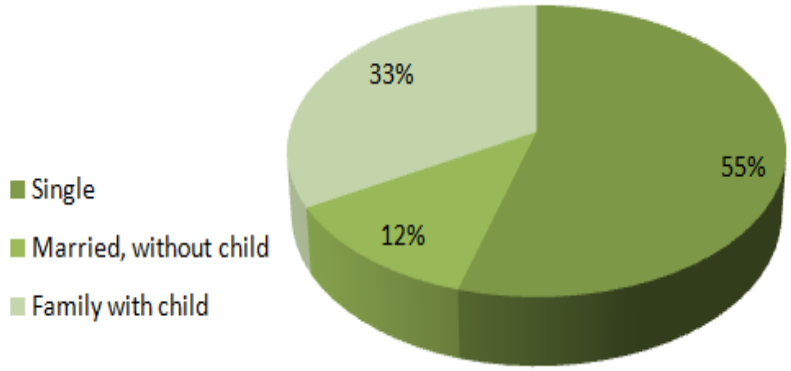
As illustrated in Figure 3.4the sample group is dominated by respondents from İstanbul, which is 77.5% of the total since the convenience sampling technique is preferred for the data collection. Nevertheless, Çanakkale, Edirne, and Ankara are worth to mention representing 12.3% of the sample size. Other cities have less than 10 respondents



Location	Number
İstanbul	303
Çanakkale	19
Edirne	15
Ankara	14
Tekirdağ	8
Balıkesir	6
Bursa	6
İzmir	5
Kocaeli	5
Sakarya	4
Kırklareli	2
Düzce	2
Yalova	1
Adana	1

Figure 3.4 Sample's Area of Residence

As illustrated in Figure 3.5 55% of the sample size is single, 12% is married and 33% of the family with a child. The influence of the marital status on the respondent's attitude and behavior will be measured and discussed in the following topics.



Marital Status	Number
Single	213
Married, without child	48
Family with child	130

Figure 3.5 Sample's Marital Status

3.2.2 Experience and Knowledge of the Sample Group

Before asking questions about perceptions and opinions focusing on autonomous vehicles, the survey aims to investigate traveling habits. In this regard, we have asked respondents about their driving frequency and 52.6% of the respondents stated that they drive frequently. In the same vein, we have asked how often they use public transportation and 62.1% of them answered as frequently. As a result, we can interpret the sample group as frequent travelers so they have enough experience in traffic to imagine and comment on various aspects of autonomous vehicles.

Subsequently, the survey asked respondents about their knowledge and experience level on autonomous vehicle technology. When the respondents are asked if they have knowledge about the autonomous vehicles and requested to grade their knowledge from 1 to 5, the average knowledge results as 287. Then, they are asked how much information do they have about the driving experiments in the World with autonomous vehicles. The average knowledge equals to 2,70 out of 5. In order to ensure fundamental knowledge about the autonomous vehicles and maintain valid results from the survey, a basic explanation is given to the respondents.

As mentioned in previous chapters, the luxurious cars are at autonomy level 3 at the moment. In accordance with this fact, the respondents are asked if they have intelligent driving control systems in their car and 23,5% of them stated that they have partially automated vehicles.

Finally, we questioned the intention of using an autonomous vehicle in the future. The mean value of planning to use an autonomous vehicle in the future is 3.43; whereas it is 3.50 and 3.52 for the belief and the consideration.

3.3. Factor Analyses for Individual Innovativeness and Experience

Factor analysis is an essential test for data reduction in researches that contain a large number of variables. Running factor analysis we can decrease the size of the interdependent variables to a manageable level, before proceeding to analyze responses with correlation and regression analysis. A high correlation between the items means that they build the same factor and the low correlation between the items means separate factors (Altunışık et al., 2007). Therefore, factor analysis is performed to differentiate the items by grouping them according to their relevance.

The questionnaire contains more than 60 variables. Nevertheless, some variables are considered to be sub-factors of the main intended factors of behavioral intention. As shown in Table 3.1 below, we have 5 variables for measuring behavioral intention and one of them consist of sub-factors to achieve better explanation of exact motivation underlying them.

Table 3.1 Considered Variables of the Suggested Model

No	Variables	Factors	Type of Variable	Number of items included
1	Perceived Ease of Use		Independent	4
2	Perceived Usefulness		Independent	4

3	Trust		Independent	3
4	Individual Innovativeness	Resistance to Change	Independent	8
		Opinion Leading	Independent	5
		Openness to Experience	Independent	5
		Risk Taking	Independent	2
5	Experience		Independent	7
6	Behavioral Intention		Dependent	3

Regarding the above variables included in the survey, same scaling technique (5 Point Likert Scale) is preferred while preparing the questionnaire, so that several measuring tests such as factor analysis could be applied. Though only independent variables subject to the trust and individual innovativeness are included in the factor analysis. In order to simplify the test and understand the structure easier, factor analysis is conducted separately for the variables of these two constructs. Consequently, the factor analysis was realized for 36 independent variables in total, 9 variables for trust construct and 20 variables for individual innovativeness construct.

While starting factor analysis in SPSS, KMO (Keiser-Meyer-Olkin) and Bartlett's test of sphericity and anti-image correlation matrices were checked. The KMO numerical value shows if the variables are correlated and whether it is acceptable to run the factor analysis (Field, 2005). The minimum value for KMO should be 0,50. If the value is below 0.5, any further tests will not be acceptable. Values between 0.5 – 0.7 are satisfactory, 0.7 -0.8 are fine, between 0.8 – 0.9 are quite high and values higher than 0.9 are excellent. The anti-image correlation shows whether the variables are convenient for factor analysis (Kaiser,1974)

3.3.1. Factor Analysis for Individual Innovativeness

Table 3.2 KMO and Bartlett's Test (Individual Innovativeness)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.894
Bartlett's Test of Sphericity	Approx. Chi-Square	4888.570
	df	190
	Sig.	.000

As seen in Table 3.2 KMO and Bartlett's Test (Individual Innovativeness), KMO result for the variables of individual innovativeness is 0.894, which is a quite high level of correlation, for reference Kaiser specified 0.80 to 0.89 meritorious and 0.90 to 1.00 marvelous (Kaiser, 1974). Additionally, Bartlett's Test of Sphericity has a perfect level of significance as 0.00<0.05, confirming that the variables that we included in the factor analysis are correlated (Field, 2005).

In order to figure out whether a variable is suitable for factor analysis, we check the Anti-image metrics table and the diagonal values with "a" symbol in the Anti-image correlation. If there is a value less than 0.50, then this variable must be extracted from the factor analysis and the test should be performed again. Since all of the values are over 0.50, now it is convenient to carry on the test.

The principal component analysis method was used for the extraction of factors. Eigenvalues greater than 1.0 were kept based on Kaiser's standard (Field, 2005). The total variance explained matrix and scree plot are captured from these test (appendix 3 and 4)

The way to determine factors from the independent variables is to check the total variance explained matrix. The total column under initial eigenvalues part shows 3 values greater than 1 for the variables subject to individual innovativeness. This means that we can create 3 groups out of 20 variables included. Under Cumulative % column at Rotation Sums

of Squared Loadings part, we can see that these 3 factors can explain 63.291% of the total variance.

After determining the number of factors to be extracted from the variables, there are various methods to rotate these factors in SPSS. These methods are Varimax, Direct Oblimin, Quartimax, Equamax, and Promax. Varimax method is selected for rotation of factors because of being the most preferred method because of its ability to simplify interpretation and contributes to the distribution of the variable loadings (Field, 2005).

In social sciences, factor loading must be greater than at least 0.30 and should be above 0.50 to be interpreted as meaningful (Hair, 1998). Thus, this study only takes factor loadings above 0.50 into consideration. The Rotated Component Matrix shows the variables that are included under each factor with the loading of each variable. Since we checked "sorted by size", the table shows the values from higher to lower and extracts the values below 0.50 due to "suppress smaller coefficient" option. Thus, we can avoid the multiple loadings of the variables under each factor to interfere and complicate of comprehending the rotation of the factors. Thanks to the rotating component matrix table, we can determine the variables for the factor and proceed to the test for reliability and run correlation and regression analysis.

Table 3.3 Rotated Component Matrix for Individual Innovativeness

Rotated Component Matrix[a]

	Component		
	1	2	3
OL3	.872		
OL4	.844		
OE2	.841		
OE1	.833		
OE4	.819		
OE5	.807		
OL2	.785		
OL5	.756		
OL1	.729		
OE3	.698		

RC4		.795	
RC5		.762	
RC8		.753	
RC3		.746	
RC7		.695	
RC2		.670	
RC6		.666	
RC1		.587	
RT2			.877
RT1			.864

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

OL stands for Opinion Leading
OE stands for Openness to Experience
RC stands for Resistance to Change
RT stands for Risk Taking

According to Table 3.3Rotated Component Matrix for Individual Innovativeness, the first factor is containing all the variables suggested for Opinion Leading and Openness to Experience by earlier researches mentioned in Literature Review chapter. Interestingly, the result of this test combines them as a single factor consists of 10 variables in total. Checking the items carefully, the statements go as “My peers often ask me for advice or information.”, “I am an inventive kind of person.”, “I seek out new ways to do things.” and “I frequently improvise methods for solving a problem when an answer is not apparent.”, so defining the factor as “Creative Opinion Leading” would be appropriate for the rest of the research.

The second and third components are in accordance with earlier studies and the factor analysis have shown the same variables subjected to measure Resistance to Change and Risk Taking.

3.3.3. Factor Analysis for Experience

Table 3.4KMO and Bartlett's Test for Experience

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.617
Bartlett's Test of Sphericity	Approx. Chi-Square	758.092
	df	21
	Sig.	.000

As seen in Table 3.4KMO and Bartlett's Test for Experience, the KMO value for the variables of Experience is 0.617, which is satisfactory as being greater than 0.5 and Bartlett's Test of Sphericity is significant.

According to principal component analysis, 3 factors can be extracted explaining 70.2% of the variance.

Table 3.5 Rotated Component Matrix for Experience

Rotated Component Matrix[a]

	Component		
	1	**2**	**3**
EXP1		.628	
EXP2_REV*		.806	
EXP3	.610		
EXP4	.917		
EXP5	.895		
EXP6		.520	.631
EXP7			.868

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.

*EXP2_REV = ExperienceReversed

In Table 3.5Rotated Component Matrix for Experience, the first factor consists of the variables questions about the travel methods such as driving own car or public transportation and also if one had an accident in the past. Hence this factor can be named as “Travel Experience”.

The second group of variables investigates whether of having first-hand experience with partially automated vehicles or having knowledge about autonomous vehicles. Therefore it would be appropriate to name the second factor as “Knowledge”.

Since the last variable has a greater loading on the third factor and the item are more related, we group last two variables as together. These items are “I had an accident while driving a vehicle” and “I had an accident as a passenger”, so we can name this factor as “Accident History”.

3.4. Reliability and Validity Tests

In order to confirm the validity, there are several methods such as content validity and structural validity. (Dirsehan, 2015: Kurtuluş, 2004). Content validity is about confirming the relevance and meaningfulness of the items in the survey. It can be derived from the literature review and expert opinions (Altunışık et al., 2007). In this study, the questions of the survey are provided from the earlier studies in the technology domain and also confirmed by expert opinions.

Structural validity refers to the high correlation between the items that define the same factor and the low correlation between the items in separate factors (Altunışık et al., 2007). So as to differentiate the items by grouping them according to their relevance, factor analysis is performed in the previous chapter.

After conducting the factor rotation test, we acquired new factors subject to Individual Innovativeness by keeping all 20 variables suggested before. In order to confirm whether

these factors are convenient, a reliability test must be conducted for each factor separately. For an acceptable level of consistency between the variables, the Cronbach's alpha value must be at least 0.7 so that the construct could be reliable (Pallant, 2005). The test also calculates, what would be the new Cronbach's alpha value if an item is removed from the variables so that the variables that negatively change the average intercorrelation could be extracted to achieve better reliability.

Regarding Individual Innovativeness, all of the factors have an acceptable level of Cronbach's Alpha value as shown in Table 3.7.

For the first factor of Experience, Cronbach's Alpha increases to 0.920 from 0.758 if the first item is deleted. So we cancel the statement "I drive a vehicle with intelligent driving control systems."

Regarding the second factor of Experience, Cronbach's Alpha is 0.392, so the value remains under 0.7. Since there are only two variables, we cannot delete a single variable to achieve better value. Therefore this factor is not acceptable as reliable.

The third factor of experience also has only two variables and the Cronbach's Alpha is 0.414, which is unacceptable as being below 0.7. Hence we cancel this factor from the model.

Table 3.6 Final Version of Factors

No	Variables	Factors	Items	Cronbach's Alpha
1	Individual Innovativeness	Creative Opinion Leading	10	0.937
2		Resistance to Change	8	0.867
3		Risk Taking	2	0.884
4	Experience	Knowledge	2	0.920

It is seen in Table 3.6Final Version of Variables, in conclusion, we have 4 factors consist of 22 independent variables with strong correlation, consistent and reliable enough to proceed with further analysis.

3.5. Hypothesis Testing

3.5.1. Revised Model of the Study

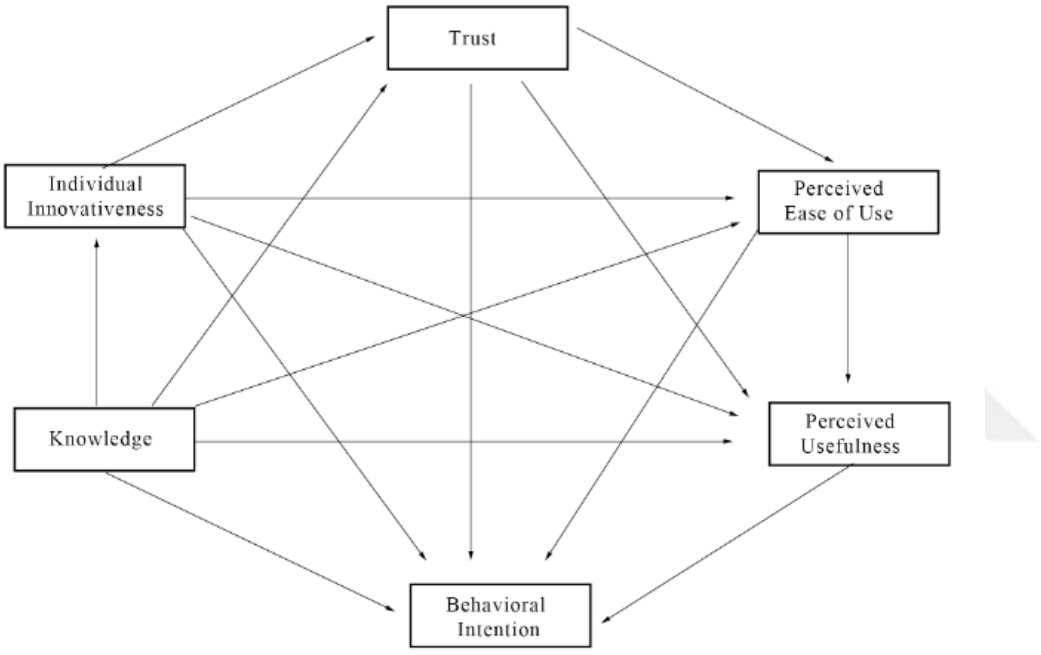


Figure 3.6. Revised Model of the Study

As illustrated in Figure 3.6, the factors suggested for experience are eliminated in the factor analysis. In the literature, knowledge is also shown in a mediation relationship with TAM and individual innovativeness. Therefore, this study will investigate the correlation between knowledge, individual innovativeness, trust, perceived usefulness, perceived ease of use and as a result, behavioral intention.

3.5.2. Normal Distribution Test

Before running the regression analysis and any further test, we calculated the mean values of the items under all variables. So now we have a new variable to unify all items under each variable according to the factor analysis and to project mean values of them.

In order to proceed regression analysis, we should first check if the dependent variable is normally distributed because when the dependent variable is not normally distributed, then the result of the regression analysis might not be acceptable.

A normally distributed variable has a symmetrical, bell-shaped curve and has equal values of mean, median, and mode. According to the population mean and population standard deviation, the depth of the curve may change, so there is an infinite number of normal distributions. Additionally, the value of skewness and kurtosis should be ideally between +1 and -1 (Hair et al., 2013; George & Mallery, 2012)

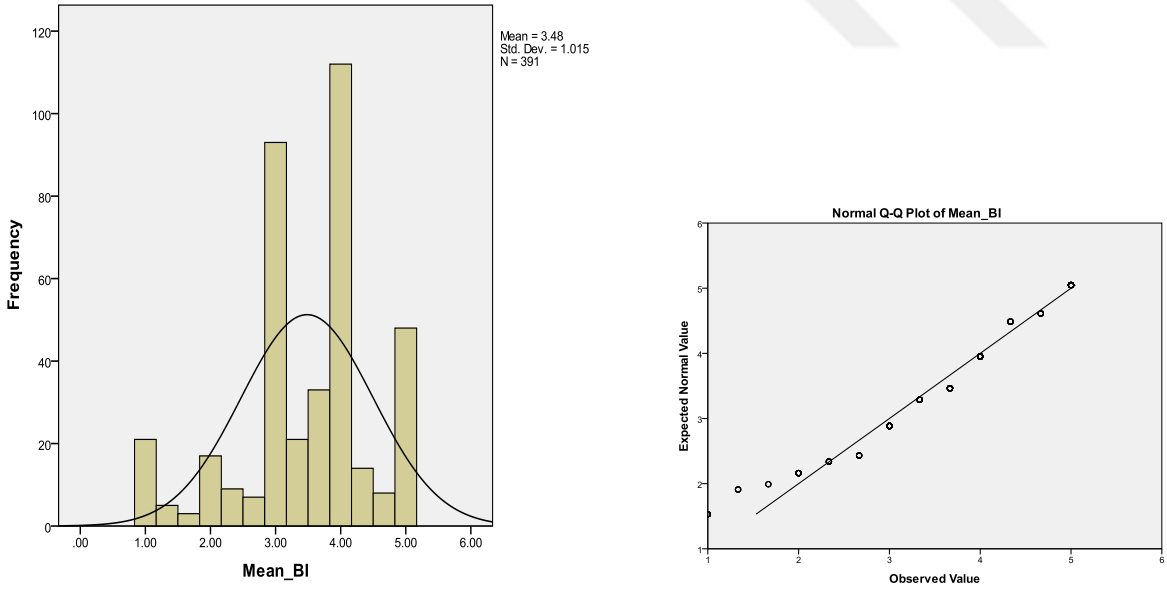


Figure 3.7 Histogram and Q-Q plot Chart of Dependent Variable "Behavioral Intention"

In this study, the dependent variable is "Behavioral Intention" as suggested in the literature review in the previous chapters. Behavioral Intention is the main factor to estimate the acceptance of autonomous vehicles. Therefore we should check whether the frequency of

scores is normally distributed for this variable. As illustrated in Figure 3.7, the curve is bell-shaped, which means the frequency of scores is greater in the middle than the ends. The Q-Q plot confirms that the observed values are near to the normality line.

Table 3.7 Normality Test Values (Behavioral Intention)

Mean Behavioral Intention	
N Valid	391
Missing	0
Mean	3.4842
Median	3.6667
Variance	1.029
Std. Deviation	1.01455
Skewness	-.664
Std. Error of Skewness	.123
Kurtosis	.246
Std. Error of Kurtosis	.246

As suggested in Table 3.7 the mean and median values are almost equal. A perfectly normal distribution would have the value 0 for skewness and kurtosis, but in the table, skewness is -.664 and kurtosis is .246. However, we will continue to analyze data further as the graphical data supports the normal distribution even though the sample size of the research may not be adequate to simulate better distribution.

3.5.3. Differences Between Genders in Terms of Autonomous Vehicle Use Intention

The survey questioned the gender, age, marital status, education, and income to investigate the influence of the demographics over the behavioral intention of using an autonomous vehicle. Therefore, independent sample t-test is conducted for the gender variable.

Based on the independent sample t-test, two genders are significantly different than each other (.003<.05). It is seen inTable 3.8 Differences Between Genders in Terms of Autonomous Vehicle Use Intention, there are 235 male respondents while the female number is 156. The mean for a male is 3.6099 and for the female is 3.2949. The average intention is higher for male respondents, which is a predictable result since the main perception is that men are more interested in vehicles and technology than women in Turkey.

Table 3.8 Differences Between Genders in Terms of Autonomous Vehicle Use Intention

Section	N	Mean	Std. Deviation	F	P
Male	235	3.6099	1.04577	2.467	0.003
Female	156	3.2949	.93744		

3.5.4. Differences Between Age Groups in Terms of Autonomous Vehicle Use Intention

One-way ANOVA test is applied for the rest of the demographic variables, as they have more than two groups. The test result for age groups is suggesting there is no significant difference as we can realize by comparing the mean values in Table 3.9 Differences Between Age Groups in Terms of Autonomous Vehicle Use Intention.

Table 3.9 Differences Between Age Groups in Terms of Autonomous Vehicle Use Intention

Section	N	Mean	Std. Deviation	F	P
18 – 25	119	3.4062	.91458	2.635	0.050
26 – 40	148	3.6599	1.02535		
41 – 60	102	3.3203	1.11488		
60 +	22	3.4848	.83398		

3.5.5. Differences Caused by Marital Status in Terms of Autonomous Vehicle Use Intention

For marital status, the test of homogeneity of variances shows that the variances are not equal, So we check the robust tests of equality of means. The significance value of Welch tests (.119 > .05) shows that there is no significant difference between groups shown in Table 3.10 Differences Caused by Marital Status in Terms of Autonomous Vehicle Use Intention.

Table 3.10 Differences Caused by Marital Status in Terms of Autonomous Vehicle Use Intention

Section	N	Mean	Std. Deviation	F	P
Single	213	3.5540	.97389	2/162	.119
Married no kids	48	3.5972	.85872		
Married with kids	130	3.3282	1.11677		

3.5.6. Differences as a Result of Education Level in Terms of Autonomous Vehicle Use Intention

The test results indicate that the education level has no significant effect on behavioral intention of using an autonomous vehicle seen in Table 3.11 Differences as a Result of Education Level in Terms of Autonomous Vehicle Use Intention. Yet, the group with Masters Degree and above education level groups have slightly greater the mean value of 3.68 which could be interpreted as higher education level increase the intention, but there is no scientific evidence supporting that assumption.

Table 3.11 Differences as a Result of Education Level in Terms of Autonomous Vehicle Use Intention

Class	N	Mean	Std. Deviation	F	P
Elementary	4	3.4167	1.13448	1.270	.276
High School	27	3.2593	1.05544		
Ass. Uni	36	3.4167	1.06122		
Bachelor	216	3.4259	1.01037		
Masters D.	90	3.6815	.94929		
Ph.D. and Above	18	3.6852	1.16300		

3.5.7. Differences Between Income Levels in Terms of Autonomous Vehicle Use Intention

Regarding income groups, the ANOVA table showed that the means are significantly different (.00<.05), thus we check the multiple comparisons table where Tukey HSD and Scheffe tests are done. Accordingly, we determine two groups are significantly different than the other groups. Two highest income group has significantly higher mean values than the other groups. When we check more carefully, we realize that the mean increase as the income increases after some level. In Table 3.12Differences Between Income Levels in Terms of Autonomous Vehicle Use Intention, it is seen that only the lowest income level does not fit this relationship. Between 18.001 - 36.000 annual income has the mean value of 3.1892, where it is 3.3869 for 36.001 - 72.000 and increases to 3.9506 for 72.001 - 150.000 and 3.9130 for 150.000 - above income level. This effect could be explained as the higher income group is already experiencing the partially automated vehicles and considers to own a fully automated vehicle as more possible in the future.

Table 3.12 Differences Between Income Levels in Terms of Autonomous Vehicle Use Intention

Section	N	Mean	Std. Deviation	F	P
0 - 18.000	128	3.4661	.99986	6.006	0.000
18.001 - 36.000	74	3.1892	1.04260		
36.001 - 72.000	112	3.3869	1.04986		
72.001 - 150.000	54	3.9506	.82010		
150.000 +	23	3.9130	.78636		

3.5.8. Testing the Model of the Study

3.5.8.1. Testing the Relationship Between Variables with Correlation Analysis

After checking the normality of the dependent variable, we can investigate the correlation of variables before proceeding to the regression analysis.

Firstly, we check the significance of the variables for the Behavioral Intention as the dependent variable. Perceived Usefulness, Perceives Ease of Use and Trust are significant at the 0.01 level since the significance value is 0.000.

Regarding the sub-factors of the suggested variable “Individual Innovativeness”, Creative Opinion Leading is significant at the 0.01 level. On the other hand, Risk Taking and Resistance to Change is not significant as their values are 0.633 and 0.244, so these variables also should be canceled.

Interestingly, Sustainability is another variable that appears to be significant with 0.000 value, although is not suggested as a factor to leads to the acceptance of new technology in the earlier studies, yet mentioned to be an important result of the progress.

Correlation matrix Table 3.15 shows the relations between all significant variables: Behavioral Intention, Perceived Ease of Use, Perceived Usefulness, Trust, Individual Innovativeness, Knowledge, and Sustainability.

Table 3.13 Correlations of Variables

Variables	**BI**	**PEOU**	**PU**	**TRU**	**II**	**KN**	**SUS**
BI	1.000						
PEOU	.649	1.000					
PU	.649	.776	1.000				
TRU	.658	.736	.741	1.000			
II	.372	.443	.379	.373	1.000		
KN	.329	.315	.362	.282	.358	1.000	
SUS	.645	.664	.654	.661	.369	.307	1.000

As shown in Table 3.13Behavioral Intention (BI), Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Trust (TRU), Individual Innovativeness (II), Knowledge (KN) and Sustainability (SUS) have a positive relationship with dependent variable Behavioral Intention at a moderate level.

Additionally, there is a strong correlation between Perceived Ease of Use, Perceived Usefulness, and Trust variables.

Even though we can estimate the regression model relations from the correlation matrix table, we cannot judge whether the hypothesized model is valid since we need the results of regression analysis to scientifically prove the relationships.

3.5.8.2. Linear Regression Between Variables

The objective of this study is to understand and analyze the factors leads to autonomous vehicle usage according to the technology acceptance model. In this regard, an extensive literature review has applied to investigate the earlier suggested factors and several interviews are conducted to propose new factors. After collecting the data from the survey questions, many tests and analysis are applied to measure the validity and reliability of each item.

Regression analysis is a test to find out how much an independent variable explains the dependent variable. However, the association between two variables should be explored before proceeding regression analysis. The correlation analysis helps to understand how strong is one variable is related to another. Yet, the variables are not considered in a relationship in terms of being dependent or independent the correlation analysis.

Although correlation analysis suggested whether an independent variable has a strong or weak relation to the dependent variable, regression analysis may result in different outputs, because variables might be stronger together than the individual.

In order to propose a scientific theory to explain dependent variable Behavioral Intention through the suggested independent variables and determine their level of significance, we need to run a regression analysis. The regression analysis is conducted by IBM SPSS Statistics v19 software. The projected equation to be defined after regression analysis is shown below:

Behavioral Intention to Use Autonomous Vehicle = a + b1*Perceived Ease of Use + b2*Perceived Usefulness +b3*Trust +b4*Individual Innovativeness + b5*Sustainability

{a = constant base amount (intercept), b = regression coefficients (slope), x = explanatory variable, y = response variable (estimate)}

Finally, we conduct a regression analysis to determine the influence of independent variables on the dependent variable: Behavioral Intention. The significance value 0.000 as a result of the test shows in Table 3.14 Regression Model Summary that the independent variables significantly explain the dependent variable and the model predicts 55.2% of the variance.

Table 3.14 Regression Model Summary

Factors	**Beta**	**T**	**Sig.**	**R**	**R2**	**Adj. R2**	**F**	**Sig.**
(Constant)		.300	.765	.743	.552	.545	78.867	.000
PEOU	.151	2.462	.014					
PU	.156	2.557	.011					
II	.043	1.079	.281					
TRU	.227	3.996	.000					
KN	.067	1.759	.049					
SUS	.256	5.154	.000					

According to the results, all the independent variables have a positive relationship with the dependent variable since their Beta values are above 0. We can predict the dependent variable based on the Beta value of the independent variables. For instance, the beta value of Trust (.227) indicates that behavioral intention of using the autonomous vehicle will increase 0.227% when trust increases 1%. However, Individual Innovativeness has a weak effect on Behavioral Intention, based on its beta value (.043) as similarly with the correlation analysis results.

Additionally, P-value of the independent variables confirms whether they have a significant effect on the dependent variable. Hereunder, P-value of Individual Innovativeness (0.281>0.05) is not significant, hence we can say that this variable is not influential over Behavioral Intention. The P-values of the other variables, Perceived Usefulness (0.004 <0.05), Perceived Ease of Use (0.016 <0.05), Trust (0.000<0.05), and Sustainability (0.000<0.05) are significant to confirm their influence on behavioral intention to use autonomous vehicles.

3.5.8.3. Multiple Mediation Analysis

The correlation analysis points out that there is collinearity between trust, perceived usefulness and perceived ease of use as shown in table 3.13. Therefore, multiple mediation analysis is applied to check the association between these factors. The effect of perceived ease of use on perceived usefulness is already suggested by earlier studies as explained in the literature review chapter. Since trust has a correlation with both perceived usefulness and perceived ease of use, the mediation effect is investigated for both factors. Figure 3.8 illustrates the suggested serial multiple mediator models

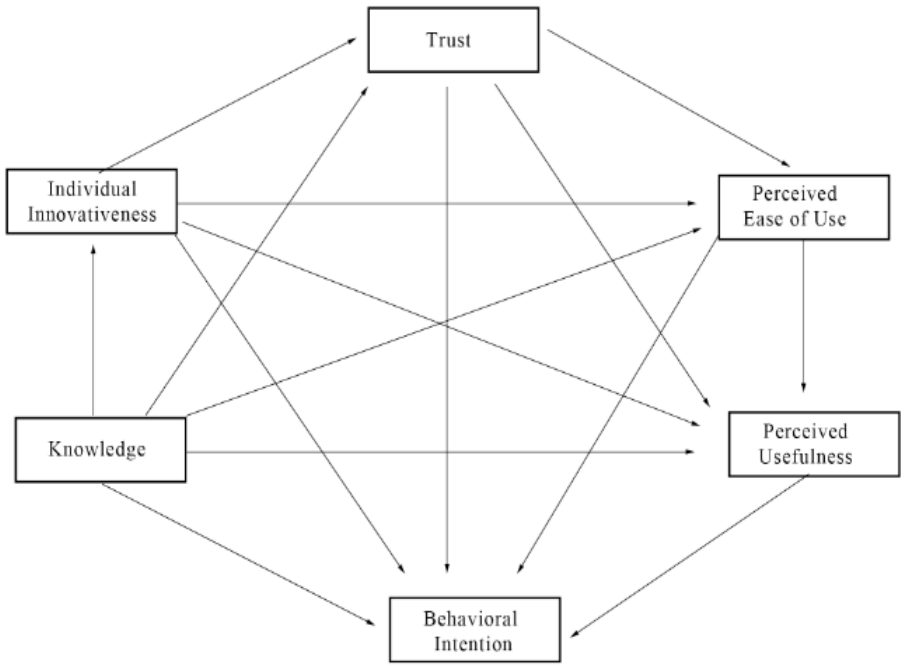


Figure 3.8 The suggested serial multiple mediator model

The mediation analysis can be performed with any statistics program, yet it requires further calculation after regression analyses. On the other hand, a PROCESS modeling tool for SPSS provides a versatile solution for moderation and mediation analyses through pre-defined model structures (Hayes, 2012). It is a plugin for SPSS application, coded by Hayes and helps researchers to run multiple moderations and mediation analysis with the detailed explanations of each test given in the reference book named "Process: Introduction to Mediation, Moderation, and Conditional Process Analysis: a Regression-based Approach" written by Hayes in 2018. Therefore, PROCESS command is preferred to analyze the calculate the multiple mediations, because it enables to estimate coefficients with relative ease and additionally provides information about the indirect effect (Hayes, 2018). The output is summarized in Table 3.15 Model Summary Information for the Presumed Mediator Effects**.**

Table 3.15 Model Summary Information for the Presumed Mediator Effects

	II		**TRU**		**PEOU**		**PU**		**BI**	
	coeff	p	coeff	p	coeff	P	coeff	p	coeff	p
Constant	3.107	.000	1.620	.000	0.585	.000	0.241	.108	0.197	.323
KN	0.226	.000	0.133	.000	0.050	.056	0.087	.000	0.069	.040
II			0.390	.000	0.203	.000	0.009	.830	0.076	.170
TRU					0.606	.000	0.357	.000	0.326	.000
PEOU							0.515	.000	0.251	.001
PU									0.225	.001
	$R^2 = 0.128$		$R^2 = 0.164$		$R^2 = 0.578$		$R^2 = 0.677$		$R^2 = 0.521$	

As can be extracted from the PROCESS output (appendix 6) or the summary table, the equation form is expressed as below:

II = 3.107 + 0.226 * KN

TRU = 1.620 + 0.133 * KN + 0.390 * II

PEOU = 0.585 + 0.203 * II + 0.606 * TRU

PU = 0.241 + 0.087 * KN + 0.357 * TRU + 0.515 * PEOU

BI = 0.197 + 0.069 * KN + 0.326 * TRU + 0.251 * PEOU + 0.225 * PU

The PROCESS command also provides information about the indirect effects by generating bootstrap confidence intervals. The output reaches 95% confidence intervals based on 5000 bootstrap samples. This presumed multiple mediator model has fifteen indirect effects as a result of regression coefficients linking Knowledge, Individual Innovativeness, Trust and Perceived Ease of Use to Behavioral Intention. Indirect effects can be interpreted as significantly positive if their bootstrap confidence intervals are entirely greater than zero. The indirect effects that are not significant in Table 3.19 are also eliminated according to their bootstrap confidence intervals. As a result, the total indirect effect is 0.211. The revised model after multiple mediation analysis as illustrated in Figure 3.9 Revised Serial Multiple Mediator Model.

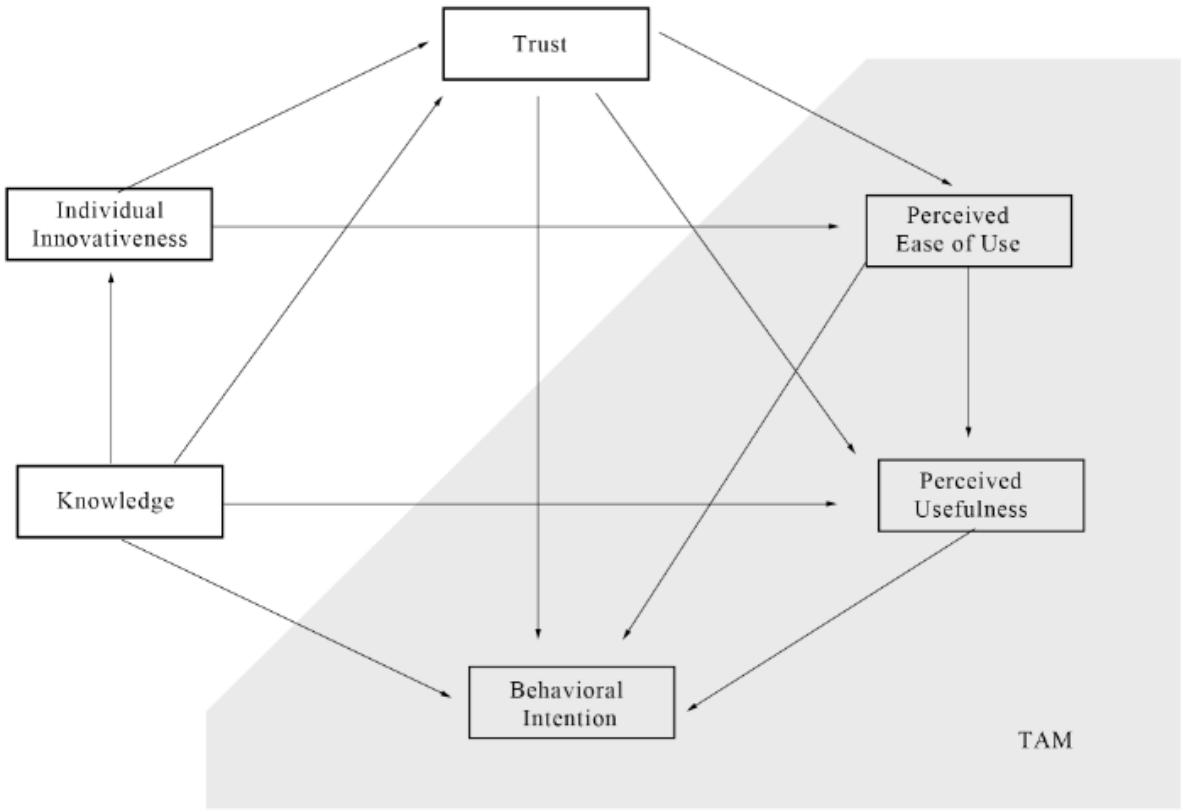


Figure 3.9 Revised Serial Multiple Mediator Model

3.5.8.4. Structural Equation Modeling

Structural Equation Modelling is a method to analyze the components of a model by calculating each item under variables and the relationships between variables through drawn paths. Uniting Factor Analysis and Regression, Structural equation modeling offers flexibility to the researcher's thanks to its suitability for causal analysis.

In order to realize structural equation modeling, LISREL and AMOS are the most preferred tools. In this research, AMOS Structure Equation Modelling is chosen to confirm the factors and the paths of the presumed model. As a result of the analysis Chi-suare=834.986, degrees of freedom=287 and p=.000, so the model is significant which means we need to reject but we still look for the model fit values. (GFI=.910>0.9, AGFI=.859>0.85, NFI=.917>0.9, TLI=.937>0.9, CFI=.944>0.9 and RMSEA=.070<0.08) Since all of the model fit values are at an acceptable level, we can accept the model fit (Zhang, 2014), as illustrated in Figure 3.11 Structural Equation Modelling Results.

Subsequently, we check the estimates to confirm if everything is significant and find out the regression weights. All of the items are significant at .01 level and their standardized regression weights are greater than 0.50 (appendix 6), so we can proceed to check to construct validity.

We need to calculate the average variance extracted to check whether it explains enough convergent validity. If the value is above 0.5, then we need to calculate construct reliability which must be at least 0.7 for an acceptable level of reliability. Finally, we check for discriminant validity. Accordingly, the average variance extracted for the factors should be greater than the square of the correlation between two factors. Since all values are at an acceptable level, thus we can confirm the model fit (appendix7).

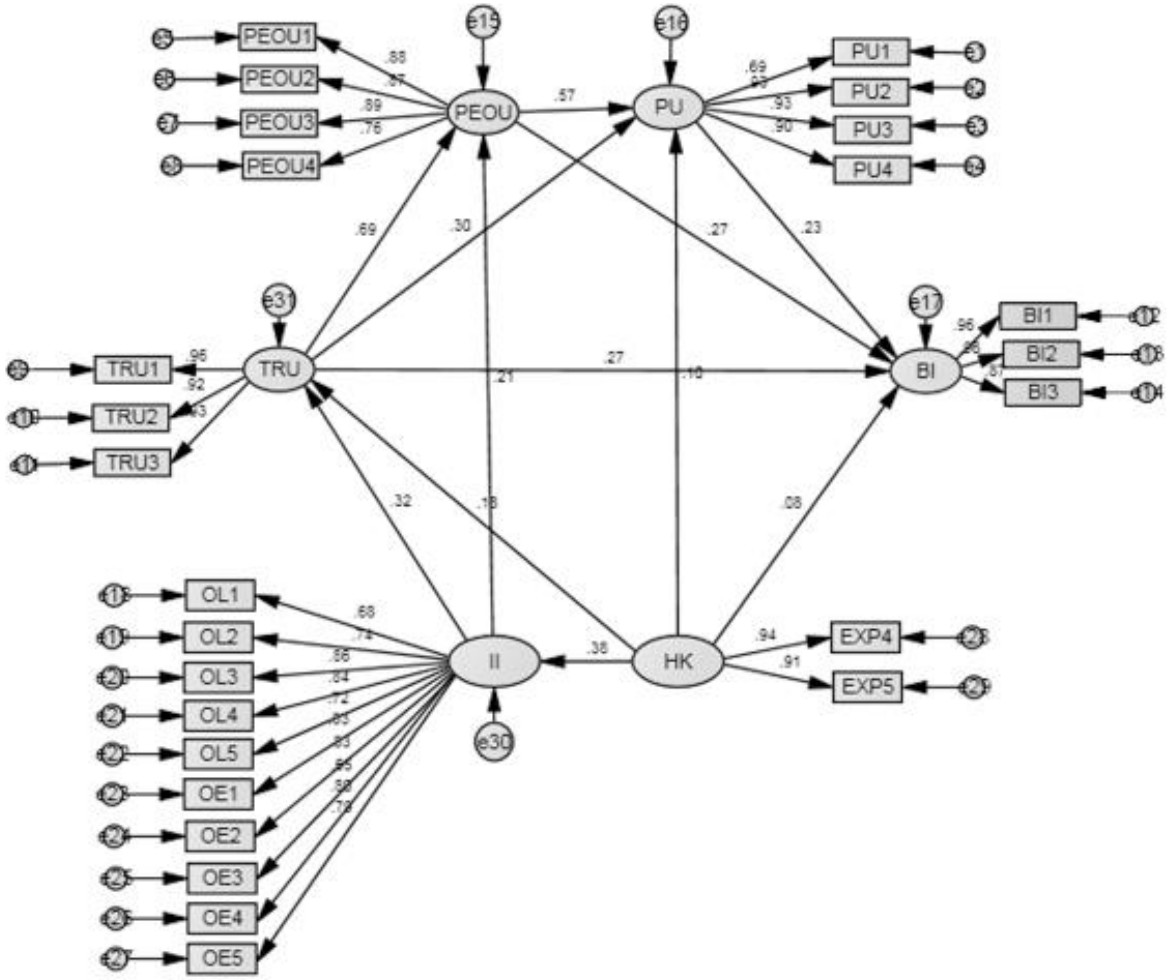


Figure 3.10 Structural Equation Modelling Results

3.5.9. Summary of Hypothesis Tests

Table 3.16 Summary of Hypothesis Tests

No	Factor	Hypothesis	Result
1	PEOU	Perceived Ease of Use leads to the Behavioral Intention to use an autonomous vehicle.	Accepted
2	PU	Perceived Usefulness leads to the Behavioral Intention to use an autonomous vehicle.	Accepted
3	PEOU	Perceived Ease of Use leads to Perceived Usefulness to use an autonomous vehicle.	Accepted
4	II	Individual Innovativeness leads to the behavioral intention to use an autonomous vehicle	Rejected
5	II	Individual Innovativeness leads to perceived ease of use in autonomous vehicle usage	Accepted
6	II	Individual Innovativeness leads to perceived usefulness in autonomous vehicle usage	Rejected
7	II	Individual Innovativeness leads to trust in an autonomous vehicle	Accepted
8	TRU	Trust leads to the behavioral intention to use an autonomous vehicle	Accepted
9	TRU	Trust leads to perceived ease of use in autonomous vehicle usage	Accepted
10	TRU	Trust leads to perceived usefulness in autonomous vehicle usage	Accepted
11	KN	Knowledge leads to the behavioral intention to use an autonomous vehicle	Accepted
12	KN	Knowledge leads to the individual innovativeness in autonomous vehicle domain	Accepted
13	KN	Knowledge leads to trust in an autonomous vehicle	Accepted
14	KN	Knowledge leads to perceived ease of use in autonomous vehicle usage	Rejected
15	KN	Knowledge leads to perceived usefulness in autonomous vehicle usage	Accepted
16	GEN	Gender leads to Behavioral Intention to use an autonomous vehicle.	Accepted
17	AGE	Age leads to Behavioral Intention to use an autonomous vehicle.	Rejected
18	EDU	Education Level leads to the Behavioral Intention to use an autonomous vehicle.	Rejected
19	MAR	Marital Status leads to the Behavioral Intention to use an autonomous vehicle.	Rejected
20	INC	Income Level leads to the Behavioral Intention to use an autonomous vehicle	Accepted

According to the results of the Summary of Hypothesis Thesis shown in Table 3.16; Perceived Ease of Use leads to the Behavioral Intention to use an autonomous vehicle, Perceived Usefulness leads to the Behavioral Intention to use an autonomous vehicle, Perceived Ease of Use leads to Perceived Usefulness touse an autonomous vehicle, Individual Innovativeness leads to perceived ease of use and trust on an autonomous vehicle, Trust leads to the behavioral intention to use, perceived ease of use and perceived usefulness in autonomous vehicle usage, Knowledge leads to the behavioral intention, individual innovativeness, trust and perceived usefulness in autonomous vehicle usage, Gender leads to Behavioral Intention to use an autonomous vehicle, Income Level leads to the Behavioral Intention to use an autonomous vehicle, but Individual Innovativeness does not lead to the behavioral intention to use an autonomous vehicle, Individual Innovativeness does not lead to perceived usefulness in autonomous vehicle usage, Knowledge does not lead to perceived ease of use in autonomous vehicle usage, Age does not lead to Behavioral Intention to use an autonomous vehicle, Education Level does not lead to the Behavioral Intention to use an autonomous vehicle, Marital Status does not lead to the Behavioral Intention to use an autonomous vehicle

IV. DISCUSSION

This research was conducted to examine the factors that lead to peoples' behavioral intention towards autonomous vehicles around. The constructs of TAM (perceived usefulness, perceived ease-of-use, and behavioral intention) were taken as the starting point of the proposed research model. TAM was extended by adding external factors to predict the constructs of original TAM; namely, satisfaction, enjoyment, subjective norm, and interactivity and control. The relationships between these constructs were analyzed using structural equation modeling. Panagiotopoulos and Dimitrakopoulos(2018) determined that the trend of automation technology being used in vehicles by the most important vehicle manufacturing industries is expected to move closer to high or fully Autonomous Vehicles (AVs) through technological advancements in sectors of robotics and artificial intelligence. Panagiotopoulos and Dimitrakopoulos (2018) also emphasised in the their study ''An empirical investigation on consumers' intentions towards autonomous driving'' that results show that the constructs of perceived usefulness, perceived ease to use, perceived trust and social influence, are all useful predictors of behavioral intentions to have or use Autonomous Vehicles (AVs,) with perceived usefulness having the strongest impact. The insights derived from this study could significantly contribute to ongoing research related to technology acceptance of AVs and are expected to allow automobile industries to improve their design and technology.

Zhang at al. (2019) explains the purpose of their study was to explore factors leading to users' acceptance of automated vehicles (AVs, Level 3). Their study hypothesized that initial trust was built upon perception factors which are perceived usefulness, perceived ease of use, perceived safety risk and perceived privacy risk) and was a key determinant of AV acceptance. The validity of their model was confirmed with a structural equation modeling analysis based on data collected from 216 survey samples. Results revealed that initial trust was the most critical factor in promoting a positive attitude towards AVs, which, together with PU, determined users' intention to use AVs. The initial trust could be enhanced by improving PU and reducing PSR associated with AVs. Theoretically, these findings suggest that initial trust offers another and probably more important pathway for other factors to impact consumers' adoption of systems with uncertainty. Practically, the findings provide guidance for designing interventions aimed at improving the public's acceptance of AVs.

A lot of social and economic losses occur after these traffic accidents. All over the world, Europe and Central Asia, North America, East Asia and the Pacific, Latin America and the Caribbean, South Asia, Middle East, and Africa everywhere have the same problem. Causes of death in 15-49 years old in 2016 traffic accident is ninth place over top thirty all over the world (Ritchie and Roser, 2018).

Individual Innovativeness

The survey starts by investigating individual innovativeness as a personality trait that could lead to the acceptance of autonomous vehicle technology. The first statement is "I am generally cautious about accepting new ideas.". The mean of 210 responses is 3.41, which is between neutral and agree. This means that new ideas should overcome personal barriers first. The second statement says "I am suspicious of new inventions and new ways of thinking". The mean value is calculated as 2.48, so the respondents do not have a skeptical attitude in general. Next statement is "I rarely trust new ideas until I can see whether the vast majority of people around me accept them.". The participants' response was between neutral and disagree. Thus, we can say that resistance to change is not strong.

Similarly, "I am reluctant about adopting new ways of doing things until I see them working for people around me." saying has a mean value of 2.26 shows that the respondents are not hesitant for change. An item is stating "I am aware that I am usually one of the last people in my group to accept something new.". The average result is 2.07 which is almost equal to disagree. So we can say that the respondents are less resistant to change in general. Another item is "I must see other people using new innovations before I will consider them.". The average value for this item is 2.44, which is between neutral and disagree. This shows that people do not depend on other behavior for developing their own opinions.

The saying "I tend to feel that the old way of living and doing things is the best way." has the mean value of 2.21 and as it is close to the disagree option, we can interpret this data as even sometimes there are some concerns about new inventions, people still expect them to change their living. Item 8 is "I often find myself skeptical of new ideas.". The mean is 2.34 as consistent with previous questions. For this reason, we can understand that the resistance to

change is somehow lower than the neutral level. We also asked if the respondents agree to "My peers often ask me for advice or information.". The average value of 3.60 shows that they tend to agree with the claim.

A similar item is "I feel that I am an influential member of my peer group.". The mean of this item is 3.55 in accordance with the previous item. So we can say that our respondents are mostly opinion leaders. Another item is saying "I enjoy taking part in the leadership responsibilities of the group I belong to." and the average result is 3.62 showing that the respondents are glad to be the pioneer of new ideas. The survey asks the statement "I consider myself to be creative and original in my thinking and behavior.". The average answer is 3.71, which is a close value to agree. According to this, we can assume that the respondents enjoy finding new and creative ways of doing things.

The statement "I am an inventive kind of person." has an average response of 3.64. As the respondents mostly describe themselves as inventive, we can assume that they will also be open to inventions. The average value of the saying "I enjoy trying new ideas." is 3.87 which is between neutral and agree but closer to agree on option. So, these replies confirm that the openness to experience is high enough to accept new technologies. The item "I seek out new ways to do things." Has the average response as 3.90, which is almost equal to the agree option. This shows us that people are not only open to new ideas but also actively try to find new and better ways of doing things.

Next item is "I frequently improvise methods for solving a problem when an answer is not apparent.". The mean is 3.58, thus we can say that the respondents create new ideas where there is no obvious solution. Considering this fact, if they are given new and useful technology, they would gladly accept it. When "I find it stimulating to be original in my thinking and behavior." phrase is asked, the average response is 3.84, which is closer to the agree on option. Another phrase is "I am receptive to new ideas.". The respondents mostly agreed with this sentence as the mean value is 3.99 hence we can expect them to easily accept new technologies as well.

Alternatively, "I am challenged by ambiguities and unsolved problems." statement is asked to the respondents. Their response was between neutral and disagree as 2.87, which is consistent with the previous result saying that the respondents would seek new methods where there is no solution for their problem. The last statement regarding the individual

innovativeness is “I am challenged by unanswered questions.”. The mean value is 2.86, so the respondents disagree in general as similar to the previous question.

To sum up, the part of the survey about the individual innovativeness shows that the respondents are open to innovations and besides enjoying to experience new ideas, they also create new solutions if necessary. As a result, we can assume that they would accept the autonomous vehicle technology as a new way of traveling.

Technology Acceptance Model

Since Technology Acceptance Model is the base of the suggested model of the research, we investigated the thoughts about two main constructs: Perceived Usefulness and Perceived Ease of Use. The first item of the Perceived Usefulness is “Using autonomous vehicle improves my performance in my job.”. The average response for this item is 3.22, which is between neutral and agree. Thus we can understand that our respondents perceive autonomous vehicles as useful.

Next item was “Using the autonomous vehicle in my job increases my productivity.” The result is close to agreeing on option with the value 3.57, which makes sense because both the autonomous vehicles would be programmed to optimize the traveling method and spare the passengers free time as there will be no need to a driver and they can spend driving time doing other things. The survey asks if the respondents agree with: “Using autonomous vehicle enhances my effectiveness in my job.” The result shows that the respondents mostly agree as the mean value is 3.58. We can interpret this result as the effectiveness would be increased since the time and the energy will be saved when the driving task will be eliminated.

“I find the autonomous vehicle to be useful in my job.” item has the average response as 3.73, showing that the autonomous vehicle technology is perceived as useful by respondents. The first item regarding the Perceived Ease of Use is “I find the autonomous vehicle would be easy to use.” The average response 3.70 shows us that the respondents mostly agree with the statement. This is a quite important result as advanced technologies are usually expected to be complicated, but in this case, the respondents have a positive attitude about the ease of use.

A similar item “I would find it easy to get an autonomous vehicle to do what I want to do.” has the mean value 3.54 confirming the previous result that the respondents mostly agree with the ease of use. Another statement is “My interaction with the autonomous vehicle would be clear and understandable.”. The average response was again between neural and agree as 3.55 showing that it is not only considered as easy to use but also clear and understandable.

The last statement of Perceived Ease of Use is “Interacting with the autonomous vehicle would not require a lot of my mental effort.”. The mean is equal to 3.49 for this item, so we can say that the respondents believe the autonomous vehicles will not be complicated to use, maybe do not even require a license or training to use.

Trust

Another essential factor in understanding the acceptance of autonomous vehicle technology is Trust. Trust is investigated in several different dimensions, based on the literature review such as Technical Competence, System Transparency and Situation Management.

The first item of trust is “Autonomous vehicle is dependable.”. The average response is between neutral and agrees as 3.43, so the technology created a positive image in respondents minds much before it is available for public use. A similar item “Autonomous vehicle is reliable.” has the mean value as 3.46, showing the respondents have a positive approach towards this technology and we can assume that there is a good potential of the market already.

The last item to measure trust level is “Overall, I can trust autonomous vehicle.” The average 3.45 confirms previous results that the respondents mostly trust this technology already, so after the tech-companies finishes all the tests and release the final product, the trust level could expect to be even greater. System Transparency is measured as “I believe that autonomous vehicle acts consistently and its behavior can be forecast” and has an average response as 3.47. This result is similar to the earlier questions for trust. So we can interpret this data as people trust a system when they think it has consistent and predictable behavior.

Sustainability

In order to measure the future predictions of the respondents, some potential environmental effects of autonomous vehicle technology are also included in the survey.

We asked if the respondents agree with the statement “I believe that autonomous vehicle will increase unemployment” and the average reply is neutral. It could be expected that the truck drivers, taxi drivers, etc. will not be needed in the future, yet some other professions could arise at the same time. Since it is a tricky subject that is hard to foresee, the neutral answers are not surprising.

A generic statement about sustainability is “I believe that autonomous vehicle will decrease environmental pollution” and has the mean value as 3.59, showing many people think that it is beneficial for a healthier environment. It is necessary for people to understand its advantage for sustainability so that they would prefer autonomous vehicle for a better future.

The respondents mostly agreed to say “I believe that autonomous vehicle will decrease fuel consumption” as 3.62 mean value. As discussed in previous chapters, the autonomous vehicle will expectedly increase the total vehicle mile traveled, but at the same time will use the fuel more efficiently.

Similar to the trust questions we also asked the phrase “I believe that autonomous vehicle will decrease traffic accidents” and has the average response as 3.09, means that most of our respondents believe the autonomous vehicle will be an effective and safe travel method.

V. CONCLUSION

The objective of the study was to investigate how people would react to autonomous vehicle technology and which factors are effective in their attitudes and acceptance.

In literature, technology acceptance model is widely applied and several additional constructs are suggested to measure the factors influencing the acceptance of autonomous vehicles. Therefore this study investigated technology acceptance as a base model to explain the attitudes and intentions towards autonomous vehicles. In accordance with earlier studies, both perceived usefulness and perceived ease of use are resulted as significant factors to explain the acceptance.

Besides technology acceptance model, individual innovativeness scale is preferred as a complementary factor to measure the tendency to accept the technology by many researchers, since it is describing a person's tendency to accept innovations as a personality trait. However, the results of the analysis showed that individual innovativeness is not a determinant scale in autonomous vehicle domain.

Additionally, Trust is a major determinant as suggested in earlier studies, yet its path varies in each model. In the same vein with the literature, trust is determined mostly by technical features and not influenced by past experiences or the knowledge. This research also confirms the effect of trust on the acceptance of autonomous technology and proposes new paths by adding moderation effect with perceived usefulness and perceived ease of use. This result shows that trusting a technology enhances the perception of other qualities, thus building a trustworthy image is vital for autonomous technology.

On the other hand, as an interesting result of the research, sustainability appears to be significantly important to explain the acceptance of autonomous vehicles. The sustainability aspect of this technology is analyzed and discussed in many research since environment-friendly Technologies become more and more important because of global warming and the countries follow policies to support sustainable Technologies. Even though sustainability is a common concern to all people, realizing its direct effect on technology acceptance would be a contribution to further studies.

The survey asked the statement " I intend to use the autonomous vehicle in the future" and the mean value of the responses is 3.50, which is between neutral and agree. Similarly, "I

expect that I would use the autonomous vehicle in the future" statement has an average response as 3.52, showing that the respondents have a tendency to accept the technology in the future. Finally, the phrase "I plan to use the autonomous vehicle in the future" has a mean response as 3.43 between neutral and agree again, which shows a positive approach towards autonomous vehicles, although it is a more decisive phrase. Therefore, this study suggests that people react positively to autonomous vehicle technology.

5.1. Academic Implications

There are three primary branches in which AVs are being got involved around the world: First; the implementation of autonomous forms of public transport for example trains and buses, secondly; ride-share companies are developing autonomous fleets, and thirdly; individuals are purchasing personal vehicles with autonomous features for example lane keeping systems, adaptive cruise control, parking assistance, automatic braking while skidding, and blind spot and collision warning systems (Eby, Molnar, Zhang, St. Louis, Kostyniuk and Stanciu, 2016). Especially in Turkey, even though the technological development of autonomous vehicles is widely investigated in engineering departments, its social science dimension is yet to be studied. The acceptance of autonomous vehicle technology is studied by many researchers and this study aims to contribute to the understanding of the behavioral intention by adding Knowledge, Individual Innovativeness and Trust. Additionally, by proposing sustainability as a new variable to determine the behavioral intention, new directions for further studies are suggested.

5.2. Managerial Implications

The production of autonomous vehicles (AVs) constitutes another major negative affect technological change that is likely to have enormous implications for many workers around the world. It is guessed that globally there will be wide-scale works among drivers in the trucking, taxi, ride-share, courier, and food-delivery industries and workers in other related industries, such as warehousing and manufacturing, are also likely to be greatly affected (Hanna, 2017; Snyder, 2016).

In the US, the Department of Commerce estimates that nearly %10 of workers are currently in occupations that will be affected by the introduction of AVs (Beede, Powers, and Ingram, 2017).

Autonomous vehicles will cause a major change in the markets of vehicle selling, transportation, and logistics. Therefore it is crucial to understand consumer acceptance so that the companies in these markets should develop their penetration strategies accordingly and the technology companies would shape their technology development strategies accordingly. In the era, where the world changes in a technology-driven way, it is much more important than ever to understand an individual's attitude and behavior toward technology.

5.3. Research Limitation

The results of our survey need to be interpreted in consideration of several limitations. One limitation is that subjective measure of trust and acceptance might not represent objective behaviors (Perkins et al., 2010). Behavioral indicators as engagement in secondary-tasks and physiological indicators heartrate (Waytzetal.,2014)can be used in future studies to scale trust level. Another limitation is that the majority of the respondents did not have actual experience of AVs and trust discussed in the survey was the initial trust built upon respondents' knowledge social media, internet, and television. The level of trust and its history would change in the future, with users' more closeness with the system (Koustanaï et al., 2012) and a new experiences of how the system works (Balfeetal.,2018).

The limitation of this study is, the survey participants are 391 people. They are from 14 different cities, mainly from Istanbul and the rest of the cities in the Marmara region. The total sample size of 391 people, mostly consists of male respondents as similar to most of the vehicle technology enthusiasts and the driver population. The majority of the sample group is male although the convenience sampling technique is preferred; there were no equal respondents for genders because the level of interest in the subject of the research was lower for women. 60,1% of the sample is male and 39,9% is female. For both genders, the age group of 26 to 40 is the majority which equals to 37,9% in total more than the third of the whole sample group. The second largest age group is 18 to 25 which is 30,4% of the total, followed by the age group of 41 to 60 as 26,1% of the respondents. Since the respondent

group is relatively at younger ages, they may not represent the potential consumer group at the moment yet will become in the future.

5.4.Recommendations

This study is aiming to form a basis for future studies about autonomous vehicles. Everyday technology and artificial intelligence are improving. This phenomenon is irresistible. The level of autonomous vehicles will astonish people. In the very very close future, the vehicle markets should be ready for competition. Therefore it is vital to understand consumer acceptance and the factors that lead to acceptance. This study proposes additional variables to determine behavioral intention such as trust, individual innovativeness, and knowledge. Additionally suggests sustainability as a new variable. Further studies could investigate these factors in a greater scale of participants with a wider reach of the region in the future.

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Appendix 1 – Questionnaire in Turkish

Cinsiyet:

Yaş:

Medeni Durum:

Eğitim Seviyesi:

Gelir seviyesi (aylık):

Yaşadığı Bölge (lütfen belirtiniz):

( ) Kadın	( ) Erkek			
( ) 18-	( ) 18-25	( ) 26-40	( ) 41-60	( ) 60+
( ) Bekar	( ) Evli	( ) Evli, Çocuklu		
			( ) Yüksek Lisans	
( ) İlköğretim	( ) Lise	( ) Üniversite		( ) Doktora
( ) 0-1500	( ) 1501-3000	( ) 3001-6000	( ) 6000-10000	( ) 10000+

1	Yeni fikirleri kabul ederken genellikle temkinli davranırım.
2	Yeni fikir ve icatlara süphe ile yaklaşırım.
3	Çevremdeki insanların büyük çoğunluğu kabul edene kadar yeni fikirlere nadiren güvenirim.
4	Çevremde genellikle yeni şeyleri en son kabul eden insanlardan biri olduğumun farkındayım.
5	Çevremdeki insanlarda başarılı olduğunu görene kadar bir işi yapmanın yeni yöntemlerini kabul etmeye tereddütlü yaklaşırım.
6	İşleri eski yöntemlerle yapmanın en iyi yol olduğunu düşünmeye eğilimliyim.
7	Yeni icatları kullanmayı düşünmem için önce diğer insanların kullandığını görmem gerekir.
8	Yeni fikirlere sıklıkla şüpheci yaklaşırım.
9	Çevremdeki insanlar sık sık benden bilgi ya da tavsiye isterler.
10	Çevremde etkili bir insan olduğumu düşünüyorum.
11	Kendimi düşünce ve davranış olarak yaratıcı ve özgün biri olarak görüyorum.
12	Yaratıcı bir insanım.
13	Çevremde liderlik sorumluluklarını üstlenmekten keyif alırım.

14 Yeni fikirler denemekten zevk alırım.
15 İşleri yapmanın yeni yöntemlerini araştırırım.
16 Çözümü belli olmayan problemlerle karşılaştığımda çözüm için sıklıkla doğaçlama yaparım.
17 Düşünce ve davranışlarımda özgün olmayı ilham verici bulurum.
18 Yeni fikirlere açık biriyim.
19 Çözümsüz problemler ve belirsizlikler karşısında zorlanırım.
20 Cevapsız sorular karşısında zorlanırım.
21 Aktif olarak araç kullanıyorum.
22 Ulaşımda toplu taşıma kullanıyorum.
23 Kazasız sürüş temelde şans meselesidir.
24 Kazalar genellikle sürüş esnasında gerçekleşen beklenmedik olaylardan dolayı gerçekleşir.
25 Karanlık, yağmur, bol virajlı dar yollar gibi zorlu sürüş koşullarında kazaları önlemek zordur.
26 Aracımda akıllı sürüş kontrol sistemleri mevcut.
27 Otonom araçlarla ilgili bilgi sahibiyim.
28 Otonom araçlarla ilgili dünyada yapılan sürüş deneyleri ile ilgili bilgi sahibiyim.

Otonom araçlar içerisinde bulundurdukları otomatik kontrol sistemleri sayesinde bir sürücüye ihtiyaç duymadan yolu, trafik akışını ve çevresini algılayarak sürücünün müdahalesi olmadan seyir halinde gidebilen taşıtlardır. Otonom araçlar radar, lidar, GPS, odometri, bilgisayar görüşü gibi teknolojiler ve teknikler kullanarak çevresindeki nesneleri algılayabilmektedir.

29 Otonom araç kullanmak sürüş performansını geliştirir.
30 Otonom araç kullanmak ulaşımda verimliliği arttırır.
31 Otonom araç kullanmak daha etkin bir ulaşım sağlar.
32 Otonom araçları ulaşım için faydalı olacağına inanıyorum.
33 Otonom araçların kullanımının kolay olacağını düşünüyorum.
34 Otonom araçlara istediğim komutları vermenin kolay olacağına inanıyorum.
35 Otonom araçlarla etkileşimin açık ve anlaşılır olacağına inanıyorum.
36 Otonom araçlarla etkiletişim çok fazla zihinsel çaba gerektirmeyeceğine inanıyorum.
37 Otonom araçları güvenilir buluyorum.

38 Otonom araçları emniyetli buluyorum.
39 Genel olarak otonom araçlara güvenebilirim.
40 Otonom araçların tutarlı ve öngörülebilir davranışlar sergileyeceğine inanıyorum.
41 Otonom araçların çalışma mantığını anlayabileceğime inanıyorum.
42 Otonom araçların belirli bir şekilde davranacağı öngörebileceğime inanıyorum.
43 Otonom araçların hatasız çalışacağına inanıyorum.
44 Otonom araçlara güvenebileceğime inanıyorum.
45 Otonom araçların çeşitli şartlar altında tutarlı performans göstereceğine inanıyorum.
46 Otonom araçların ulaşımda alternatif çözümler sağlayacağına inanıyorum.
47 Otonom araçların davranışlarını kontrol edebileceğime inanıyorum.
48 Otonom araçların ulaşımda yeterli, etkili ve hassas yardım sağlayacağına inanıyorum.
49 Gelecekte otonom araç kullanmayı düşünüyorum.
50 Gelecekte otonom araç kullanacağıma inanıyorum.
51 Gelecekte otonom araç kullanmayı planlıyorum.
52 Otonom araçların gelecekte işşizliği arttıracağına inanıyorum.
53 Otonom araçların çevre kirliliğini azaltacağına inanıyorum.
54 Otonom araçların yakıt tüketimini azaltacağına inanıyorum.
55 Otonom araçların trafik kazalarını azaltacağına inanıyorum.
56 Otonom araçların kaza durumunda daha doğru davranacağına inanıyorum.
57 Otonom araçlara tehlikeli durumlarda hayatımı emanet edebilirim.
58 Otonom araçların kazada kayıp yaşanmasının önüne geçilemeyeceği durumlarda daha doğru karar alacağına inanıyorum.
59 Araç kullanırken kaza yaptım. (kaza büyüklüğüne göre 0-4 arası puan veriniz)
60 Yolcu olarak kaza deneyimim var. (kaza büyüklüğüne göre 0-4 arası puan veriniz)

Appendix 2 – Questionnaire in English

Model	Constructs	Item No	Statement	Source
Individual Innovativeness	Resistance to Change	RC1	I am generally cautious about accepting new ideas.	Hurt, H. T., Joseph, K., & Cook, C. D. (1977). Scales for the measurement of innovativeness. Human Communication Research, 4, 58-65.
		RC2	I am suspicious of new inventions and new ways of thinking	
		RC3	I rarely trust new ideas until I can see whether the vast majority of people around me accept them.	
		RC4	I am aware that I am usually one of the last people in my group to accept something new.	
		RC5	I am reluctant about adopting new ways of doing things until I see them working for people around me.	
		RC6	I tend to feel that the old way of living and doing things is the best way.	
		RC7	I must see other people using new innovations before I will consider them.	
		RC8	I often find myself skeptical of new ideas.	
	Opinion Leading	OL1	My peers often ask me for advice or information.	
		OL2	I feel that I am an influential member of my peer group.	
		OL3	I consider myself to be creative and original in my thinking and behavior.	
		OL4	I am an inventive kind of person.	
		OL5	I enjoy taking part in the leadership responsibilities of the group I belong to.	
	Openness to Experience	OE1	I enjoy trying new ideas.	
		OE2	I seek out new ways to do things.	
		OE3	I frequently improvise methods for solving a problem when an answer is not apparent.	
		OE4	I find it stimulating to be original in my thinking and behavior	
		OE5	I am receptive to new ideas.	
	Risk Taking	RT1	I am challenged by ambiguities and unsolved problems	
		RT2	I am challenged by unanswered questions	

Technology Acceptance Model	Behavioral Intention	BI1	I intend to use an autonomous vehicle in the future.	Venkatesh & Bala, 2008, Technology Acceptance Model 3 and a Research Agenda on Interventions
		BI2	I expect that I would use an autonomous vehicle in the future.	
		BI3	I plan to use an autonomous vehicle in the future.	
	Perceived Usefulness	PU1	Using autonomous vehicle improves my performance in my job.	
		PU2	Using an autonomous vehicle in my job increases my productivity.	
		PU3	Using autonomous vehicle enhances my effectiveness in my job.	
		PU4	I find the autonomous vehicle to be useful in my job.	
	Perceived Ease of Use	PEOU1	I find the autonomous vehicle would be easy to use.	
		PEOU2	I would find it easy to get an autonomous vehicle to do what I want to do.	
		PEOU3	My interaction with the autonomous vehicle would be clear and understandable.	
		PEOU4	Interacting with an autonomous vehicle would not require a lot of my mental effort.	
	Trust	TRU1	Autonomous vehicle is dependable.	Jong Kyu Choi & Yong Gu Ji, 2015, Investigating the Importance of Trust on Adopting an Autonomous Vehicle
		TRU2	The autonomous vehicle is reliable.	
		TRU3	Overall, I can trust an autonomous vehicle.	
	Experience	EXP1	I drive a vehicle regularly	Developed by the Researcher
		EXP2	I use public transportation	
		EXP3	I drive a vehicle with intelligent driving assistance systems	
		EXP4	I have knowledge about autonomous vehicles	
		EXP5	I have knowledge about the experiments with autonomous vehicles	
		EXP6	I had an accident while driving a vehicle	
		EXP7	I had an accident as a passenger	
	Sustainability	SUS1	I believe that autonomous vehicles will decrease traffic incidents	Developed by the Researcher
		SUS2	I believe that autonomous vehicles will decrease environmental pollution	
		SUS3	I believe that autonomous vehicles will support fuel efficiency	

Appendix 3 – *Results of Factor Analysis for Individual Innovativeness*

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.894
Bartlett's Test of Sphericity	Approx. Chi-Square	4888.570
	df	190
	Sig.	.000

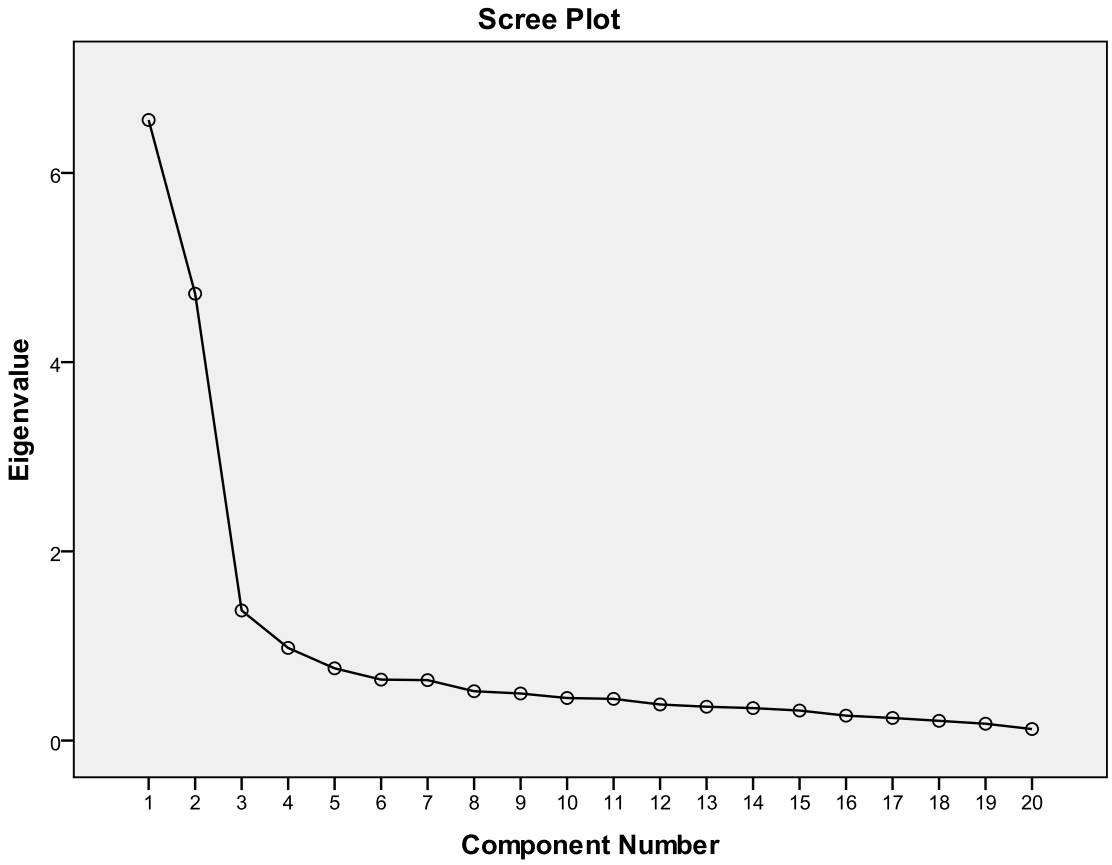
Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.559	32.797	32.797	6.524	32.620	32.620
2	4.724	23.618	56.416	4.356	21.778	54.397
3	1.375	6.875	63.291	1.779	8.893	63.291
4	.979	4.895	68.186			
5	.763	3.817	72.003			
6	.644	3.221	75.224			
7	.639	3.193	78.417			
8	.521	2.606	81.023			
9	.497	2.486	83.509			
10	.450	2.248	85.757			
11	.440	2.202	87.960			
12	.381	1.906	89.866			
13	.357	1.787	91.653			
14	.343	1.714	93.367			
15	.317	1.586	94.953			
16	.263	1.316	96.269			
17	.239	1.193	97.462			
18	.208	1.042	98.504			
19	.178	.889	99.393			
20	.121	.607	100.000			

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.559	32.797	32.797	6.524	32.620	32.620
2	4.724	23.618	56.416	4.356	21.778	54.397
3	1.375	6.875	63.291	1.779	8.893	63.291
4	.979	4.895	68.186			
5	.763	3.817	72.003			
6	.644	3.221	75.224			
7	.639	3.193	78.417			
8	.521	2.606	81.023			
9	.497	2.486	83.509			
10	.450	2.248	85.757			
11	.440	2.202	87.960			
12	.381	1.906	89.866			
13	.357	1.787	91.653			
14	.343	1.714	93.367			
15	.317	1.586	94.953			
16	.263	1.316	96.269			
17	.239	1.193	97.462			
18	.208	1.042	98.504			
19	.178	.889	99.393			
20	.121	.607	100.000			

Extraction Method: Principal Component Analysis.



Rotated Component Matrix[a]

	Component		
	1	2	3
OL3	.872		
OL4	.844		
OE2	.841		
OE1	.833		
OE4	.819		
OE5	.807		
OL2	.785		
OL5	.756		
OL1	.729		
OE3	.698		
RC4		.795	
RC5		.762	

RC8		.753	
RC3		.746	
RC7		.695	
RC2		.670	
RC6		.666	
RC1		.587	
RT2			.877
RT1			.864

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Reliability Statistics

Cronbach's Alpha	N of Items
.867	8

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
RC1	16.14	28.547	.513	.863
RC2	17.06	28.214	.586	.854
RC3	17.22	27.449	.666	.846
RC4	17.47	27.065	.672	.845
RC5	17.28	27.296	.678	.844
RC6	17.34	28.440	.571	.856
RC7	17.11	27.209	.624	.850
RC8	17.20	27.732	.644	.848

Reliability Statistics

Cronbach's Alpha	N of Items
.937	10

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
OL1	33.74	47.810	.666	.934
OL2	33.75	46.651	.728	.931
OL3	33.64	45.333	.829	.926
OL4	33.72	45.465	.795	.928
OL5	33.73	45.884	.694	.933
OE1	33.49	45.886	.795	.928
OE2	33.49	45.835	.798	.928
OE3	33.78	47.409	.636	.936
OE4	33.51	45.912	.771	.929
OE5	33.36	45.724	.760	.930

Appendix 4 – *Results of Factor Analysis forExperience*

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.617
Bartlett's Test of Sphericity	Approx. Chi-Square	758.092
	df	21
	Sig.	.000

Rotated Component Matrix[a]

	Component		
	1	**2**	**3**
EXP1		.628	
EXP2_REV*		.806	
EXP3	.610		
EXP4	.917		
EXP5	.895		
EXP6		.520	.631
EXP7			.868

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.

*EXP2_REV = ExperienceReversed

Appendix 5 – *Results of Correlation Analysis*

Correlations

		Mean_KN	Mean_II	Mean_TRU	Mean_PEOU	Mean_PU	Mean_BI	Mean_SUS
Mean_KN	Pearson Correlation	1	.358**	.282**	.315**	.362**	.329**	.307**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	391	391	391	391	391	391	391
Mean_II	Pearson Correlation	.358**	1	.373**	.443**	.379**	.372**	.369**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
	N	391	391	391	391	391	391	391
Mean_TRU	Pearson Correlation	.282**	.373**	1	.736**	.741**	.658**	.661**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	391	391	391	391	391	391	391
Mean_PEOU	Pearson Correlation	.315**	.443**	.736**	1	.776**	.649**	.664**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	391	391	391	391	391	391	391
Mean_PU	Pearson Correlation	.362**	.379**	.741**	.776**	1	.649**	.654**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	391	391	391	391	391	391	391
Mean_BI	Pearson Correlation	.329**	.372**	.658**	.649**	.649**	1	.645**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	391	391	391	391	391	391	391
Mean_SUS	Pearson Correlation	.307**	.369**	.661**	.664**	.654**	.645**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	391	391	391	391	391	391	391

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

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.743[a]	.552	.545	.68433

a. Predictors: (Constant), Mean_SUS, Mean_KN, Mean_II, Mean_TRU, Mean_PU, Mean_PEOU

b. Dependent Variable: Mean_BI

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	221.602	6	36.934	78.867	.000[a]
	Residual	179.829	384	.468		
	Total	401.431	390			

a. Predictors: (Constant), Mean_SUS, Mean_KN, Mean_II, Mean_TRU, Mean_PU, Mean_PEOU

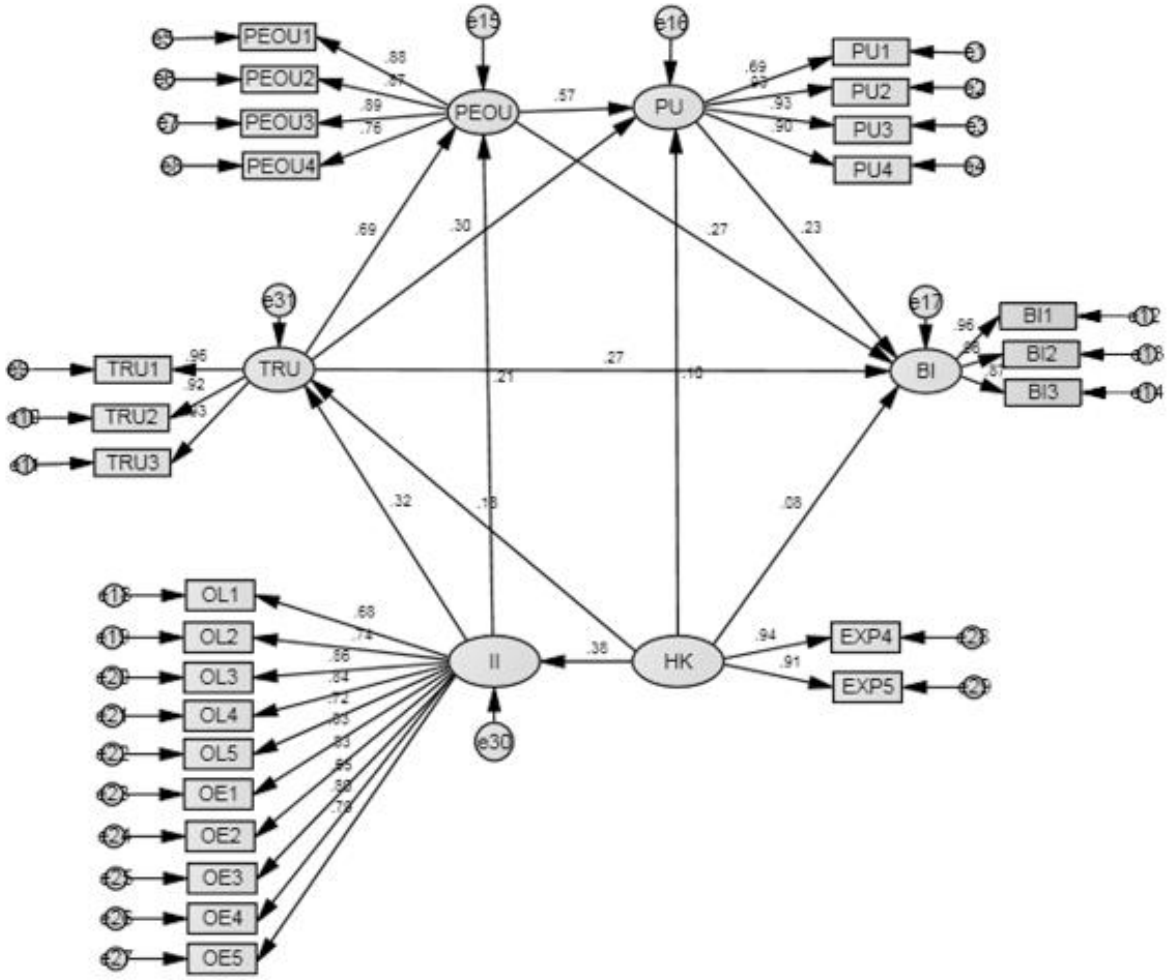
b. Dependent Variable: Mean_BI

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.058	.194		.300	.765
	Mean_KN	.057	.032	.067	1.759	.079
	Mean_II	.058	.053	.043	1.079	.281
	Mean_TRU	.246	.062	.227	3.996	.000
	Mean_PEOU	.175	.071	.151	2.462	.014
	Mean_PU	.169	.066	.156	2.557	.011
	Mean_SUS	.272	.053	.256	5.154	.000

a. Dependent Variable: Mean_BI

Appendix 6 – *Results of Structure Equation Modelling*



Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	351
Number of distinct parameters to be estimated:	64
Degrees of freedom (351 - 64):	287

Result (Default model)

Minimum was achieved
Chi-square = 834.986
Degrees of freedom = 287
Probability level = .000

Model Fit Summary

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.039	.910	.859	.703
Saturated model	.000	1.000		
Independence model	.450	.154	.087	.143

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.917	.906	.944	.937	.944
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.070	.064	.076	.000
Independence model	.278	.273	.282	.000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
II	<---	HK	.190	.028	6.688	***	par_25
TRU	<---	II	.502	.089	5.622	***	par_27
TRU	<---	HK	.141	.043	3.263	.001	par_28
PEOU	<---	TRU	.576	.041	14.113	***	par_13
PEOU	<---	II	.272	.055	4.970	***	par_30
PU	<---	PEOU	.568	.065	8.716	***	par_12
PU	<---	TRU	.251	.045	5.572	***	par_16
PU	<---	HK	.068	.022	3.148	.002	par_29
BI	<---	TRU	.289	.071	4.073	***	par_9
BI	<---	PEOU	.344	.108	3.202	.001	par_14
BI	<---	PU	.303	.109	2.794	.005	par_15

			Estimate	S.E.	C.R.	P	Label
BI	<---	HK	.072	.034	2.113	.035	par_26
PU4	<---	PU	1.122	.067	16.663	***	par_1
PEOU1	<---	PEOU	1.089	.058	18.744	***	par_2
PEOU2	<---	PEOU	1.082	.058	18.562	***	par_3
PEOU3	<---	PEOU	1.096	.057	19.112	***	par_4
PEOU4	<---	PEOU	1.000				
TRU1	<---	TRU	1.000				
TRU2	<---	TRU	.954	.026	36.520	***	par_5
TRU3	<---	TRU	.965	.025	38.845	***	par_6
BI1	<---	BI	1.000				
BI2	<---	BI	1.003	.023	44.407	***	par_7
BI3	<---	BI	.921	.030	30.662	***	par_8
PU1	<---	PU	1.000				
PU2	<---	PU	1.252	.073	17.200	***	par_10
PU3	<---	PU	1.216	.071	17.200	***	par_11
OL1	<---	II	1.000				
OL2	<---	II	1.154	.085	13.607	***	par_17
OL3	<---	II	1.361	.088	15.527	***	par_18
OL4	<---	II	1.359	.089	15.200	***	par_19
OL5	<---	II	1.243	.095	13.122	***	par_20
OE1	<---	II	1.278	.086	14.909	***	par_21
OE2	<---	II	1.281	.086	14.912	***	par_22
OE3	<---	II	1.045	.087	12.061	***	par_23
EXP4	<---	HK	1.000				
EXP5	<---	HK	.932	.062	14.972	***	par_24
OE5	<---	II	1.298	.090	14.400	***	par_31
OE4	<---	II	1.263	.087	14.437	***	par_32

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
II	<---	HK	.380
TRU	<---	II	.316
TRU	<---	HK	.177
PEOU	<---	TRU	.694
PEOU	<---	II	.206
PU	<---	PEOU	.570
PU	<---	TRU	.304
PU	<---	HK	.104
BI	<---	TRU	.269
BI	<---	PEOU	.266

			Estimate
BI	<---	PU	.233
BI	<---	HK	.085
PU4	<---	PU	.896
PEOU1	<---	PEOU	.880
PEOU2	<---	PEOU	.873
PEOU3	<---	PEOU	.895
PEOU4	<---	PEOU	.762
TRU1	<---	TRU	.964
TRU2	<---	TRU	.918
TRU3	<---	TRU	.932
BI1	<---	BI	.961
BI2	<---	BI	.962
BI3	<---	BI	.875
PU1	<---	PU	.694
PU2	<---	PU	.928
PU3	<---	PU	.928
OL1	<---	II	.678
OL2	<---	II	.745
OL3	<---	II	.864
OL4	<---	II	.843
OL5	<---	II	.716
OE1	<---	II	.825
OE2	<---	II	.825
OE3	<---	II	.653
EXP4	<---	HK	.938
EXP5	<---	HK	.910
OE5	<---	II	.793
OE4	<---	II	.796

Standardized Regression Weights: (Group number 1 - Default model)

Standardized Regression Weights				total lambda	(total lambda)^2	error (1 - lambda^2)	total error	construct reliability	total lambda^2	variance extracted	easy methdod
BI3	<--- BI	0.88	0.766	2.798	7.829	0.234	0.385	0.95	2.615	0.87	0.65
BI2	<--- BI	0.96	0.925			0.075					
BI1	<--- BI	0.96	0.924			0.076					
PU4	<--- PU	0.90	0.803	3.446	11.875	0.197	0.993	0.92	3.007	0.75	0.75
PU3	<--- PU	0.93	0.861			0.139					
PU2	<--- PU	0.93	0.861			0.139					
PU1	<--- PU	0.69	0.482			0.518					
PEOU4	<--- PEOU	0.76	0.581	3.410	11.628	0.419	1.082	0.91	2.918	0.73	0.73
PEOU3	<--- PEOU	0.90	0.801			0.199					
PEOU2	<--- PEOU	0.87	0.762			0.238					
PEOU1	<--- PEOU	0.88	0.774			0.226					
TRU3	<--- TRU	0.93	0.869	2.814	7.919	0.131	0.359	0.96	2.641	0.88	0.66
TRU2	<--- TRU	0.92	0.843			0.157					
TRU1	<--- TRU	0.96	0.929			0.071					
OL5	<--- II	0.72	0.513	7.738	59.877	0.487	3.965	0.94	6.035	0.60	1.21
OL4	<--- II	0.84	0.711			0.289					
OL3	<--- II	0.86	0.746			0.254					
OL2	<--- II	0.75	0.555			0.445					
OL1	<--- II	0.68	0.460			0.540					
OE5	<--- II	0.79	0.629			0.371					
OE4	<--- II	0.80	0.634			0.366					
OE3	<--- II	0.65	0.426			0.574					
OE2	<--- II	0.83	0.681			0.319					
OE1	<--- II	0.83	0.681			0.319					
EXP5	<--- KN	0.94	0.880	1.848	3.415	0.120	0.292	0.92	1.708	0.85	0.43
EXP4	<--- KN	0.91	0.828			0.172					

		Estimate
II	<--> KN	0.38
TRU	<--> II	0.32
TRU	<--> KN	0.18
PEOU	<--> TRU	0.69
PEOU	<--> II	0.21
PU	<--> PEOU	0.57
PU	<--> TRU	0.30
PU	<--> KN	0.10
BI	<--> TRU	0.27
BI	<--> PEOU	0.27
BI	<--> PU	0.23
BI	<--> KN	0.09

	variance extracted		correlation	correlation^2	fornell lacker
II	0.60	KN	0.38	0.14	0.46
TRU	0.88	II	0.32	0.10	0.78
		KN	0.18	0.03	0.85
PEOU	0.73	TRU	0.69	0.48	0.25
		II	0.21	0.04	0.69
PU	0.75	PEOU	0.57	0.32	0.43
		TRU	0.30	0.09	0.66
		KN	0.10	0.01	0.74
BI	0.87	TRU	0.27	0.07	0.80
		PEOU	0.27	0.07	0.80
		PU	0.23	0.05	0.82
		KN	0.09	0.01	0.86