



**Sosyal Bilimler
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T.C.
MARMARA ÜNİVERSİTESİ
SOSYAL BİLİMLER ENSTİTÜSÜ
İNGİLİZCE İŞLETME ANABİLİM DALI
ÜRETİM YÖNETİMİ VE PAZARLAMA (İNGİLİZCE) BİLİM DALI

**EXAMINING THE FACTORS LEADING TO THE USE OF E-SCOOTERS IN THE
CONTEXT OF MICROMOBILITY**

Yüksek Lisans Tezi

MUSTAFA MERT FİL

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İSTANBUL, 2022

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Mustafa Mert FİL

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EXAMINING THE FACTORS LEADING TO THE USE OF E-SCOOTERS IN THE CONTEXT OF MICROMOBILITY

ABSTRACT

Today, humanity demands more and more to live in cities. Better health, education, work and living conditions can be counted as important reasons for this. Due to this universal demand, which is valid all over the world, some problems have begun to emerge today. In cities where the population has increased uncontrollably, in addition to concrete problems such as traffic, air pollution, difficulty in accessing resources, unemployment and inability to find housing, social and psychological problems such as the feeling of being lost in the crowd or lack of belonging have begun to emerge. Related to all these problems, academics and those who design the future have revealed the concept of smart city. Thanks to smart cities, efficiency in areas such as transportation, air pollution and population planning in cities can be maximized, and social and psychological deformations can be minimized. Today, smart cities have been implemented as a concept in some pilot cities. One of the most effective ways to make cities smarter is to apply to micromobility solutions. Today, micromobility solutions have gained a rapidly expanding usage area. Along with the concept of micromobility, some solutions, which are also considered as sharing economy tools, have started to come into the service of people living in cities. Among these, e-scooters have an increasingly widespread use. This study aimed to understand what is the factors of e-scooter usage and continuance intention to use in Turkey. Technology Acceptance Model was accepted and this study managed new model that investigates after the e-scooter usage stages. To research, survey was done with 204 participants who used e-scooters before or still use. The survey questions created were statistically analyzed in SPSS and Smart PLS programs. As a result of the study, it was seen that saving time was effective in using e-scooters and continuance intention to use e-scooters. On the other hand, it turned out that when the participants started using e-scooters, they intended to continue to use it. When the other hypotheses of the study were tested, it was seen that male and female participants differed from each other on environmental awareness. Similarly, people aged 18-25 differed from those aged 26-35 in environmental awareness and energy conservation. It was observed that the participants differ in energy saving according to their education level.

Keywords: Smart City, Micromobility, Smart Mobility, Technology Acceptance Model, E-Scooter

MİKROMOBİLİTE KAPSAMINDA E-SCOOTER KULLANIMINDA ROL OYNAYAN FAKTÖRLERİN İNCELENMESİ

ÖZET

Günümüzde insanlık, şehirlerde yaşamayı daha çok talep etmektedir. Bunun önemli sebepleri olarak daha iyi sağlık, eğitim, iş ve yaşam koşulları sayılabilir. Tüm dünyada geçerli olan bu evrensel talepten dolayı günümüzde bazı sorunlar ortaya çıkmaya başlamıştır. Nüfusun kontrolsüz arttığı şehirlerde trafik, hava kirliliği, kaynaklara ulaşmada sıkıntı, işsizlik ve konut bulamama gibi somut sıkıntıların yanı sıra kalabalıkta kaybolmuşluk hissi veya aidiyetsizlik gibi sosyal ve psikolojik sorunlar da ortaya çıkmaya başlamıştır. Bütün bu sorunlarla alakalı, akademisyenler ve geleceği tasarlayanlar, akıllı şehir kavramını ortaya çıkarmıştır. Akıllı şehirler sayesinde şehirlerdeki ulaşım, hava kirliliği, nüfus planlaması gibi alanlarda verimlilik en üst seviyeye çıkarılabilir, bu sayede de sosyal ve psikolojik deformasyonlar en az seviyeye indirilebilir. Günümüzde akıllı şehirler bazı pilot şehirlerde konsept olarak uygulamaya geçmiştir. Şehirlerin akıllanmasını sağlamadaysa en etkili yollardan biri mikromobilité çözümlerine başvurmaktır. Günümüzde mikromobilité çözümleri hızla yaygınlaşan bir kullanım alanına kavuşmuştur. Mikromobilité kavramıyla beraber, paylaşım ekonomisi aracı da sayılan bazı çözümler, şehirlerde yaşayan insanların hizmetine girmeye başlamıştır. Bunlarda e-scooter'lar, gittikçe yaygınlaşan bir kullanım ağına sahiptir. Bu çalışma, Türkiye'de e-scooter kullanımı ve kullanmaya devam etme niyetini etkileyen faktörlerin neler olduğu araştırılmıştır. Teknoloji Kabul Modeli kabul edilmiş ve bu çalışma, e-scooter kullanımından sonraki aşamalarını araştıran yeni bir modeli yönetmiştir. Araştırma için daha önce e-scooter kullanan veya halen kullanmakta olan 204 katılımcı ile anket yapılmıştır. Oluşturulan anket soruları SPSS ve Smart PLS programlarında istatistiksel olarak analiz edilmiştir. Çalışma sonucunda e-scooter kullanımında ve e-scooter kullanımına devam etme niyetinde zamandan tasarruf etmenin etkili olduğu görülmüştür. Öte yandan, katılımcıların e-scooter kullanmaya başladıklarında kullanmaya devam etmeyi düşündükleri ortaya çıkmıştır. Araştırmanın diğer hipotezleri test edildiğinde erkek ve kadın katılımcıların çevresel adanmışlık konusunda birbirlerinden farklılaştığı görülmüştür. Benzer şekilde, 18-25 yaş arası kişiler çevresel adanmışlık ve enerji tasarrufu açısından 26-35 yaş grubundan farklıydı. Katılımcıların eğitim seviyelerine göre enerji tasarrufu konusunda farklılık gösterdiği gözlemlenmiştir.

Anahtar Kelimeler: Akıllı Şehir, Mikromobilité, Akıllı Mobilite, Teknoloji Kabul Modeli, E-Scooter

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INTRODUCTION

In the last fifty years, dimensions of cities have been increasing more and more, all over the world (Benevolo et al., 2016). It is estimated that by 2050, 70% of population will live in cities, that means 2.5 billion people more compared to today's statistics (Dameri, 2014), (CB Insights, 2021). Cities have some pros like better health services, company settlements, education opportunities, cultural and social activities. With these advantages, cities sounds like they are the best place for living. But they have some cons too: crowded, traffic, feeling of being lost and environmental pollution. For example, Roche claimed "cities account for 75% of total energy consumed and 80% of CO2 emission" (Roche, 2014). Due to the infrastructure and superstructure that started to be insufficient, city people, governments and academicians started looking for new solutions. Thanks to these searches and technological development, in today's world, we have concepts like smart city and micromobility.

"Smart city is considered like a winning urban strategy using technology to increase the quality of life in urban space, both improving the environmental quality and delivering better services to the citizens", according to Hall (Hall, 2000). Although might be count as a new topic, several academical papers have been published about smart city concept. Smart city concepts can include limitless topics to search, like waste treatment to air quality, from green energy production to buildings energetic efficiency, from open data to e-government in smart city (Benevolo et al., 2016). Except those topics, smart city has some smart solutions for urban transportation. "Smart mobility is one of the most promising topics in smart city, as it could produce high benefits for the quality of life of almost all the city stakeholders", according to Benevolo (Benevolo et al., 2016). In recent years, many paper also have written about the relationship with the concept of smart city and smart mobility.

According to Orłowski and Romanowska, smart mobility means "the area of a smart city representing mobility" and broadly defined "the components which comprise not only the traditionally understood transport of people and goods, but also the dissemination of information by digital means" (Orłowski & Romanowska, 2019). Ridesharing, bicycle commuting, carsharing and on-demand ride services (like Uber) are examples of smart mobility. Smart mobility is very important topic for smart cities and can effects on the important topics of cities like sustainability, economy and lifestyle (Aletà et al., 2017). Smart mobility is one of the key factor to make cities smarter, efficient and eco-friendly from every aspect. As seen, smart mobility has close relationship with the concept of sharing economy and be more powerful with sharing economy.

Heinrichs defines sharing economy as an "economic and social systems that enable shared access to goods, services, data and talent. These systems take a variety of firms but all leverage

information technology to empower individuals, corporations, nonprofits and government with information that enables distribution, sharing and reuse of excess capacity in goods and services.” (Heinrichs, 2013). With the help of the sharing economy, the resources of people, companies and countries started to be used more efficiently. There are so many examples can be given to understand sharing economy. For example, “recent sharing economy and information technology innovations have expanded beyond traditional transportation and ownership models”, according to Shaheen (Shaheen et al., 2019). Consumers can request a private driver and vehicle via an app, access a car, bicycle, or scooter for a short trip. They all using internet-enabled smartphones and tablets. These examples are “the new normal” of the today’s world, and we could give more and more examples in the future’s world, thanks to the new technologies. But for now, we have to understand the new normal and it’s tools like “micromobility”.

“Micromobility or Shared Micromobility means the shared use of bicycles, scooters, or other low-speed modes and is an innovative transportation strategy growing across the world that includes various service models such as docked, dockless, and e-bike service models”, according to Lazarus (Lazarus et al., 2020). Micromobility and its businesses rapidly growing almost every country in the world. If we evaluate together with all the concepts we have listed above, micromobility is serving new urban transportation options to the city dwellers. According to Statista report, global micromobility market revenue in 2019 in Europe approximate \$546 million (Shown in Appendix 1) (Salas, E. 2021). They are at the second place after the North America. Again, according to another report by Statista, estimated micromobility market size in 2030 would be between \$100 billion and \$150 billion in Europe (Shown in Appendix 2) (Carlier, M. 2019). “The number of vehicles available through bike-sharing programs is estimated to reach 36M by 2024, up from 23M in 2019”, according to market research firm Berg Insight. The number of scooters in sharing services is estimated to grow from 774K to 4.6M in the same period (CB Insights, 2021). Turkey's population is 82 million. This means that Turkey is the second most populous country in Europe after Germany. Therefore, Turkey will be one of the places where the micromobility sector will find the most opportunities in Europe and it has started to be. Many academic studies have been conducted abroad on the micromobility sector, which is newly developing all over the world, creating new business areas, and a candidate to change people's lifestyles.

The writing purpose of this thesis is to inform the reader about the situation of micromobility sector in Turkey. The concept of micromobility has developed rapidly with the globalizing world and has entered the agenda and daily lives of countries and people. As in the global, initiatives in the micromobility sector have started to take place in Turkey, although not as rapidly as in the world. At this point, this study focuses on the micromobility in Turkey and searches this from the situation of the e-scooter sector in Turkey, which is one of the sub-branches of micromobility, and the main focus will be on the stages and degrees of e-scooter customers' adoption of this new technology. In doing so, the

characteristics of the people will also be taken into consideration. The main purpose is to reveal the characteristics of the customers in the e-scooter sector in Turkey and how they accept this technology.

Firstly, we focus on the concepts of smart city, smart mobility, share economy and micromobility. It's important to know these concepts before focusing on micromobility and e-scooter sector in Turkey. We also look into the situation of e-scooter sector in Turkey, including mobile applications and newfangled regulations about e-scooter usage. Secondly, we focus on the Technology Acceptance Model. We give brief informations about TAM and different versions of TAM. We also look into the applications of TAM in different areas. Thirdly, we focus on our model for this study, frameworks of the model, research model and brief information about the survey. Fourthly, we analyze the survey via SPSS and SmartPLS and give informations and statistical results of the survey results. At this point, we analyze the hypothesis of the study. Finally, we give informations of whole study's result.



1. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

1.1. A Brief Information About Smart City Concept and Smart Mobility

Why do we need to make cities “Smart”? This is a common question nowadays. Everything is changing thanks to technology. So, of course city concept needs to be changing with the new developments in technology.

In today’s world, cities have some big problems, especially biggest ones, or as we call them “metropol’s”. Let’s focus on İstanbul, biggest city in Turkey and talk about metropol’s problems from İstanbul’s eyes. Today, İstanbul’s population is almost 19 million. It is estimated that the population of Istanbul will be approximately 49 million in 2050 (İBB Açık Veri Portalı, 2022). Considering a population increase of this magnitude, it is certain that some problems will born in transportation, air pollution, waste, housing, reaching to the services like hospital, education etc. Thanks to smart city concept, cities can be more efficient now, and the future.

“The smart city concept was first introduced in 1990 in order to incorporate advanced information and communication technology (ICT) based hardware and software in urban planning”, according to Bibri and Krogstie (Bibri & Krogstie, 2017). Ismagilova described smart city concept’s benefits as a “Smart city utilizes ICT to enhance ‘citizens’ quality of life, foster economy, facilitate a process to resolve transport and traffic problems through proper management, encourage a clean and sustainable environment, and provide accessible interaction with the relevant authority of the government” (Ismagilova et al., 2019). Smart city concept is all about making cities efficient, easy to live and enjoyable. Although the concept of smart city seems like a new concept, we will soon be hearing it everywhere.

Smart city concept is the best solution for almost every bad situation of cities, but the concept needs complex solution methods with the support of ICT, and this causes some problems (Al & Pokharel, 2021). Techatassanasoontorn and Suo mentioned “socio-political risks, approval risks, financial risks, technical risks, partnership risks, and resource management risks for smart cities. Risks are also associated with the security and privacy within the smart city system” (Techatassanasoontorn & Suo, 2010).

Among the above-mentioned dimensions, due also to technological advances and the interest of large enterprises in the transport sector, many cities are investing in smart mobility (Battarra et al., 2018). “Smart mobility can be defined as a network system mainly characterized by connections, both digital and physical, in order to satisfy people’s needs; use of appropriate technologies, to enhance performance and attractiveness of the mobility system; sustainability, to reduce the need to travel and hence reduce energy consumption and carbon emissions”, according to Lam and Head (Lam & Head,

2011). There are many academical studies and papers about smart mobility, and they point out that smart mobility's characteristics encapsulate three features: Accessibility, sustainability and ICT (Information and Communication Technology) (Battarra et al., 2018). Hitachi's five expert about transportation and urban planning designed an approach to smart mobility in smart city. Hitachi's approach is to consider the elements that make up a society based on smart mobility in terms of the five separate layers listed below, which it calls the "five layers of transportation functions":

- 1. Transportation user experience layer (domain of transportation service users):** Layer in which users receive transportation, information, and other services from transportation companies as they travel from place to place
- 2. Transportation services layer (domain of transportation companies):** Layer in which transportation companies supply services to users
- 3. Information collection layer (domain of transportation companies):** Layer in which usage information is collected, such as on how users use the services supplied by transportation companies
- 4. Information management and control layer (domain of transportation companies):** Layer in which information management and control is performed to ensure that transportation companies supply their services smoothly
- 5. Transportation company coordination layer (domain of transportation companies):** Layer in which information from all the transportation companies is collected and analyzed, and information is provided to guide the operation, control, and other functions of the transportation companies with the aim of optimizing the city's overall transportation system (Okuda et al., 2012).

The concept of smart city brings us some other new topics like sharing economy and micromobility. Below, we give brief information about both of them.

1.2. Sharing Economy & Micromobility

"The sharing economy refers to a set of organizational and business models based on sharing, collaborative, gig, or access approaches to the use of resources", according to Schlagwein and others. (Schlagwein et al., 2020). The previous sentence gives a general definition for the sharing economy, and over time, many different definitions have been introduced from many different perspectives. However, it can be said that these definitions contain some common concepts like renting and swapping of assets that are typically underutilized, either because they are lying unused or because they have not yet been monetized. (Felländer et al., 2015). In other words, the concept of sharing economy includes two simple sub-concepts: sharing services and making money from it. The sharing economy is a concept that has entered our lives rapidly today and will be at the center of our lives in

the future. With the global spread of the internet and smart phone usage, many successful initiatives have emerged that focus on the sharing economy model like Airbnb, Uber etc. Airbnb is an app that has no house itself but serves housing service. Like Airbnb, Uber is an app that has no car or taxi itself but serves taxi-like public transportation service. “Taxi service is a century-old idea of transportation service but Uber brought a new model and reformed the entire idea of taxi service”, said Hoq (Hoq, 2017). Bonciu & Bâlgăr compared old economical model and sharing economy in following lines: “The major difference between sharing economy and business as usual approach consists in the fact that sharing economy is based on the idea of “being able to use something” instead of “owning something”. The underlying assumption is that in many cases (though not in all of them) people are interested in the usage or access to products or services and not necessarily in owning them” (Bonciu & Bâlgăr, 2016). This is a simple example for win-win situation: While businesses can minimize their expenses to achieve their goals, this also opens the way for users to reach the services more cheaply.

We see one of the biggest contributions of the sharing economy under the concept of sustainability. Thanks to the sharing economy, waste of resources is limited and economic and natural resources can be used more efficiently (Liu & Yang, 2018). Numerous academic papers have been published about sustainability and sharing economy relationship. For example, Martin and Shaheen found that car sharing decreases average greenhouse gas emissions of households in North America (Martin & Shaheen, 2011). With respect to socio-economic impacts, Fang and others found that the sharing economy would have a positive net effect on employment in the tourism industry (Fang et al., 2016), (Plewnia & Guenther, 2018).

The concept of the sharing economy has started to appear in many sectors, and it continues to appear in different sectors. In this study, we focus on e-scooter sector in Turkey. So, before that, we need to explain micromobility concept and it’s relation with sharing economy.

“Micromobility is an innovative urban transport solution aimed at providing short distance travel options including first and last kilometer trips”, according to Abduljabbar and others (Abduljabbar et al., 2021). Generally, the term of micromobility has been used to substitute e-scooter, e-bike etc. On the contrary, these are vehicles in which micromobility is used.

In order to talk about micromobility, some concepts need to catch our eye: These are flexibility, sustainability, cost-effective and on-demand transport alternative (Shaheen et al., 2020). Micromobility can produce very useful solutions, especially for cities. Thanks to micromobility, carbon emissions in cities can be reduced, and this is achieved by vehicles such as e-scooters and e-bikes powered by electricity. With the dissemination of these vehicles in short distance transportation, not only will a solution be produced for traffic, but also a very important step will be taken to protect the environment. (Abduljabbar et al., 2021).

Nowadays, micromobility has a huge market size around the world, and it rapidly grows day by day. “The global micromobility market was valued at \$195.42 billion in 2021”, according to Singh and Mutreja (Singh & Mutreja, 2021). Mckinsey modeled the baseline shared micromobility market and created a forecast, which revealed a 2030 market potential of roughly \$200 billion to \$300 billion in the United States, \$100 billion to \$150 billion in Europe, and \$30 billion to \$50 billion in China. The main differences across regions stem from unique pricing-per-kilometer strategies when comparing today's micromobility businesses (Shown in Appendix 2) (Heineke et al., 2019), (Carlier, 2019).

Thanks to technological developments, we can see new apps that focus on micromobility. This means micromobility has a potential to be cities’ number one transportation option in the future. Micromobility completes smart city concept.

1.3. Global Situation of E-Scooter and The Background Information

E-scooter defined as a light, battery-powered scooter, ridden standing up (Collins, 2022). E-scooters are the new and another solution of public transportation: They are easy to use and they work with electricity. People can buy and use the e-scooter themselves, or generally they use the more common way: E-scooter sharing apps. Shared e-scooter services first started in the USA in 2017 and are now seen in many cities around the world. (Haworth et al., 2021). Firstly emerged e-scooter app in USA is Lime, after that, we saw and continue to see so many popular apps in the market like Bird, Spin, Skip etc. “With the development of information communication technologies, it is estimated that more than 23 million shared bikes have been deployed around the world in 2019”, said Svegander (Svegander, 2020). By 2030, the global scooter market is expected to be valued at 300 billion to 500 billion dollars, according to CB Insights report (CB Insights, 2021).

We can classify e-scooters into two types, docked or dockless. In Europe and USA, e-scooter systems are dockless, which means users only have to park them to available areas and leave them. In Turkey, e-scooter systems are docked, this means users have to park e-scooter after your ride and tie it with its steel chain to somewhere like fence, wall, tree etc.

According to Statista report (Shown in Appendix 3) (Carlier, 2020), total number of dockless bike-share and e-scooter systems in the USA have been increasing. Interestingly but understandable, e-bike sharing systems decreased in 2019. On the contrary, as seen, e-scooter sharing systems is getting more popular by year.

Scooter sharing began amassing popularity in Europe in late 2018, but companies lately have seen waves of consolidation (CB Insights, 2021). Lime, Hive, Spin, Voi, Free Now, Bird and Tira are the firms that have an e-scooter operations in Europe.

“Electric scooters can be more efficient than other modes of transport. One kilowatt hour of energy can only get a gasoline-powered car to travel 0.8 miles, according to Wired. An electric vehicle can travel 4.1 miles under the same conditions. However, an electric scooter can travel 82.8 miles using the same amount of energy”, according to CB Insight report published in 2021 (CB Insights, 2021). They are efficient both in energy saving and time saving.

1.4. An Overview of E-Scooter Applications in Turkey

When we look at Turkey's e-scooter adventure, we can take the year 2019 as the foundation date of Marti, the first startup established in this field. When the word "scooter" is searched in Google Trends, we see that the interest in this field in Turkey peaked in the summer of 2020 and the interest still continues (Google Trends, 2022). In addition to these interests and usage rates, the lack of legal regulation regarding e-scooters in the country was causing problems in many areas such as accidents, roads, safety measures and parking issues. With the regulation named "Electric Scooter Regulation" issued by the Ministries of Transport and Infrastructure, Environment and Urbanization and Interior, the legal regulation in this field has been established. In the regulation published on April 14, 2021, some of the decisions taken are as follows:

- With the new regulation, it was decided that electric scooters that can be used on the roads and can travel at a maximum speed of 25 kilometers per hour. The age limit for use is also set at 15.
- Vehicles cannot be used on pedestrian roads.
- Scooters cannot be driven from the carriageway where there is a cycle path or lane.
- This vehicle cannot be used on highways with a minimum speed limit of 50 kilometers or more.
- Scooter drivers are also prohibited from occupying the lane by driving their vehicles side by side in a lane, or from holding onto and using other vehicles.
- Drivers were also required to constantly control the vehicle with both hands, except when signaling for maneuver.
- Violation of private property, disruption of public order, and parking of scooters in a way that hinders the movement of pedestrians or the disabled are also prohibited. Companies will need to remove vehicles parked this way within two hours.

With the new regulation, more than one person will not be able to ride on the scooters, and loads cannot be carried on the scooters except for the items carried on the back (Erem, 2021).

Despite these developments, there is no rule regarding the use of helmets. According to the regulation, a shared e-scooter license can be granted as much as one-200th of that population in each district in metropolitan cities. This means that there can be a maximum of 77,300 shared scooters in

Istanbul. To compare, the number of taxis in Istanbul is 17,395. Moreover, the number of shared scooters allowed in metropolitan municipalities can be increased by 50 percent in cases such as usage rate and increase in demand. In this case, the maximum shared scooters that can be found in Istanbul will exceed 115 thousand (Erem, 2021).

1.4.1. Martı

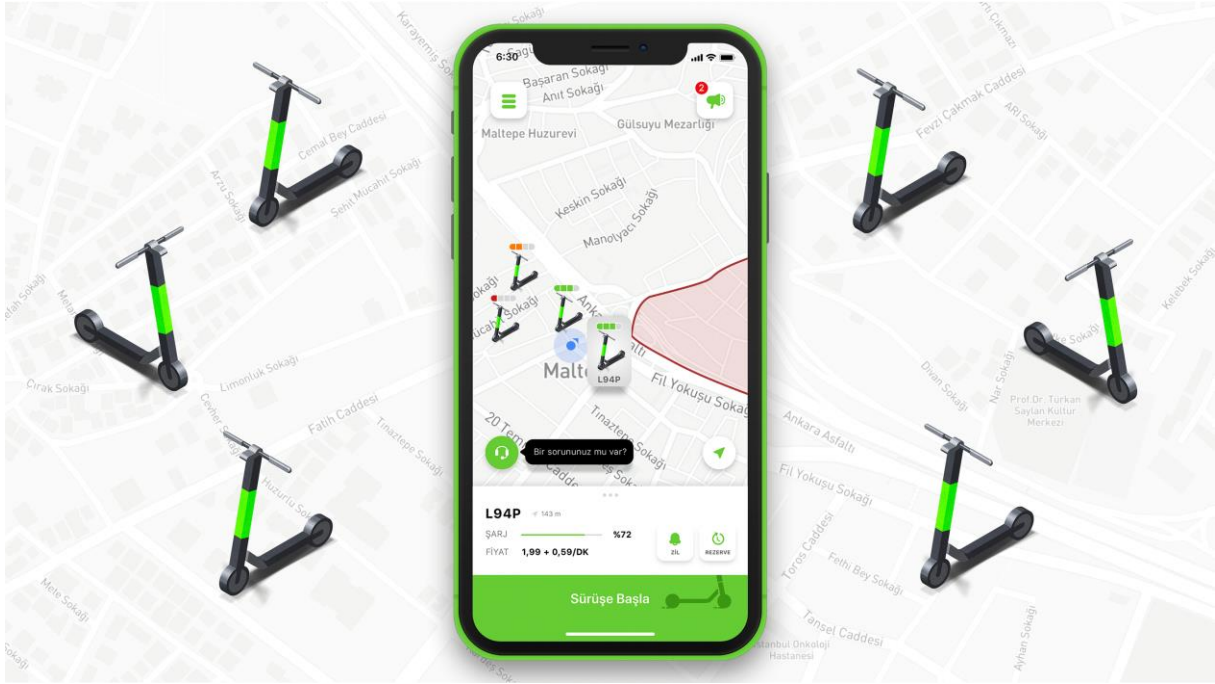


Figure 1. Screenshot from the Martı App

Source: <https://www.ufukaydin.com/work/marti-scooter-kiralama-uygulamasi-redesign/>

Martı is a leading technology company the rapidly growing micro-mobility trend in Turkey. According to search on the internet and general knowledge, Martı is the first e-scooter company in Turkey. According to Webrazzi, one of Turkey's most followed internet startups and technology news sites, Martı is seen as the first news about e-scooters in Turkey (Webrazzi, 2019). Martı's mobile app is number one on Travel category in AppStore. The number of cities they serve is increasing day by day. Martı's starting fee is 1,99 TL and its price per minute is 0,79 TL, according to the official website and in-app information.

According to the information given in January, the number of users of Martı has exceeded 5 million. They operate in cities such as Istanbul, Ankara, Izmir, Bursa, Yalova, Antalya, Eskisehir, Ordu, Sakarya and Gaziantep (Webrazzi, 2021).

The company has also received investments from foreign investors and investment groups as of the dates of this study. Martı's website can be accessed at: <https://www.marti.tech/>

1.4.2. Palm by Fenix

Palm is an e-scooter company that started to serve on university campuses in the first place. Currently, they serve in certain parts of the city, and the number of places they serve is increasing day by day. It was founded in October 2018 by Berhan Gökşin (Webrazzi, 2020b). Palm's mobile app is number thirty on Travel category in AppStore. Palm's starting fee is 2,00 TL and its price per minute is 0,60 TL, according to the official website and in-app information.

In 2021, Fenix paid \$5 million to acquire the Palm startup. Fenix company, like Palm, is a company that takes electric scooters to its center. With this acquisition, Fenix aims to be the only regional platform operating in the Middle East region by expanding from the Gulf Countries to Turkey in the field of micromobility (Webrazzi, 2021b). Palm by Fenix's website can be accessed at: <https://letspalm.com/>

1.4.3. BinBin

BinBin is an e-scooter company founded by Kadir Abdik in 2019 (Webrazzi, 2020a). Firstly they started their operations in university campuses and unlike other companies, they also started operations in the Istanbul Airport. BinBin's mobile app is number third on Travel category in AppStore. Binbin's starting fee is 1,00 TL and its price per minute is 0,50 TL, according to the official website and in-app information. BinBin's website can be accessed at: <https://www.binbin.tech/>

1.4.4. HOP!

HOP! is an e-scooter company founded in 2019 in Ankara. Firstly, they have started their operations in Ankara's university campuses, now they serve in 5 biggest cities in Turkey. HOP! received an investment from a local partner in the past months. According to Webrazzi, 15.5 percent of the shares of the HOP! venture passed to Inveo Investment Holding (Webrazzi, 2021a). According to the agreement, a total of 24 million 204 thousand TL financing will be provided to the HOP! initiative. HOP!'s mobile app is number eleventh on Travel category in AppStore. HOP!'s starting fee is 2,00 TL and its price per minute is 0,60 TL, according to the official website and in-app information. HOP!'s website can be accessed at: <https://hoplagit.com/>

1.4.5. Roket Scooter

Rocket Scooter is an e-scooter startup operating only in Istanbul for now. Roket Scooter's mobile app is number one hundred fourth on Travel category in AppStore. Roket Scooter's starting fee is 1,99 TL and its price per minute is 0,79 TL, according to the official website and in-app information. Roket Scooter's website can be accessed at: <https://roketmobilite.com/>

1.4.6. Tazı

Tazı is an e-scooter startup operating only two cities in Turkey. Tazı's mobile app is number one hundred forty ninth on Travel category in AppStore. Tazı's starting fee is 1,49 TL and its price per minute is 0,59 TL, according to the official website and in-app information. Tazı's website can be accessed at: <https://tazi.tech/>

1.4.7. Biri

Biri is an e-scooter startup founded in Çanakkale under the leadership of a female entrepreneur. Biri's starting fee is 2,50 TL and its price per minute is 0,45 TL, according to the official website and in-app information. Biri's website can be accessed at: <https://biri.net/>

1.4.8. Tornet

Tornet Technology is a micromobility company founded in 2021. Tornet's mobile app is number fifty third on Travel category in AppStore. Tornet's website can be accessed at: <https://www.tornetteknoloji.com/>

Below we mentioned these brands, their starting fee's and fee's per minute informations in Table 1.

Table 1. E-Scooter Brands, Starting Fee's and Fee's per Minute in Turkey (Based on official websites of the brands and in-app informations)

Brand	Starting Fee (TL)	Fee per Minute (TL)
Martı	1,99	0,79
Palm	2	0,6
BinBin	1	0,5
HOP!	2	0,6
Roket	1,99	0,79
Tazı	1,49	0,59
Biri	2,5	0,45
Tornet	N/A	N/A

Source: Collected by the researchers based on official websites of apps and AppStore informations.

1.5. Theory Of Reasoned Action (TRA) and Technology Acceptance Model (TAM)

“One of the most referred and respected theories on estimating human behavior including the core constructs of attitudes toward behavior and subjective norms is the theory of reasoned action (TRA)”, said Dirsehan and Can (Dirsehan & Can, 2020). The technology acceptance model (TAM), which is based on Fishbein and Ajzen’s theory of reasoned action (TRA), was developed by Davis in 1989. Thanks to the Technology Acceptance Model, the factors underlying individuals’ acceptance and use of a technological development or invention could be examined. The model, which was used as a basis for studies in the field of IT in the past, is now used as a basis for many social science studies. Before focusing on the technology acceptance model, we give brief informations about the theory of reasoned action below.

“The Theory of Reasoned Action, which founded by Fishbein and Ajzen in 1975, is a well established social psychological model that is concerned with the determinants of consciously intended behaviors”, according to Yousafzai and others (Yousafzai et al., 2010). The TRA aims to explain the relationship between attitudes and behaviors within human action. TRA is a theory based on social psychology. The main purpose of the theory is to explain the behaviors that occur as a result of human will. According to this theory, a particular behavior of a person is determined by the person's behavioral intention, and behavioral intention is also influenced by attitude and subjective norms.

The theory of reasoned action has been widely used in the fields like health, education, consumer behavior, brand choice etc (Haque et al., 2014). From a marketing perspective, TRA has received particular attention in the field of consumer behavior and has been used to explain consumer behavior towards different products and services.

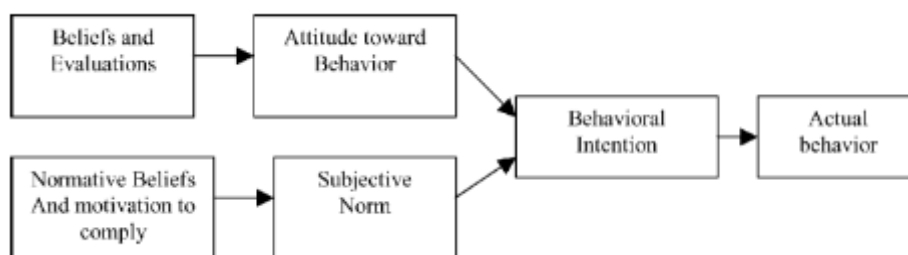


Figure 2. A Theory of Reasoned Action

Source: (Hill et al., 1977)

“Behavioral Intention (BI) measures the motivation of an individual to perform a given behavior, hence higher the BI higher will be the probability of performing that behavior. BI is function of person’s attitude towards performing that behavior and his consideration of approval or disapproval of other people (subjective norm)”, according to Haque (Haque et al., 2014). Attitudes are the

tendency to react positively or negatively to people, objects or environments. Haque describes subjective norm as a “Subjective norm reflects the social pressure that an individual takes into consideration that is exerted from his important referents while considering to perform the subject behavior” (Haque et al., 2014).

Davis introduced Technology Acceptance Model as an adaption of Theory of Reasoned Action (TRA). “He used TRA as a theoretical basis to point out the casual linkages between determinants”, according to Cankat (Cankat, 2020).

“Technology Acceptance Model (TAM) is one of the most acknowledged models designed to explain the acceptance and the usage of the technology by individuals”, says Can (Can, 2019). Fred D. Davis founded the Technology Acceptance Model during his doctorate proposal in 1986. The goal of TAM is “to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified” (Davis et al., 1989). The predecessor of TAM is considered as Ajzen and Fishbein’s Theory of Reasoned Action (TRA). “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”, according to Can (Can, 2019).

1.5.1. History Of Technology Acceptance Model (TAM)

Originally, Technology Acceptance Model was founded in 1986 by Fred D. Davis for his doctorate proposal. Davis was inspired by the Theory of Reasoned Actions while developing Technology Acceptance Model. Davis added three variables as motivating variables for people to use the system. These are Perceived Usefulness, Perceived Ease to Use and Attitude Toward Using. Three years later, Davis developed TAM to indicate computer usage behavior. “While the model established in 1986 has been explaining usage behaviors for technologies, Davis has modified the model and focused on broader usage behaviors for computers in 1989”, according to Lai (Lai, 2017).

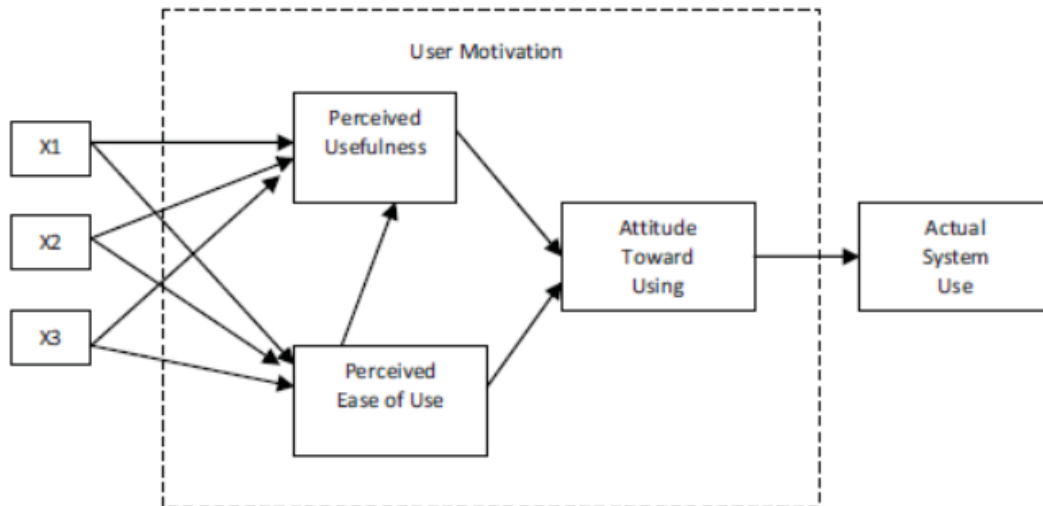


Figure 3. Original Technology Acceptance Model

Source: (Davis, 1985)

The differences between original Technology Acceptance Model and the first modified version of TAM are that three independent factors (which are X1, X2, X3) in Figure 4 were collocated as external variables and also one more determinant, which is “intention to use” was added to the modified version of TAM.

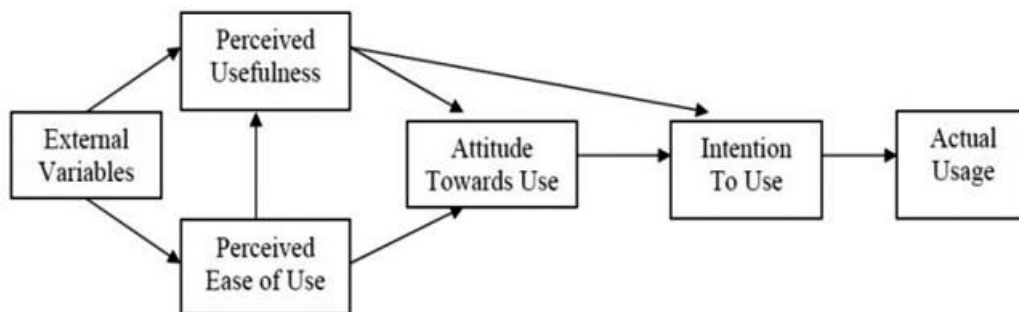


Figure 4. First Modified Version of Technology Acceptance Model

Source: (Davis et al., 1989) (Lai, 2017)

“The advanced version of Technology Acceptance Model was formed by Venkatesh and Davis (1996) as shown in Figure 5 after the main finding of both perceived usefulness and perceived ease of use were found to have a direct influence on behaviour intention, thus eliminating the need for the attitude construct”, according to Lai (Lai, 2017).

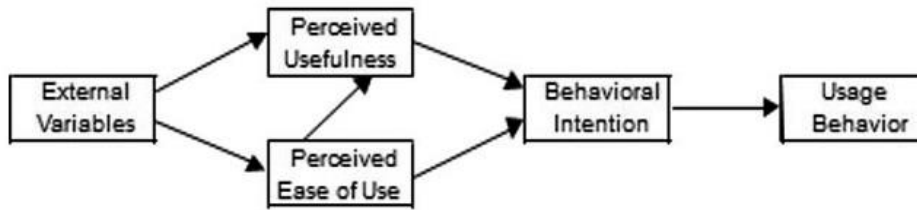


Figure 5. Advanced Version of Technology Acceptance Model

Source: (Venkatesh & Davis, 1996)

The latest version of the Technology Acceptance Model has been used many times in the literature and continues to be used.

1.5.2. Variables Of The Advanced Version of TAM Model

The advanced version of Technology Acceptance Model, which is formed by Venkatesh and Davis in 1996, includes four variables: External Variables, Perceived Usefulness, Perceived Ease of Use and Behavioral Intention. The model basically argues that External Variables have a significant effect on Perceived Usefulness and Perceived Ease of Use, Perceived Ease of User has a significant effect on Perceived Usefulness, both Perceived Usefulness and Perceived Ease of Use have significant effect on Behavioral Intention, and finally, Behavioral Intention has significant Intention on Usage Behavior. Below, we examined all of the variables included in the model but before that, the statements below are proposed:

- P1.** External variables have impacts on perceived usefulness.
- P2.** External variables have impacts on perceived ease of use.
- P3.** Perceived ease of use influences perceived usefulness.
- P4.** Perceived ease of use influences behavior intention.
- P5.** Perceived usefulness influences behavior intention.
- P6.** Behavior intention influences mobile usage behavior.

1.5.2.1.External Variables

External variables are the variables that support the study's needs. Researchers can take any factor as an external variable. Because the Technology Acceptance Model can be used limitless areas, there are so many different external variables in academic studies or papers. Researchers use external

variables to strengthen and meet the needs of the model more (Praveena and Thomas, 2014). Although it changes according to the needs of the study, external variables such as Perceived Trust, Perceived Value, Social Norms, Perceived Enjoyment, Environmental Awareness are included in the literature. The model claims that External Variables have a significant effect on Perceived Usefulness and Perceived Ease of Use. So the statements below are proposed:

P1. External variables have impacts on perceived usefulness.

P2. External variables have impacts on perceived ease of use.

Although this will be discussed in more detail later in this study, this study has not included any external variables.

1.5.2.2. Perceived Ease of Use

Davis, who founded the Technology Acceptance Model, describes Perceived Ease of Use as a “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989). Considering today’s quickly developing technology, Perceived Ease to Use is very important part of Technology Acceptance Model. For example, many mobile app ideas that have intelligent solutions for people may not last long and be failed because of complicated and non-user-friendly design. Davis continues: “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). The model claims that Perceived Ease of Use have a significant effect on Perceived Usefulness and Behavioral Intention.

P3. Perceived ease of use influences perceived usefulness.

P4. Perceived ease of use influences behavior intention.

In this study, the hypothesis presented by the Technology Acceptance Model were accepted. In other words, in this study, the stages after the usege has been examined. Therefore, a hypothesis related to perceived ease of use was not claimed in the study.

1.5.2.3. Perceived Usefulness

“Perceived usefulness is defined here as “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989). “A significant body of Technology Acceptance Model research has shown that perceived usefulness is a strong determinant of user acceptance, adoption, and usage behavior” (Venkatesh & Morris, 2000).

P5. Perceived usefulness influences behavior intention.

In this study, the hypothesis presented by the Technology Acceptance Model were accepted. In other words, in this study, the stages after the usege has been examined. Therefore, a hypothesis related to perceived usefulness was not claimed in the study.

1.5.2.4. Behavioral Intention To Use

“Behavioral Intention as defined by Davis refers to the strength of the prospective adopter’s intention to make or to support the adoption decision in their company” (Kanchanatane et al., 2014).

P6. Behavior intention influences mobile usage behavior.

In this study, the hypothesis presented by the Technology Acceptance Model were accepted. In other words, in this study, the stages after the usege has been examined. Therefore, a hypothesis related to behavioral intention to use was not claimed in the study.

1.6. Different Technology Acceptance Models

The Technology Acceptance Model has been a widely used model in the literature for years. Therefore, new TAM models have emerged to suit different needs, depending on the developing literature and technology. We give brief informations about some of these different versions of TAM below.

1.6.1. Technology Acceptance Model 2 (TAM 2)

“After Final Version of Technology Acceptance Model, Venkatesh and Davis continued to research user’s acceptance by extending Technology Acceptance Model and creating a new model referred to as Technology Acceptance Model 2 (TAM 2)” (Cankat, 2020). TAM 2 includes Perceived Usefulness, Perceived Ease of Use, Intention to Use and Usage Behaviour just as previous model. “Using TAM as the starting point, TAM2 incorporates additional theoretical constructs spanning social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use).” (Venkatesh & Davis, 2000).

Venkatesh and Davis compares TAM and TAM 2: “TAM 2 extends TAM by showing that subjective norm exerts a significant direct effect on usage intentions over and above perceived usefulness and perceived ease of use for mandatory (but not voluntary) systems” (Venkatesh & Davis, 2000).

To compare TAM and TAM 2, we can say that TAM includes external variables while TAM 2 does not. Instead of external variables, TAM 2 has predetermined variables that effect Perceived Usefulness. In TAM 2, there is no external variable that effect Perceived Ease of Use.

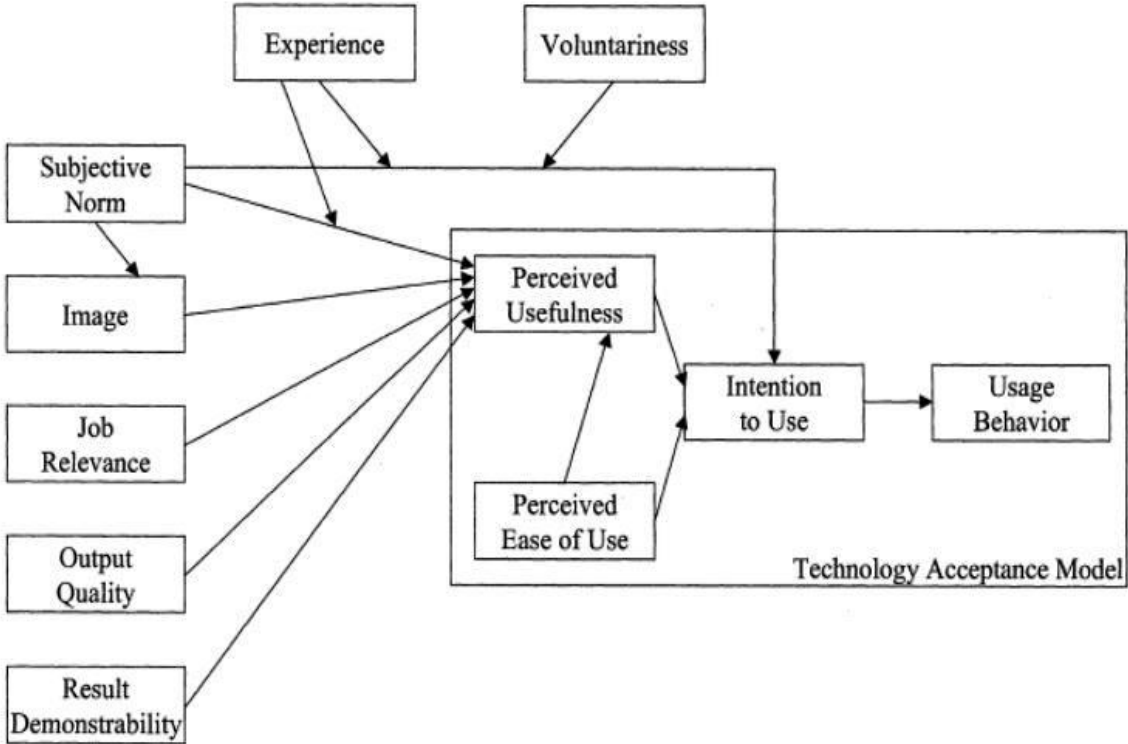


Figure 6. Technology Acceptance Model 2

Source: (Venkatesh & Davis, 2000)

1.6.2. Cognitive-Affective-Normative (CAN) Model

The CAN model is based on the previous technology acceptance models TAM and TAM2. “The CAN model combines the cognitive variables perceived usefulness and perceived ease of use, as well as the normative variable subjective (or social) norm, from the TAM models with the affective variables positive emotions, negative emotions and anxiety” according to (Pelegri n-Borondo et al., 2017).

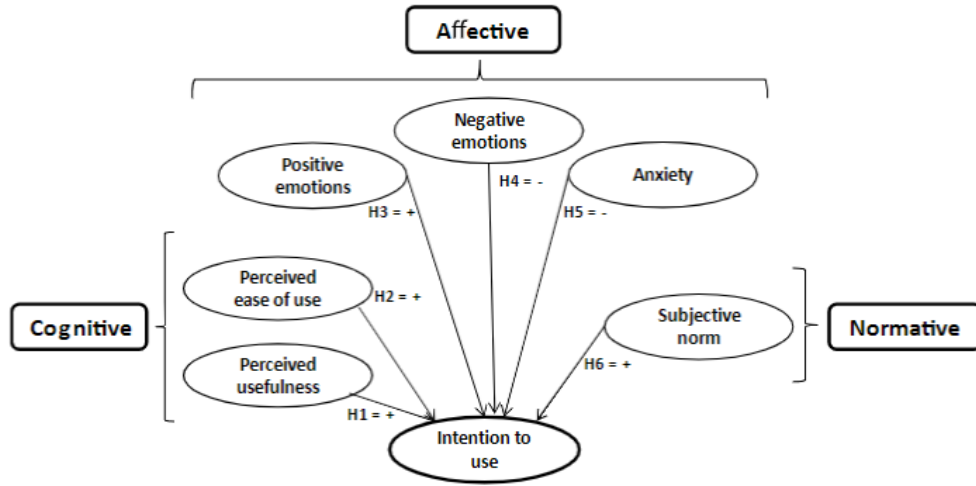


Figure 7. Unified Theory of Acceptance and Use of Technology

Source: (Pelegri n-Borondo et al., 2017)

1.6.3. Unified Theory of Acceptance and Use of Technology (UTAUT)

“In 2003, Venkatesh, Morris and Davis developed a unified model that brings together alternative views on user and innovation acceptance – The unified theory of acceptance and use of technology (UTAUT)”, according to Williams and others (Williams et al., 2015). UTAUT has four main determinants of intention and usage: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions. In addition to the main variables, the model includes four moderators. These four moderators are Gender, Age, Experience and Voluntariness of Use. “It is argued that by examining the presence of each of these constructs in a “real world” environment, researchers and practitioners will be able to assess an individual’s intention to use a specific system, thus allowing for the identification of the key influences on acceptance in any given context” (Williams et al., 2015).

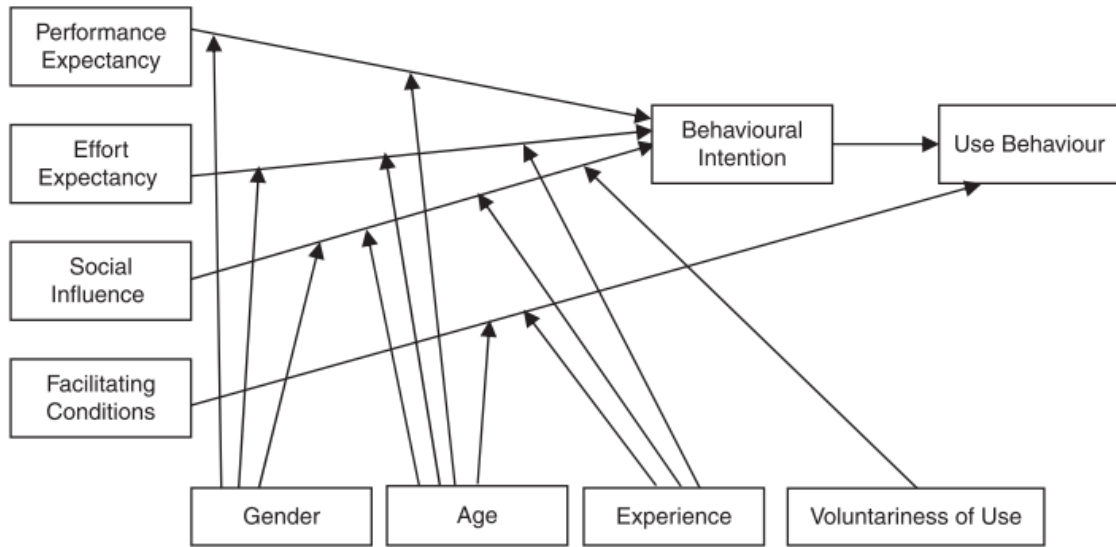


Figure 8. Unified Theory of Acceptance and Use of Technology

Source: (Venkatesh et al., 2003)

1.6.1. Unified Theory of Acceptance and Use of Technology 2 (UTAUT 2)

“UTAUT2 incorporates three constructs into UTAUT: hedonic motivation, price value, and habit” according to (Chang, 2012).

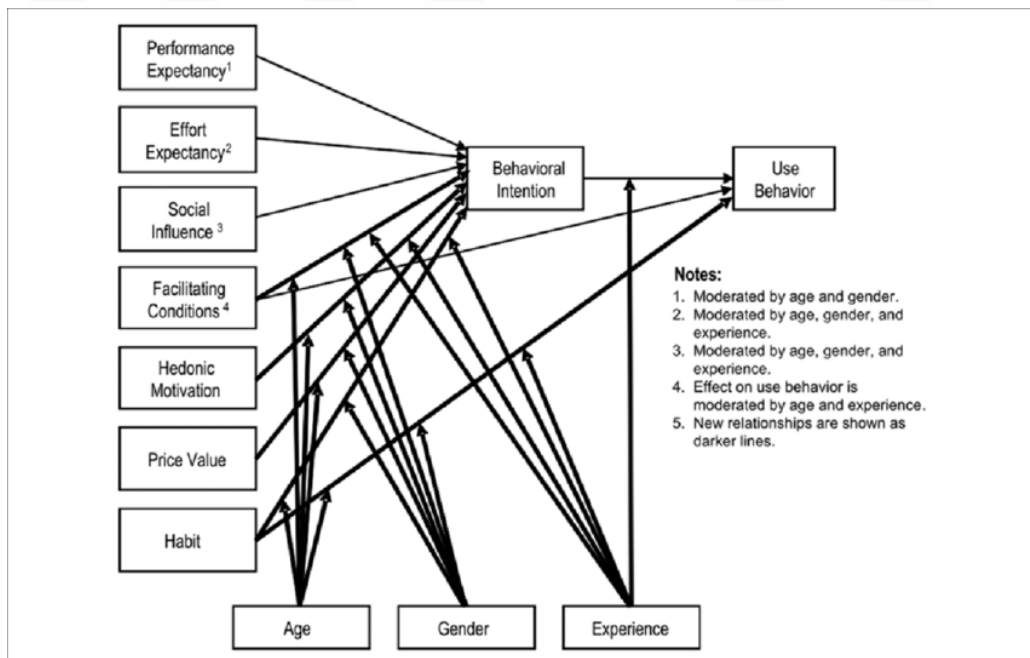


Figure 9. Unified Theory of Acceptance and Use of Technology 2

Source: (Dakduk et al., 2018)

1.6.2. Technology Acceptance Model 3 (TAM 3)

Venkatesh and Bala developed TAM 3 in 2008. They combined TAM 2 and the model of the determinants of perceived ease of use and develop an integrated model of technology acceptance (TAM 3) (Venkatesh & Bala, 2008). “TAM 3 suggested three new relationships: Experience will moderate the relationships between (i) perceived ease of use and perceived usefulness; (ii) computer anxiety and perceived ease of use; and (iii) perceived ease of use and behavioral intention” (Venkatesh & Bala, 2008). “Venkatesh & Bala (2008) remarked the determinants of perceived ease of use: Computer Self-Efficacy, Perception of External Control, Computer Anxiety, Computer Playfulness, Perceived Enjoyment, and Objective Usability”, Cankat says and continues: Determinants of perceived usefulness have directly taken from TAM 2 and TAM 3 indicates a comprehensive model by taking determinants of perceived ease of use into account (Cankat, 2020).

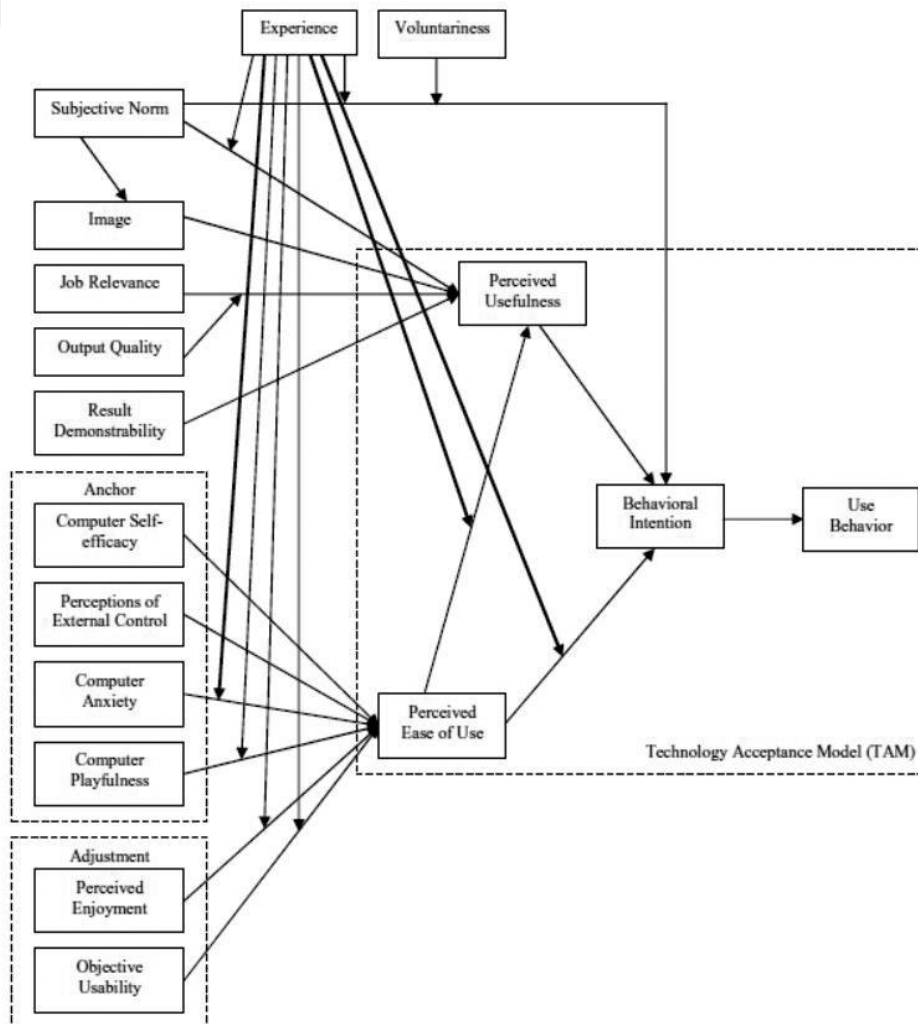


Figure 10. Technology Acceptance Model 3

Source: (Venkatesh & Bala, 2008)

1.7.Diverse Applications of Technology Acceptance

The Technology Acceptance Model, which was found by Davis in 1986, has been frequently used in the literature since its birth. “As the main idea of the original Technology Acceptance Model is to understand the users’ acceptance of information systems, many researchers have tried to grasp the details of technology and information systems acceptance in different areas” (Cankat, 2020). At the beginning, TAM had used for understanding consumers’ acceptance situation in newly emerging IT techs. Years later, we can see that TAM has changed in time to meet new academic researchs, also the world has changed. Because of that two progresses, in the literature, we can see different TAM versions (including extended versions for unique studies) in different fields such as e-commerce, health, smart city etc. Below, we mentioned TAM-based academical studies that used in this study. We can clearly see that TAM has been still using in different fields to understand consumers’ technology acceptance.

Table 2. Various Applications of Technology Acceptance Models

Article	Author(s)	Year	Model	Added Variables	Implementation Area
Towards an Understanding of the Travel Behavior Impact of Autonomous Vehicles	(Zmud & Sener, 2017)	2016	Car Technology Acceptance Model (CTAM)	Desire for control, technology use, and technology acceptance	Autonomous Vehicles
Exploring Factors Influencing the Adoption of Mobile Commerce	(Bhatti & Bhatti, 2007)	2007	TAM	Subjective norms, Personal Innovativeness, Perceived Behavioral Control	Mobile Commerce
Understanding consumer intention to participate in	(Agag & El-Masry, 2016)	2016	TAM	Trust, Attitude, Intention to Purchase Travel Online,	Online Community and Purchasing

online travel community and effects on consumer intention to purchase travel online and WOM: An integration of innovation diffusion theory and TAM with trust				WOM	
Exploring the adoption of a virtual reality simulation: The role of perceived ease of use, perceived usefulness and personal innovativeness	(Fagan et al., 2012)	2012	TAM	Personal Innovativeness	Virtual Reality (VR)
Continuance Intention to Use Facebook: A Study of Perceived Enjoyment and TAM	(Praveena & Thomas, 2014)	2014	TAM	Perceived Enjoyment	Social Media
Why do people play on-line games? An extended TAM with social	(Hsu & Lu, 2004)	2004	TAM	Flow Experience, Social Influence	Online Gaming

influences and flow experience					
Factors affecting the decision to use autonomous shuttle services: Evidence from a scooter-dominant urban context	(Chen, 2019)	2019	TAM	Trust, Perceived Enjoyment	Transportation
Antecedents and consequences of perceived value in Mobile Government continuance use: An empirical research in China	(C. Wang, 2014)	2014	TAM	Perceived Value	E-Government Systems
High speed rail passengers' mobile ticketing adoption	(Y. H. Cheng & Huang, 2013)	2013	TAM	Personal Innovativeness, Perceived Risk	Mobile Adoption
Explaining Internet Banking Behavior: Theory of Reasoned Action, Theory of Planned Behavior, or Technology	(Yousafzai et al., 2010)	2010	TAM	-	Online Banking

Acceptance Model?					
Predicting the drivers of behavioral intention to use mobile learning: A hybrid SEM-Neural Networks approach	(Tan et al., 2014)	2014	TAM	Personal Innovativeness in IT, Social Influence	Mobile Learning, Education
Integrating user interface and personal innovativeness into the TAM for mobile learning in Cyber University	(Joo et al., 2014)	2014	TAM	User Interface, Personal Innovativeness, Satisfaction in Learning	Mobile Learning
Exploring the intention to use mobile learning: the moderating role of personal innovativeness	(Y. M. Cheng, 2014)	2014	TAM	Personal Innovativeness, Compatibility, Perceived Enjoyment	Mobile Learning
Examination of trust and sustainability concerns in autonomous vehicle adoption	(Dirsehan & Can, 2020)	2020	TAM	Trust, Sustainability Concerns	Autonomous Vehicle
Examining	(Alalwan et	2018	TAM	Perceived	Mobile Internet

adoption of mobile internet in Saudi Arabia: Extending TAM with perceived enjoyment, innovativeness and trust	al., 2018)			Enjoyment, Innovativeness, Trust	
Empirical Examination of Users' Adoption of the Sharing Economy in China Using an Expanded Technology Acceptance Model	(Liu & Yang, 2018)	2018	TAM	Trust, Imitating Others, Subjective Norm, Gender	Sharing Economy
Extending the Technology Acceptance Model to Account for Social Influence: Theoretical Bases and Empirical Validation	(Malhotra & Galletta, 1999)	1999	TAM	Compliance	-
Predicting Public Bicycle Adoption Using the Technology Acceptance	(Hazen et al., 2015)	2015	TAM	Perceived Quality, Perceived Value, Perceived	Bicycle Sharing, Sharing Economy

Model				Convenience	
Technology Complexity, Personal Innovativeness And Intention To Use Wireless Internet Using Mobile Devices In Malaysia	(Parveen & Sulaiman, 2008)	2008	TAM	Technology Complexity, Personal Innovativeness	IT
Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior	(Venkatesh & Morris, 2000)	2000	TAM	Subjective Norm, Gender, Experience	IT
The effect of personal innovativeness on technology acceptance and use	(Rosen & Wilson, 2005)	2005	UTAUT	Personal Innovativeness in the Domain of Information Technology	IT
An empirical study of consumers' intention to use ride-sharing services: using an extended technology acceptance model	(Y. Wang et al., 2020)	2020	TAM	Perceived Risk, Personal Innovativeness, Environmental Awareness	Sharing Economy

<p>What drives mobile commerce?</p> <p>An empirical evaluation of the revised technology acceptance model</p>	(Wu & Wang, 2005)	2005	TAM	Perceived Risk, Cost, Compatibility	E-Commerce
<p>A Theoretical Model Proposal:</p> <p>Personal Innovativeness and User Involvement as Antecedents of Unified Theory of Acceptance and Use of Technology</p>	(Turan et al., 2015)	2015	UTAUT	Personal Innovativeness, User Involvement, End-User Satisfaction	-
<p>An assessment of the influence of perceived enjoyment and attitude on the intention to use technology among pre-service teachers: A structural equation modeling approach</p>	(Teo & Noyes, 2011)	2011	TAM	Perceived Enjoyment,	Education
Personal	(Lu et al.,	2005	TAM	Social	IT

innovativeness, social influences and adoption of wireless Internet services via mobile technology	2005)			Influence, Personal Innovativeness In IT	
A model of user adoption of interface agents for email notification	(Serenko, 2008)	2008	TAM	Computer Playfulness, Personal Innovativeness in IT, Perceived Enjoyment with Email IAs	IT
Extending the Technology Acceptance Model in Understanding the Outcomes of Food Ordering Mobile Application Usage	(Cankat, 2020)	2020	TAM	WOM, Social Influence, Mobile Quality Dimensions, Functionality, Value-added, Design, Perceived Risk, Free of Error, Comprehensive	Mobile Apps

Source: Developed by the researcher

2. RESEARCH DESIGN AND METHODOLOGY

The aim of this research is to analyse the impact of energy saving, time saving and environmental awareness' to consumers' continuous intention to use e-scooters and e-scooter usage. To do this, firstly we design our research model. After that, we collect secondary data via the survey about e-scooter preferences. Then, we analyze the data using statistic programs named SPSS and SmartPLS.

2.1. Research Purpose And Objectives

In this study, we don't focus on the dynamics leading to the acceptance, but we study with a sample who already adopted the use of e-scooter. In other words, this study explores the stages after the e-scooter use has emerged. In doing so, factors such as energy saving, time saving and environmental awareness taken from the previously tested literature were added to the study. In the study, these factors were investigated in terms of e-scooter use and continuance intention to use e-scooter. In this way, a unique study was revealed.

2.2. Research Model of the Study

We aim to analyze the factors of the usage of e-scooters in Turkey with the model that focuses after the usage stage of Technology Acceptance Model (TAM). In other words, we accept all the steps and hypothesis before the e-scooter usage of TAM. We mainly focus on after-usage stage. Although we accept all the hypothesis of TAM, we take usage behavior in the model.

This research investigates further steps of usage behavior. In this part, we search about the impact of environmental awareness, energy saving and time saving on e-scooter usage and continuance intention to use. E-scooter usage is getting more popular day by day both in the world and in Turkey. We need to understand the consumers' motivation to use e-scooters to prepare to changing transportation and city life. Research model of the study shown in Figure 11 below.

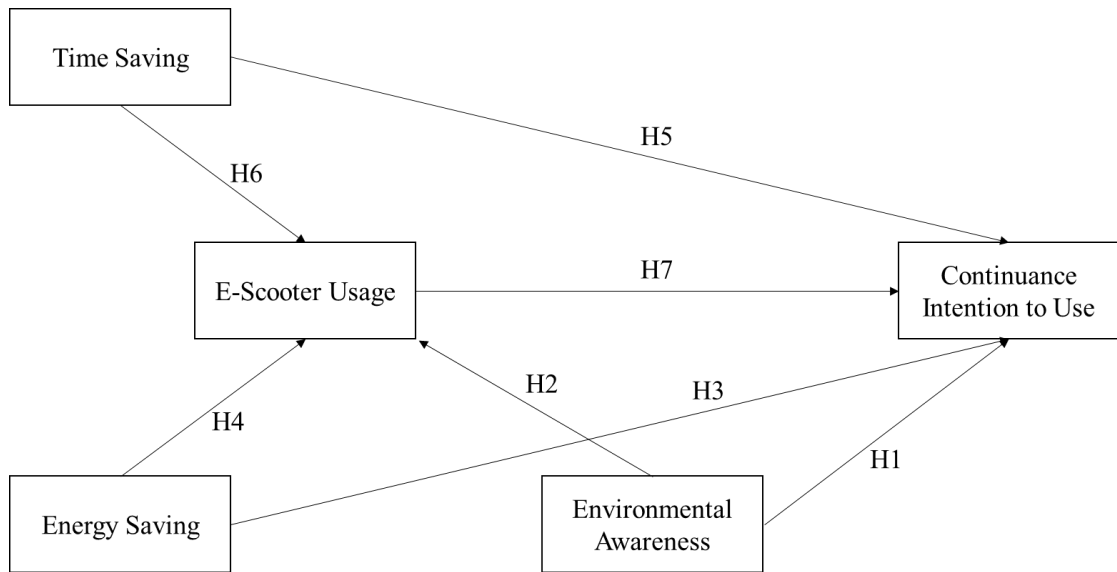


Figure 11. Research Model of the Study

Source: Developed by the researcher

2.3. Variables of the Study

The variables of the study have been adopted from previous researchs and decided by adviser's suggestions. Since e-scooter is kinda new way of the micromobility, there are more studies about e-bike or bike share systems in the literature. These studies mostly add external variables to the Technology Acceptance Model, they mostly focus on the acceptance and usage of the technology. On the other hand, some studies focus on further steps from usage behavior: What is bringing from the usage of the technology?

This study's purpose is to understand the post-usage behavior section of e-scooters. To search what is related with e-scooter usage and continuance intention to use, we searched literature and we added, envirmental awareness, energy saving and time saving as variables from previous studies. Below, we mention studies about these variables and give some informations about the findings of these studies.

2.3.1. Environmental Awareness

Environmental awareness refers to the knowledge of and concern about the impact of human behavior on the climate and environment (Schuitema et al., 2013), (Y. Wang et al., 2020). Environmental awareness is a person's general understanding and awareness of environmental problems and it is an important determinant for making individuals change from their current behavior to more environmental-friendly behavior (Y. Wang et al., 2020). Wang et al. noted that environmentalist are more easily motivated to use energy-sustainable transport innovations such as

electric vehicles and regard them as an emission reduction tool to respond to their concerns about climate change (S. Wang et al., 2017), (Y. Wang et al., 2020).

Eccarius and Lu's study shows that awareness-knowledge about the sharing system and environmental values influence the formation of usage intention in indirect ways (Eccarius & Lu, 2020). Bai et al.'s study shows that the level of environmental awareness, gender, age, education, income, the ownership of car and conventional bike, and trip distance affect e-bike users' choices significantly (Bai et al., 2020). Wang et al.'s study's results indicate that personal innovativeness, environmental awareness, and perceived usefulness are positively associated with consumers' intention to use ride-sharing services (Y. Wang et al., 2020).

In this study, environmental awareness refers to the degree to which a person has a sensibility to environment and tries to keep it clean as he/she can. These people can make some choices under environment pressure. Based on these arguments, the following hypotheses are developed:

H1. Environmental awareness positively related with continuance intention to use.

H2. Environmental awareness positively related with e-scooter usage frequency.

2.3.2. Energy Saving

Energy Saving relates to conditions that prevent loss of energy (Sepasgozar et al., 2019). E-scooters are running with batteries. Generally, e-scooter firms have personals that change e-scooters' batteries at night. These batteries are rechargeable and electric-powered. That means they are eco-friendly, compared to other traditional transportation options. Based on these arguments, the following hypotheses are developed:

H3. Energy saving is positively related with continuance intention to use.

H4. Energy saving is positively related with e-scooter usage frequency.

2.3.3. Time Saving

Time Saving refers to conditions that prevent loss of time (Sepasgozar et al., 2019). E-scooters are micromobility solutions that people can found them easily, use it easily and go from point A to B easily. In other words, people can use e-scooters to avoid from traffic. Based on these arguments, the following hypotheses are developed:

H5. Time saving is positively related with continuance intention to use.

H6. Time saving is positively related with e-scooter usage frequency.

2.3.4. E-Scooter Usage Frequency

E-scooter usage frequency refers to how often a person uses the e-scooter in their life. Based on this argument, the following hypothesis is developed:

H7. E-Scooter usage frequency is positively related with continuance intention to use.

2.3.5. Continuance Intention to Use

Continuance intention to use indicates that a person is satisfied with using e-scooters and wants to continue using them.

2.3.6. Group Differences

Demographic and socioeconomic characteristics are very important factors for research in the social sciences. The inclusion of these factors in studies in social sciences, their analysis and interpretation of their results contribute to both academic and administrative fields. Below are the hypotheses that test the demographic and socioeconomic characteristics of the survey conducted within the scope of this study.

H8: There is a difference between female and male in terms of using e-scooter, energy saving, time saving, environmental awareness and continuance intention to use.

H9: There is a difference between age groups in terms of using e-scooter, energy saving, time saving, environmental awareness and continuance intention to use.

H10: There is a difference between income levels in terms of using e-scooter, energy saving, time saving, environmental awareness and continuance intention to use.

H11: There is a difference between educational levels in terms of using e-scooter, energy saving, time saving, environmental awareness and continuance intention to use.

2.4.Hypotheses Of The Study

As it is explained, the objective of this study is to analyze the factors that effect to use e-scooter in Turkey. Hypotheses of the study was prepared in line with adviser's suggestions and based on past studies. Hypotheses shown in Table 3.

Table 3. Hypotheses of the Study

Item No	Hypothesis	Sources	Variables Involved
H1	Environmental awareness positively related with continuance intention to use.	(Okada et al., 2019), (Eccarius & Lu, 2020), (Y. Wang et al., 2020)	Environmental Awareness, Continuance Intention to Use
H2	Environmental awareness positively related with e-scooter usage frequency.	(Okada et al., 2019), (Eccarius & Lu, 2020), (Y. Wang et al., 2020)	Environmental Awareness, Usage Behavior
H3	Energy saving is positively related with continuance intention to use.	(Sepasgozar et al., 2019)	Energy Saving, Continuance Intention to Use
H4	Energy saving is positively related with e-scooter usage frequency.	(Sepasgozar et al., 2019)	Energy Saving, Usage Behavior
H5	Time saving is positively related with continuance intention to use.	(Sepasgozar et al., 2019)	Time Saving, Continuance Intention to Use
H6	Time saving is positively related with e-scooter usage frequency.	(Sepasgozar et al., 2019)	Energy Saving, Usage Behavior
H7	E-Scooter usage frequency is positively related with continuance intention to use.	(Sepasgozar et al., 2019), (Natarajan et al., 2017)	Usage Behavior Frequency, Continuance Intention to Use
H8	There is a difference between female and male in terms of using e-scooter, energy saving, time saving, environmental awareness and continuance intention to use.	Developed by the researcher	Gender
H9	There is a difference between age groups in terms of using e-scooter,	Developed by the	Age Groups

	energy saving, time saving, environmental awareness and continuance intention to use.	researcher	
H10	There is a difference between income levels in terms of using e-scooter, energy saving, time saving, environmental awareness and continuance intention to use.	Developed by the researcher	Income Levels
H11	There is a difference between educational levels in terms of using e-scooter, energy saving, time saving, environmental awareness and continuance intention to use.	Developed by the researcher	Educational Levels

2.5. Research Method

The notation that indicates the idea that guides the research in which all the variables related to the research and the interactions between these variables are revealed is called the research method (Kurtuluş, 2010). Deciding on the research method is one of the most important steps in concluding a research. Because the data collection method and data analysis method will change according to this decision. This study uses descriptive research method.

The main purpose of descriptive research models is to define the event that is the subject of investigation, the variables of this event and the relationships between these variables, and to make forward-looking predictions based on these definitions (Kurtuluş, 1999). In this type of research, the researcher has some variables and hypotheses regarding the relationship between these variables. Descriptive research proceeds after determining the variables, defining the problem, and forming the hypotheses. This type of research usually uses the survey method (Kurtuluş, 2010). Unlike exploratory research, the researcher knows what research questions to ask in descriptive research (Gegez, 2015).

As this study has tried to describe the problem that is the role of TAM in micromobility and it's e-scooter sector by testing specific hypotheses, it is descriptive research. Also, since the sample of this study is collected for only once, this study is a single cross-sectional descriptive research with a survey.

2.6. Measurement Development

In this study, hypotheses are examined based on quantitative method. Therefore, a survey is designed to collect data. Hypotheses was tested by 5 points Likert scales, ranging from “strongly don’t agree (1)” to “strongly agree (5)”.

Environmental Awareness (EA) is one of the variables in the study. This variable tested with three questions based on the adapted verions of past study’s constucts from Simsekoglu and Klöckner’s paper (Simsekoglu & Klöckner, 2019).

Travel Time Saving (TS) and Energy Saving (ES) are two other variables added in the survey. These variables tested with six questions (four of them is for testing TS and other two is for testing ES) based on the adapted verions of past study’s constucts from Sepasgozar’s paper (Sepasgozar et al., 2019).

E-Scooter Usage Frequency was tested with a multiple choice question. "How often do you use e-scooters?" question was asked and participants were asked to choose one of five predetermined answers.

Continuance Intention to Use is the final variable of the study. This variable tested with four questions based on the adapted verions of past study’s constucts from Sepasgozar’s paper (Sepasgozar et al., 2019).

Below, we mentioned all constructs, items, measurements and references for these variables in the Table 4.

Table 4. List of Constructs and Their Items

Construct	Items	Measurement	References
Environmental Awareness	EA1	I am worried about carbon dioxide (CO2) emissions due to car use.	(Simsekoglu & Klöckner, 2019)
	EA2	Car use leads to serious environmental problems.	
	EA3	Using fossil fuels in cars is an important factors of climate change.	
Time Saving	TS1	I believe that by using e-scooters I can complete my trip in the shortest possible time.	(Sepasgozar et al., 2019)

	TS2	In my opinion, using e-scooters saves my time.	
	TS3	I can use e-scooters whenever I want or whenever I need.	
	TS4	Using e-scooters prevents time spent in traffic.	
Energy Saving	ES1	Using e-scooter reduces intra-city traffic and thus reduces fuel consumption.	(Sepasgozar et al., 2019)
	ES2	Using e-scooter reduces travel energy costs as service are delivered with electric power.	
E-Scooter Usage Frequency	Usage	How often do you use e-scooters?	Developed by the researcher
Continuance Intention to Use	CITU1	I intend to continue using e-scooters.	(Sepasgozar et al., 2019)
	CITU2	I always try to use e-scooters.	
	CITU3	I encourage everyone to use e-scooters.	

Source: Developed by the researcher

2.7. Sampling Design

Topics such as the target population of the survey, the sampling techniques, and the sample size are included in sample design and discussed below.

2.7.1. Target Population

With the latest legal regulations, a minimum age limit of 15 has been decided to use e-scooters in Turkey (Resmi Gazete, 2021). Before starting the e-scooter ride, a credit or debit card informations must be added in the application. The minimum age to have a credit card is 18, which is the legal age

of being adult in Turkey. On the other hand, although the age limit for additional cards to be issued by family members varies in banks, it generally starts from the age of 12 (Hesap Kurdu, 2022). In addition to all these, it would be necessary to obtain permission from the university's ethics committee to conduct a survey for under 18s. Instead, the survey was conducted with people over the age of 18 who use e-scooters. In other words, our target population is people who are over the age of 18, live in Turkey, have used e-scooters before or are still using them via e-scooter apps.

2.7.2. Sampling Techniques

As a sampling technique, we used Snowball Sampling. Snowball sampling is a sampling method used when it is difficult to determine the desired population and the sampling frame obtained by the researcher does not include a large number of sample individuals (Gegez, 2015). To give an example from this study, we reached out to people who we thought had used e-scooters before, through social medias and tools such as Facebook (especially groups about e-scooters), Instagram stories, WhatsApp messages, e-mail groups. Afterwards, we asked them to forward the survey to people who use e-scooters in their close circle. In this way, we were able to reach the number of people required for the consistent analysis of the survey with the snowball sampling technique, in about 10 days.

2.7.3. Sample Size

In this study, it was planned to do the analyzes using SPSS and SmartPLS. For analyzes to be made with SmartPLS, it is recommended to work with a sample of 200 people or more. In this study, a total of 204 people participated in the survey and constituted a sufficient sample for the analyzes to draw meaningful results. Although the analyzes were made with 204 people who used e-scooters, 208 people who had never used e-scooters before were also included in the study to investigate the reasons for not using them. In other words, a total of 412 people participated in our survey.

2.8. Data Collection Method

After the survey questions were decided, survey were created through Google Docs. In the first stage, a pre-test was conducted with five people from our close circle to evaluate whether the survey questions were understandable or not. As a result of the positive comments received, it was decided that there was no semantic or expressive problem in the survey questions. Afterwards, the survey was made publicly available. In the first place, the survey announcement was made on social media platforms such as Instagram, Twitter and LinkedIn. On the other hand, the survey was also announced via e-mail as a traditional method. Some time after the survey announcements were made, reminder announcements were made through the same platforms. Snowball method was used to reach

new participants to the survey. In addition, new methods of reaching people in the digitalized world were also tried. For example, the QR code seen below was generated. When this QR code was scanned via smart phone's camera, people were able to access the survey we prepared directly on Google Docs. In this way, it has been possible for a randomly contacted person to fill out the survey without asking for any personal information (for example, phone number or social media accounts).



Figure 12. QR Code used to access directly to the survey

Source: Developed by the researcher

At the beginning of the survey (Shown in Appendix 4 in Turkish and Appendix 5 in English), general information about the survey was given. Afterwards, general information about e-scooters is given. Thus, it was aimed for the participants to understand whether the questionnaire was right for them or not. In the first question, users were asked if they had ever used an e-scooter before. If they stated that they did not use it as an answer, they were allowed to proceed directly to the sixth section of the questionnaire. In the sixth section, they were asked why they did not use an e-scooter before. The purpose of asking this is to provide a preliminary preparation for future studies in this field. If the participants stated that they had used an e-scooter before and chose the e-scooter application they used most, they could move on to the next sections of the survey.

In the first part of the survey, three questions were asked about users' preferences for using e-scooter.

In the second, third and fourth sections of the survey, there are Likert scale questions. Here, based on the model of the study, participants were asked about their degree of agreement with sentences containing some judgments. Questionnaire was prepared to measure the variables of exposure to Perceived Usefulness, Perceived Ease of Use, Intention to Use, Environmental Awareness, Travel Time Saving, Travel Energy Saving and Continuance Intention to Use. In addition to these, the participants were asked a question about the transportation options they use in their daily life.

In the fifth section of the survey, participants were asked demographic questions related to age, gender, the city they live in, their job, education level, with whom they lived and income level.

2.9. Data Analysis Method

The resulting data from the survey was exported directly from Google Docs in Excel format. Afterwards, the data were classified numerically in order to be able to analyze in programs such as SPSS and SmartPLS. First, the data was entered into the SmartPLS program and the model was created in the program. We used structural equation modeling to test the hypotheses. (Hoelter, 1983) suggested that minimum sample size of 200 is enough to use SEM analysis. The structural model was tested using consistent partial least squares path modeling (PLSc-PM). PLSc-PM method has some advantages to use in this study. It is based on regression, which minimizes the residual variances of the variables (Dirsehan & Cankat, 2021). Afterwards, some analyzes were conducted to measure the reliability of the model. After the model was found reliable, relational analyzes were started. All of these are discussed in detail in Chapter 3 of the study.

3. RESEARCH FINDINGS

In this section, we will talk about the results of the survey study carried out within the scope of the study, after it was analyzed with statistical programs.

3.1. Non-Response Bias Test

Non-response bias is analyzed by using the extrapolation method, which is a well-known method to avoid non-response bias. To measure, Independent Samples T Test was used. “Persons who respond in later waves are assumed to have responded because of the increased stimulus and are expected to be similar to non-respondents” according to (Armstrong & Overton, 1977). The first 30 responses to the survey and the last 30 responses were taken and it was checked whether there was a significant difference between them. All five variables in the model were included to this test. The findings show that there is no significant 0.05 level differences between these groups. All these informations can be seen in Table 5.

Table 5. Independent Samples t-test of the First 30 and the Last 30 of Respondents

<i>Variables</i>	<i>F</i>	<i>Sig.</i>	<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>
Frequency	,097	,757	,585	58	,561
ES	,643	,426	0,000	58	1,000
EA	,571	,453	1,240	58	,220
TS	,646	,425	,787	58	,434
CITU	,031	,860	,236	57,981	,814

Source: Developed by the researcher

3.2. Descriptive Analysis of Respondents

In the descriptive analysis part, the demographic and socioeconomic characteristics of the survey participants are examined. During this examination, the concepts in the survey, their frequencies and percentages are given. A total of 204 people participated in the survey. Although no official report has been published on the use of shared e-scooters in Turkey, it has been stated by the Minister of Transport and Infrastructure, Adil Karaismailoğlu that there are around 35,000 shared e-scooters and 10 million shared electric scooter rides have been made to date (Habertürk, 2020).

In the question in which the participants were asked about their gender, they were chosed between 4 predetermined options. When the genders of the respondents are examined, it can be said that an equal distribution is observed with a slight difference. 103 of the 204 people who participated

in the survey are female and 100 are male. 1 person did not want to specify her/him gender. Proportionally, female are 50.5%, male are 49%, and those who do not specify their gender are 0.5%.

The age of the participants was asked open-ended and they were asked to write their own age. The majority of the respondents, 55.9%, are between the ages of 26-35. This is followed by 32.8% between 18-25 years old, 8.3% between 36-45 years old and 2.9% over the age of 45. In numerical terms, the number of participants between the ages of 26-35 is 114, the number of participants between the ages of 18-25 is 67, the number of participants between the ages of 36-45 is 17, and finally the number of participants over the age of 45 is 6 people. "Average age of Turkish e-scooter riders is 27", according to the news in Hurriyet Daily News (Hurriyet Daily News, 2021). In our study, average age of e-scooter riders is 27,81. We can say that our study is consistent from the users age.

The education levels of the participants were asked with a predetermined 12-choice question. All of the 204 participants who participated in the survey consist of people who have at least high school graduation. When the education levels of the participants are examined, undergraduate graduates are in the first place with 88 people and 43.1%. This is followed by undergraduate students with 51 people and an average of 25%, graduate or doctorate students with 42 people and an average of 20.6%, graduate or doctorate graduates with an average of 20 people and 9.8%, and high school graduates with 3 people and 1.5%.

In the question asking about the professions of the participants, four predetermined choice and one "Other" option were added. Accordingly, 103 people with a ratio of 50.5% of the respondents described themselves as "Employee". 64 people described themselves as "Student" with 31.4%, 17 people as "Manager" with 8.3%, 11 people as "Academician" with 5.4%. People entering different professions are 9 people with a rate of 4.4%.

In the question of the province of residence, three predetermined options, namely Istanbul, Ankara and Izmir, which are the 3 most populated cities of Turkey, and one "Other" option were added. Accordingly, 136 people, 66.7% of the participants, stated that they live in Istanbul. Istanbul was followed by Ankara with 17.6% and 36 people, 25 "Other" responses with 12.3%, and İzmir with 3.4% and 7 people.

The question, in which respondents are asked who they live with, includes four predetermined options and an "Other" option. According to this, 108 people with a rate of 52.9% stated that they live with their parents. According to this, 108 people with a rate of 52.9% stated that they live with their parents. 41 people with a rate of 20.1% stated that they live with their spouses, 36 people with a rate of 17.6% stated that they live alone, 13 people with a rate of 6.4% stated that they live with their friends, and finally, 6 people with a rate of 2.9% chose the "Other" option.

There are six predetermined options in the question asking about the monthly income of the participants. According to this, 48 people stated that they earned 10.000 TL or more with a rate of

23.5%. This is followed by those who earn between 7501-10.000 TL with a rate of 19.1% and 39 people, and those who earn between 1-2500 TL with the same ratio and the same number of people. These are followed by 18.1% with 37 people earning between 5001-7500 TL, 14.7% with 30 people with 2501-5000 TL earning and 5.4% with 11 people without a monthly income.

The descriptive statistics mentioned above are listed in the Table 6.

Table 6. Sample's Demographic and Socioeconomic Characteristics

<i>Attributes</i>	<i>Distribution</i>	<i>Frequency</i>	<i>%</i>
<i>Gender</i>	Female	103	50,5%
	Male	100	49,0%
	Other	0	0,0%
	Not stated	1	0,5%
<i>Age</i>	18-25	67	32,8%
	26-35	114	55,9%
	36-45	17	8,3%
	45+	6	2,9%
<i>Education Level</i>	High School (Student)	0	0,0%
	High School (Graduate)	3	1,5%
	University (Student)	51	25,0%
	University (Bachelor)	88	43,1%
	Master - PhD (Student)	42	20,6%
	Master - PhD	20	9,8%
	Others	0	0,0%
	<i>Job</i>	Student	64
Employee		103	50,5%
Manager		17	8,3%
Academician		11	5,4%
Others		9	4,4%
<i>Place of Residence</i>	İstanbul	136	66,7%

	Ankara	36	17,6%
	İzmir	7	3,4%
	Others	25	12,3%
<i>Live With</i>	Alone	36	17,6%
	Parents	108	52,9%
	Spouse	41	20,1%
	Friends	13	6,4%
	Others	6	2,9%
<i>Montly Income</i>	0 TL	11	5,4%
	1-2500 TL	39	19,1%
	2501-5000 TL	30	14,7%
	5001-7500 TL	37	18,1%
	7501-10000 TL	39	19,1%
	10000+ TL	48	23,5%

Source: Developed by the researcher

3.2.1. E-scooter Usage Habits

This section contains the statistics of the questions we asked in the first part of the survey, related to e-scooter usage preferences. The first statistic we examined was related to the first question of the survey, e-scooter brand preference. A total of 8 e-scooter brands were included in this question, and there was also an option stating that users had never used an e-scooter before. Once participants chose an e-scooter brand, they were able to continue with the rest of the survey. However, the participants who stated that they did not use an e-scooter before were faced with an open-ended question asking why they had not used an e-scooter before.

As seen in Figure 13, the participants stated that they use 6 out of 8 e-scooter brands. Accordingly, Martı was the most popular brand with 89.2% and 182 people. This is followed by BinBin with 6.4% rate and 13 people, HOP! with 2.5% rate and 5 people, Palm by Fenix with 1% rate and 2 people, Rocket Scooter with 0.5% and 1 person and the same rate and the number of people followed by Tornet.

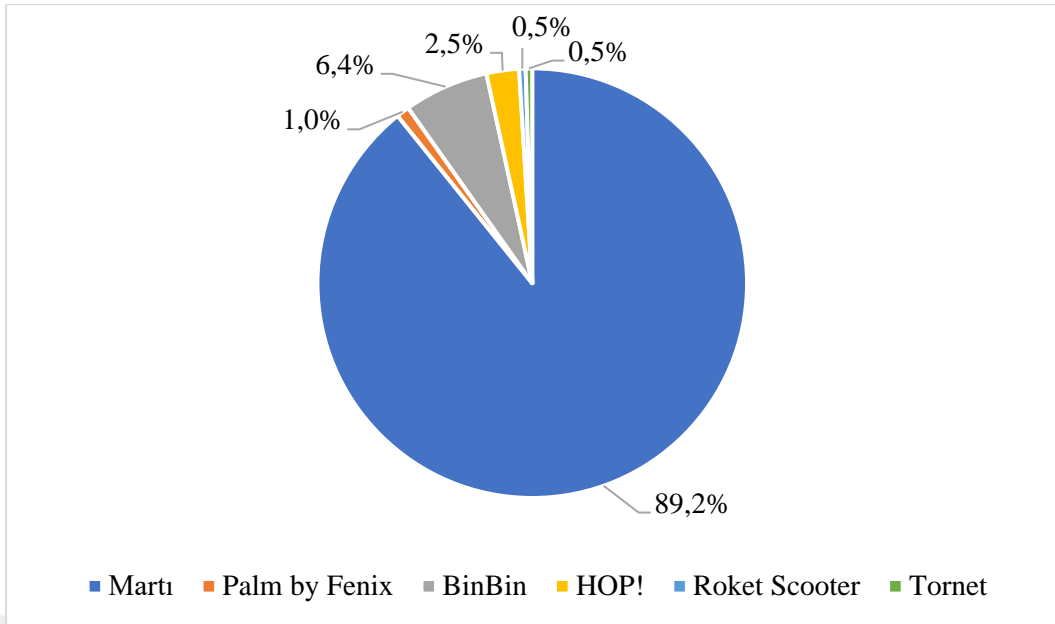


Figure 13. E-Scooter Brand Choice of Participants

Source: Developed by the researcher

Participants were asked about their purpose of using the e-scooter with an open-ended question. Afterwards, all answers to this question were read and categorized. Accordingly, the answers were analyzed in 5 different categories: Entertainment, Transportation, Trial, Cost and Other. As can be seen in Figure 14, 134 people with a rate of 65.7% stated that they use e-scooters for transportation. This was followed by entertainment with 21.1% and 43 people, other reasons with 6.9% and 14 people, cost with 3.4% and 7 people, and finally trial with 2.9% and 6 people. We have share this information in Figure 14 below.

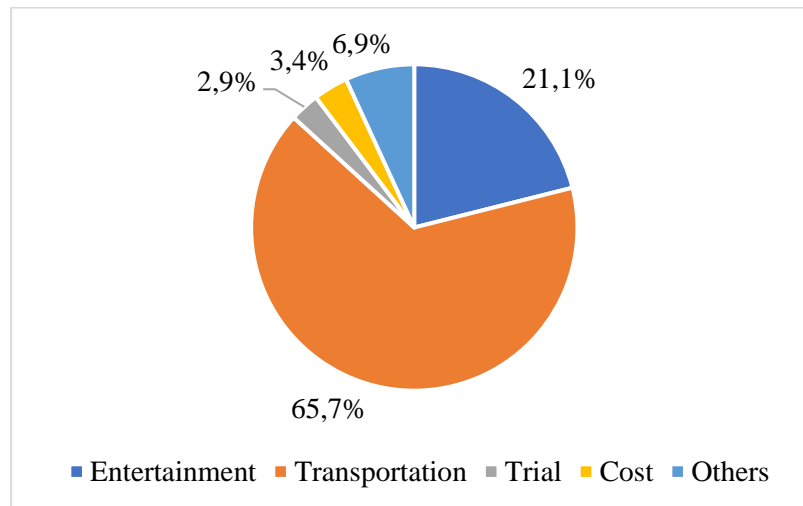


Figure 14. Reasons to Use E-Scooters

Source: Developed by the researcher

According to the newly released e-scooter regulation in Turkey, it is obligatory to use e-scooters by one person. However, this rule is not a rule that people often follow, as is often seen on the streets. That's why we asked respondents in the survey how many people they use e-scooters with. Interestingly, a total of 26 people stated that they use e-scooters with two people. The remaining 178 people stated that they use e-scooters alone in accordance with the regulations. We have share this information in Figure 15 below.

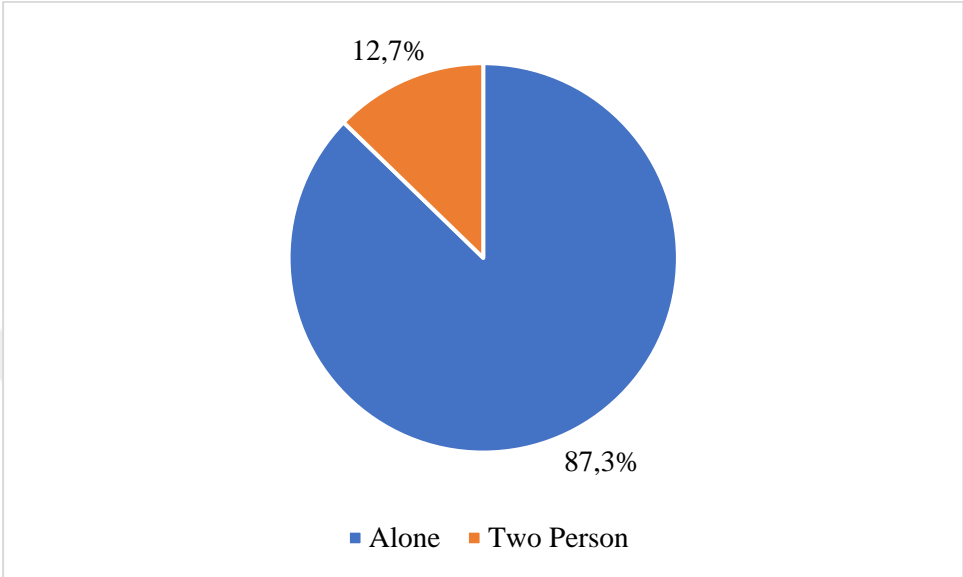


Figure 15. How many people do you usually use the e-scooter with?

Source: Developed by the researcher

3.2.2. Other Transportation Option’s Usage Habits

Participants were also asked how often they used each of the seven predetermined vehicles, apart from the e-scooter. Brief information about these vehicles and their frequency of use is shared below.

We asked the question "How often do you use personal cars in travelling?". As seen in the Figure 16, among the 204 answers, 69 replied as "More Often" which is 33,8% of total, 51 replied as "Often" which is 25,0% of total, 32 replied as "Sometimes" which is 15,7% of total, 16 replied as "Rare" which is 7,8% of total, 18 replied "Very Rare" which is 8,8% of total and 18 replied "Never" which is 8,8% of total.

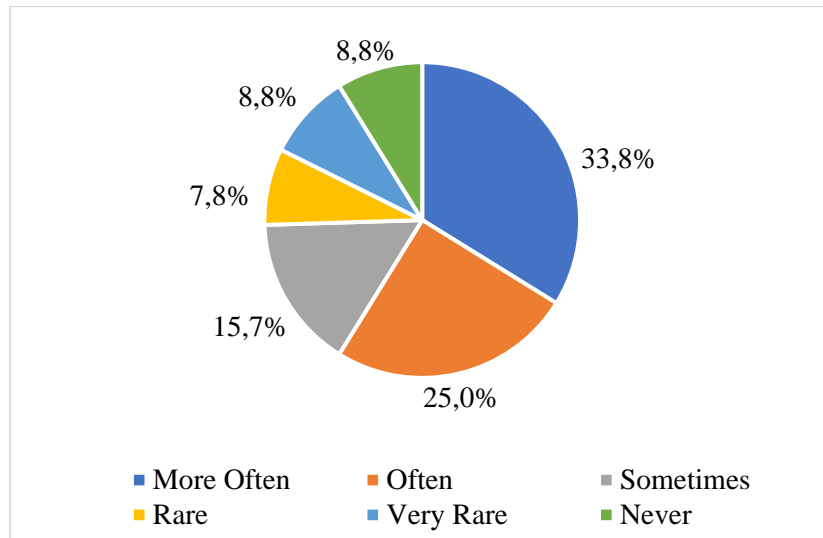


Figure 16. Participants' Personal Car Usage Stats

Source: Developed by the researcher

We asked the question "How often do you use motorcycle in travelling?". As seen in the Figure 17, among the 204 answers, 3 replied as "More Often" which is 1,5% of total, 1 replied as "Often" which is 0,5% of total, 7 replied as "Sometimes" which is 3,4% of total, 8 replied as "Rare" which is 3,9% of total, 15 replied "Very Rare" which is 7,4% of total and 170 replied "Never" which is 83,3% of total.

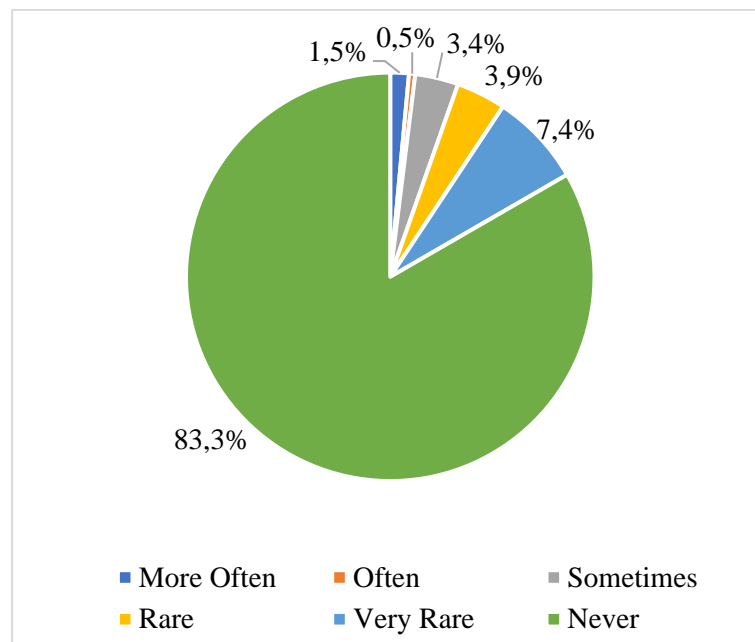


Figure 17. Participants' Motorcycle Usage Stats

Source: Developed by the researcher

We asked the question "How often do you use bicycle in travelling?". As seen in the Figure 18, among the 204 answers, 3 replied as "More Often" which is 1,5% of total, 7 replied as "Often" which is 3,4% of total, 17 replied as "Sometimes" which is 8,3% of total, 36 replied as "Rare" which is 17,6% of total, 52 replied "Very Rare" which is 25,5% of total and 89 replied "Never" which is 43,6% of total.

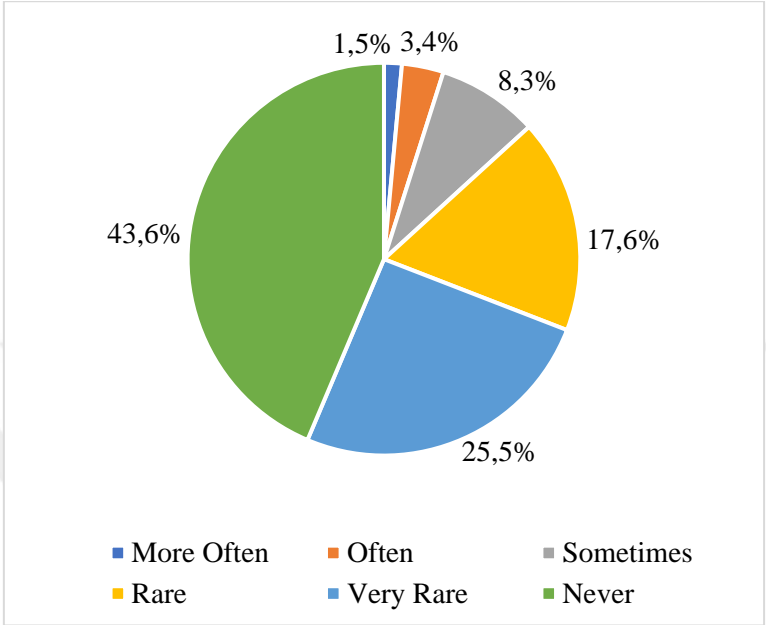


Figure 18. Participants' Bicycle Usage Stats

Source: Developed by the researcher

We asked the question "How often do you use shared automobiles in travelling?". As seen in Figure 19, among the 204 answers, 5 replied as "More Often" which is 2,5% of total, 11 replied as "Often" which is 5,4% of total, 16 replied as "Sometimes" which is 7,8% of total, 20 replied as "Rare" which is 9,8% of total, 29 replied "Very Rare" which is 14,2% of total and 123 replied "Never" which is 60,3% of total.

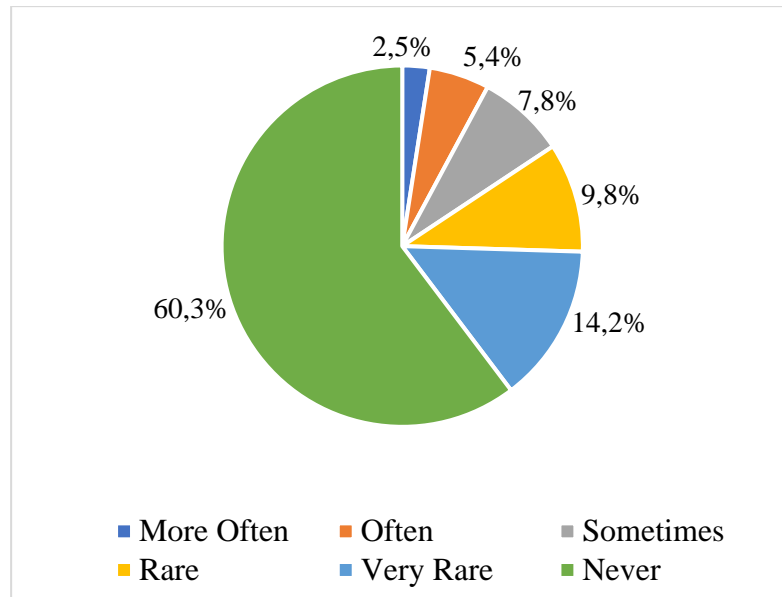


Figure 19. Participants' Shared Automobile Usage Stats

Source: Developed by the researcher

We asked the question "How often do you use shared bicycles in travelling?". As seen in the Figure 20, among the 204 answers, 1 replied as "More Often" which is 0,5% of total, 0 replied as "Often" which is 0,0% of total, 2 replied as "Sometimes" which is 1,0% of total, 12 replied as "Rare" which is 5,9% of total, 22 replied "Very Rare" which is 10,8% of total and 167 replied "Never" which is 81,9% of total.

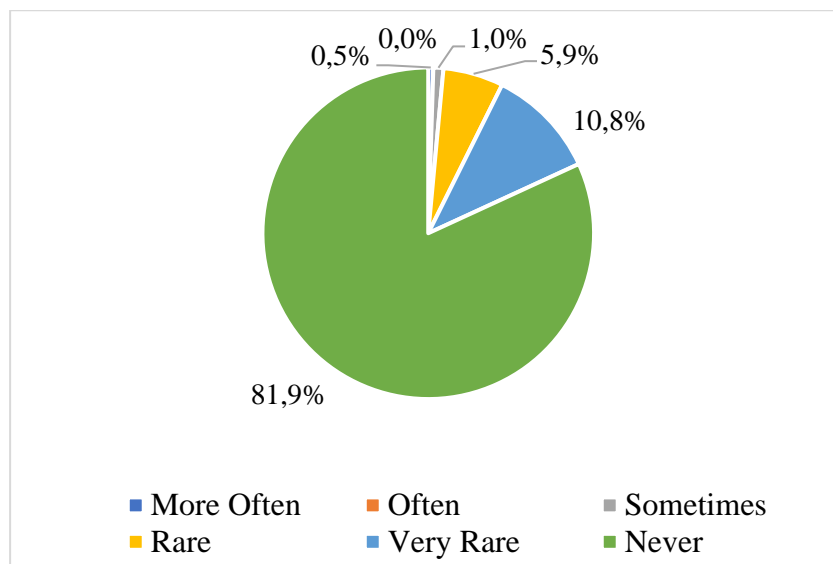


Figure 20. Participants' Shared Bicycle Usage Stats

Source: Developed by the researcher

We asked the question "How often do you use metro in travelling?". As seen in the Figure 21, among the 204 answers, 48 replied as "More Often" which is 23,5% of total, 51 replied as "Often"

which is 25,0% of total, 33 replied as "Sometimes" which is 16,2% of total, 34 replied as "Rare" which is 16,7% of total, 23 replied "Very Rare" which is 11,3% of total and 15 replied "Never" which is 7,4% of total.

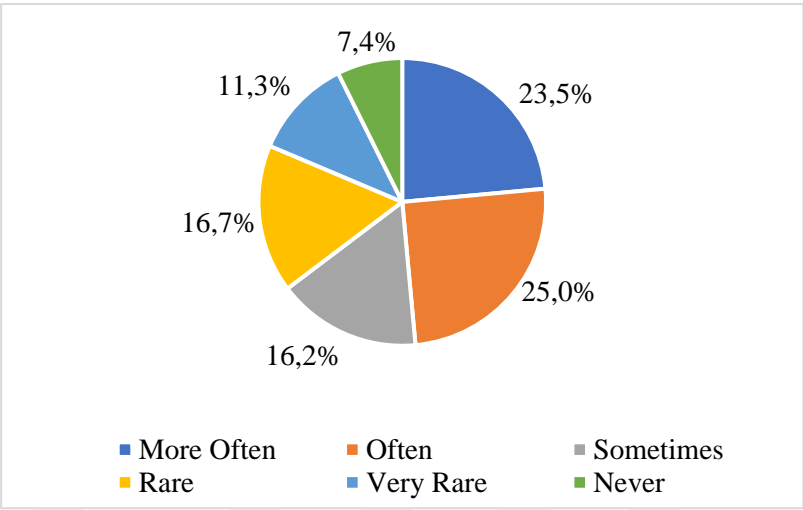


Figure 21. Participants' Metro Usage Stats

Source: Developed by the researcher

We asked the question "How often do you use bus in travelling?". As seen in the Figure 22, among the 204 answers, 47 replied as "More Often" which is 23,0% of total, 30 replied as "Often" which is 14,7% of total, 41 replied as "Sometimes" which is 20,1% of total, 36 replied as "Rare" which is 17,6% of total, 34 replied "Very Rare" which is 16,7% of total and 16 replied "Never" which is 7,8% of total.

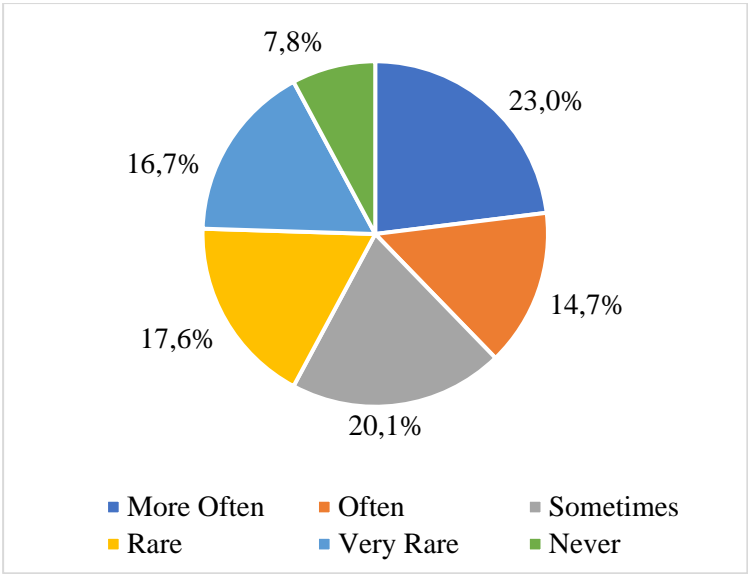


Figure 22. Participants' Bus Usage Stats

Source: Developed by the researcher

3.3. Analysis of the Constructs

As explained earlier, the model of the study includes 4 independent variables and 1 dependent variable. While creating the model, it was accepted that users found e-scooters useful and easy to use, if we looked from the Technology Acceptance Model framework. In other words, the model tested the stages after the use of e-scooters. Time Saving, Energy Saving, Environmental Awareness and Usage Frequency are independent variables of the model, while Continuance Intention to Use is dependent variable of the study. For the analysis, consistent PLS algorithm was preferred in this study; because, it yields more accurate results with reflective variables (Dijkstra & Henseler, 2015). Also, for the analysis, SmartPLS programme was used. In Figure 23, the proposed model is seen. The analysis was carried out on this model.

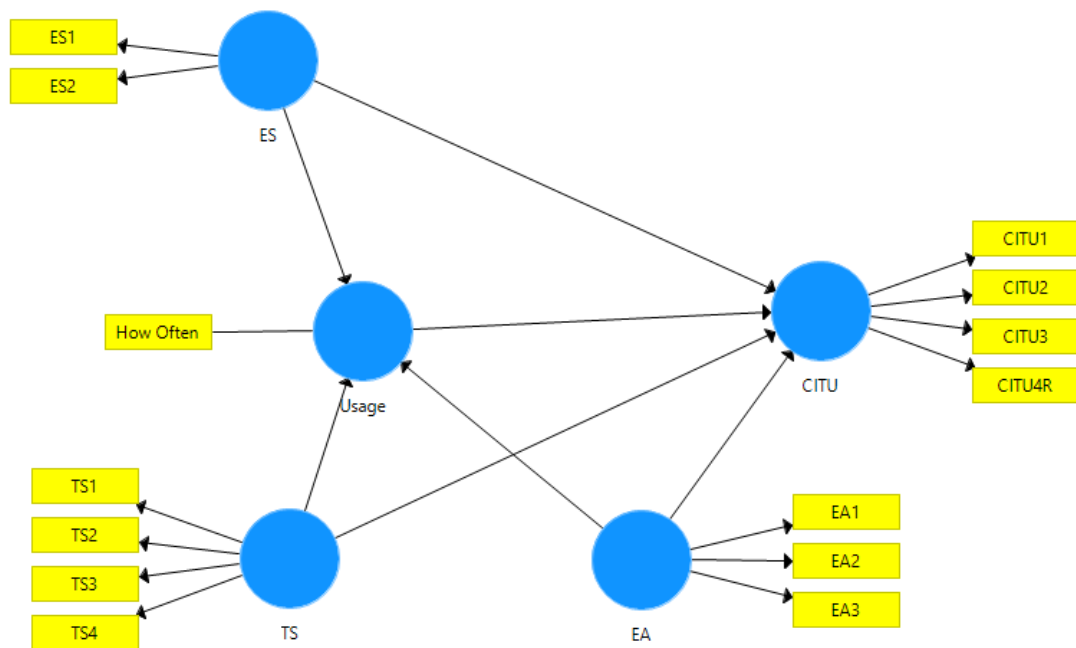


Figure 23. Proposed Model of the Study

Source: Developed by the researcher

Cronbach's Alpha and Composite Reliability (CR) values of the constructs are more than 0,70, suggested by (Cohen, 1988). In addition, As (Hair et al., 2014) suggested that Average Variance Extracted (AVE) value should exceed 0,50 and all constructs have more than 0,50 AVE values. As seen in Table 7, the values obtained as a result of the analysis meet the recommended values. On the other hand "Support is provided for convergent validity when each item has outer loadings above 0.70", according to (Hair et al., 2014).

Table 7. Reliability and Validity of Reflective Constructs

	<i>Cronbach's Alpha</i>	<i>Composite Reliability (CR)</i>	<i>Average Variance Extracted (AVE)</i>
<i>CITU</i>	0.843	0.845	0.650
<i>EA</i>	0.846	0.848	0.651
<i>ES</i>	0.776	0.778	0.637
<i>TS</i>	0.868	0.873	0.637
<i>Usage</i>	1.000	1.000	1.000

Source: Developed by the researcher

“A heterotrait-monotrait (HTMT) ratio of 0.85 was used as the cutoff value for assessing discriminant validity, as suggested by (Jörg Henseler et al., 2015) and (Voorhees et al., 2016)”, according to (Dirsehan & Cankat, 2021). As seen in Table 8, the values obtained as a result of the analysis meet the recommended values.

Table 8. Heterotrait Monotrait Ratios (HTMT)

	<i>CITU</i>	<i>EA</i>	<i>ES</i>	<i>TS</i>	<i>Usage</i>
<i>CITU</i>					
<i>EA</i>	0.545				
<i>ES</i>	0.608	0.604			
<i>TS</i>	0.825	0.625	0.608		
<i>Usage</i>	0.475	0.073	0.197	0.294	

Source: Developed by the researcher

3.4. The Model's Goodness of Fit

“In order to assess model fit in PLS-PM, a Standardized Root Mean Square Residual (SRMR) should be estimated. If the SRMR value is smaller than 0.080, the model can be acceptable”, according to (Benitez et al., 2020) and (Cankat, 2020). That means the study can be acceptable. “NFI is the other value to be able to assume the model fits well. In this context NFI values must be higher than 0.90”, according to (Lohmöller, 1989) and (Ünalmiş, 2021). In this study, the NFI value of the Estimated Model was calculated as 0.912. As seen in Table 9, the values obtained as a result of the analysis meet the recommended values.

Table 9. Model Fit Results

	<i>Estimated Model</i>
<i>SRMR</i>	0.046
<i>d_ULS</i>	0.190
<i>d_G</i>	0.130
<i>Chi-Square</i>	134.693
<i>NFI</i>	0.912

Source: Developed by the researcher

“R Square is assessed as it used to evaluate the goodness of fit in regression analysis (Wooldridge, 2012), (Benitez et al., 2020)” according to (Cankat, 2020). R squared values range from 0 to 1 and are commonly stated as percentages from 0% to 100% (Fernando, 2021). In this study, adjusted R square of Continuance Intention to Use is 0.758. As seen in Table 10, the values obtained as a result of the analysis meet the recommended values.

Table 10. Evaluation of R Square

	<i>R Square</i>	<i>R Square Adjusted</i>
<i>CITU</i>	0.763	0.758
<i>Usage</i>	0.111	0.098

Source: Developed by the researcher

Benitez et al., 2020 suggest 0,707 level for the factor analysis. As seen Table 11, all of the items except CITU2 and TS3 are higher than this level. Since the factor loading value is 0.194, it was decided that the CITU4R was excluded from the model. Since other variables were significant, they were not excluded from the study in order not to impair the validity. CITU2 and TS3 values are just below the recommended value. We did not exclude these values from the model because the t values are significant.

Table 11. Factor Loadings of Variables

<i>Variable</i>	<i>Item</i>	<i>Content Description</i>	<i>Factor Loading</i>
<i>Continuance Intention to Use</i>	CITU1	I intend to continue using e-scooters.	0.935
	CITU2	I always try to use e-scooters.	0.661
	CITU3	I encourage everyone to use e-scooters.	0.798
<i>Environmental Awareness</i>	EA1	I am worried about carbon dioxide (CO ₂) emissions due to car use.	0.852
	EA2	Car use leads to serious environmental problems.	0.742
	EA3	Using fossil fuels in cars is an important factors of climate change.	0.822
<i>Energy Saving</i>	ES1	Using e-scooter reduces intra-city traffic and thus reduces fuel consumption.	0.839

	ES2	Using e-scooter reduces travel energy costs as service are delivered with electric power.	0.755
<i>Frequency</i>	How Often	How often do you use e-scooters?	1.000
<i>Time Saving</i>	TS1	I believe that by using e-scooters I can complete my trip in the shortest possible time.	0.844
	TS2	In my opinion, using e-scooters saves my time.	0.853
	TS3	I can use e-scooters whenever I want or whenever I need.	0.575
	TS4	Using e-scooters prevents time spent in traffic.	0.882

Source: Developed by the researcher

3.5. Analysis of the Structural Model

The structural model was examined by PLS-PM. Hypothesis testing results shown in Table 12. The table includes path coefficients, T statistics and P value. T statistics' show the significant relations of path analysis. The T score is a ratio between the difference between two groups and the difference within the groups. The larger the T score, the more difference there is between groups. The smaller the T score, the more similarity there is between groups. If the P value found in a test result is less than 0.05, it means that there is a significant difference in the comparison result. "Hypotheses were tested using Efron's (1987) bias-corrected bootstrapping (Jörg Henseler et al., 2009), (Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, 2017) and 4999 (Henseler, 2017) subsamples were selected", like the similar study of (Hurmacı, 2021).

Table 12. Hypothesis Testing Results

<i>Hypothesis</i>	<i>Path</i>	<i>Path Coefficient</i>	<i>T Statistics</i>	<i>P Value</i>	<i>Decision</i>
H1	EA -> CITU	0.057	0.640	0.522	Not supported
H2	EA -> Usage	-0.214	1.909	0.056	Not supported
H3	ES -> CITU	0.151	1.387	0.165	Not supported
H4	ES -> Usage	0.112	0.943	0.346	Not supported
H5	TS -> CITU	0.627	7.414	0.000	Supported
H6	TS -> Usage	0.356	3.172	0.002	Supported
H7	Usage->CITU	0.256	4.712	0.000	Supported

Source: Developed by the researcher

H1 estimates that environmental awareness is positively related with continuance intention to use. The results show that environmental awareness ($\beta=0.057$; $t=0.640$; $p=0.522$) is not statistically significant and positively not related with continuance intention to use. H1 is not supported.

H2 estimates that environmental awareness is positively related with e-scooter usage frequency. The results show that environmental awareness ($\beta=-0.214$; $t=1.909$; $p=0.056$) is not statistically significant and negatively not related with e-scooter usage frequency. H2 is not supported.

H3 estimates that energy saving is positively related with continuance intention to use. The results show that energy saving ($\beta=0.151$; $t=1.387$; $p=0.165$) is not statistically significant and positively not related with continuance intention to use. H3 is not supported.

H4 estimates that energy saving positively related with e-scooter usage frequency. The results show that energy saving ($\beta=0.112$; $t=0.943$; $p=0.346$) is not statistically significant and positively not related with e-scooter usage frequency. H4 is not supported.

H5 estimates that time saving is positively related with continuance intention to use. The results show that time saving ($\beta=0.627$; $t=7.414$; $p=0.000$) is statistically significant and positively related with continuance intention to use. H5 is supported.

H6 estimates that time saving is positively related with e-scooter usage frequency. The results show that time saving ($\beta=0.356$; $t=3.172$; $p=0.002$) is statistically significant and positively related with e-scooter usage frequency. H6 is supported.

H7 estimates that e-scooter usage frequency is positively related with continuance intention to use. The results show that e-scooter usage frequency ($\beta=.256$; $t=4.712$; $p=.000$) is statistically significant and positively related with intention to use. H7 is supported.

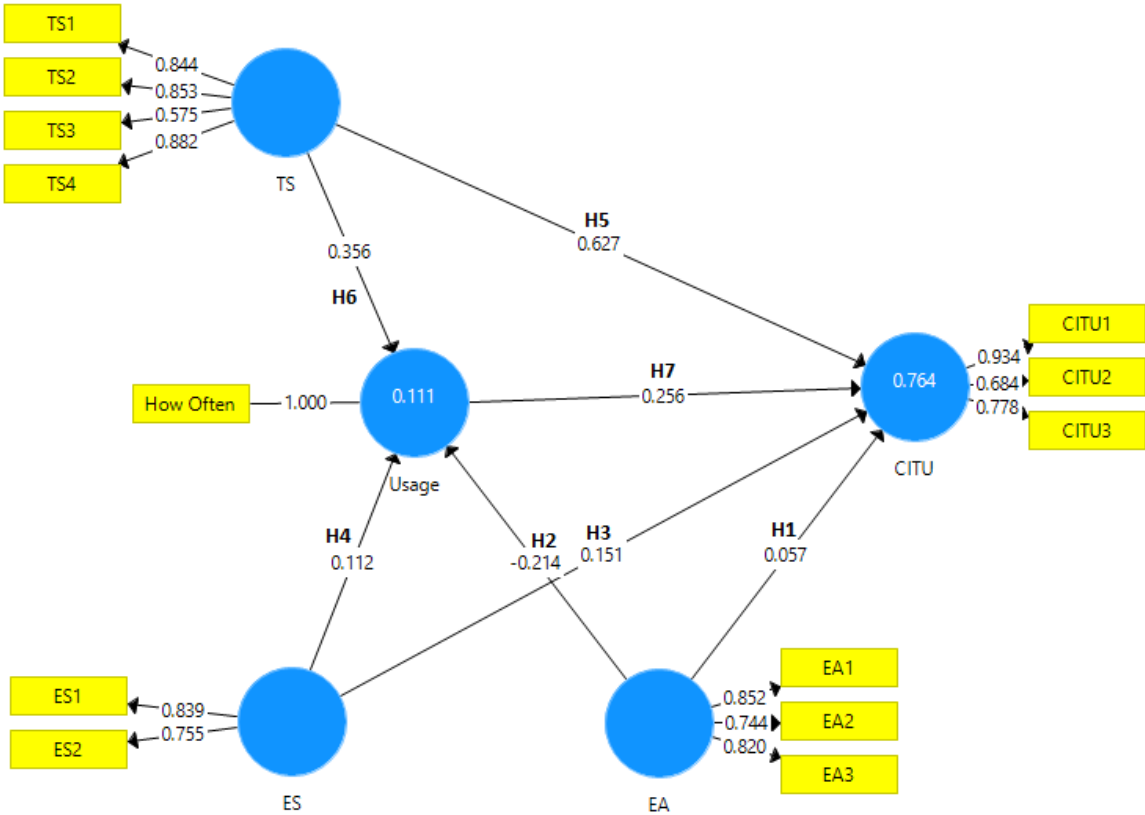


Figure 24. Structural Model with Path Coefficients

Source: Developed by the researcher

Table 13. Summary of Hypothesis

<i>Hypothesis Number</i>	<i>Hypothesis</i>	<i>Supported</i>	<i>Not Supported</i>
H1	Environmental awareness positively related with continuance intention to use.		X
H2	Environmental awareness positively related with e-scooter usage frequency.		X

H3	Energy saving is positively related with continuance intention to use.		X
H4	Energy saving is positively related with e-scooter usage frequency.		X
H5	Time saving is positively related with continuance intention to use.	X	
H6	Time saving is positively related with e-scooter usage frequency.	X	
H7	E-Scooter user frequency is positively related with continuance intention to use.	X	

Source: Developed by the researcher

Table 14 includes the Total Effect table of the study. The most prominent result in this table is that the TS-> CITU direct effect is 0.627, while the total effect is 0.718. It has been determined that TS has both a direct effect on CITU and an indirect effect on Usage.

Table 14. Total Effects

	<i>Original Sample (O)</i>	<i>Sample Mean (M)</i>	<i>Standard Deviation (STDEV)</i>	<i>T Statistics (O/STDEV)</i>	<i>P Values</i>
<i>EA -> CITU</i>	0.002	0.002	0.093	0.022	0.983
<i>EA -> Usage</i>	-0.214	-0.225	0.112	1.921	0.055

<i>ES -> CITU</i>	0.180	0.185	0.118	1.516	0.130
<i>ES -> Usage</i>	0.112	0.127	0.120	0.937	0.349
<i>TS -> CITU</i>	0.718	0.719	0.085	8.417	0.000
<i>TS -> Usage</i>	0.356	0.355	0.111	3.208	0.001
<i>Usage -> CITU</i>	0.256	0.254	0.055	4.691	0.000

Source: Developed by the researcher

3.6. Testing Group Differences

Group difference tests were done via SPSS. Before analysis, variables' questions re-grouped in SPSS, then the analysis have been done. First test focuses on gender differentiation on variables of the study. For this analysis, we ignored one answer which does not includes specific gender. Table 15 indicates that there are no statistically significant differences between female and male in terms of e-scooter usage frequency, energy saving, time saving and continuance intention to use. On the other hand, there is statistically significant differences between female and male in terms of environmental awareness. So, H8 is partially supported.

Table 15. Independent Samples T-test for Differences between Female and Male

<i>Variables</i>	<i>Gender</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>t-test for Equality of Means</i>		
					<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>
<i>Frequency</i>	Woman	103	2,291	1,0350	-1,300	201	,195
	Man	100	2,490	1,1415	-1,298	197,801	,196
<i>ES</i>	Woman	103	3,9320	,83151	-,675	201	,500
	Man	100	4,0200	1,01732	-,673	191,060	,502
<i>EA</i>	Woman	103	4,2524	,71472	2,192	201	,030
	Man	100	3,9900	,97494	2,182	181,344	,030
<i>TS</i>	Woman	103	3,9539	,70689	,846	201	,399
	Man	100	3,8575	,90680	,843	187,075	,400
<i>CITU</i>	Woman	103	3,3851	,88038	,239	201	,811
	Man	100	3,3533	1,00929	,239	195,658	,812

Source: Developed by the researcher

Second test focuses on age differentiation on variables of the study. To analyse, one way ANOVA test has done. Before analysis, age informations were re-grouped as 18-25, 26-35, 36-45 and 45+. At the first part of the analysis, homogeneity of variances had been tested. Accordingly, robust test was performed for two values that did not pass the homogeneity of variances test.

Table 16. Test of Homogeneity of Variances in the Context of Age Groups

<i>Variables</i>	<i>Levene Statistic</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
<i>Frequency</i>	1,040	3	200	,376
<i>ES</i>	1,998	3	200	,116
<i>EA</i>	3,547	3	200	,016
<i>TS</i>	4,888	3	200	,003
<i>CITU</i>	1,094	3	200	,353

Source: Developed by the researcher

Table 17 indicates that there are no statistically significant differences between age groups in terms of e-scooter usage frequency, time saving and continuance intention to use.

In robust test, it is seen that environmental awareness is not statistically significant. That means, in the context of age groups, environmental awareness differs. To determine differences between groups, posthoc method was applied. As a result of the Scheffle and Games-Howell tests, it is seen that people between the ages of 18-25 differ in a positive and significant way in terms of environmental awareness compared to people between the ages 26-35. So, H9 is partially supported.

Table 17. Robust Tests of Equality of Means in the Context of Age Groups

		<i>Statistic</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
<i>Frequency</i>	Welch	1,088	3	20,230	,377
<i>ES</i>	Welch	3,041	3	20,401	,052
<i>EA</i>	Welch	3,708	3	19,810	,029
<i>TS</i>	Welch	1,205	3	20,564	,333
<i>CITU</i>	Welch	1,433	3	20,283	,262

Table 18. ANOVA Test for Differences between Age Groups

<i>Variables</i>	<i>f</i>	<i>Sig.</i>
<i>Frequency</i>	1,024	,383
<i>ES</i>	2,978	,033
<i>EA</i>	4,178	,007
<i>TS</i>	1,299	,276
<i>CITU</i>	,994	,397

Source: Developed by the researcher

H10 is focuses on income level differentiation on variables of the study. At the beginning, environmental awareness did not pass homogeneity of variances test. After the robust test, we found

that environmental awareness is statistically significant. Finally, H10 is not supported because no value differs significantly.

Table 19. ANOVA Test for Differences between Income Levels

<i>Variables</i>	<i>f</i>	<i>Sig.</i>
<i>Frequency</i>	1,619	,157
<i>ES</i>	,501	,776
<i>EA</i>	,755	,584
<i>TS</i>	,347	,884
<i>CITU</i>	1,531	,182

Source: Developed by the researcher

H11 is focuses on educational level differentiation on variables of the study. At the first part of the analysis, homogeneity of variances had been tested. Accordingly, robust test was performed for one value that did not pass the homogeneity of variances test.

Table 20. Test of Homogeneity of Variances in the Context of Educational Levels

<i>Variables</i>	<i>Levene Statistic</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
<i>Frequency</i>	1,286	4	199	,277
<i>ES</i>	6,904	4	199	,000
<i>EA</i>	2,046	4	199	,089
<i>TS</i>	2,419	4	199	,050
<i>CITU</i>	2,101	4	199	,082

Source: Developed by the researcher

Table 22 indicates that there are no statistically significant differences between educational levels in terms of e-scooter usage frequency, environmental awareness, time saving and continuance intention to use.

In robust test, it is seen that energy saving is not statistically significant. That means, in the context of educational levels, energy saving differs. To determine differences between groups, posthoc method was applied. As a result of the Games-Howell test, it is seen that people with Master or PhD degree differs compared to the people with High School diploma in terms of energy saving. In addition, it is seen that people that studies in university, differs compared to the people that studies in Master – PhD and people with High School diploma in terms of energy saving. H11 is partially supported.

Table 21. Robust Tests of Equality of Means in the Context of Educational Levels

		<i>Statistic</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
<i>Frequency</i>	Welch	1,255	4	14,186	,333
<i>ES</i>	Welch	3,932	4	14,171	,024
<i>EA</i>	Welch	,883	4	14,067	,499
<i>TS</i>	Welch	,690	4	14,062	,611
<i>CITU</i>	Welch	,843	4	14,130	,521

Source: Developed by the researcher

Table 22. ANOVA Test for Differences between Educational Levels

<i>Variables</i>	<i>f</i>	<i>Sig.</i>
<i>Frequency</i>	1,800	,130
<i>ES</i>	5,505	,000
<i>EA</i>	,777	,541
<i>TS</i>	,990	,414
<i>CITU</i>	1,039	,388

Source: Developed by the researcher

As a result of these explanations about group differences, the status of the hypotheses is compiled separately in the table below.

Table 23. Summary of Group Differences Hypothesis

<i>Hypothesis Number</i>	<i>Hypothesis</i>		<i>Supported</i>	<i>Not Supported</i>	<i>Hypothesis Status</i>
H8	There is a difference between female and male in terms of	Using e-scooter		X	Partially Supported
		Energy saving		X	
		Time saving		X	
		Environmental awareness	X		
		Continuance intention to use		X	

H9	There is a difference between age groups in terms of	Using e-scooter		X	Partially Supported
		Energy saving		X	
		Time saving		X	
		Environmental awareness	X		
		Continuance intention to use		X	
H10	There is a difference between income levels in terms of	Using e-scooter		X	Not Supported
		Energy saving		X	
		Time saving		X	
		Environmental awareness		X	
		Continuance intention to use		X	
H11	There is a difference between educational level in terms of	Using e-scooter		X	Partially Supported
		Energy saving	X		
		Time saving		X	
		Environmental awareness		X	
		Continuance intention to		X	

		use			
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Source: Developed by the researcher

Of course, not all of the people who filled out the questionnaire were using e-scooters. Those who did not use it went directly to section 6 of the questionnaire. Here they were asked why they had not used an e-scooter before. The incoming answers were categorized and the following results were obtained:

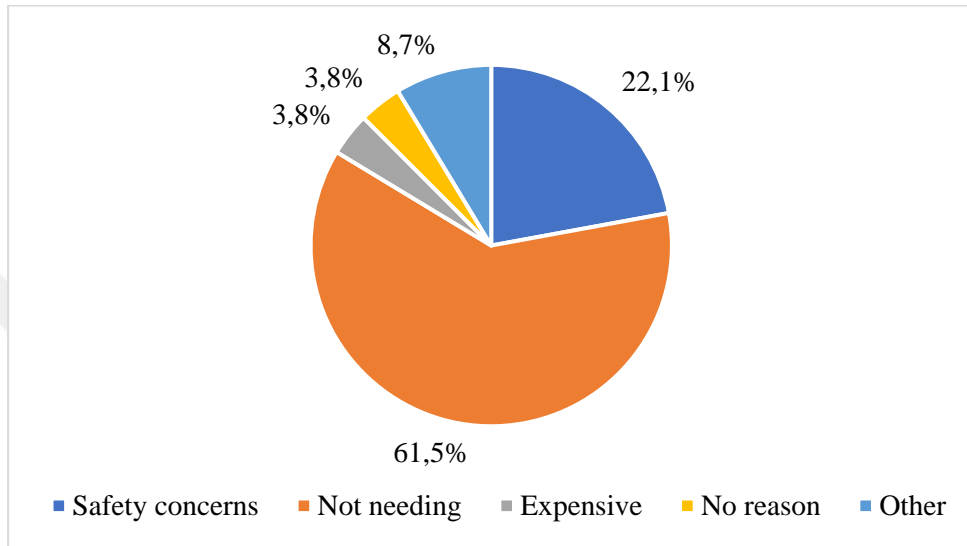


Figure 25. What is the reason you have not used an e-scooter before?

Source: Developed by the researcher

As Figure 25 shows, the majority of users have never needed to use an e-scooter before. This result is interesting considering that the users use it more for entertainment purposes. One group sees e-scooters as a part of entertainment, while another group sees it as a necessity. Another interesting point is that some of the non-users stated that it was expensive, but some of the users stated that they used it because it was cheap.

4. DISCUSSION

This study aimed to explain the e-scooter usage preferences in Turkey through the Technology Acceptance Model. In doing so, concepts such as Smart City, Smart Mobility, Sharing Economy and Micromobility were explained from a broad perspective, before mentioning e-scooters in the first place. In this way, the reader was conveyed what the essence of the subject is and on what ground the work should be done. Afterwards, the Technology Acceptance Model, which forms the basis of the study, its history, its different variations and its applications in different fields in academia were mentioned. In this way, it has been shown that the model has a wide application area, and can be applied to this study and can meet needs of this study. Afterwards, the main model of the study was revealed. While the main model was being put forward, it was assumed that the necessary stages of the Technology Acceptance Model were completed. In other words, the model focused on the stages after the use of e-scooters. In the next stages, our research topic was time saving, energy saving, environmental awareness and the interest of continuous intention to use.

After the model was established, a survey study was conducted in accordance with the model. The data obtained as a result of the survey study, in which 204 people participated, were converted into numerical data and analyzed with the SmartPLS program. In the first stage, factor analyzes were looked at and the model was tested to see if it was significant. Afterwards, path analyzes were made and the relations between the variables were tested. As a result, 4 of the 7 predetermined hypotheses were not supported and 3 were supported.

According to the accepted hypotheses, the intention of the participants to use the e-scooter continues when they think that they save time. Similarly, participants continue to use e-scooters when they think they save time. On the other hand, as long as e-scooter usage continues, participants' intention to use e-scooter continues. In addition, this results supported (Sepasgozar et al., 2019)'s findings.

Regrettably, environmental factors were not found to influence users' continued use or intention to use the e-scooter. (Okada et al., 2019) claimed direct effect of environmental awareness' on behavioral intention. So, our findings don't support this study. As a general result of the study, it was determined that people think about themselves in the first place rather than the environment. This difference may be due to the culture of the country and society in which the study was conducted.

In this study, it was observed that environmental awareness, energy saving, time saving, e-scooter use and continuance intention to use changed according to factors such as age, education level, and gender. On the other hand, no different effect of income level on environmental awareness, energy saving, time saving, e-scooter usage and continuance intention to use was observed.

The table below includes the findings of our study, studies that support our findings, and studies that do not support our findings.

As seen, we found that time saving leads people to use e-scooters. In addition, we found that e-scooter users intend to continue using e-scooter when they think they save time. Sepasgozar et al. founded that time saving affects consumers' behavioral intention to use mobile urban services. Based on this argument, we can claim that our finding has similarities with some former academic studies (Sepasgozar et al., 2019).

We found that personal benefit such as time saving over the environmental concerns. There are some academic studies those support our finding like Gimpel et al.'s study and Eccarius & Lu's study. On the other hand, there are some academic studies those does not support our findings like Y. Wang et al.'s study.

Our other findings are females are more environmentally aware than males, younger people care more about energy saving and environmental awareness than older people and higher educational level leads energy saving. They also have some supportive former studies and also they have some studies that have opposite view. The reason for this difference may be cultural differences, educational differences, demographic and socioeconomic characteristics.

Table 24. Our Findings, Similer Studies and Different Studies

Our Findings	Similar With...	Different With...
Time saving leads people to use e-scooters.	Time saving affects consumers' behavioral intention to use mobile urban services (Sepasgozar et al., 2019).	-
E-scooter users intend to continue using e-scooter when they think they save time.	Time saving affects consumers' behavioral intention to use mobile urban services (Sepasgozar et al., 2019).	-
Personal benefit such as time saving over the environmental concerns.	Environmental concern has no significant explanatory value on behavioral intention (Gimpel et al., 2020). No matter how pronounced a respondent's environmental	Consumers who have a higher level of environmental awareness are more willing to use the sustainable transportation of ride-sharing services (Y. Wang et al., 2020).

	values are, they only lead to a positive intention to use an e-scooter if its use is perceived as compatible with one's lifestyle or transportation needs and as being within the control of the respondent, or easy enough to perform (Eccarius & Lu, 2020).	
Females are more environmentally aware than males.	It is found that a significant difference is exist between male and female in their level of environmental attitudes (Awan & Abbasi, 2013).	Gender has no significant effect on environmental awareness (Shivakumara et al., 2015).
Younger people care more about energy saving and environmental awareness than older people.	Younger and more educated respondents tended to be more knowledgeable and concerned about the environment than older and less educated respondents (Abdul-Wahab & Abdo, 2010)	Environmental awareness rises with age, reaches a peak in early to late middle age and then declines with the oldest age groups (Morrison & Beer, 2017).
Higher educational level leads energy saving.	Individuals with a higher educational level tend to be more 'environmentally-friendly' (Zimmer et al., 1992)	Educational levels are not significant for distinguishing the more pro-environmental individuals from the others (Paço & Varejão, 2010)

Source: Developed by the researcher

5. CONCLUSION

The aim of this research was to analyse the impact of energy saving, time saving and environmental awareness' to consumers' continuous intention to use e-scooters and e-scooter usage. To analyse, we collected the data via the survey that we prepared for this study. We analyzed it through SmartPLS and SPSS. Results shows that people who had used or use e-scooters prioritize personal benefit instead of environmental factors. The reason for this may be cultural differences, education level, and insufficient environmental education.

5.1. **Academical Implications**

This study, by designing the Technology Acceptance Model and a new model, investigated and revealed the factors affecting the use of e-scooter users in Turkey. In the first stage, a new thesis study using the Technology Acceptance Model was brought to the academy. On the other hand, with a new model designed by the researchers, a new approach has been developed on the use of e-scooters.

At the time of this study, there were not many studies related to e-scooters in the foreign literature. Academic resources related to similar micromobility solutions were used as helpful resources. This study aims to be a reference for academic studies based on e-scooters. On the other hand, there are very few academic studies on micromobility in Turkey. Our study, which aims to be a pioneering study in this field, will guide the future articles and thesis studies.

As a result of the study, it was seen that saving time was effective in using e-scooters and continuance intention to use e-scooters. On the other hand, it turned out that when the participants started using e-scooters, they intended to continue to use it.

When the other hypotheses of the study were tested, it was seen that male and female participants differed from each other on environmental awareness. Similarly, people aged 18-25 differed from those aged 26-35 in environmental awareness and energy conservation. It has been observed that the participants differ in energy saving according to their education level.

5.2. **Managerial Implications**

The e-scooter sector is growing rapidly in Turkey. In the survey conducted within the scope of this study, 8 e-scooter companies operating in Turkey were asked. According to the sample, the most used e-scooter companies were analyzed and their percentages were extracted. This is of course information that closely concerns the relevant companies. In addition, according to the result of the e-scooter usage preferences, which is the main focus of the study, it was seen that people care more about travelling quickly than protecting the environment. Of course, this is information that can

change the marketing plans of companies and the industry. Companies can follow new advertising and marketing methods in the light of this information. Companies should also take a good look at why users have never used e-scooters before. Most of the people stated that they never needed it before and that's why they didn't use it. An aggressive marketing campaign that goes on top of this can be carried out by companies. In addition, for security concerns, brands can take certain measures separate from other brands and highlight them in their marketing activities.

5.3. Research Limitations

The biggest limit to research for this study was recruiting respondents. E-scooters are becoming more and more common, but nowadays it is quite difficult to reach people who use e-scooters. In this study, as mentioned before, many methods were tried to reach users, but contrary to what was thought, the survey study had to take a long time.

There has been no demographic study on the e-scooter sector in Turkey before. For this reason, although the demographic findings in this study seem consistent within themselves, they may not reflect the Turkey average. It should be emphasized that the study reflects the characteristics of the sample rather than the conditions in Turkey. If there was a general report, the study could be generalized.

5.4. Further Research Directions

Future research should certainly include the impact of the Covid-19 pandemic, and test health-related variables. The importance of such micromobility vehicles has increased with the epidemic, but on the other hand, they create a hygiene problem due to their shared use. This aspect must be examined. Again, testing different hypotheses for future research will both contribute to the micromobility industry and diversify academic studies on micromobility. While there are deficiencies in both fields in Turkey, any academic work to be done in these fields will be beneficial.

In future academic studies, analysis of people who do not use e-scooters can also be carried out. This issue can be examined in more detail by making exploratory studies about people not using e-scooters.

As another suggestion, factors related to the new e-scooter regulation can be examined. Subjects such as which e-scooters are used in accordance with the rules, and the damages to people and e-scooters that are not used according to the rules can be investigated.

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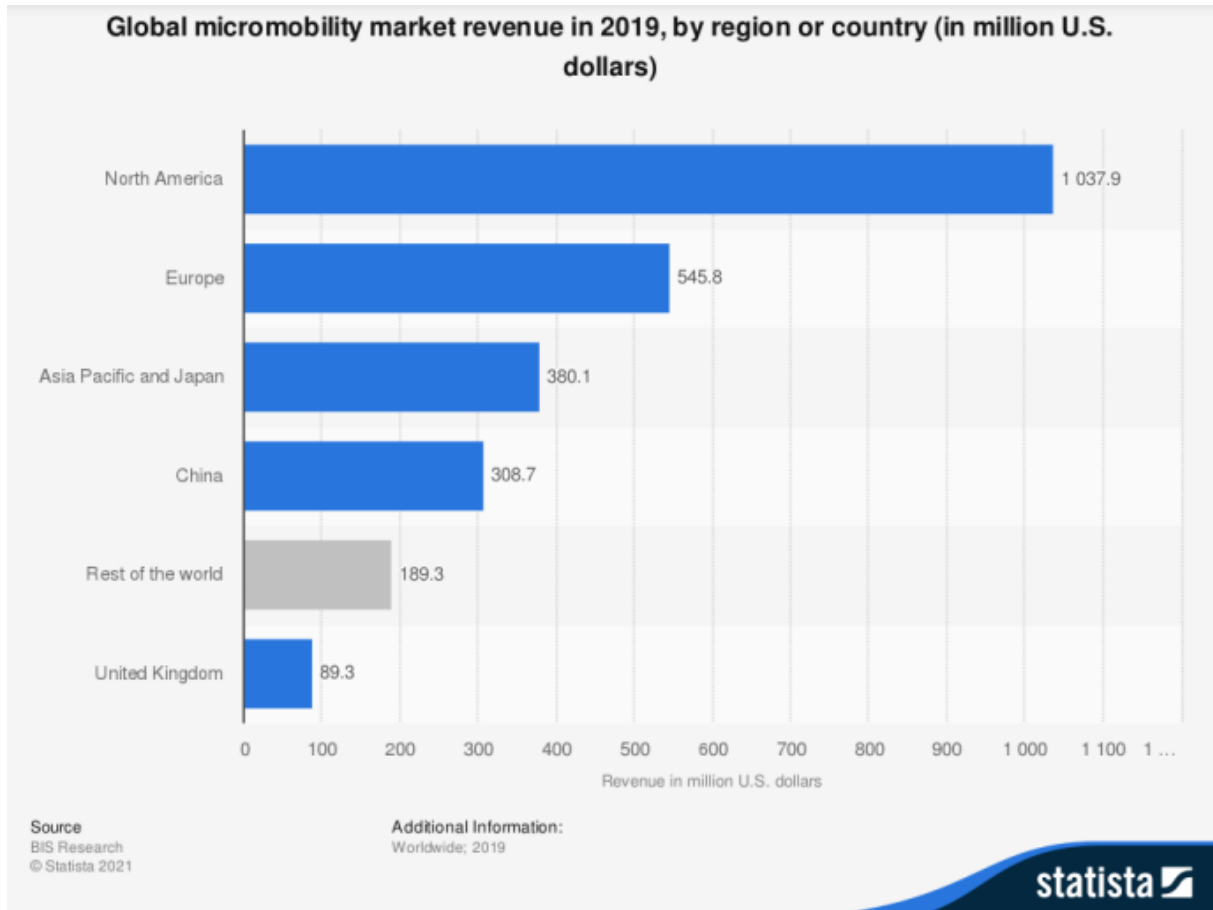
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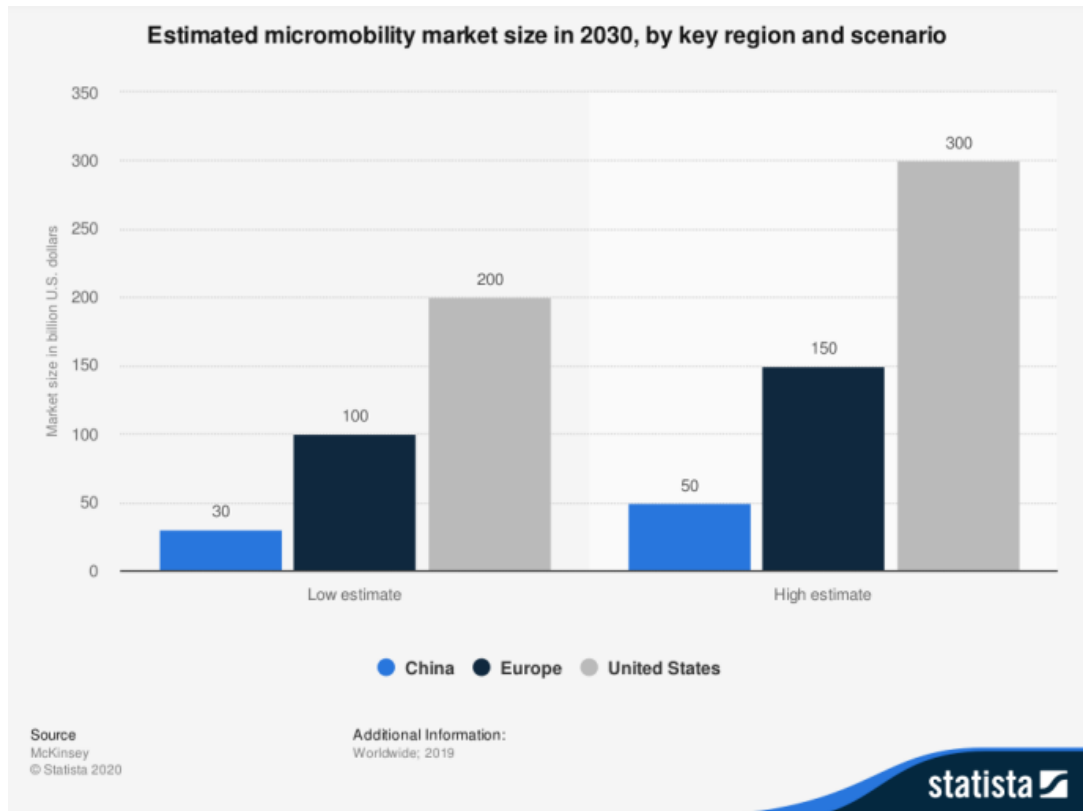
APPENDICES

Appendix 1: Global Micromobility Market Revenue in 2019, by Region or Country (In Million U.S. Dollars)



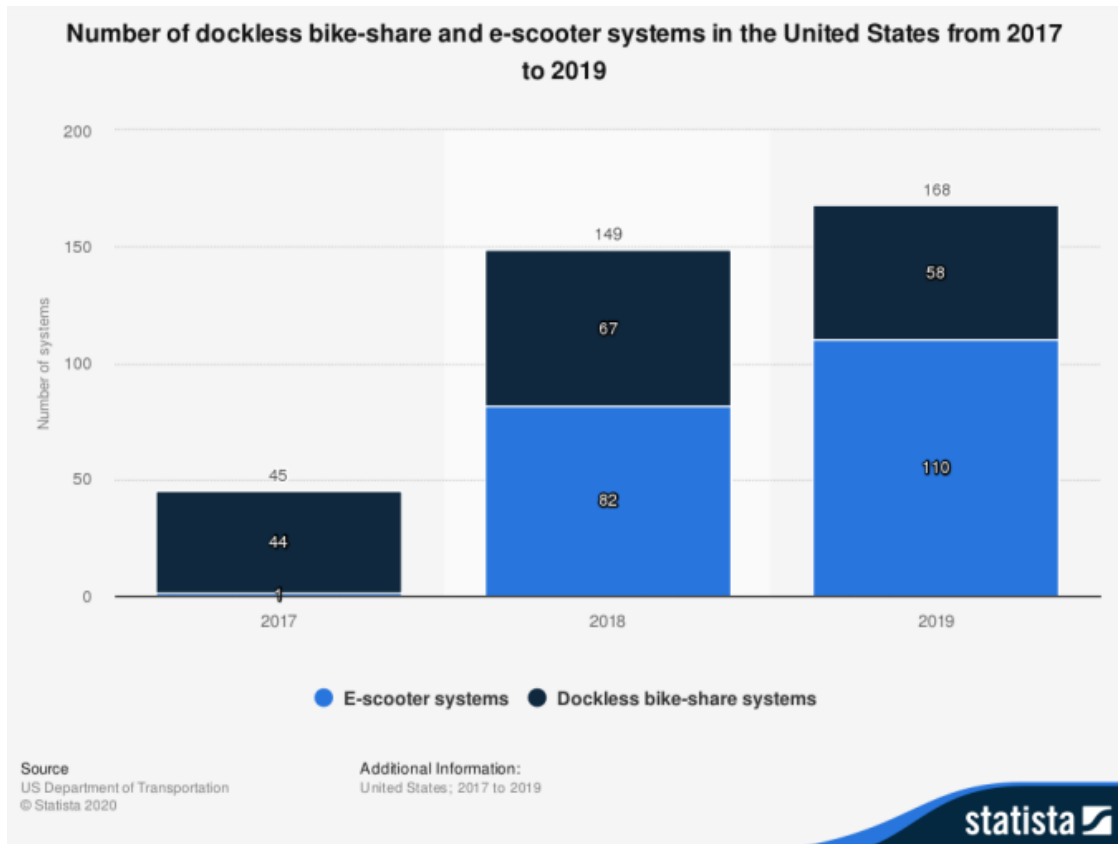
Source: Salas, E. (2021). *Global micromobility market revenue in 2019, by region or country*. from Statista: <https://www.statista.com/statistics/1201028/micromobility-market-revenue-worldwide-by-region/>

Appendix 2: Estimated Micromobility Market Size in 2030, by Key Region and Scenario



Source: Carlier, M. (2019). *Estimated micromobility market size in 2030, by key region and scenario.* from Statista: <https://www.statista.com/statistics/1012311/estimated-micromobility-market-size-by-region/>

Appendix 3: Number of Dockless Bike-Share and E-Scooter Systems in the United States from 2017 to 2019



Source: Carlier, M. (2020). *Number of dockless bike-share and e-scooter systems in the United States between 2017 and 2019*. from Statista: <https://www.statista.com/statistics/1135193/number-of-dockless-bike-share-and-e-scooter-systems-united-states/>

Appendix 4: Questionnaire in Turkish

E-Scooter Kullanım Anketi

Değerli Katılımcı,

Bu anket formu T.C. Marmara Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı İngilizce Üretim Yönetimi ve Pazarlama bölümünde sürdürmekte olduğumuz yüksek lisans programı tez çalışmasının istatistiksel uygulama bölümüne aittir. Sizden alınacak tüm bilgiler tamamen gizli tutulacak ve sadece akademik çalışma için kullanılacak olup, adınızı/soyadınızı belirtmenize gerek yoktur. Sizlerden alacağımız cevaplar ile e-scooter kullanımının kullanıcılar üzerine etkilerini araştıracağız. Sağlıklı bilimsel veriler elde edebilmek için her soruyu dikkatle okuyup cevaplandırmanızı rica eder, katılımınız ve desteğiniz için çok teşekkür ederiz.

Yüksek Lisans Öğrencisi Mustafa Mert FİL
Doç. Dr. Taşkın DİRSEHAN

E-scooter nedir?

Elektrikli scooter (veya yaygın kullanımıyla e-scooter), iki teker üzerinde ilerleyen, direksiyonu sayesinde yön ve hızı ayarlanabilen, elektrik ile şarj edilerek çalışan, bu özellikleri ile kısa mesafelerde ulaşım sağlamak için uygun olarak tasarlanmış, bir çeşit küçük ulaşım aracıdır. Bisiklet veya elektrikli bisikletlere alternatif oluşturur. Yaygın kullanımı mobil uygulamalar üzerinden kısa süreli kiralama şeklindedir. Kullanıcılar, ilgili mobil uygulamayı indirdikten sonra uygulama üzerindeki haritadan, kendilerine en yakın e-scooter'a ulaşırlar. Uygulama üzerinden e-scooter'daki karekod okutulmuş e-scooter'ın kilidi açılır ve sürüş başlatılır. Sürüş tamamlandıktan sonra e-scooter uygun bir yere park edilip bağlanır ve fotoğrafı çekilip uygulamaya yüklenir. Bu sayede sürüş tamamlanmış olur, ödeme daha önceden uygulamaya tanımlanmış kredi kartı üzerinden çekilir.

E-scooter kullanırken en çok hangi uygulamayı kullanıyorsunuz?

- Martı
- Palm by Fenix
- BinBin
- HOP!
- Roket Scooter
- Tazı
- Biri
- Tornet
- Daha önce bir e-scooter kullanmadım.

*Anketin devamında cevaplayacağımız sorulara bu uygulamayı düşünerek cevap veriniz.

BÖLÜM 1

Hangi sıklıkla e-scooter kullanıyorsunuz?

- Çok sık
- Sık
- Ara sıra
- Nadir
- Çok nadir

Genellikle e-scooter'ı kaç kişiyle beraber kullanıyorsunuz?

- Yalnız
- İki kişi
- Üç kişi
- Diğer:.....

Neden e-scooter kullanıyorsunuz? Kısaca bahsedebilirsiniz.

.....

BÖLÜM 2

Bu bölümde çeşitli ifadeler ve görüşler yer almaktadır. Lütfen aşağıdaki ifade ve görüş cümlelerine en sık kullandığımız e-scooter firmasını ve mobil uygulamasını birlikte düşünerek katılma derecenizi uygun kutuya çarpı işareti koyarak belirtiniz.

		Kesinlikle katılmıyorum (1)	Katılmıyorum (2)	Ne Katılmıyorum ne katılmıyorum (3)	Katılıyorum (4)	Kesinlikle katılıyorum (5)
PEOU2	E-scooter kullanmada ustalaşmak benim için kolaydır.					
PU4	E-scooter kullanmak bana daha iyi bir yolculuk deneyimi sağlar.					
PU2	E-scooter kullanmanın benim için değerli bir hizmet olduğunu düşünüyorum.					
PEOU4	E-scooter uygulamalarını kullanmak benim için kolaydır.					

ES2	E-scooter kullanmak, elektrik gücüyle sağlandığından dolayı seyahat enerji maliyetlerini azaltır.					
PU1	E-scooter kullanmak, yolculuğumu sorunsuz tamamlamamı sağlar.					
PEOU1	E-scooter kullanmayı öğrenmek benim için kolaydır.					
PU3	E-scooter'ları faydalı bulurum.					
PEOU3	E-scooter uygulamaları kullanıcı dostudur.					
PU5	E-scooter uygulamalarını kullanmak, e-scooter hizmetlerini kullanmanın etkili bir yoludur.					
ES1	E-scooter kullanmak şehir içi trafiği azaltır ve böylece yakıt tüketimini azaltır.					

BÖLÜM 3

Bu bölümde çeşitli ifadeler ve görüşler yer almaktadır. Lütfen aşağıdaki ifade ve görüş cümlelerine en sık kullandığınız e-scooter firmasını ve mobil uygulamasını birlikte düşünerek katılma derecenizi uygun kutuya çarpı işareti koyarak belirtiniz.

		Kesinlikle katılmıyorum (1)	Katılmıyorum (2)	Ne Katılıyorum ne katılmıyorum (3)	Katılıyorum (4)	Kesinlikle katılıyorum (5)
EA1	Araba kullanımından kaynaklanan karbondioksit (CO2) emisyonları konusunda endişeliyim.					

EA2	Araba kullanımı ciddi çevre sorunlarına yol açmaktadır.					
EA3	Otomobillerde fosil yakıtların kullanılması iklim değişikliğinin önemli bir nedenidir.					
TS1	E-scooter kullanarak seyahatimi en kısa sürede tamamlayabileceğime inanıyorum.					
TS2	Bence e-scooter kullanmak zamandan tasarruf ettirir.					
TS3	E-scooter'ı istediğim veya ihtiyacım olduğu zaman kullanabilirim.					
TS4	E-scooter kullanmak trafikte geçirilen zamanı kısaltır.					
CITU1	E-scooter kullanmaya devam etmek niyetindeyim.					
CITU2	Her zaman e-scooter kullanmaya çalışırım.					
CITU3	Herkesi e-scooter kullanmaya yönelik cesaretlendiririm.					
CITU4R	E-scooter kullanabilecek bir durumda olsam bile, yine de geleneksel seyahat yöntemlerini tercih ederim.					

BÖLÜM 4

Aşağıdaki ulaşım seçeneklerini ne sıklıkla kullanıyorsunuz?

	Hiç (0)	Oldukça nadir (1)	Nadiren (2)	Ortalama (3)	Sık sık (4)	Oldukça sık (5)
Özel Araç (Otomobil)						
Özel Araç (Motosiklet)						
Bisiklet						
Paylaşımlı Otomobil						
Paylaşımlı Bisiklet						
Metro						
Otobüs						
E-Scooter						

BÖLÜM 5

Lütfen yaşınızı belirtiniz:

Lütfen cinsiyetinizi belirtiniz:

- Kadın
- Erkek
- Diğer
- Belirtmek istemiyorum

Lütfen yaşadığınız ili belirtiniz:

- İstanbul
- Ankara
- İzmir

- Diğer:.....

Lütfen işinizi belirtiniz (Öğrenci, Çalışan, Yönetici, Öğretmen vb.):

- Öğrenci
- Çalışan
- Yönetici
- Akademisyen
- Diğer:.....

Eğitim düzeyiniz:

- İlköğretim
- İlkokul Terk
- İlkokul Mezunu
- Ortaokul Terk
- Ortaokul Mezunu
- Lise Terk
- Lise Öğrencisi
- Lise Mezunu
- Lisans Öğrencisi
- Lisans Mezunu
- Yüksek Lisans veya Doktora Öğrencisi
- Yüksek Lisans veya Doktora Mezunu
- Diğer:.....

Kiminle yaşıyorsunuz?

- Yalnız
- Ailemle (Ebeveyn)
- Eşimle
- Arkadaşlarımla
- Diğer:.....

Lütfen aylık ortalama gelirinizi TL olarak belirtiniz:

- 0
- 0-2500
- 2501-5000
- 5001-7500
- 7501-10000
- 10000+

BÖLÜM 6

Daha önce bir e-scooter kullanmamanızın sebebi nedir?

.....



Appendix 5: Questionnaire in English

E-Scooter Usage Survey

Dear Participant,

This survey belongs to T.C. Marmara University Institute of Social Sciences, Department of Business Administration, Department of Production Management and Marketing in English and the statistical application section of the thesis. All information received from you will be kept completely confidential and will only be used for academic study, you do not need to specify your name/surname. We will investigate the effects of e-scooter usage on users with the answers we will receive from you. In order to obtain healthy scientific data, we ask you to carefully read and answer each question, thank you very much for your participation and support.

Graduate Student Mustafa Mert FİL
Doç. Dr. Taşkın DİRSEHAN

What is e-scooter?

The electric scooter (or e-scooter as it is commonly used) is a kind of small transportation vehicle that moves on two wheels, can be adjusted in direction and speed thanks to its steering wheel, works by being charged with electricity, and is designed suitable for transportation over short distances with these features. It creates an alternative to bicycles or electric bicycles. Its common use is in the form of short-term rentals via mobile applications. After users download the relevant mobile application, the closest e-scooter can be found from the map on the application. By scanning the QR code on the e-scooter through the application, the e-scooter is unlocked and the drive is started. After the ride is completed, the e-scooter is parked in a suitable place and docked and its photo is taken and uploaded to the application. In this way, the ride is completed, the payment is done via the credit card previously introduced to the application.

Which application do you use most when using an e-scooter?

- Martı
- Palm by Fenix
- BinBin
- HOP!
- Roket Scooter
- Tazı
- Biri
- Tornet
- I have never used an e-scooter before.

*Answer the questions that you will answer in the continuation of the survey, thinking about this application.

SECTION 1

How often do you use e-scooters?

- Very often
- Often
- Sometimes
- Rare
- Very rare

How many people do you usually use the e-scooter with?

- Alone
- Two person
- Three person
- Other:.....

Why are you using an e-scooter? You can answer briefly.

.....

SECTION 2

Various statements and opinions are included in this section. Please consider the e-scooter company and mobile application you use most frequently, and indicate your level of agreement by putting a cross in the appropriate box.

		Strongly disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly agree (5)
PEOU2	It is easy for me to become skillful to use e-scooter.					
PU4	Using e-scooter gives me better trip experience.					
PU2	I think, using e-scooter provides a valuable service for me.					
PEOU4	It is easy for me to use e-scooter apps.					

ES2	Using e-scooter reduces travel energy costs as service are delivered with electric power.					
PU1	Using e-scooter enables me to complete trip without any issue.					
PEOU1	Learning to use e-scooter is easy for me.					
PU3	I find e-scooters useful.					
PEOU3	E-scooter apps are user-friendly.					
PU5	Using e-scooter apps is effective way to use e-scooter services.					
ES1	Using e-scooter reduces intra-city traffic and thus reduces fuel consumption.					

SECTION 3

Various statements and opinions are included in this section. Please consider the e-scooter company and mobile application you use most frequently, and indicate your level of agreement by putting a cross in the appropriate box.

		Strongly disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly agree (5)
EA1	I am worried about carbon dioxide (CO ₂) emissions due to car use.					
EA2	Car use leads to serious environmental problems.					
EA3	Using fossil fuels in cars is an important factors of climate change.					

TS1	I believe that by using e-scooters I can complete my trip in the shortest possible time.					
TS2	In my opinion, using e-scooters saves my time.					
TS3	I can use e-scooters whenever I want or whenever I need.					
TS4	Using e-scooters prevents time spent in traffic.					
CITU1	I intend to continue using e-scooters.					
CITU2	I always try to use e-scooters.					
CITU3	I encourage everyone to use e-scooters.					
CITU4R	Even though e-scooters are available to use, I still use traditional trip options.					

SECTION 4

How often do you use the following transportation options?

	Never (0)	Very rare (1)	Rare (2)	Sometimes (3)	Often (4)	Very often (5)
Private Vehicle (Car)						
Private Vehicle (Motorcycle)						
Bicycle						

Shared Car						
Shared Bicycle						
Metro/Subway						
Bus						
E-Scooter						

SECTION 5

Please specify your age:.....

Please specify your gender:

- Female
- Male
- Other
- I do not want to specify

Please specify the city you live in:

- İstanbul
- Ankara
- İzmir
- Other:.....

Please specify your job (Student, Employee, Manager, Teacher, etc.):

- Student
- Employee
- Manager
- Academician
- Other:.....

Your education level:

- Elementary Education
- Primary School Dropout
- Primary School Graduate

- Secondary School Dropout
- Secondary School Graduate
- High School Dropout
- High School Student
- High School Graduate
- Undergraduate Student
- Bachelor's Degree
- Master or PhD Student
- Post Graduate or Doctorate Degree
- Other.....

Who do you live with?

- Alone
- With my family (Parent)
- With my wife/husband
- With my friend
- Other:.....

Please specify your monthly average income in TL:

- 0
- 0-2500
- 2501-5000
- 5001-7500
- 7501-10000
- 10000+

SECTION 6

Why have you never used an e-scooter before?

.....