LUISS Guido Carli
LIBERA UNIVERSITA' INTERNAZIONALE DEGLI STUDI SOCIALI

Department of Business and Management
Chair of Machine Learning

SHARED MOBILITY: ADOPTION AND BARRIERS OF E-SCOOTERS

Supervisor

Prof. Luigi Laura

Co-Supervisor

Prof. Giuseppe Italiano

Prof. Giovanni Luca Cascio Rizzo

Candidate

Shadi Almaradi

Student No.

704061

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Introduction

The research project has the objective to explore and analysis the attitude of people toward the e-scooter sharing in the Italian market. The phenomena of urbanization and the rise of megacity (more than 10 million people), 33 around the world, concentrated in 20 countries, with 529 million people living in these giant towns made urban mobility over the years a challenge increasingly difficult. Most towns do not have a strategy and vision to re-think mobility systems, due to a lack of interaction between public and private sector leading to sub-optimal mobility results, and a diminishment in the quality life of the citizens. Digital technology is helping operators to provide infrastructure in a safer, cheaper, and more effective way, with stronger automation and allowing customer to access to different options for travelling. Furthermore, the automotive industry is preparing for drastic changes in personal vehicles, seeking innovative and creative solutions for smart urban mobility with the expansion of autonomous vehicle.

The most important innovation that has improved urban mobility is the shared mobility phenomena, which has been active in the major cities around the world and has brought several benefits that brought have been demonstrated such as cost reduction, comfort, diminishment in vehicles miles usage and decreased in vehicle ownership, and also reduced greenhouse gas emission. Initially, shared mobility involved only cars, but with the time companies have introduced motorcycle and bikes sharing system. The latest innovation regarding the micro-mobility theme is e-scooters sharing, which has created several benefits and discussion around the main American and European cities. In 2020 the major e-scooters companies (Lime, Bird, Helbiz) have announced their launch in the Italian market, for this reason, I choose to investigate and explore deeply the attitude and willingness to try these new product in the Italian Market. The research project can be fundamental for e-scooters managers, who can better understand their marketing strategy but also the future of e-scooter sharing system in an integrated part of urban mobility, as well as policy maker who can take advantage of this innovation to reduce traffic jams in cities, reduce gas emission, and creating new opportunities of travel mode that can better suit the different needs of people.

The following research is structured in four chapters. The first one is a general introduction to the sharing economy, covering the main principles of the business model and how this has impacted the society. The second chapter is dedicated to urban mobility, analysing in depth the rise of megacity around the world and the different policies that urban planners and policymakers have used to reduce traffic jams and create a more sustainable mobility. Moreover, the second part of this chapter cover the innovations that hit the automotive industry, from electric to autonomous vehicles. The third chapter cover all the phenomena of shared mobility from cars to bikes. In the last part, there is a detailed analysis on the main topic of the research e-scooter. In the fourth chapter, it is written the methodology for the research analysis: the data were collected through a survey made with Qualtris, spread online and the analyais done with SPSS. A linear regression analysis based on the TPB model was done, studying if the dependent variables “Attitude,

Perceived Behavioural Control and Social Norms" have a significant level on the dependent variable Usage Intention. At the end, managerial implications and limitations were explained, point out useful information for e-scooters managers and policy makers and possible future research.

Chapter 1 – Sharing Economy

1.1 Sharing Economy Definition

The Sharing Economy is a business model that allows customer, through the use of technology and a specific internet platform, to rent, share products or a service underutilized, without any constriction to buy the product itself but having only temporary access to it. Examining the past literature is evident that there is not a clear definition of "sharing economy" that reconcile the majority of authors. Sharing economy, technically, does not include any sale activity or transfer of ownership (e.g., Gutt & Herrmann, 2015) [2], while some author includes also that actions (e.g Botsman & Rogers, 2010b) [2]. Other definition covers the "peer-to-peer" phenomenon (e.g., Gobble, 2015) [2] whereas others do not mention it (e.g., Heinrichs, 2013) [2].

Another problem is that "Sharing Economy" is not the only term used to refer to this kind of business model but also terms such as "collaborative economy", "peer-to-peer economy" (e.g., Bellotti et al., 2015) [3] or "collaborative consumption" (e.g., Belk,2014b) [3] when for example the whole family use only one oven in the house, are included in the concept of Sharing Economy. References also involve the circular economy, which is an economic system based on reuse, share and recycle products or services with the aim to minimize pollution, waste and carbon emission (Geissdoerfer, Martin; Savaget, Paulo; Bocken, Nancy M. P.; Hultink, Erik Jan 2017) [4].

Despite all the hype that has been created in the last years, some authors such as Giana M.Eckhardt and Fleura Bardhi have been discussing deeply against this term. Their argument is based on the fact that sharing happens among individuals who already know each other, such as friends or family. In this business model, the company is always an intermediary among people who do not know each other. Consumers do not share their own vehicle or product but pay to have access to someone else commodity, which often belongs to the firm itself. For this reason, they prefer to call it "Access Economy" According to the authors, the principle factor that engages and pushes the consumer to use sharing economy platform is not the social interaction or the desire to share service, but is mainly a utilitarian reason, with the aim to have access to a certain good or product at the lowest possible price. (Giana M. Eckhardt and Fleura Bardhi, 2015) [5].

The author's Daniel Schlagwein, Detlef Schoder, Kai Spindeldreher have been working to find an appropriate definition for the sharing economy and after multiple reviews from different academic papers and resources they concluded that: *"The sharing economy is an IT-facilitated peer-to-peer model for commercial or non-commercial sharing of underutilized goods and service capacity through an intermediary without a transfer of ownership."* (Daniel Schlagwein, Detlef Schoder, Kai Spindeldreher, 2019) [2]

1.2 Business Model

Sharing Economy is mainly based on three key pillars: access to the economy, a platform using ICT and a community-based economy (Acquier et al.2017) [3]. The most common business model is characterised by a company that provides for a fee the use of their product or service, therefore there is not an actual sharing, but we should more precisely be speaking about renting (Rebecca Mead, 2019) [1]. The top firms in every industry that have been a pioneer bringing the sharing economy in the mainstream business are all profit and business to consumer (B2C) oriented. (M. Hossain 2020) [3].

Sharing Economy has had an impact in several industries and the pioneer of this new business model was Uber. The American multinational ride-hailing company, based in San Francisco, provide a service, UberX, that allow anyone with a vehicle to become a taxi driver, enabling people to share their vehicle as a taxi service and earning an income. Another service that the company provide is UberPOOL, which enable passengers to share their ride in return to a discounted fare, according to the time and city, the price can be 25% to 40% less expensive than a normal UberX ride (Brett Helling 2020) [7]. Uber has disrupted the taxi industry by cutting the prices down significantly and allowing more consumers to satisfy their need for transportation (Ryan Lawler 2013) [6].

Another example of disruption, it happened in the hospitality industry. Airbnb is a platform that offers to lodge, which means the possibility to visitors, during a holiday, to share the apartment with a local of the city they are travelling. The American firm is not the owner of the buildings listed on the website but is only an intermediary that takes a commission for every room or house booked (Bloomberg, 2018) [8].

Sharing Economy has not always disrupted the entire industry, but in certain cases, it has brought a new trend and showed how a different business model can be applied in the industry. Rent the Runway is an example of sharing economy tendency delivered in the fashion industry. The firm promise to make high luxury clothes accessible to everyone by allowing customers to rent clothes up to 8 days for 10% of the original price. The real innovation has been the introduction of the monthly subscription, which enable to rent an unlimited number of items [9].

Companies work hard to gain a significant advantage against competitors and have adopted a different business model. In the franchiser model (i.e Uber), the firm has total supervision over the product and service (M.Hossain, 2020) [3], having control over the driver in the taxi industry and bikes (Uber JUMP) for the bike-sharing industry. In the chaperone model (i.e Airbnb), the firm supervises the platform activities (M.Hossain, 2020) [3] with the aim to bring as many consumers as possible in the platform and having the widest range of accommodation on the website. The last model is called gardener, where the platform

stimulates people to self-organize (i.e Couchsurfing). Payments are processed and controlled by the platform therefore clients do not have to share personal data (Birinci et al. 2018).

1.3 Impact of Sharing Economy

According to Statista, the total value of the entire sharing economy in 2014 was worth around 15 billion $ and is set to grow up to 335 billion in 2025 (Statista 2019) [10]. The Sharing economy has often been seen a threat to the traditional economy, which emphasize the value that is perceived by the consumer and therefore can foster competition (Kim et al., 2018) [3] and improve the product or the service for the final consumer. Sharing Economy has also changed, improved and shaped the way many people have been living (Cheng 2016b)[3], for example, the introduction of Uber, has given access to the taxi service to people who could not afford it before by reducing the price and affect consumption habits by diminishing ownership (de Leeuw and Gössling, 2016) [3].

Sharing Economy has impacted consumer with their consumption habits, the environment and the overall financial resources of the country. From an economic perspective, sharing economy has increased the overall gross domestic product (Harvey et al., 2017)[3] and revolutionize the labour market (Cheng,2016a)[3] as it happened for the driver of Uber, where a huge debate is happening if drivers should be considered as an employed worker by Uber or a self-employed. From an environmental impact, Ala- Mantila et al. (2016) [3] affirms that the sharing economy increases the sustainability and environmental awareness, which could be confirmed by the massive introduction of the electric vehicle. Sustainability may be a relevant factor for people who already mindful about environmental problems (Hamari et. Al., 2016) [3]. Another claim that the environmental element is only a secondary motivation for people (Barnes and Mattsson, 2016; Botsman and Rogers, 2010; Tussyadiah, 2016).

1.4 Reasons for the success of the Sharing Economy

Sharing Economy has been a success in a certain field (i.e Accommodation and Transportation) and several reasons brought to success in this business model, mainly flexibility and convenience. The motivations can be divided in extrinsic and intrinsic (Acquier et al., 2017; Möhlmann, 2015) [3], other factors that increase the predisposition to use commodities of the Sharing Economy companies are the functional motivation, hedonic motivation or the recognized safety of accessing to their services (Amirkiaee and Evangelopoulos, 2018) [3]. In certain circumstances, for example in the collaborative economy or non-profit association, the sharing practice is not pushed by economic reason but is oriented by the enjoyment to be useful to a community, excited to meet new people or share your own experience (Bucher et al. 2016, Guttentag and Smith, 2017, Benoit et al.,2017). Sociability is the crucial factor, together with income-earning that has brought Sharing Economy to become mainstream (Liang et al.,2017).

Chapter 2 – Urban Mobility

2.1 Urban Areas

Urbanization is a sophisticated socioeconomic mechanism that changes the geographical distribution of a population environment, bringing people from rural to urban areas. The switch involves different areas of the individuals such as professions, lifestyle, society, and behaviour, and thus, remodel both urban and rural demographic and social structures (World Urbanization Prospects 2018 Highlights) [13]

The phenomenon of Urbanization is influenced by public and private investments in buildings and infrastructure. For this reason, a growing proportion of economic development and production are clustered in towns, which become an emerging hub for travel, business and knowledge. The concentration of information and money create a synergy in the city, where the best standard of public and private facilities are available and where essential services are often more accessible than in rural areas. (World Urbanization Prospects 2018 Highlights) [12]

According to the United Nations, over half of the population lives in urban areas. By 2050, it is prospected a significant increase of people moving to cities that should reach 68%. Moreover, the growth of the population could add another 2.5 billion people (Urbanization Prospects 2018 Highlights) [12]. Based on of the "2018 Revision of World Urbanization Prospects" written by the Population Division of the UN Department Of Economic and Social Affairs, the rise of the population in urban areas will be focused in few countries such as India, China and Nigeria, that will count for 35% of the whole increase of population in the urban areas by 2050. India will add 416 million citizens in urban areas, China 225 million and Nigeria 189 million (Urbanization Prospects 2018 Highlights) [12].

Data from the United Nation shows that up to 2018, North America has the highest urbanized areas (82%), Latin America 81%, Europe 74%, Oceania 68% and Asia is almost half of the regions. As expected, Africa is the least developed with only 43% of the population living in urban areas. In 2018, around 23% of the world's inhabitants (1.7 billion people) lived in a town with at least 1 million individuals, 548 towns. By 2030, this percentage will increase up to 28% of inhabitants living in cities larger than 1 million citizens, 706 cities (Urbanization Prospects 2018 Highlights) [12].

2.2 Megacity

The clear consequences of the increase of population in urban areas are the birth of many new Megacities, cities with a population of more than 10 million people, around the world. At the moment, the number of megacities is 33 around the world, concentrated in 20 countries, with 529 million people living in these giant

towns. Tokyo is the world's largest city with 37 million residents, followed by New Delhi with 29 million, Shanghai with 26 million, and Mexico City and São Paulo, each with around 22 million inhabitants.

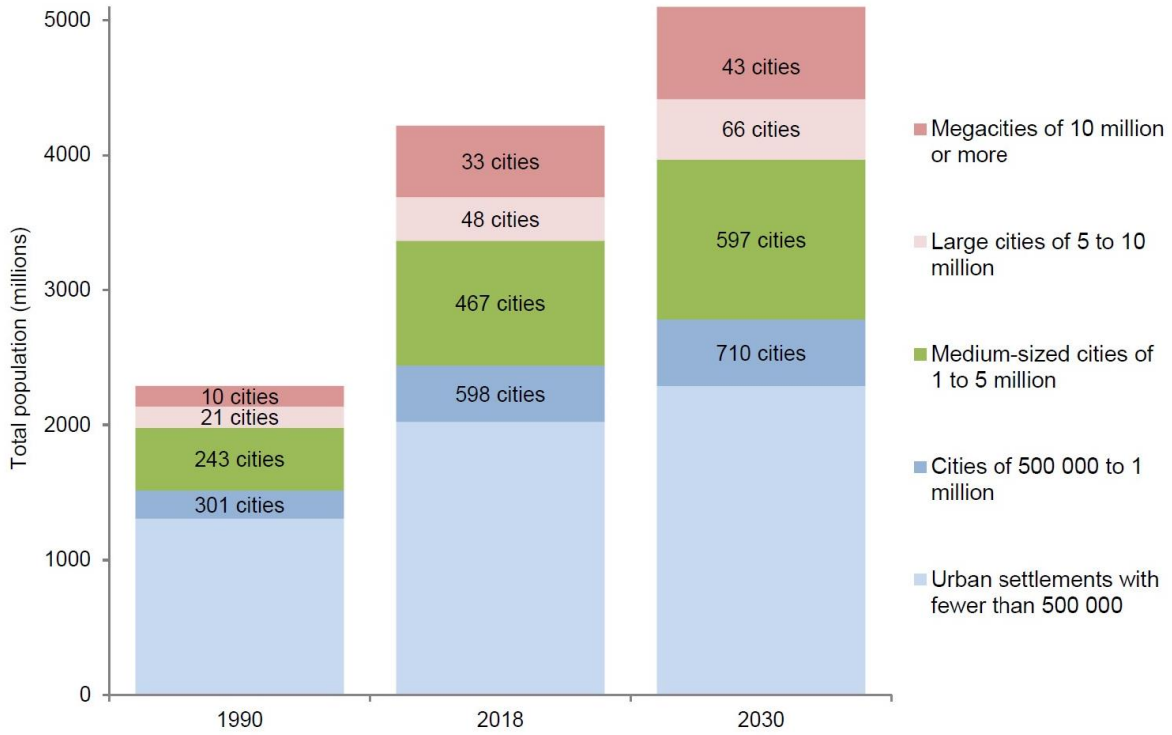


Figure 1 - Source: Source: World Urbanization Prospects. The 2018 Revision. United Nations [12]

By 2028 Delhi is predicted to become the most crowded city in the world around 2028 (Urbanization Prospects 2018 Highlights) [13]. By 2030, the planet is estimated to have 43 megacities with a population of more than 10 million, much of them in developing areas. Nonetheless, many of the fastest-growing urban areas, are towns with less than 1 million residents, many of them in Asia and Africa. Although one in eight residents' dwell in one of 33 mega-cities worldwide, almost half of the world's urban population reside in smaller communities of less than 500,000 inhabitants. (Urbanization Prospects 2018 Highlights) [13].

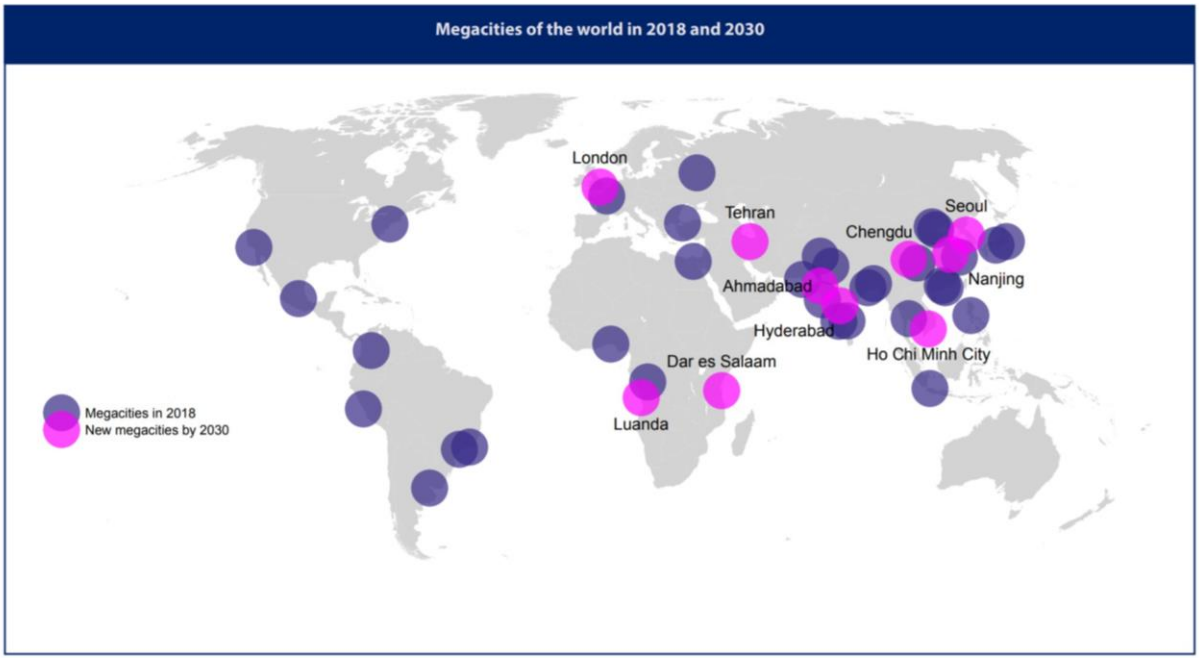


Figure 2 - Source: World Urbanization Prospects. The 2018 Revision. United Nations [12]

2.3 Challenges of cities

In the coming years, it will be crucial to understand the consequences and the key challenges of urbanization, for instance, insufficient public transport, overloaded infrastructure and parking capacity problem. Local governments will face several obstacles to reshape towns from a living, economical, environmental and mobility perspective. By 2050, the average time spent by a citizen in traffic congestion will be 106 hours per year (Arthur D.Little 2014) [15] and traffic jams are already unsustainable in some cities, losing 2 to 4 percent of national GDP, while based on the World Health Organization data of 2014, air pollution is responsible for 7 million premature deaths (McKinsey,2015) [13]. According to research from the Norwegian University of Science and Technology, only 100 cities are the cause of 18% of global carbon dioxide emission with Seoul Guangzhou, New York, Hong Kong, and Los Angeles performing the worst (Daniela Rathe 2019) [11].

Transport demand keeps increasing year after year. On average, Europeans ride about 35,000 kilometers per year, whilst the ordinary individual travels 923 trips every year, with more than half of the trips made by car (64%) (Deloitte 2015) [19]. In 2012, the United Kingdom has exceeded a historic 1,509 billion fares taken by train, if the current trend continues, it is possible that by 2025 there will be 2,5 billion passengers annually only in Britain, and it is not an isolated case but a collective phenomenon across Europe (Deloitte 2015) [19]. A further trend is the popularity of public transport in Europe, that has reached the same level in 2015. In 2013, in the UK, almost 17% of bus ticket was sold to people between 17-20.

Geography still represents a significant factor in planning a vision of integrated mobility. Flat cities like Amsterdam and Copenhagen have been projected differently, building a massive infrastructure of bicycle line and pushing the bicycle culture. Other cities are not gifted by nature, and present complex dynamic mobility, such as hills, mountains, river or small hamlet where cars cannot be used (2019 European Cyclists' Federation) [16].

Moreover, dispersive cities (i.e Los Angeles) are complicated to manage and a different strategy has to be implemented compared to a concentrated city like Helsinki (Arthur D.Little 2014) [15]. By comparing cities like Paris, with an area of 814 km^2 and a population of 7,200,000 (2016) and Rome, with an area of 5,363 km^2 and population of 4,356,908 (2017), according to the Deloitte Mobility Index 2019, the Italian capital has a performance score significantly lower than the French counterpart, probably due to the fact that the area of control is almost 7 times larger than the French equivalent (Deloitte City Mobility Index Rome-Paris) [17]-[18]. Notwithstanding, the width of Paris and Rome are not the only variable which affected the performance from a mobility perspective, but the are several elements to consider, from the company that manage the whole system to the money invested by the state. Another challenge that currently faces towns is the use of private cars. Taking into consideration Rome, private car account for 50% of the journey and the congestion is estimated at 135 million hours annually (Deloitte City Mobility Index Rome-Paris) [17].

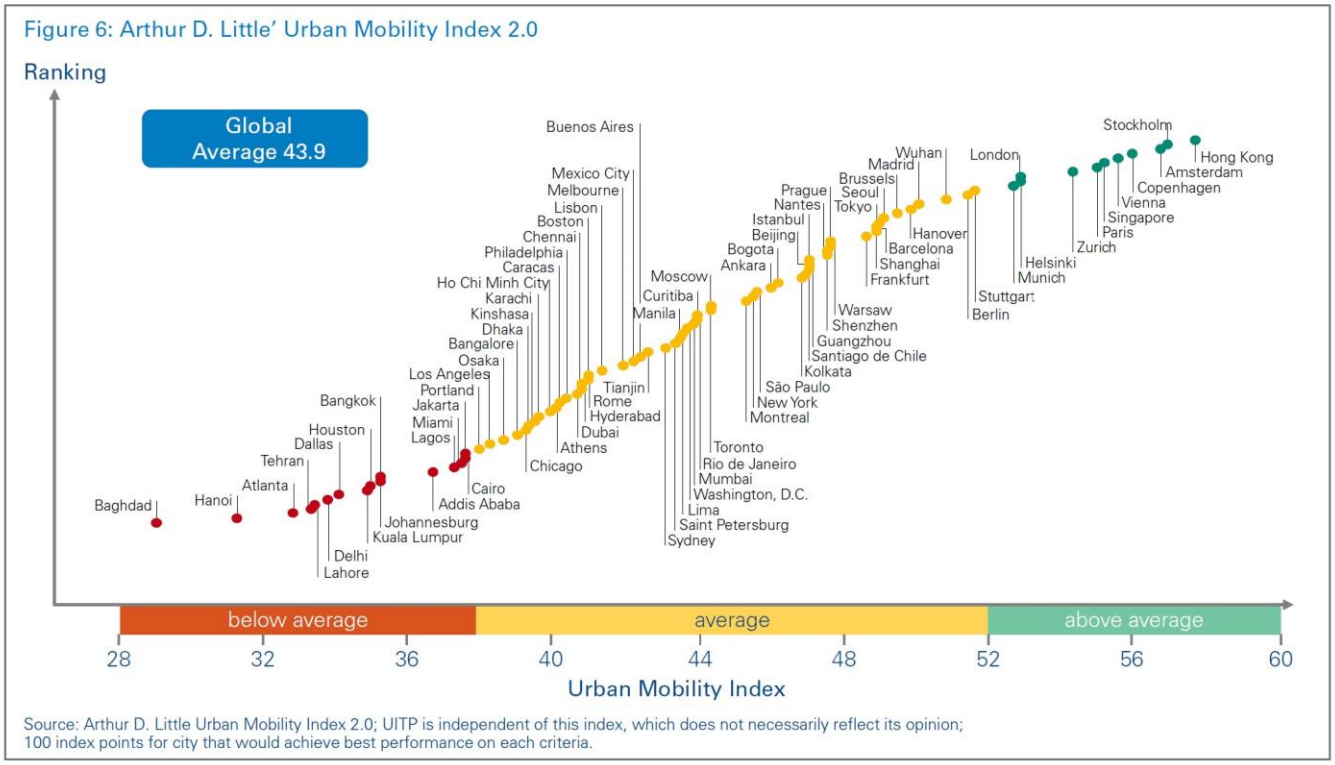


Figure 3 - Source: The Future of Urban Mobility 2.0. Arthur D.Little, 2014. [15]

The Italian capital is one of the worst in Europe in terms of mobility performance according to Arthur D.Little Urban Mobility Index and can give a benchmarking of how essential and spread the use of automobiles in

other cities around the world (Arthur D.Little 2014) [15]. Private cars are especially used in North American and Australian towns due to their extensive cities in terms of kilometres square. For this reason, private cars are the main transportation mode with low use of public transport. An alternative to private ownership is possible, as a matter of fact, Germany has already reached 2,46 million car-sharing users in 2019 (BMW 2020) [14]. The free-floating car-sharing scheme allows the customer to park their vehicle in a predetermined large area that usually covers most of the cities. This cannot be thought of as the only solution for the problem of private ownership but can reduce the reliance on personal vehicles (Arthur D.Little 2014) [15].

2.4 Strategy for Urban Mobility

The rise of the population has contributed to an increase in demand for urban mobility and evolution of people behaviour. Most towns do not have a strategy and vision to re-think mobility systems. The lack of interaction between public and private sector initiatives leads to sub-optimal mobility results, which needs a more integrated approach. Local politicians need to deal with the urban mobility challenge, for this reason, it is required to tailor political agendas to plan the mobility ecosystem towards public transport and sustainability (Arthur D.Little 2014) [15].

The first step in order to establish urban mobility policies is to elaborate a holistic vision and objectives based on strategic alignment between all key public and private stakeholders. Urban mobility, due to the increase of population, will face higher and more complex demand. Therefore, cities necessitate to broaden their public transport and change their mindset from “delivering transport” to “delivering solutions”. (Arthur D.Little 2014) [15]. Government's central function is to establish policies, ensure citizens' protection and encourage the development of inclusive and effective transport services. Nonetheless, when thinking of the future of travel, one of the toughest issues to tackle is how progress can be coordinated and who is going to pay for it (Deloitte 2015) [19].

2.4.1 Smart Mobility

The effect of digital transformation has disrupted financial services, education, media industry and many more. The technology innovation is impacting also how the customer interacts in all sectors and will raise the standards for transportation services. Digital technology will allow operators to provide infrastructure in a safer, cheaper and more effective way, with stronger automation. Customer will have the opportunity to access to different options for travelling and through a user information system, consumers will have a personalised and superior consumer experience. Moreover, the automotive industry is preparing for drastic changes in personal vehicles, seeking innovative and creative solutions for smart urban mobility by putting together automotive producers and urban planners. For the purpose of realizing smart mobility and enhance

the journey experience for a citizen, the vision is to seize of these developments and promote seamless convergence between various modes of transport (Deloitte 2015) [19].

As a result of digital innovation, the amount of information and data has risen significantly, and it is shared among people and companies. The modern age has offered more travel choices and real-time information, that has transferred control to consumers, overturning who dictate and shape the market. Public transport, as we know it today, is being challenged by the introduction of new business models, for instance, ridesharing or in general mobility as service (MaaS). An efficient mobility system provides options for passengers, adapts to satisfy demand and mass transit operators ought to deliver city facilities to encourage people to prefer public transport to the private car. The goal is to realize a multi-modal transportation system that allows consumer, based on their position, real-time events, traffic conditions and available parking space, to give you different choice on how to reach your destination. Based on this detail, the smartphone will analyse and figure out which option is more suitable for you at that moment (Deloitte 2015) [19].

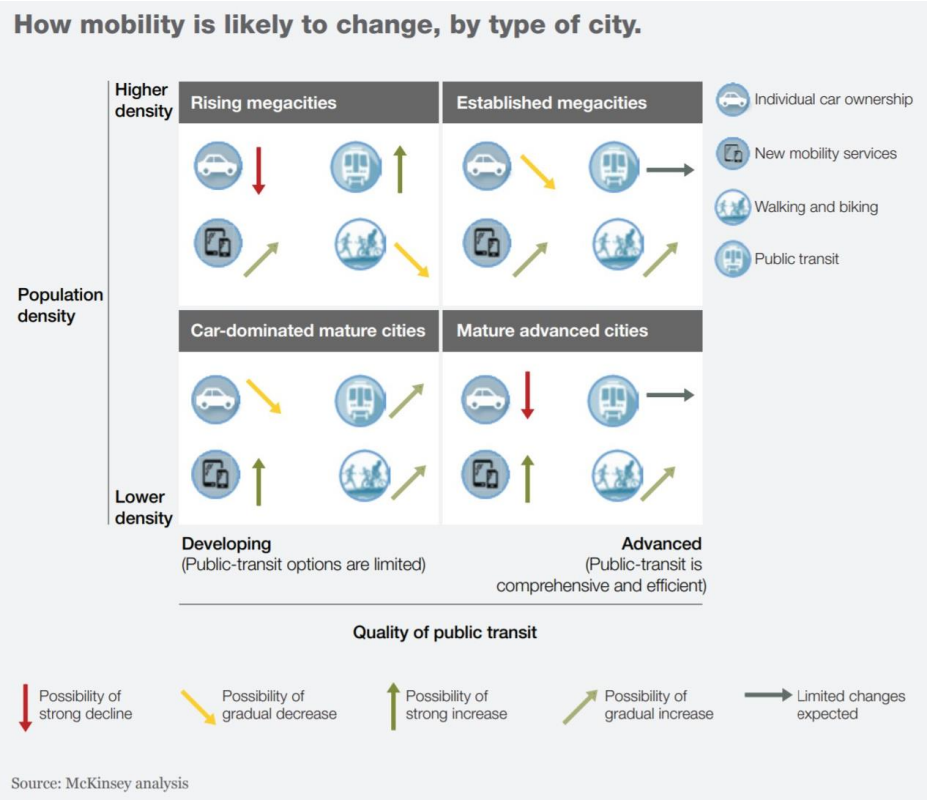


Figure 4 - Source: Shannon Bouton, Stefan M. Knupfer, Ivan Mihov, and Steven Swartz. McKinsey 2015. [13]

Public transportation is also facing a new wave of automation disruption, even though is not new to these technologies. Every year thousands of people die or get injured in a mobility system, and the largest source is the human error. In the next years, automation will have the role of saving millions of lives worldwide. One mode of transportation that is going to be optimized through automation and is the perfect candidate is

the underground systems. Due to the small size of the metro network in a city, the strong density of passengers, and the high frequency of service, innovation could allow metro operators to run trains at different intervals according to real-time demand, decreasing the number of time passengers spend waiting for a train on platforms. For instance, there are few cities that have already implemented automation in their metro system, such as Copenhagen and Madrid, which is completely automated. Moreover, the Dubai Underground network run without the need for drivers. (Deloitte 2015) [19].

2.4.2 Policies and regulations

In most cities, the current level of public transport's capacity is not sufficient to cope with the future demand for mobility. Moreover, the investment required for the development of transport infrastructure is costly and complex. Today, urban policy strategy will shape the efficiency of mobility for the next 10 to 20 years. A vision thought for the next 5 or 10 years lead to a different vision and output, thus the decisions have to take in account different variables and objectives, from a financial, social and environmental perspective. Consequently, the mobility has to be encouraged toward biking, public-transit and shared-services options. For example, European cities like London and Stockholm have worked on the overcrowded use of cars to smooth and decline traffic jam. New technology could enable citizens to employ more vehicles in cities in the long term, in a sustainable and fluent way (McKinsey 2015) [13].

Several towns attempting to reduce congestion and emission have limited the number of vehicles, by instituting road space rationing, reducing parking or increasing the price of it and banning completely cars by establishing car-free zones. Multiple Chinese towns, in particular Beijing, Guangzhou, Shanghai, and Tianjin, restricted the increment of new cars trough auctions or lotteries for new license plates. A few cities, also in China, often banned automobiles with nonlocal plates. Other cities around the world are trying hard to reach the same aim but with a different approach. The financial hub of Italy, Milan, is offering free public transit vouchers to passengers. (McKinsey 2015) [13]. Rome and Paris have tried partial driving restriction as well based on the last digits of license plate numbers (BBC 2015) [20].

From a financial point of view, it is fundamental to plan the right funding mix for public transport from the public and private sector. The public debt crisis is rising the pressure on public resources, besides funding are onerous to satisfy the high-quality infrastructure and the whole project. Policy-makers need to reach new possibilities to gather additional revenues from the private sector to recognize revenues from secondary beneficiaries of mobility (Arthur D.Little 2014) [15].

2.4.3 Urban design

Urban planners have the power to define how lands will be employed, how cities will be designed and how new neighbourhoods will be constructed, thereby what type of transportation will be utilized. For instance, more family residence strengthens the necessity for cars, whereas apartment buildings or skyscrapers, with limited parking space, force people to choose public transport system. For example, In the United States during the 1950s, 1960s, and 1970s, there has been a spread of cars that enabled citizens to move out from the cities to bigger houses in the suburbs (McKinsey 2015) [13].

Furthermore, particularly in the United States, cities are divided through zoning codes that divide residential, business, and industrial zones. This approach implies people to drive to reach their destination and makes it impossible to deliver cost-effectively public transportation. This partially explains why the United States, with 1.93 cars per family, has the greatest ownership rate in the country. In comparison, most European cities have formed their urban centres before the advent of the car. Consequently, the pedestrian area is larger, it is more compact, more likely to have a combination of public transport and cars. As a consequence, automobile ownership rates are smaller, and people drive fewer kilometres (McKinsey 2015) [13].

These aspects are constantly taken into examination by architects and engineers when building new urban areas. In the less developed countries, cities have just begun to entry in a growth and expansion phase, planners have the power to encourage small, transit-oriented, and sustainable towns. For instance, outside the antique capital of Chengdu in southwestern China, a new township is being constructed for 80,000 citizens which could act as a model for a modern suburb. The roads and street of the future Tianfu District Great City are built in a way that every place can be reached in 15 minutes on foot. Just half the roads would require motorized vehicles; the remainder will be for walkers and cyclists (McKinsey 2015) [13].

As mentioned before, Tianfu is an example of transit-oriented development (TOD). This is a form of urban development that optimizes the amount of house, business and recreational space within walking distance from public transport. It encourages a holistic synergy between cities dense and smooth use of public transport. The goal of TOD is to intensify public transport and reducing car ownership, by promoting sustainable urban development (Cervero, Robert; et al. 2004) [21].

2.4.4 Parking Issue

The economics' growth in several countries and the rise of purchasing power of people drove the increase rate of private car usage in cities, in addition, the lack of policies and incentivise directed to sustainable urban mobility are the key reasons for making vehicles the only mode of transportation suitable for consumers need, creating issues in parking and traffic management. (Janak Parmar, Pritikana Das, Sanjaykumar M.

Dave, 2020) [22]. Local governments have not always given priority to parking topic, relying on the fact that it does not affect directly traffic and there would always find space somehow. But the lack of parking policies and traffic control showed how parking is accountable for the ineffective and inadequate usage of lands (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22].

In American towns, the typical vehicle is parked 95%, which create various parking problems and a need for large spaces (Shoup, 2005). It is calculated that parking spaces cover an area of 3,590 square miles and more than 500 million parking spots (Ben-Joseph, 2012). According to (Chester et al., 2010), for every driver who owns a private vehicle, the town ought to have roughly four to eight parking spots to satisfy the parking demand. These conditions come to a high price for citizens, that pay millions for buildings, service and maintenance. Parking cruising continues to be the most anxious part of travel, also with an abundance of parking facilities, causing environmental and economic issues in metropolitan zones (Shoup, 2005) (Wenwen Zhang, Kaidi Wang 2020) [23].

According to Shen (1997), the most significant motives of the increase of car ownership are the increment of population and economic development, which brings to the rise of living standards. For this reason, residents choose to ride private vehicles over public transport, also due to accessible cheap cars and free or limited parking costs. Therefore, the high increase of car ownership brought parking to become an essential element of buildings and streets, turning in a prerequisite for planning new construction and infrastructure (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22]. Indeed, when parking policies are neglected, it leads to accidents and injury, traffic congestion and poor use of resources (Young et al. 1991)

One of the main issue related to parking topic is the overcrowded request of space in the older areas of the town, called “central business district” (CBD), that due to the high value of land and real-estate, fail to offer enough space for off-street parking and bring to an increase of request for on-street parking in the city (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22]. Consequently, cities are overloaded with cruising parking phenomena in the central area of the city. The average amount of parking-related to congestion during rush hours, according to some research, shows that can reach between 30% and 50% of total traffic (Shoup, 2006). Parking issues occurs primarily, according to researchers, because citizens’ desire is to park in the closest point to their destination (Behrendt, 1940). Academic writers reveal that the rate of injuries correlated with angled parking is twice or three timers greater than those induced by parallel parking, thus is suggested that curb parking should be banned or limited in main streets (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22].

Another important issue is parking space, indeed according to Donald Shoup professor at the University of California in urban planning, states that not just parking facilities waste precious public property, but also a

total of 30 per cent of the vehicles in congested traffic jams are simply searching for a parking spot. As a matter of fact, in recent years, many smart parking systems have been offered as a solution. For instance, the parking programme, in San Francisco, is gaining considerable interest thanks to the implementation of networked meters that are capable to detect and transmit the information of the availability of the space in real-time. At the same time, these services have been installed in Santiago de Chile, Barcelona and Moscow, where searching time has decreased up to 35% (Deloitte 2015) [19].

A further concern regarding parking subject is illegal parking. Spiliopoulou and Antoniou (2012) have studied these phenomena in six different cities in Greece and discovered that licensed parking was under-utilized while unauthorized parking was overwhelmed in certain places. In the Greek city of Kos, while illegal parking was saturated, just 67% of legal one was occupied. The explanation for this, as already mentioned, is the propensity of drivers to walk the least possible, by parking close to the destination (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22]. Illegal parking has several consequences, including lack of revenues from legitimate parking, decreased flow in traffic, increase in injuries and a diminishment degree of respect toward rules of the road (Cullinane and Polak, 1992).

Furthermore, an additional cause for cars congestion is given by looking for vacant parking space. Based on Shoup (2006) studies, searching for a parking spot produces a substantial amount of traffic jam. In his research for 11 American cities, he demonstrated that 30 % of drivers waste an average of 8.1 minutes looking for parking lots. Moreover, Arnott and Rowse (2009) have noticed that parking cruising adds to 14% to vehicles in traffic jams, that cause almost a 50% rise in time-wasting road cars as a consequence of congestion. The research was based on an analysis of the integrated model of parking and traffic in medium-sized American towns (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22].

As mentioned early, high parking demand is mainly generated by the rising rate of car ownership and widespread use of them. Parking demand is particularly sensitive to parking costs, and previous researches have explained that parking rates tend to be one of the most important drivers for parking demand. Among the several policies, parking costs and availability limitation are the most commonly known for regulating drivers habit (Institution of Highways and Transportation, 2005), (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22].

Feeney (1986) has analysed the effect of parking policies and showed that the expense charged by drivers when "out-of- vehicle " (either time or money) is considerably more relevant than "in-vehicle-cost" in choosing what transportation mode to use. For some circumstances, the time element acts in a crucial role in selection attitude of drivers for parking space, as a matter of fact, the period spent looking for parking space contributes a large proportion to the overall travel time (Polak and Axhausen, 1990). For instance, just 7%

of the citizens use private vehicles in Hong Kong (Territory Transport Planning Division, MVA Asia, 1993) (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22].

Therefore, to efficiently limit the utilization of private cars without impacting the viability of towns and shrink the urban growth, it is necessary to implement a "parking restrain policy" (Department of the Environment, Transport and the Regions DETR 1998). For these reasons, parking policies act a crucial role in the implementation of a well-structured traffic network to improve travel conditions for drivers. Parking policies often lead to the efficient usage of the limited parking services and are valuable from an environmental mobility perspective (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22]. Suitable parking strategies induce the development of effective usage of the road system, reduce pollution and greater improvement of urban planning (Institution of Highways and Transit, 2005; Shoup, 2005; Stubbs, 2002).

The policies should require the introduction of new technology and smart meters for parking schemes (Melanson, 2010; Transport Department, 2017), thus the combination of apps and smartphones could easily create a list of free parking spots in the area and could efficiently address the issue (Grazioli et al., 2013; Jebur and Mahmuddin, 2009). The innovative method could successfully direct drivers into the correct option of parking space and decrease illegal together with on-street parking. In the US, Europe and some countries in Asia, especially in off-street parking infrastructure at every floor, LED street panels have been introduced to inform in real-time the conditions of vacant parking space, according to GPS localization, decreasing wasting-time for searching an available spot (Ji et al., 2014; Thompson et al., 1995) (Janak Parmar, Pritikana Das, Sanjaykumar M. Dave, 2020) [22].

2.4.6 Parking and Shared Autonomous Vehicle (SAV)

The introduction of autonomous vehicles (AVs) and Mobility-on-Demand (MoD services) is projected to dramatically change the urban parking outlook, by diminishing the metropolitan parking demand. These innovations will decrease the demand for parking and optimize car usage levels. One crucial role is played by Shared Autonomous Vehicle (SAV), which will diminish car ownership and thus significantly minimize the need for parking space (International Transport Forum, 2015; Kondor et al., 2018; Zhang and Guhathakurta, 2017; Zhang et al., 2015a). The new technology SAV, commensurate to the classical shared mobility with a normal vehicle, is going to optimize land usage for parking through economical and effective centralized control (Fagnant and Kockelman, 2014). On the contrary, private autonomous vehicle (PAV) will diminish parking spots only by 10% (Zhang et al., 2018) but it will change the geographical configuration of public parking areas since these cars would eventually be able to drive to more accessible

and economic parking spaces once the owners have arrived at their destinations (Shoup, 2005) Wenwen Zhang, Kaidi Wang (2020) [23].

According to several market share estimates, shared autonomous vehicle can reduce parking demand up to 80%, by utilizing real-time information from other vehicles. The International Transport Forum (2015) has built an agent-based simulation to discuss the relationship between SAVs and citizen with a high and low degree of autonomy from a mobility point of view in Lisbon. The findings indicate that SAVs will eliminate all on-street parking and more than 80% off-street parking. In Singapore, further parking models have demonstrated that 85% of parking services, if all private cars are substituted by SAVs, might not be necessary (Kondor et al., 2018). The decrease could reach up to 92% if citizens are eager also to share rides (i.e., multiple passengers served by one SAV at the same time) (Shoup, 2005) (W. Zhang, Kaidi Wang 2020) [23].

On the other hand, private autonomous vehicle (PAVs) do not have the same effect of SAVs, because do not decrease the car ownership rate just as SAVs. According to Zhang et al. (2018) study, just 18% of families can diminish car ownership by sharing the same vehicle among their relatives. The author built an algorithm and a Mixed Integer Programming (MIP) model to investigate the effect of the private autonomous vehicle, by studying data of 10 cities in Atlanta. In conclusion, PAV could radically alter the spatial arrangement of parking spots, since PAVs can park in a different area from the destination with the lowest parking cost, but is difficult that the innovation could decrease the parking demand of a metropolitan area (Wenwen Zhang, Kaidi Wang 2020) [23].

Autonomous vehicles are still in an early phase and SAVs will be widespread only in the future. A great deal of work has been made to estimate the long-term growth of AVs and the predicted outcomes differ considerably based on the expectations and simplifications. The simulation that has been taken into consideration has a range between from 2015 to 2045. The model has developed eight different scenarios, whereby the year 2045, the rate of acceptance full autonomous vehicles ranged from 25% to 87%. Table 1 shows the most positive case from the Bansal and Kockelman (2017) where the rate of acceptance of fully autonomous cars will be 5.5%, 33.8%, and 74.7% for the years 2020, 2030, and 2040 (Wenwen Zhang, Kaidi Wang 2020) [23].

Table 1
Forecasted Market Penetration of PAVs, SAVs, and CVs by Year.

Mode Type	Year			
	2015	2020	2030	2040
PAVs	0.0%	4.95%	23.7%	37.35%
SAVs	0.0%	0.55%	10.1%	37.35%
SCVs	0.0%	9.45%	19.9%	12.65%
PCVs	100.0%	85.05%	46.3%	12.65%

Figure 5 -Source: Wenwen Zhang, Kaidi Wang (2020). [23]

Consequently, Urban planner and politicians will need to change parking standards, because counterintuitively is possible to have an oversupply of parking facilities, due to a decrease of parking space of 35% by the year 2040. Moreover, parking pricing systems need to shift from fix to more complex and versatile approach due to the fact that with the introduction of AVs, politicians will gradually handle parking demand in real-time by adjusting rates depending on the scarcity of parking spaces and traffic congestion (Wenwen Zhang, Kaidi Wang 2020) [23].

Policymakers will face other issues such as loading and unloading zones for commercial purposes and cities should be more ready for more variable and elastic for on-street parking policies. Cities like San Francisco and Washington D.C. have already dealt with these phenomena, reconsidering parking streets into “pick-up and drop-off streets” (e.g., Fehr and Peers, 2018; ITF, 2018; Nelson Nygaard, 2014). Local governments have implemented several policies including diminished parking spots, applied dynamic pricing, introduced loading and unloading area through geofencing technology (a technology that uses the global positioning system (GPS) to define geographical boundaries of activities), and given the preference for sustainable vehicles and modes of transportation, such as ride-sharing passengers, cyclists, and pedestrians. (Wenwen Zhang, Kaidi Wang 2020) [23].

2.4.7 Travel Demand Management (TDM)

As we have seen, the expansion of towns in terms of area and growth of population is directly connected with a necessity for a more sustainable and efficient mobility system to face the rise of the demand for public transportation. The main transportation mode chosen by people is a personal vehicle, which is the only way to have versatility and convenience to satisfy citizen’s needs. The lack of suitable policies have contributed to increasing rates of traffic jams, air pollution, noise and decrease of inhabitants’ quality life, also due to inefficient usage of road space, an insufficient alternative to transportation system (Friman, Larhult, & Gärling, 2013; Meyer, 1997; Singh, 2005) (İrfan Batur, Muammer Koç (2017) [25].

For this reason, local governments have introduced Travel Demand Management (TDM) policies with the goal to change people's travel behaviour in a way to diminish and reallocate travel demand around the city, offering different choices for mobility (Meyer, 1997). Such initiatives are classified as hard and soft policies depending on the application of various reward and disincentive system. Hard policies have the purpose to reduce the desirability of vehicle by introducing economic disincentives, regulations, rising parking rates, tolling roads, cut road capacity, rise fuel's price and congestion charges (Tuan Seik, 2000) (Fujii, Garling, & Kitamura, 2001; Shiftan & Golani, 2005; Vanoutrive, 2015) meanwhile "soft policies" act as a nudge, pushing gently inhabitants' behaviour for substituting vehicles toward a more sustainable way of travel, intensifying awareness campaign related to pollution and the congestion problems and preference lanes for greener vehicles (Gärling & Fujii, 2009; Steg & Vlek, 1997) (İrfan Batur, Muammer Koç 2017) [25].

Some research in literature that has studied the feasibility of "hard policies" like car-free city centres and car-restricted areas, bringing the positive effect of changing behaviour toward sustainable travels (Topp & Pharoah, 1994; Weisbrod, 1982). Other researchers have demonstrated that only "hard policies" cannot contribute to a decline in the usage of automobiles, in the long run, also due to the fact that these strategies have been facing strong popular resistance, being economically unfeasible showing just short-term results (Tommy Gärling & Schuitema, 2007) (İrfan Batur, Muammer Koç 2017) [25].

Among "hard policies", congestion pricing has been researched for years since one of the most effective strategy but, at the same time, hardly discussed between citizens. The concept of congestion pricing is that if travellers are adequately charged with overcrowded city centre roads, the policy could reach an extent where social welfare is maximized or at least enhanced (Hau, 1998). Consequently, the introduction of congestion pricing will force a certain passenger to adjust their itinerary, however, it might enlarge the whole well-being of a city's population. Therefore, an estimation in terms of socio-economic attributes, salary, job status has to be made for the individuals affected by the congestion pricing policy (Litman, 1996) (Katsuhiko Nakamura, Kara Maria Kockelman 2002) [26]. Policymakers are generally worried that this strategy would harm people, above all voters, who spend a greater part of their salary on mobility, making this action, politically infeasible. As a consequence, a congestion pricing system such as cordon charges with car drivers in the area of central business districts will face more the higher income citizen more than the low-income commuters. (Linn et al. 2015) (D. Chakraborty 2016) [27]

The strategies have been introduced around the world in different manners according to the needs and the culture of the city. The results have demonstrated a significant diminish of private cars travel, behaviour change toward more sustainable mode and improvement of quality life. For instance, congestion charges have been implemented in London (Litman, 2006) and in Stockholm (Börjesson, Eliasson, Hugosson, &

Brundell-Freij, 2012), while electronic road pricing in Singapore (Tuan Seik, 2000) and parking management in Portland, Oregon (Hess, 2001). Notwithstanding these findings, there is continued controversy on how "hard policies" alone effectively contribute to diminishing automobile usage (Stopher, 2004) and if soft policies have a direct influence on reduced car usage (Möser & Bamberg, 2008). In contrast, several soft TDM guidelines, have been applied in both small and large-scale towns with effective outcomes, mainly in the developing world, offering huge potential(Mees, 2014; Richter et al., 2010) (Bueno, Gomez, Peters, & Vassallo, 2017; Petrunoff, Wen, & Rissel, 2016) (İrfan Batur, Muammer Koç 2017) [25]

Among all the TDM, road pricing perhaps is the most famous strategy for handling travel demand (e.g., Mohring and Harwitz, 1962; Arnott and Small, 1994; Verhoef, 2002; Zhang and Ge, 2004; Brownstone and Small, 2005 among others). Nonetheless, for road pricing policy there has been a huge contentious due to its resemblance to a heavy tax, the issue regarding welfare redistribution (Giuliano, 1994; Harrington et al., 2001; Yang et al., 2004; Zhang et al., 2008); (4) and privacy apprehension for the new innovations. Space rationing, on the other hand, do not require any cost for the inhabitants and is considered less inequal the other Travel Demand Management policies (e.g. Evans, 1983) (Shanjiang Zhu, Longyuan Du, Lei Zhang 2013) [24]

Rationing has been introduced in a variety of urban areas around the world, despite the implications in mobility have not been fully known. For instance, Singapore introduced the Vehicle Quota Scheme (VQS) in 1990 (Barter, 2005), which only issues a few of car procurement permits per month by auctions. A parallel quota scheme was introduced in 2001 in Shanghai. Another severe policy is car ownership rationing system was introduced in China, Beijing, where residents can only receive automobile buying permits through a monthly lottery (Lim, Accessed on April 8, 2011). Rationing strategies can refer not just to possession of automobiles, but also for the use of it. Due to pollution and air quality issues in Latin American countries have adopted policies to limit the usage of cars. The Mexican government implemented a law banning vehicles from travelling o a certain day of the weeks according to its license plate number. A Similar strategy has been used also in Sao Paolo, Bogotá, Quito and Santiago in Chile (Davis, 2008). In the last decade, the air quality issues have not improved, thus limits on car usage have been applied to smaller towns such as Medellin and Cali. All over the world, this policy has been implemented in Manila, Philippines, Lagos, Nigeria (Thomson, 1998), Athens, Greece (Kambezidis et al., 1995), Guangzhou, China (Hao et al., 2010). Shanjiang Zhu, Longyuan Du, Lei Zhang (2013) [24]

2.5 Connected Vehicles

The key innovations in private vehicles are connected-vehicle, electrification, autonomous driving, and shared mobility. When politicians and urban planners will be able to find out how to effectively operate these aspects, urban mobility strategies will be substantially enhanced (BMW 2020) [14]. New technologies have

been introduced to improve the drivers' experience, enhancing comfort and efficiency to move from a point A to a point B. The latest vehicles, even the low-cost category, have an embedded system or computer, while previous cars, that are not supported by the most recent technologies, are equipped the users' smartphones. The extensive introduction of connected vehicles is initiating modern technique and possibilities to mobility efficacy. For example, real-time data on traffic conditions can advise drivers the best route, in terms of timing, by avoiding traffic jams and bottlenecks (McKinseyy,2015) [13].

Already today, certain models can interact with other vehicles or objects from their environment he more cars that are equipped with this technology, the more accidents can be avoided. All information sent by cars is processed by apps such as Google Maps or Waze, maximizing traffic flow, reducing congestion, and alerting people of an accident to avoid them. Waze has partnered with a variety of cities, like Barcelona, Boston, Jakarta, and Rio de Janeiro, to incorporate their data into the city's Smart transportation hub. An interesting example is the city of Wuxi in China, where all the crowd-sourced traffic data are analysed by an elaborate traffic light system constantly optimises traffic flow (BMW 2020) [14].

New vehicles through connectivity, advanced types of car engagement, artificial intelligence, voice commands, will not satisfy only a utilitarian need, moving from a point A to a point B, but also will offer a superior experience for customers, creating also a valuable asset for car manufactures. Cars producers and vendors now have access to an abundance of data from vehicles to develop or optimize their services, for example, restaurants might advertise travellers during their trip. (McKinsey 2020) [28]

Mckinsey has established five rates of connectivity integration, each of them including an incremental level of improving user engagement and enhancing new opportunities for revenues, cost reduction and customer safety. These different levels indicate the ability of data to connect vehicles with drivers offering them several rates of personalization, conversation to the auto-pilot mode. Around 45% of modern cars will achieve the third level of connectivity by 2030 (McKinsey 2020) [28].

In the first level of connectivity, insurance companies can provide a personalised package of services to the consumer according to driving behaviour. In the second level, through more specific data, the insurance provided to the clients is improved. At levels 3 and 4, devices may monitor and advise the driving for safer driving behaviour through voice messages. Finally, at level 5 the computer system of the vehicle will include sensors that could predict if a driver is exhausted and recommend rest time. The vehicles could also enable autonomous driving to guarantee driver safety (McKinsey 2020) [28].

2.6 E-Vehicle

Electric-Vehicles (EV) have reached another global selling milestone in 2019, and the new technology becomes mainstream among public awareness, especially in the European countries. Global shipments of EV rose to more than two million units in 2018 and a 5.1 million electric car fleet: with a steady rise of 63 per cent every year. Nonetheless, despite a penetration rate of 2.2%, EV constitute just a small portion of the overall demand for electric vehicles (McKinsey 2020) [28]

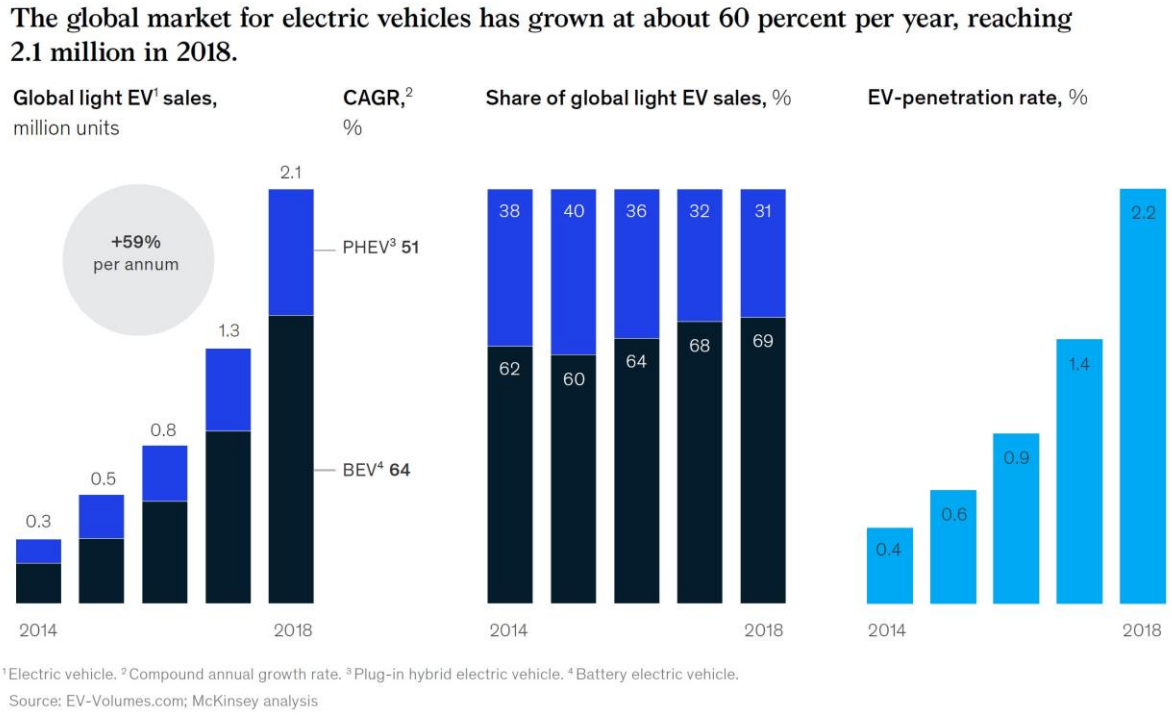


Figure 6 - Source: McKinsey 2020 “The future of mobility is at our doorstep” [28]

The increase in car ownership has dramatically affected the environmental issue of pollution. For this reason, to improve mobility, buyers are converting their classical vehicle to low emission EV, which are gaining an essential role in the global market. In 2017 world shipments of EVs reached more than one million units (1.3 million), and it is expected that demand will grow to up to 3 million cars in 2020 globally. Car manufactures are designing and producing about 120 different vehicles and around 20% of all future customers claim they will take in consideration EVs as a future car. In the last years, batteries performance has increased and become increasingly cost-effective, the capacity of kilometres range grow and charging stations expand, for this reasons, the number of battery electric vehicles (BEVs) sold has exceeded the first technology of plug-in hybrid-electric vehicles (PHEVs). Thanks to the government’s subvention and legislation to promote the adoption of EV, the units sold have doubled in many countries (McKinsey 2020) [28].

China continues to be the largest market for EV, preceded by Europe and the United States. In 2018, China's EV demand rose by 85, higher than the European and American market. The European and US's EV industry is almost three times less the size of the Chinese one that, despite a government reduction in incentives that were one of the main factors for the growth, the industry has faced a robust increase in sales, with 1.1 million vehicles that stand for half of the global EV sales in 2018. Europe' EV sector has seen a modest increase in sales (90,000 units) with a significant difference among all the countries. Scandinavian nations are performing the strongest with Norway 40 per cent of maker share, Iceland 17 per cent and Sweden 7 per cent, while France, Germany and United Kingdom have reached only 2 per cent of EV market share. The most prominent example among European countries is Norway, wherein four years, from 2014 to 2018, EV units reached 32% of total sales compared to 11 per cent of 2014. Nevertheless, the strengthening of CO2 pollution legislation will contribute to increasing the market share for EVs across Europe in the future (McKinsey 2020) [28].

The 2019 Global Electric Vehicle Outlook report issued by the International Energy Agency, affirmed that the government's policies have a vital function. Countries with the highest number of EV has used several actions to incentives citizens to switch their cars, such as financial instruments to help to reduce the difference cost between electric and fuel vehicles. Furthermore, a strong economic aid has been offered also to companies for the strategic importance of battery technology (IEA, 2019) (Yi Hu, Ziyi Wang, Xuerong Li, 2020). In the last decades, The Republic of China has gone through fast-economic development and urbanization, which increased dramatically energy consumption and CO2 emission. Consequently, in light of environmental concern and pollution issues, the government enforced a sustainability plan to update the automobile sector (Wang et al., 2017). This new trend and change toward EV helps the environment through the reduction of CO2 emission and at the same tame encourages economic growth opportunities, facilitating the transition from conventional auto to renewable auto (Yi Hu, Ziyi Wang, Xuerong Li, 2020).

Sales of EV in China between 2017 and 2019 has faced a positive trend but a significant fluctuation on the growth rate for several reasons. Car manufactures are influenced by both internal and external elements. Internal element involves R&D investment and high economic market entry, while external factors entail to unstable demand and variations in government's invectives policy. Many potential buyers are in a "wait-and-see" situation due to several doubts about their purchase, such as charging station, the safety of EV, the ease and time to charge the auto. For this reason, part of the sales is reliant on the help of incentives from the state (Yi Hu, Ziyi Wang, Xuerong Li, 2020).

In the last years, the Chinese government has incentivized several guidelines to encourage car producers to manufacture electric vehicles, mainly monetary and non- monetary bonus. Monetary investment programs involve economic aid and measures to support infrastructure, while non-monetary aid policies include

transport policies, investment R&D policies, and so on. From the customers' perspective, the state has reduced the taxes and stimulate economic subsidies. Despite the several economic incentives have been decreased during the time, the financial help from the government is still the main driver of purchase. (Zhang et al., 2018) (Yi Hu, Ziyi Wang, Xuerong Li, 2020).

For the suppliers, the subsidies have a larger effect on electric cars than buyers' purchase subsidies. For the consumers, the influence of the purchasing subsidy program and the limitation of driving in the urban area had an enormous impact. In the short term, the increasing price of fuel drive driver's choice on electric cars, while in the long term, giving a priority on the sustainability topic, the charging infrastructure and the advancement of the company's key technologies would ensure the longevity of the production of electric automobile sector (Zhang et al., 2018) (Yi Hu, Ziyi Wang, Xuerong Li, 2020).

When considering electric vehicle, the public opinion is directed toward battery-powered electric vehicles (EVs), which indeed are not the only option to automobiles with internal combustion engines (ICE). In several markets throughout Asia, Europe and North America, Hydrogen fuel cell automobiles have already started to spread. Even though it is a new technology that needs several years and fund of investment in research and development, hydrogen provides a range of advantages over batteries. For example, Hydrogen refuelling takes around ten times less volume compared to EVs fast charging, also this innovation allows vehicles to fuel up 15 times quicker than battery-powered EVs (McKinsey 2020) [28].

For the next 5 years 2025–30, it is predicted that the difference between EVs and traditional vehicles will diminish. Moreover, with the persistent investment in research and developments powered by chemistry and scale enhancement, the cost of batteries could decrease by 50%, which could significantly increase sales due to the fact that batteries constitute one-quarter of today's EV costs (McKinsey 2020) [28].

2.7 Autonomous Driving

Autonomous vehicle is not a total recent idea, indeed in 1925, the company Houdina Radio Control did an experiment by building a radio-commanded driverless vehicle (Dormehl and Edelstein, 2018). Broad attention to the technology started at the General Motor's Futurama exhibition in 1939, where the idea was introduced (Ferlis, 2007). The two countries that have been the pioneer of autonomous driving were Germany and Japan, which in 1977 has elaborated a car that could stick to white street with a speed of 32km per hour (Forrest and Konca, 2007). Finally, the key event that has given a massive impact to the knowledge of autonomid car was the DARPA Urban Challenge in 2007 financed by U.S. Defense Advanced Research Projects Agency (DARPA) (Defense Advanced Research Projects Agency, 2014) (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40]

Autonomous Vehicles (AVs) are vehicles with different level of automation, that analyse the surrounding environment and do not need human assistance for all the activities. The society of Automotive Engineers (SAE) has identified various levels of automatic capability, varying from no automatic actions (level 0) to complete automation (level 5 – describing a self-driving or driverless car) (Santhanakrishnan Narayanana, Emmanouil Chaniotakis, Constantinos Antoniou, 2020). Among several reviews and research, the word "autonomous" has been utilized in irregularly, but according to the SAE international, only level 3 or above can be considered an autonomous automobile. (Santhanakrishnan Narayanana, Emmanouil Chaniotakis, Constantinos Antoniou, 2020).

Research and development in the car industry have been growing intensely in the last years and the infrastructure investment in the fifth generation of cellular network technology, bringing the AVs to reach 25% of the global private automobile by 2040. Autonomous Vehicles are supposed to drive the next paradigm change in the transportation industry (Santhanakrishnan Narayanana, Emmanouil Chaniotakis, Constantinos Antoniou, 2020). Indeed, the implementation of AVs will offer various advantages for the citizens, such as increased traffic security and improved urban life (Becker and Axhausen, 2017; Fagnant and Kockelman, 2015; Kim et al., 2019; Narayanan et al., 2020). On the other hand, AVs will be not accessible to everyone due to the high cost and will bring some disadvantages such as loss of workers in the transportation and logistics industry as well as socioeconomic inequality (Milakis et al., 2017; Wey and Huang, 2018) (Kum Fai Yuen, Yiik Diew Wong, Fei Ma, Xueqin Wang, 2020) [30].

Among the several benefits that AVs can bring to society, the most relevant is that AVs can boost protection by diminishing the cars accident. Recent studies have shown how large part of traffic injuries are generated by human error. This innovation can surmount the limits of human's capacity to the response by utilizing robust technology such as radar, GPS, and computer vision. Moreover, urban habitability will raise as a result of improvement of traffic jam and diminishment of vehicle ownership, decrease in transport infrastructure which will free areas for parks and other entertaining activities, and diminish in air pollution (Liu et al., 2019a) (Kum Fai Yuen, Yiik Diew Wong, Fei Ma, Xueqin Wang, 2020) [30].

In conclusion, customers thanks to autonomous driving will gain free time from driving and dedicate it to more fruitful tasks. Besides, AVs have the opportunity to decrease travel time and save fuel usage through optimization of the travel route. Nonetheless, to obtain a vital success and benefit for all the society from an economic, social and environmental point of view, it is necessary that AVs must be adopted all over the country. The introduction of new technologies is always hard to accept, and a significant public opposition is present for the acceptance of AVS (Haboucha et al., 2017). AVs reflect a major potential technical jump from traditional vehicles that may impact consumer adoption due to issue of security, protection, reliance,

confidence, and legal problems (König and Neumayr, 2017; Kyriakidis et al., 2015; Schellekens, 2015) (Becker and Axhausen, 2017) (Kum Fai Yuen, Yiik Diew Wong, Fei Ma, Xueqin Wang, 2020) [30]

2.7.1 Autonomous vehicle and Policy Issue

A fast and dynamic environment where new technologies are introduced in the market are hard to manage for policymakers that need to find the right policy to handle technology-related risks (OECD, 2011; Bosso, 2010). Although policymakers can promote modernization and innovation through monetary incentives and creating a business ecosystem (Caiazza, 2016), establishing standards to protect intellectual property or encourage research and development for industries is more complicated. Therefore it has been a long and intense debate between industrial and regulatory policy, "Technology symbolizes markets, enterprise, and growth, while regulation represents government, bureaucracy, and limits to growth" (Wiener, 2004 p 483) (Greig Morduea, Anders Yeungb, Fan Wuc, 2020) [32].

Indeed, the recent innovation of autonomous vehicle in the automotive industry has brought a substantial gap in a legal context (Fagnant and Kockelman, 2015; Bonnefon et al., 2016; Public Policy Forum, 2018). With cars producers reaching a greater degree of vehicle autonomy, where the responsibility and control switch to the vehicle itself, different players such as car manufacturers, suppliers of component, car developer, will have significant responsibilities (Greig Morduea, Anders Yeungb, Fan Wuc, 2020) [32].

As a result, the impact of these actors, car producers, governments and the policy that will be established, these will significantly impact reputation, market share, revenues, and the whole strategy of the industry (Winkle, 2016). Also, in case of lack of stance from the policymakers to regulate autonomous vehicle, this might cause troubles to the expansion of this new technology. One of the issues for car manufactures is that there is no global norm for determining the reliability of the level of autonomous driving. For this reason, when car producers will introduce vehicles with a high standard of autonomous driving (SAE Level 4), this will create a legislative gap all over the world, escalating the problem. (Greig Morduea, Anders Yeungb, Fan Wuc, 2020) [32].

Another problem that stakeholders such as programmer and regulators will face is including aspects of morality and ethics that must include several choices. Issues regarding "the prioritization of the safety of drivers over passengers, occupants over pedestrians, young versus old or vehicles with fewer occupants being sacrificed over ones with more, what standards are applied to determine if one outcome is less or more "dangerous" than another?" (Greig Morduea, Anders Yeungb, Fan Wuc, 2020) [32].

Chapter 3 – Shared Mobility

3.1 Shared Mobility

Shared mobility is a concept that refers to an innovative way of using transportation facilities among people. These include multiple modes of transportation, such as bike-sharing, e-scooter sharing, and car-sharing, which can be based on a classical form of station-based to a free-floating system. Also, public transport or taxi are considered a form of shared mobility. The programme allows the citizen to use them for short-term when they needed it. The sharing involves vehicle itself shared during the day or a system where the ride itself is shared. (Frances Sprei, 2018) [34].

Shared mobility has been classified as disruptive for the transportation industry in many types of research. Based on Christensen framework (Clayton M. Christensen, 1997), disruptive innovation has an initial low price and efficiency compared to the current technologies but with advancement on the performance can take control over the industry (Alexandra König, Niels Kowala, Jan Wegener, Jan Grippenkoven, 2019) [33].

Shared mobility has been active in cities around the world and the several benefits that brought have been demonstrated such as cost reduction, comfort, diminishment in vehicles miles usage and decreased in vehicle ownership, and also reduced greenhouse gas emission. Furthermore, shared mobility has produced financial gains for the community and rise in productivity (Wang et al., 2016; Buehler and Hamre, 2015) (Shaheen, Susan, Chan, Nelson, 2016).

Shared mobility to have a massive impact has to expand and grow exponentially. According to the Center for Automotive Research, the car-sharing user will hit 10 million in 2021, starting from the 2.2. million in 2014, with a strong increase in Europe and modest progress in the US (Center for Automotive Research 2016) (Frances Sprei, 2018) [34].

Based on McKinsey research, shared mobility will not be disruptive enough to revolutionize the transportation system but will contribute considerably to improve urban mobility in big towns, reaching one out of ten vehicles in 2030 as a shared vehicle (Mckinsey, 2016). Another approach to increase the appeal of shared mobility is to incorporate various mode of transportation, introducing the concept of "Mobility-as-a-Service" (Maas). The idea was originally developed in Finland with the aim to create a unique system of transportation that includes public transport, car sharing, bike sharing and taxis. The city could provide a single subscription or pay per use plan that includes all various mode of mobility, supplying an efficient intermodal trip for the citizens. A single monthly subscription for mobility can offer a variety of solutions that can satisfy different travel purpose, more flexibility and accessibility (International Transport Forum, 2016).

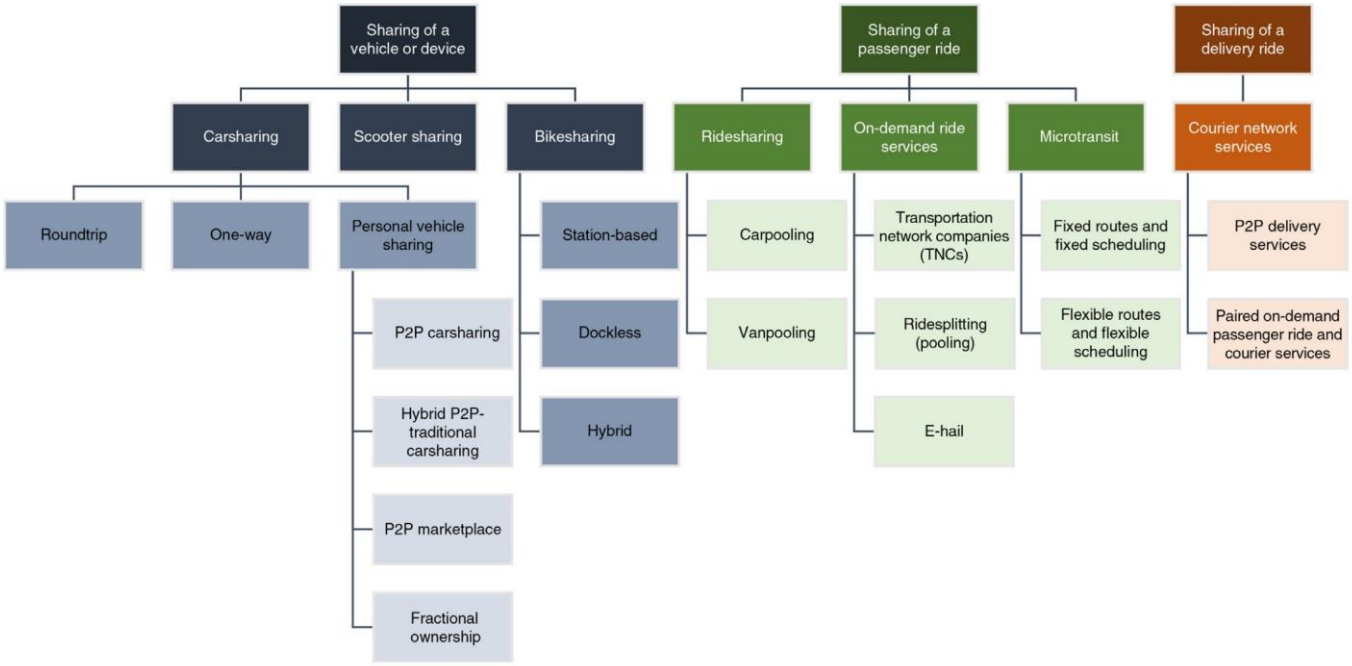


Figure 7 - Source: S.S, C.N, 2016. Mobility and the sharing economy: Potential to overcome first- and last mile public transit connections. [36]

Predicting the implications of shared mobility is hard due to the many variables that could affect the spread of it in urban centres. One main advantage is the reduction of vehicles, fewer kilometres travelled per person in private cars and optimized usage of cars (Frances Sprei, 2018) [34]. According to Clewlow, the diminishment of automobile ownership is strictly correlated with the population density of the city, higher it is, more likely is that shared service will create a positive impact (Regina R. Clewlow, 2016). Besides, the growth of Maas is strictly correlated with two factors that are necessary for expanding the service around the world, strong public transport, and a wide variety of shared mobility offer. (Li and Voege, 2017) (Daniela Arias-Molinares, Juan Carlos Palomares-García, 2020) [39]

ICT (Information communication technology) are revolutionizing people mobility, for example through travel planning apps that can find the best alternatives for user to reach a point A from a point B, based on price, time, environmental impact and the type of vehicle used (Shaheen, Susan, Chan, Nelson, 2016) [36]. Trip planning app may be divided into two broad categories:1) single-mode trip planning and 2) multi-modal trip aggregators. The latter can programme trip based on the availability and real-time information of public transit, carsharing, ridesharing, on-demand ride services, taxis, bicycling, walking, and personal vehicles (Shaheen, Susan, Chan, Nelson, 2016) [36].

Among all types of shared mobility, e-scooter sharing and bike-sharing have a different purpose compared to other modes, the aim is to cover the “last mile” travel (short trip), being a complementary mode for public transport, while car-sharing cover medium and long trip. (Daniela Arias-Molinares, Juan Carlos Palomares-García, 2020) [39]

Furthermore, firms in the shared mobility industry provide their programme through an app. Indeed, in Google Play, the android store of apps, there are more than 60,000 apps dedicated to transportation. This creates an issue for the user, that find difficult to download the precise app for the service that want to use at that moment (Matyas, 2018). For this reason, entrepreneurs are building an app that integrates all shared mobility service one unique application (hereinafter, MaaS). (Daniela Arias-Molinares, Juan Carlos Palomares-García, 2020) [39]

3.2 Car Sharing

The first form of car-sharing has born in 1948 in Switzerland (Susan Shaheen, Daniel Sperling, Conrad Wagner, 1999) and the distinction nowadays is that these programs become far more available and efficient, through an integration of various technological developments which have enabled a significant improvement of GPS technologies and mobile phones. Moreover, in the last decade, there has been a strong organization of car sharing, firms have strengthened the infrastructure and spreading all over the world, from Europe, China to North America (Susan Shaheen, Adam P. Cohen, Carsh, 2013) (Frances Sprei, 2018) [34].

One of the main examples is Share Now, a German company born from the merge between car2go and DriveNow. The firm offers different vehicles belonging to the car producers Mercedes-Benz and BMW since the company is a joint venture of BMW and Daimler AF, commonly called Mercedes-Benz. The service has reached 20,500 automobiles and 26 towns, characterised mainly by a free-floating service, where drivers can pick up or park the car in a precise and delimited area of a city (car2go 2020) [35].

Local governments have been crucial for the development of the shared mobility, where in some cases they have been the first promoter or barrier, such as Paris with the introduction of Autolib or San Francisco that found a threat in car-sharing services. The city of California decided to not give exclusive parking spot to car-sharing services because to the concern of reducing the use of bike and public transport usage through the diffusion of this programme (Frances Sprei, Diana Ginnebaugh, 2015) [34]. Another example is the ride-sharing service of Uber, which has been banned in several countries in Europe, such as Italy and Germany for motivation linked to regulations (Business Insider, 2017) (Frances Sprei, 2018) [34].

Car sharing is present around the world with several business models, the first to be introduced was the Station Based or also called “roundtrip carsharing”. Later, with the development and improvement of safety and GPS technologies a new model, the most common at the moment, has been launched, the “free-floating” system (Shaheen, Susan, Chan, Nelson, 2016) [36]. Finally, the last trend among the car-sharing industry has been the personal vehicle sharing (PVS) or peer-to-peer carsharing. The most notable example is Turo which allow people to rent their private car to other customers through an online platform (Turo, 2020).

City development strategies and urban planners play a critical part in shared mobility programme. Car-sharing significantly decreases car ownership (Cervero et al., 2007; Loose, 2010; Martin and Shaheen, 2016; Namazu and Dowlatabadi, 2018). Nevertheless, the degree to which this can be done relies on the urban structure and form of the city and at the same time the motivation by local governments and urban planner to implement strategies and re-shape town to promote sharing programmes. According to Kent and Dowling (Kent and Dowling, 2016), the future of car sharing is not only dependant by the urban environment but also by the entire ecosystem, which includes pedestrian zone, bike lines and public transport (Anu Tuominen, Antti Rehunen, Juha Peltomaa, Kirsi Mäkinen, 2019). [38]

The geographical and urban traits of a city are fundamental to implement and planning the strategy. Moreover, every neighbourhood has different demand and supply, consequently, this affects the overall strategy. Newman et al. (2016) have built a theory of urban fabrics based on three different types of city: walking city, transit city and car city to study how to execute a car-sharing programme in a city. One method to push people toward a behaviour without the use of a private car is to decrease parking spots dedicated to private vehicle and change it to an exclusive area for shared cars. (Anu Tuominen, Antti Rehunen, Juha Peltomaa, Kirsi Mäkinen, 2019). [38]

Recently, research has been conducted to understand who the typical customer of a car is in sharing services. The study was done in several European towns (Becker et al., 2017; Efthymiou et al., 2013; Kopp et al., 2015; Le Vine and Polak, 2019; Schmöller et al., 2015) and it was discovered that the average client is a young instructed guy, worried about environmental issues and living in a small family. Nevertheless, according to (Baptista et al., 2014; Voltti, 2010), low-income citizen and large household with the necessity of multiple drivers may also be potential customers for car-sharing companies (Anu Tuominen, Antti Rehunen, Juha Peltomaa, Kirsi Mäkinen, 2019). [38]

Car-sharing and car ownership are not directly comparable for several reasons. The initial cost of buying a vehicle is significantly high and this factor does not allow everyone to access it. Moreover, car owners do not have a clear overview of the maintenance cost during the years, while car-sharing is based exclusively

on a monthly fee, which allows a precise picture of the advantages and disadvantages (Thomas S. Turrentine, Kenneth S. Kurani, 2007) (Frances Sprei, 2018) [34].

One of the main factors that to push driver toward private ownership or car sharing, beyond price, is the flexibility. The private car offers flexibility in terms of availability, which allows the driver to have access to it 24/7, on the other hand, car-sharing provides a broader variety of cars model and enable the driver to pay only when they have access to the service (Jana L. Sochor, Helena Strömberg, MariAnne Karlsson, 2015) (Frances Sprei, Diana Ginnebaugh, 2015) (Frances Sprei, 2018) [34].

3.2.1 Station-Based Car Sharing

Station-based car sharing or roundtrip carsharing offers the customer a service based on minute usage, where users can choose between a collection of a different typology of cars, rent it and return the vehicle in the same place from it was collected. During the last decades, many pieces of research have been done to study the effect on vehicle kilometres travelled (VKT), car ownership and greenhouse gases (GHG) emission impact. In a research conducted in San Francisco by Cervero and Tsai (2004), it was found out that 30% of carsharing's customers, City CarShare, have sold one of their cars and 66% of users delayed the purchase of an automobile after utilizing the programme for two years. (Shaheen, Susan, Chan, Nelson, 2016) [36]

Another research conducted by Martin and Shaheen (2011) interviewed 6,000 users of car-sharing services in the U.S and Canada, analysing the effect of the station-based trip. They reported a more frequent usage of bicycle and walking but a strong decrease in public transport usage from the carsharing drivers. (Shaheen, Susan, Chan, Nelson, 2016) [36]

3.2.2 Free Floating Car Sharing

Free-floating car-sharing, or also called one-way carsharing, enable customers to collect an automobile whenever is located and leave it in a delimited area that covers a large part of the city. The free-floating car-sharing service has been introduced in 2012, entering in seven countries (Shaheen and Cohen, 2012). In 2014, more than 800,000 users join the car-sharing system, more than 300,000 in Europe, more than 400,000 in North America and almost 30,000 in Asia (Shaheen and Cohen, 2016). In 2015, almost 36% of companies integrated the free-floating system, including (BlueIndy, car2go, DriveNow, and Zipcar) in 14 different cities in North America (Shaheen and Cohen, 2015). The free-floating programme can significantly improve the first and last mile connection and with electric vehicles (EV), there has been a substantial reduction in GHG emission. (Shaheen, Susan, Chan, Nelson, 2016) [36]

Martin and Shaheen (2016) have researched car2go's customer in five different towns in the U.S, showing that every car introduced to the fleet eliminated between 7 to 11 vehicles. Depending on the drivers, 2 % to 5% sold their car, while 7% to 10% delayed car purchase. Furthermore, carsharing has an environmental impact that ranges between -6% to -16% per car regarding vehicles miles travel (VMT) and GHG emission around - 4% to -18% (Shaheen, Susan, Chan, Nelson, 2016). [36]

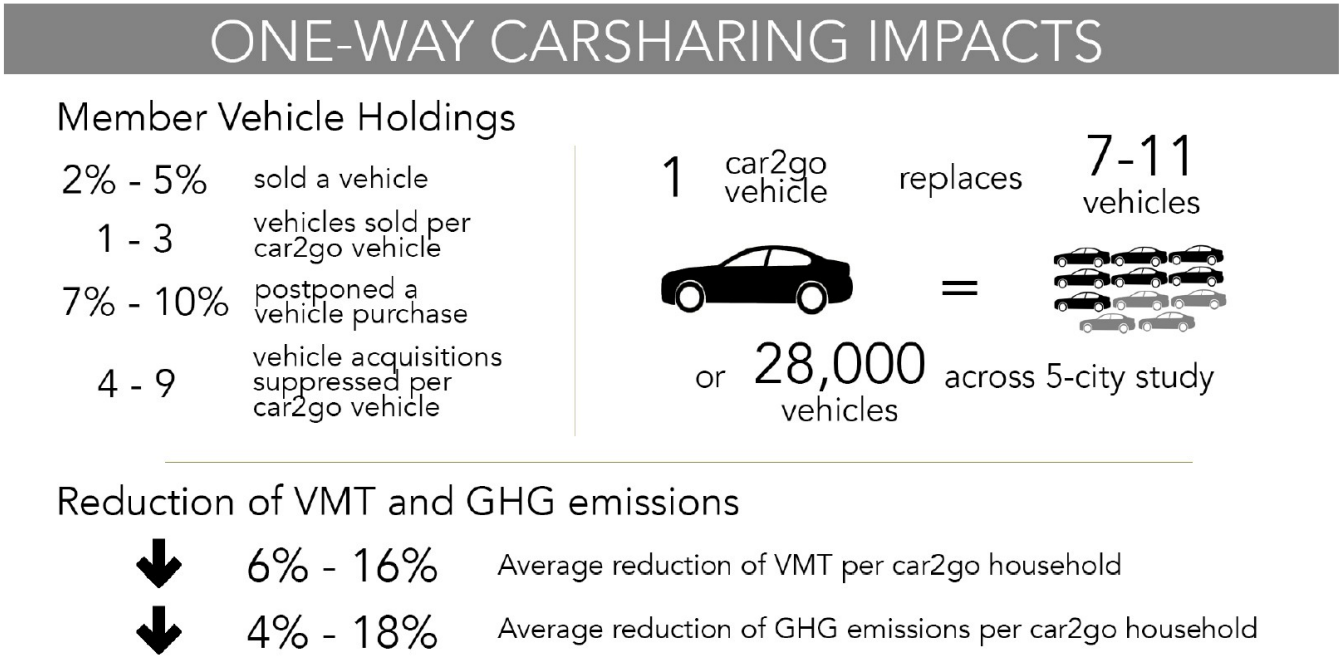


Figure 8 - Source: S.S, C.N, 2016. Mobility and the sharing economy: Potential to overcome first- and last mile public transit connections. [36]

3.2.3 Peer-to-peer Car Sharing

P2P carsharing is a recent business model introduced to support the new wave of shared mobility. Here, people who own personal car, rent them for a specific time of the day or even for several weeks, according to the demand. An intermediate puts in contacts cars owner and potential customers. One advantage of P2P carsharing is that is not forced to operate in one specific location, because the provider does not offer the car fleet. The new business model is not focused only on a roundtrip or daily usage. Indeed, until 2017 almost 3 million members shared more than 130.000 vehicles thanks to a P2P carsharing programme in North America (Shaheen et al., 2018a). The two most important start-ups in this field are Turo and Getaround. Compared to standard carsharing, prices are different and are affected by the type of vehicle to rent, which can be an entry-level or luxury. The provider takes a fee for every transaction and also offer insurance that covers all the damage for the owner of the car (Shaheen, Susan, Chan, Nelson, 2016). [36]

3.3 SAV – Shared Autonomous Vehicle

In the 1990s in Europe, Cybernetics Transportation System (CTS) has conceived the idea to combine autonomous vehicle and car-sharing (Parent and de La Fortelle, 2005). Afterwards, the two French institutions INRETS (former French national institute for transport and safety research, currently called IFSTTAR) and INRIA (French national research institute for the digital sciences) have deepened the research on the topic, explained with accuracy by Parent and Daviet (1993). The first experiment was done in 1977 at the Schiphol airport, in Netherlands (Parent and de La Fortelle, 2005). Despite the ideas was already studied in the 1990s, it was difficult to introduce it in a real-life context and academic writers studied SAV mainly based on sharing system and the booking mode, combined with the integration with the whole public transport. (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40]

At the moment, SAV is divided in reservation-based (booked in advance) and on-demand (the customers can book vehicles in real-time). The explanation can be attributed to the system on how vehicles run, indeed the car-sharing system is mainly based on-demand. The other mode with which SAV can operate "reservation-based" is technically the most efficient by offering improved forecasting of the necessary fleet size, reducing congestion and running cost (Wang et al., 2014) (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

Furthermore, SAV network can be categorized in a car–sharing, ride–sharing and mixed programme. In the second case, ride-sharing, people share the ride itself in the same moment (Sherif et al., 2017; Jäger et al., 2018; Alonso-Mora et al., 2017; Gurumurthy and Kockelman, 2018; Heilig et al., 2017; Liu et al., 2018; Martinez and Viegas, 2017; Masoud and Jayakrishnan, 2017; Alazzawi et al., 2018), while in the first case, one person at the time can use the car-sharing programme (Alam and Habib, 2018; Allahviranloo and Chow, 2019; Bischoff and Maciejewski, 2016; Chen et al., 2016; Childress et al., 2015; Dia and Javanshour, 2017; Fagnant and Kockelman, 2014, 2018; Fournier et al., 2017; Hadian et al., 2017; Jäger et al., 2017; Moreno et al., 2018; Zhao and Kockelman, 2018) (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

According to Hyland and Mahmassani (2017) research, related to the reservation issue, the writer divided three types of possibilities: short-term rentals, point-to-point service and mixed service. In the first case, the customer has complete control of the automobile for a precise time slot. In the second case, the SAV, drive the users from a starting point to a drop-off location. Finally, the third case is a fusion of short-term and point to point service. In terms of price policy, SAV offering may be distinguished with a fix or dynamic pricing programme. In the first case, the user pays in line with the kilometres or the time that the SAV has been used. In the other case, the variables of the starting point, the time of the day are integrated on the algorithm,

personalizing the price for every ride. (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

3.3.1 SAV Business Model

Stocker and Shaheen (2018) have analysed also possible different business model, according to a reasonable scenario. The research distinguishes six distinct opportunities, based on vehicle ownership and system: Business–to–Consumer (B2C) with one company, B2C with the several firms handling a different part of the business, Peer–to–Peer (P2P) with third–party firm, P2P with the decentralized company, Hybrid ownership with one single company and Hybrid ownership with third–party firm. (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

Moreover, according to the car volume, the study finds four different vehicles, large type (more than 20 people), intermediate vehicle (seven to 20 people), small vehicle (three to six users), micro vehicle (1-2 person). The research affirms that the profitability of the system would rely on several variables, such as vehicle model, usage in the city, and type of business model. The expectation in the future for Stocker and Shaheen (2018) is that single-occupant vehicles (i.e taxi) can prevail as a mode of transportation or shared-ride can be commonly accepted, optimizing cost and decreasing price for users (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

3.3.2 SAV Impact on society

The author Salazar et. (2018) demonstrated that shared autonomous mobility included in public transport, with the aim to optimize welfare, diminish operational cost, can decrease congestion. This is also dependant by several variables such as vehicle occupancy, the density of cars in a specific area or the algorithms used. Another author, Lang et al. (2018), run a conjoint analysis in Boston, USA. The result showed how shared autonomous vehicle can substitute private automobile and public transport in metropolitan areas, while substitute private vehicle in the suburban part of the city (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

Regarding safety, many academic writers agree on the fact that SAV can significantly reduce accidents. Keeney (2017) affirms that a possible decrease in a car accident can hit 80%. Fagnant and Kockelman (2015) declare that the estimation can reach 40%, based on studies of deadly crashes in the USA related to drug and alcohol consumption. Despite a general positive feeling toward the diminution of crashes caused by humans, the mistake done by algorithms will remain, even though with a considerably less impact (Täihagh and Lim, 2019), this will bring to a need to a new legislative interpretation (Hayes, 2011). Finally, the most influential factor that could prevent the improvement of safety in the urban streets is the small future penetration rate

that SAV can have in towns (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

SAV can have a significant impact also toward travel behaviour, or car ownership, that according to some research, with an accurate strategy from the government, can substitute from 1 to 11 car. Other expert forecast a substitution of 67% to 90% (Milakis et al., Mendes et al. 2017). One of the disadvantages predicted by the introduction of the autonomous vehicle is unoccupied travel that will rise kilometres travelled by the automobiles (Alam and Habib, 2018; Bischoff and Maciejewski, 2016; Chen et al., 2016; Dia and Javanshour, 2017; Fagnant and Kockelman, 2014; International Transport Forum, 2015; Jäger et al., 2017; Kondor et al., 2018; Lang et al., 2018; Moreno et al., 2018; Zhang and Guhathakurta, 2018). Notwithstanding, Lokhandwala and Cai (2018) demonstrated that if the current taxis would be substituted by a shared autonomous vehicle, there will be a decrease of VKT. Moreover, even though the presence of unoccupied trip done by SAV, Rossi et al. (2018) proved that traffic jams will not considerably rise (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

From local governments perspective, the responsibility will shift from managing local public transport to deal with SAV firms that provide the service, guarantying sustainability from an environmental point of view (Weiss et al., 2017). Regarding SAV penetration in the market, several studies have been done, but significant confusion is present for estimating the demand. In a poll done in Australia about the shared autonomous vehicle, 29% of respondents were completely not interested in autonomous vehicles. Moreover, Bösch et al. (2018a) and Pakusch et al. (2018) assert that private ownership is continuing to be an important pillar for the automotive industry (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

An important issue related to the diffusion of SAV is the willingness to quit personal vehicle. Loss aversion might be a motive that stops people to give up their car (Watkins 2018). In a survey of 1241 people done by Menon et al. (2018), more than 60% was in favour of ride-sharing service over the private autonomous car, but this also means that 40% did not agree with the same idea. In another study done by Webb et al. (2019), 16% of citizens will remain on their habits to use a personal car (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

Concerning the ideal customer, Haboucha et al. (2017) affirm that the young generation and people who have attended university are more likely to try first these innovations, while in another research done by Arbib and Seba (2017), reveal that citizens from the countryside and wealthy families could not try at all autonomous vehicle. In contrast to the previous research, Bansal et al. (2016) studies show how rich men living in highly populated towns, will be early adopters. Finally, according to Kruger et al. (2016),

individuals that often use public transport, potentially will change first to autonomous car-sharing service, while citizens that already have access to this service will have more propensity for autonomous ridesharing program (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

To conclude, even though an autonomous vehicle can be spread consistently all over the world in the long run, it is still present high uncertainty due to human behaviour and legislative modernization. Concerning the next years, the norm will be a mixed situation with normal and fully autonomous vehicles. (Santhanakrishnan Narayanana, Emmanouil Chaniotakisb, Constantinos Antonioua, 2020) [40].

3.4 Autonomous Buses

The autonomous vehicle will not only disrupt the private cars but also the public transport with a direct consequence on buses and the entire public transport infrastructure. The introduction of AV technology can improve public mobility with a significant efficiency on labour productivity, decreasing operational cost for the firm, even though the initial price for acquiring and maintenance will be higher (Viktor Nagy, Balàzs Horvath, 2020) [42]. This will also bring to light the issue of low-skilled job, such ad bus driver that will need to be re-skilled and adapt to the different kind of jobs that are needed to the company or will face considerable unemployment (Groshen et al., 2018 provide a U.S. case).

A clear consequence of the first case, optimizing the operational structure cost of the firms, is the reduction of prices for citizens. Moreover, it could allow shorter waiting times for people, an expanded service in terms of units, and larger diffusion in the city. Furthermore, AV can increase more equity and accessibility on the use of public transport, enabling elderly citizens or who cannot drive and offering a better service compared to the current one (Ryosuke Abe, 2019). Autonomous buses will have a standardized service, all the rides will have the same style (Viktor Nagy, Balàzs Horvath, 2020) [41] [42]

Ryosuke Abe (2019) has supposed an experiment in Japan cities, where “remote human-based monitoring” system was implemented. The operator can control the bus performance remotely and passengers are the only one present in the vehicle. Supposing that every operator has the responsibility for 1.66 buses, the result was a decrease in operating cost by the initial phase 21% to 53% in a final scenario. Whereas travel price for leisure could drop by 9 – 11% and for business trip 6-8% (Ryosuke Abe, 2019). [41]

Finally, to summarise, launching autonomous public transport can provide several advantages for society: enlarging the spread of vehicles in the city, having a 24 hours service, cheaper fares for citizens, significant money-saving for the government, which often it is the main stakeholder that financially support public transport. Moreover, it can optimize labour productivity or utilisation, that now reach 70% or 60% of total usage. (Ryosuke Abe, 2019) (Viktor Nagy, Balàzs Horvath, 2020) [42]

3.4.1 PODs and Personal Rapid Transit (RPT)

In the future city, where a strong integration between public transport and sharing services or shared autonomous vehicles are present, Pods will also be a fundamental piece of the puzzle. The Italian engineers Tommaso Gecchelina and Emmanuele Spera have been working for the past years at the development of PODs, founding the company “Next”. PODs are autonomous vehicle, driverless, that use the modularity to connect with other PODs and moving around the city. (Danielle Muoio, 2018) [43]

These vehicles have the advantage to perform like cars, bus and train according to the necessity of the public. PODs can move around the city based on the request of the citizen and, depending on the destination and the number of people that request the same point of arriving, PODs can join other PODs bringing people from point A to point B with the quickest and most efficient way. (Danielle Muoio, 2018) [43]

The customer can book a POD in real-time as a taxi service and place their destination, then the POD will join other PODs that are on the road and the app tells the customer to which POD the client has to switch. Every POD has 6 seats and 4 spots for people standing, with an average speed of 20 kilometres. Dubai is the first city to implement the PODs as part of public transport and the sultan Sheikh Mohammed bin Rashid Al Maktoum wants to reach 25% of travellers in the city made by driverless transport by 2030. (Kieron Monks, 2019) [44]

Figure 9 - Source: Kieron Monks, 2019, Cnn. “Smart pods' blaze a trail for autonomous public transport” [44]

Another example is the Swiss Post in the city of Sion, in Switzerland. The minibus with 11 spots is completely driverless and has been used since 2016, transporting more than 60,000 passengers. The

SmartShuttle has average speed of 6km/h with a maximum of 20km/h, transporting mainly people after grocery shopping and pensioners for 1.5km through the pedestrian streets to bus stops. (Peter Hulm, 2017) [45]

Figure 9 - Source: Peter Hulm, 2017. Switzerland's first driverless bus will run until 2019 [45]

3.5 Micro-Mobility

Micro-mobility is a recent concept often utilized in transportation literature (e.g. Anderson-Hall et al., 2019; Clewlow, 2019; McKenzie, 2019) to indicate trips and journeys of few kilometres for personal needs with a small, light and two-wheelers vehicles that usually is bike or e-scooter. Several advantages are created with the introduction of micro-mobility services such as low emission of greenhouse gas emission, significant reduction of car ownership, more free space for public activities and, it can enhance access to a faster mode of transportation to economically vulnerable communities who cannot afford a private vehicle like a car. Notwithstanding, the phenomena could die soon or have a significant positive impact on urban mobility, this depends on travel behaviour and ability of local policymakers to adapt the novelty to the local culture and city. (Timo Eccarius, Chung-Cheng Lu, 2020) [49]

Shared micro-mobility can allow citizens to access to a fleet of vehicles on a needed basis, diminishing traffic jams and boosting public health (Parkes et al., 2013). (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020) [47] The expanded regional reach and affordability of these emerging business models give tremendous opportunities for further growth and introduction of micro-mobility into the transport network (Martin and Shaheen, 2014; Peters and

MacKenzie, 2019). In many researches of multiple cities suggest major growth of micro-mobility riding in metropolitan areas (NACTO, 2019), and a project expansion in market size of 8 to 15% of all customer within 7 kilometres (Heineke et al., 2019). (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020) [47]

Emphasis on urban development persist to expand and micro-mobility has caught the attention of urban planners and experts on mobility due to the capacity to have a vehicle that is big enough for one person. The vehicle which is an e-scooter or a bike can be part of a shared mobility service or bought directly from the customer. Bike sharing, which was first introduced as a public mode to move around and the city and e-scooter have gained popularity among U.S towns, showing also a proven business potential of growth (Dediu, 2019). (Parkes et al., 2013; Shaheen and Cohen, 2019) (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020) (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [47] [48]

Even though, shared micro-mobility services have affirmed their success around the globe, especially bike sharing, for some towns the introduction of them have been dramatic (Medard de Chardon, 2019). Therefore, the favourable green and environmental effect have been questioned (Hollingsworth et al., 2019). (Timo Eccarius, Chung-Cheng Lu, 2020) [49]

Micro-mobility has been often compared with ride-hailing to analyse which was the most efficient way to move from a point A to a point B. In a study done in Washington D.C, in terms of times, ride-hailing has an average advantage of 1.5min in the morning. In comparison, micro-mobility, in weekday, during the peak of traffic jams where the majority of people move to work or school, around 8-9 am and 5 pm, is faster. The whole research demonstrated that in a certain time, micro-mobility service is better than cars in an urban environment. Notwithstanding, the advantage is only achievable on trips around 2 km, otherwise, a car is still the best mode of transportation (Grant McKenzie, 2020).[51]

As a consequence of the introduction of new technologies and innovations, some problems and conflicts have emerged on the roads. The local government had to deal with a new form of regulation and investment to adapt the streets for the new vehicles. Regarding micro-mobility vehicles, the main infrastructure development is the enhancement of cycleways. Research studying the most important element that brought to success the bike-sharing system was the investment on roads (Médard de Chardon, Caruso, & Thomas, 2017). Moreover, updated legislation, strengthen the safety not only for citizens but also for companies working in this field. The legislation is divided in two main arguments: user behaviour, like helmets, maximum speed, or parking areas, and operator behaviour, such as a minimum or a maximum

number of vehicles to serve or loyalties to the council. (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [48]

3.5.1 Equity Issue

One issue that has gained popularity on public opinion and urban planners is transportation equity, pushing companies operating on the shared mobility to have an inclusive point of view on mobility. (Shaheen and Cohen, 2019). For instance, to sustain equity on bike-sharing service, firms with the local government started to offer a discount for membership for low-income families, distributing bikes all over cities, even in points that are not profitable for companies and finally simplifying the paying method and accessing to a bank account (Buck and Buehler, 2012) (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020). [47]

Micro mobility success is also given by the main limitation of public transport, that does not cover the first and last mile on the trip, and often constrain people to use their car to reach the metro or bus station. For the low-income family, this is often a barrier that does not allow complete freedom on the choice of transportation (Chandra, Bari, Devarasetty, & Vadali, 2013; Rodrigue, Comtois, & Slack, 2006). The bike-sharing system, as well as e-scooter, can promote transport equity by offering a cheap alternative mode to private cars (Gardner & Gaegauf, 2014) (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [48]

3.6. Bike-sharing

The bike-sharing system was born in 1965 in Amsterdam, Netherlands. The first form was public and managed by the local government. Bike-sharing is present all over the world, from Europe, North America to Asia and Australia (Parkes et al., 2013, Shaheen et al. (2012a). In 2015, public bike-sharing was spread in 995 different towns, with more than 1 million bikes, most of them in China. In the U.S the programme was present in 87 cities and Europe in 433 towns. (Russell Meddin, unpublished data) (Shaheen, Susan, Chan, Nelson, 2016) (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020). [36] [47]

Bike-sharing schemes are divided into “station-based” and dockless. In the first case, trips are called roundtrip or point to point trips. In this case, bicycles are positioned at public docking station all over the city, offering an on-demand service for a different trip, connecting important spot in the city (University, city centre, bus station etc). The customer has access to the bicycle by unlocking one of them from a docking station, through an identification pass. The user can pay by credit, debit card choosing a subscription (daily, monthly or annual) or paying only for the time used (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020). [47]

Station-based bike-sharing has several benefits to society such as less use of private automobiles, better connection with the public transport, more physical activity for the users. The positive impact covers public health, fewer traffic jams, fewer gas emissions and more freedom of mobility (Shaheen et al., 2012a) (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020) [47]

In recent years, through a significant improvement in technology, the dockless bicycle has been introduced. Also called free-floating bike-sharing allow citizens to pick-up and drop-off the vehicle anywhere within a designed area. (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020) [47]

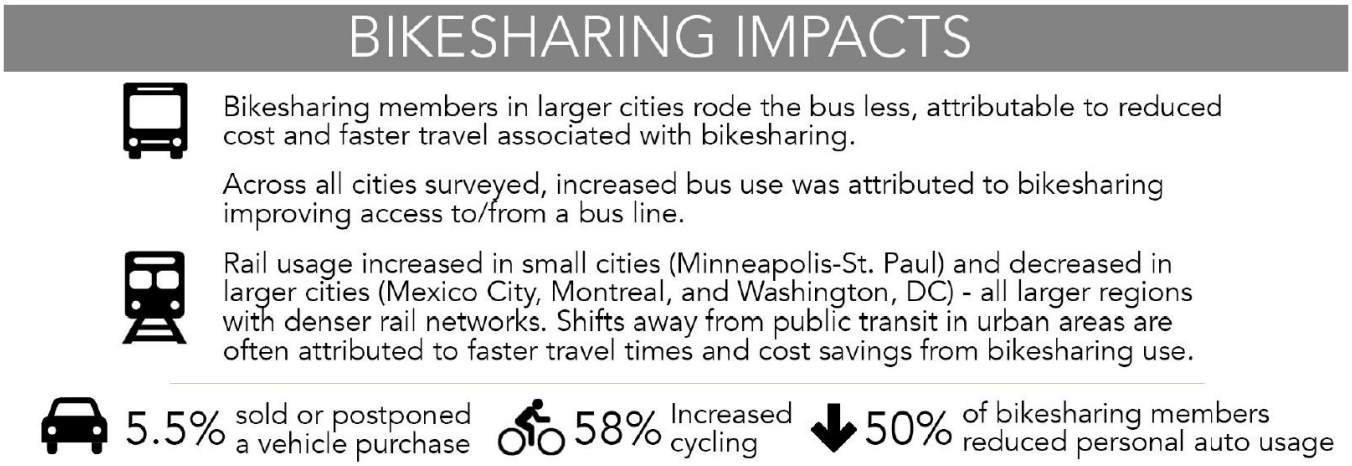
In a research done in Beijing, China, it was described that station-based bike-sharing was chosen more often for ordinary travels, such as for work or university, and that dockless bicycles did not substitute automobiles trips (Li, Zhang, Du, & Yang, 2019; Sun, 2018). Moreover, for a long trip, free-floating vehicles were preferred due to the choice of parking (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [48]

Another study was conducted in New York City, in North America by Kaufman et al. (2015). The research showed that 75% of bikes stations were close to bus or metro station, in a range of five-minute walk offering a solution for that first and last mile problem to mobility. Further research was done by Shaheen et al. (2011), through a survey of 800 people using the bike-sharing scheme in Hangzhou, China. Bike-sharing has been viewed as an integrated part of public transport as well as a competitor. Moreover, 30% of people interviewed use regularly bike-sharing and decreased the use of private cars (Shaheen et al., 2014). Other findings showed that in big towns, bike-sharing reduced the number of people on buses, while in a small city, enhance the accessibility to bus stops (Shaheen, Susan, Chan, Nelson, 2016. Mobility and the sharing economy: Potential to overcome first- and last-mile public transit connections). [36]

Regarding the buyer persona, or also called the typical user of the bike-sharing system, in North America, it was discovered that most of the costumers are young, middle o high income and high level of education (Shaheen et al., 2014; Shaheen et al., 2012a, 2012b) (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020) [47]

Past literature has analysed the main elements that influence on bike-sharing programme, which are infrastructure, geography, and demographics of customers. The first factor is related to the development of bike lanes, bike racks, the structure of bicycles' stations. The second element is connected with the

topography, if is a city is flat or hilly, factors that influence drastically the attractiveness of some spots in the metropolitan area (Wang and Akar, 2019; Wang et al., 2015) (Garcia-Palomares et al., 2012; Shu et al., 2013) (Jessica Lazarusa, Jean Carpentier Pourquierb, Frank Fengb, Henry Hammelc, Susan Shaheend, 2020) [47]



Source: S.S, C.N, 2016. Mobility and the sharing economy: Potential to overcome first- and last mile public transit connections. [36]

Bicycle-sharing network has several advantages, such as improving health, mental wellbeing, additional time in roads and in shopping areas, better social interactions. Also, the environmental impact by reducing pollution and usage of private vehicles (De Maio, 2009; Gardner & Gaegauf, 2014; Qiu & He, 2018) (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [48]

3.7 E-Scooter

Electric scooters are an alternative to bicycles and in the last 3 years, through several start-up-ups that introduced sharing services of e-scooter, has gained great popularity around the world, becoming at the moment the latest innovation in micro-mobility (CNBC, 2018). E-scooter has the advantage to be versatile, allowing people to use them for a range of space that is not suitable with cars or too far for walking (K. J. Krizek and N. McGuckin, 2019). Moreover, thanks to the small size of the vehicle, this can be used in roads as well as sidewalks or pedestrian area to overcome traffic jams (McKenzie, 2019). Also, a study in Munich, Germany supported by results, showed that e-scooter can potentially substitute cars trips (Anindya Maitiy, Nisha Vinayaga-Sureshkanthy, Murtuza Jadliwala, Raveen Wijewickrama, Greg P. Griffin, 2020). [52]

One of the reasons that have given rapid popularity to e-scooter is the efficacy in solving the last-mile issue. The vehicle can quickly bring users to transportation hubs, like bus or metro station, from their home, without any constraints but giving more choice on intermodality mobility. Another reason that enabled e-scooter to

reach rapid growth is the servitization of them, becoming an additional part of sharing services. The cost for e-scooter is around 1€ to unlock and between 0.15€ to 0,25€ per minute, according to the operator and the city. Lately, several companies have introduced weekly or monthly pass with prices such as 30€ per month. (Helbiz) (Wiggers, 2019)

Other reasons that increased the request for e-scooter is the high accessibility to the service, they are all dockless and give flexibility on the purpose of travel, no parking cost and it is not necessary practising before to use them (C. Hardt and K. Bogenberger, 2019). Despite all the success all over the world and the rapid expansion, like any new technology, e-scooters have given troubles and unforeseen problems to local governments and operators (Anindya Maitiy, Nisha Vinayaga-Sureshkanthy, Murtuza Jadliwala, Raveen Wijewickrama, Greg P. Griffin, 2020)**.** [52]

3.7.1 Market size of e-scooter

The first start-up to enter in the market in 2017 were Bird, followed then by other competitors such as Lime, Helbiz, Voi, etc. All the firms working in shared micro-mobility raised 1.5$ billion with a global market value of $40 to 50$ billion by 2025, reaching cities with at least 100,000 inhabitants. The major players are Bird and Lime that alone have reached $20 million raising funds. According to BCG, 35% of trips have a length of 2 kilometres (km), and the rest 75% is less than 10 km (D.Schellong, P.Sadek, 2019, BCG). [50]

3.7.2 Media and Regulations Issues

Mass media have mentioned e-scooter several times, talking principally in a good manner toward the new occasions that e-scooter companies could bring to cities, citizens and shared mobility, with an overwhelm optimism (2018, Le Monde). However, after a couple of weeks, first issues and problems emerged especially from a pedestrian that had to share their space with e-scooter users. The public opinion pointed out about vandalism, people using electric vehicles unsafely and parking them with no rules, which brought part of the public opinion to ask for strict regulation or ban the new technology (Amy Martyn. 2019) (The Guardian, 2018). Later, when some troubles arose, media has started to question the safety, focusing on accidents and insurance programme (The New York Times, 2018) (Sylvaine Tuncer Barry Brown, 2020). [53]

One of the main pillars of e-scooter companies is promoting their sustainability and green mobility. This topic has raised many questions on how efficient and environmentally friendly these companies are. The principal problem is the short life of e-scooter, which is around 3 months on average to a maximum of 6 in the best-case scenario. Secondly, motorised vans are used to reposition the e-scooters around the city and it was questioned how they are recharged if the energy come from renewable energy or fossil fuel source. Recently, some firms have declared to use only electric vans to pick the e-scooter up and use swappable

batteries (Joseph Hollingsworth, Brenna Copeland, and Jeremiah Johnson). Furthermore, shared micro-mobility companies have worked hard to enhance the design and material used to build e-scooter to increase their durability. The press has also reported that shared e-scooters and private e-scooters have had a different impact. The first one replaces walking more than car trips, while the last has the potential to substitute private vehicles, pushing people toward public transport and intermodal mobility (Rebekka Oostendorp, Daniel Krajzewicz, Laura Gebhardt, and Dirk Heinrichs. 2019).

The introduction of shared micro-mobility and especially e-scooter has been different from city to city. For instance, towns like Christchurch and Dallas in the U.S have taken, before the official launch, a trial period to understand deeply the dynamics and possible consequences of this innovation. In other towns, such as Paris, the launch of shared micro-mobility services was itself an experiment, indeed the local governments had to change and adapt regulations frequently to find a practical solution (Stefan Gössling, 2020). [54]

In the beginning, the French capital has given the licence to operate only to one company with 100 e-scooter. As it happens in other cases, the new vehicles gained rapid popularity to reach a point where people hide e-scooters to have a privileged use (Le Figaro, 2018). Later, the license was extended to other 11 start-ups, reaching 20,000 e-scooter, creating an unmanageable circumstance, that forced the council to give the licence only to three operators (Le Figaro, 2019) (Stefan Gössling, 2020). [54]
Another issue that has emerged with the expansion of e-scooter around the city was the use of sidewalks by e-scooters rides. Initially, it was allowed, but a series of clashes with pedestrians prompted local governments to restrict the use of e-scooter only on roads and bicycles lines (Le Figaro, 31 March 2019). Further restrictions were the maximum speed reduced to 20 km/h and 8km/h in the pedestrian zone (Le Figaro, 2018, 2019) (Stefan Gössling, 2020). [54]

The main issue described in mass media was the disagreements over space, between pedestrians, cyclists, and e-scooter riders. Discussion is primarily focused on the prohibition of e-scooters from pedestrian area and sidewalks, and until now, cities had a different approach. For example, in Brisbane, Australia, e-scooter are prohibited from sidewalks (ABC News,2019). Other media emphasized on the ample space given to cars and parking and the limited infrastructure to bicycles and e-scooters (Brisbane Times, 2019) (Stefan Gössling, 2020). [54]

The second most relevant problem discussed by the news is maximum speed limits. Cities such as Los Angeles and Dallas have adopted the philosophy of no restrictions on e-scooter, while most of the European towns like Vienna or Rome have a limit of 25 km/h (Der Standard, 2019). In several cities, news has also reported reckless riding, usage of pedestrian or sidewalk where is prohibited, cluttering that apply to casual parking and obstacle people walking. According to Stefan Gossling, 2020, policymakers and local

governments should try to reduce as much as possible all these problems. For instance, maximum speed should be around 20 to 25km/h, prohibit the use of e-scooter on the sidewalk and align e-scooter to bicycles from a legislative point. Regarding helmet usage, it was not found a common perspective and the suggestion is to adapt the rule to the local culture (Stefan Gössling, 2020). [54]

Other results demonstrated that the local culture has a dramatic effect on the success of shared micro-mobility services. In Zurich, Switzerland, mass media has always communicated positive behaviour from citizens (Stefan Gössling, 2020). [54]

3.7.3 Safety Issue

A research done in New Zealand, through a survey discovered that regulations negatively influence the usage of e-scooters. This can especially influence new adopters that have never tried shared micro-mobility services. Another barrier is the perceived risk of accidents or illegality of using it. Regulations might help to legitimise the e-scooter as an alternative mode of travelling, encouraging new users (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [48]

According to the research, frequent users that are identified with at least three usages per week prefer no regulations, which in their opinion can decrease their usage rates. Non-users that are identified with people who never tried sharing e-scooter services prefer a mandatory helmet, which makes them feel safer. This strong opposition is the reflection of technology lifecycle adoption, where early adopters tend to be risk-taker while the rest of people are risk-averse. In the research, a high number of casual users was detected, which can indicate that e-scooter is still in novelty phase and used mainly for recreational purposes rather than an alternative mode of transportation (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [48]

Regarding the use of helmet, using no rules seem the best alternative from the study, giving the choice to riders. Frequent and casual riders negatively view mandatory helmet, while other users responded that they would be more willing to use e-scooter if helmets were given. As already mentioned before in many analysis of media and news, helmets regulations did not find a common rule among all cities, and in this case, the opinion about helmet could be strongly influenced by the mandatory helmet riding bicycle in New Zealand. For instance, in Melbourne and Brisbane, Australia, helmet diminished drastically bikes utilization (Fishman, Washington, Haworth, & Mazzei, 2014; Médard de Chardon et al., 2017) (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [48]

The prohibition of using the sidewalk for e-scooter was viewed as a further barrier for non-users, and parking limitation was not seen as a positive regulation for frequent and casual users. Moreover, station-based e-

scooter, as well as bike-sharing, is seen a strong limitation for flexibility in trips. The main reason that push people to prefer a speed limitation rather than a ban from sidewalk riding is that using footpath gives a sense of safety rather than riding next to cars (Dominic Lo, Chelsea Mintrom, Kate Robinson, Ryan Thomas, 2020). [48]

The consequence of allowing e-scooter to use footpath areas is the rise concerns for pedestrian safety (K. Fang, A. W. Agrawal, J. Steele, J. J. Hunter, and A. M. Hooper,2018). Moreover, the number of accidents between people and micro-mobility vehicles has risen (N. Sikka, C. Vila, M. Stratton, M. Ghassemi, and A. Pourmand, 2019). For instance, in Brisbane, Australia, it was shown that almost 50% of rides with e-scooter was illegal, that could include two passengers in one scooter, using sidewalk were not allowed or not wearing helmets when mandatory (N. L. Haworth and A. Schramm,2019) (Anindya Maitiy, Nisha Vinayaga-Sureshkanthy, Murtuza Jadliwala, Raveen Wijewickrama, Greg P. Griffin, 2020). [52]

E-scooter and bikes as micro-mobility vehicles can cause potential damage to pedestrian and their risk is affected by urban design, traffic jams in roads as well as in pedestrian area, and density of people on sidewalks (P. Stoker, A. Garfinkel-Castro, M. Khayesi, W. Odero, M. N. Mwangi, M. Peden, and R. Ewing, 2015). According to Philip Stoker et al.'s research over 170 people, it was demonstrated that the three most relevant element that determines risk for pedestrian are pedestrian-traffic interaction, visibility and speed, which are easily manageable with proper planning (P. Stoker, A. Garfinkel-Castro, M. Khayesi, W. Odero, M. N. Mwangi, M. Peden, and R. Ewing, 2015). Detailed analysis on urban design demonstrated how road with double footpath, trees and buffers on the sidewalk can significantly reduce pedestrian treat (Z. Asadi-Shekari, M. Moeinaddini, and M. Zaly Shah, 2015) (Anindya Maitiy, Nisha Vinayaga-Sureshkanthy, Murtuza Jadliwala, Raveen Wijewickrama, Greg P. Griffin, 2020). [52]

Another research was done in Singapore, where studies found out that implementing arrows painted on the street, enhanced the safety of people (P. Z. Lim,2019). In China, a group of doctors have evaluated accident and injuries for both e-scooter users and pedestrian, showing how musculoskeletal fractures and head traumas were the most frequent (T. K. Trivedi, C. Liu, A. L. M. Antonio, N. Wheaton, V. Kreger, A. Yap, D. Schriger, and J. G. Elmore,2019), (A. Badeau, C. Carman, M. Newman, J. Steenblik, M. Carlson, and T. Madsen,2019) (Anindya Maitiy, Nisha Vinayaga-Sureshkanthy, Murtuza Jadliwala, Raveen Wijewickrama, Greg P. Griffin, 2020). [52]

A clear example of what increases the rate of accidents is the lack of infrastructure such as bike lanes, that bring riders to use the footpath, increasing drastically the potential treat for pedestrians. Another case of risk to pedestrian might be a given by an e-scooter parked inadequately, which can force people to walk on the street and increase the risk of getting hit by a car. Moreover, certain physical obstacles, such as branches,

poles, fire hydrants or benches contribute to dangerous sidewalks. This demonstrates how urban planning is key to offer safe and smooth mobility around a metropolitan area. A valid option, that should be done in parallel to urban planning is educating e-scooter rides and a pedestrian on how to ride safely and follow the rules (Anindya Maitiy, Nisha Vinayaga-Sureshkanthy, Murtuza Jadliwala, Raveen Wijewickrama, Greg P. Griffin, 2020). [52]

3.7.4 Case study of Paris

The two author S.Tuncer and B.Brown from the Stockholm University in Sweden, have studied the phenomena of e-scooter through in depth interview and video- footage in the capital of France, Paris which was the main venue of e-scooter in Europe. The results discovered different and interesting points of view from the riders. For instance, the main driver to use e-scooter is the enjoyability and the feeling of freedom, as well as the flexibility and the ability to arrive at points in the city that are not allowed for cars. Consequently, e-scooters have the power to maximize the time of the trip and do not require significant effort like bikes (Sylvaine Tuncer Barry Brown, 2020). [53]

Obviously, negative aspects are also present; indeed, many participants have felt in danger by using e-scooters close to cars and in roads, also due to the fact that e-scooters are completely unprotected. Moreover, until now, e-scooters are mostly used for recreational activity and not for commuting since the electric vehicles part of the shared system lack of trustworthiness. E-scooter companies position the vehicles everyday in different location, which does not assure reliability 24/7. Other cases was the inaccuracy of the map or e-scooters out of battery (Sylvaine Tuncer Barry Brown, 2020). [53]

To summarize, the e-scooter offers simplicity of usage, cost benefit (given by not buying and maintaining the vehicle) but at the same moment, opportunistic behaviour from the riders which do not see it as a main mode of transportation but rather a complementary piece of the public transport. As a matter of fact, e-scooters partially changed the daily travel of some riders that thanks to the introduction of this innovation have access to metro station or bus stops that were not available before. Furthermore, in peak hours, not only roads are affected by traffic jams, but also public transports, making e-scooters the most effective way to move from a point A to a point B. In conclusion, one of most important and relevant features of e-scooters is the “hybridity”, merging characteristics of car, bicycle and walk. According to the circumstance, the two-wheeler innovation can reach the same speed of a cars in congestion, but when it needed enter in a pedestrian area or being carried when walking (Sylvaine Tuncer Barry Brown, 2020). [53]

3.7.5 Case study of Spain

In the department of Civil Engineering of the “Universidad Politécnica de Madrid”, in Spain, it was conducted a survey to understand the main elements that influence the positive attitude toward the e-

scooter for urban mobility. Regarding the socio demographic specifics, gender and age were fundamentals factors, indeed, most of the users were males from 26 to 34, with higher education, i.e. university. These findings are in line with the study conducted by Degele et al. (2018) in German. The results are foreseeable due to the fact that young people are better acquainted with innovation and in great physical shape, which contribute to a positive attitude on driving e-scooter (Andressa D'Agostin, Janine Fleith de Medeiros, Gabriel Vidor, Maikielli Zulpo, Cleide Fátima Moretto, 2019). [56]

Concerning the economic factor, salary does not effect on casual utilization, but with a high salary is less likely to use e-scooter frequently. Users with a salary above 2000€ have -480% less probability to be a frequent customer in comparison with the one with 1000€. The reason can be justified for the fact that rich people are more accustomed to move around the city with private vehicles. Moreover, people that have rarely driven in town, are potentially early adopters of e-scooter, while citizens that never walk to arrive to their destination are less likely to try the products.

Lastly, similarities and synergies with bike sharing were discovered. Indeed, people who regularly utilize bikes are statistically more likely to use e-scooter and citizens conscious about the environment are more probable to be potential frequent users of e-scooters (Álvaro Aguilera-Garcíaa , Juan Gomeza, Natalia Sobrinob, 2019)

3.8 Factor affecting of the adoption of sharing vehicles

E-scooters firms are trying to expand globally in the fastest way, trying to conquer city after city, gaining market size to beat competitor and reaching profitability. However, sharing mobility has had a different level of acceptance and success in several countries. Cultures play a crucial role that determine the failure or the fortune of sharing services, for this reason there is no universal rule or method to win customers' trust and to promote this innovation around the world (Davidson, Habibi, & Laroche, 2018; p. 370) (Manjul Guptaa, Pouyan Esmaeilzadeha, Irem Uzb, Vanesa M. Tennantc. 2018). [59]

Users have various reasons to share and to be part in the sharing economy and therefore worth products alternatively through different perspectives. People not always value the idea behind the sharing economy, but are motivated only by an utilitarian perspective, accessing products with cheap price (Gianna M. Eckhardt, Fluera Bardhi 2015) (Xun Xu,2019). [58]

According to Belk (2010) research on consumer behaviour, he presents a model of sharing based on four components of sharing: 1) possessiveness, (2) independence versus interdependence, (3) privacy and contagion, and (4) utilitarianism. The first is strictly correlated with the sense of belongingness. The

second dimension indicates the importance given to objects compared to personal relationships with people. The third aspect relates to how much anonymity is relevant and how people are worried about the contact with others. Finally, utilitarianism is the degree of how much a person is motivated by an economic interest. Whereas people who prioritise possessiveness and are scared by contact are less inclined to share, people moved by an economic incentive are more willing to get involved in the sharing economy (Belk, 2010) (Manjul Guptaa, Pouyan Esmaeilzadeha, Irem Uzb, Vanesa M. Tennantc. 2018). [59]

The main characteristics of citizens in a collectivist society is the tendency to group directed rathen than individualist (Hofstede, 1980). The latest are also more materialistic and look for personal achievements and individualistic prize rather than collective prosperity (Akbar, Mai, & Hoffmann, 2016; Earley & Gibson, 1998; Hofstede, 1980).

Moreover, based on Belk (2010) studies, individualists not only are less inclined to share their products, but they try to not rely on others. In contrast, collectivist do not consider essential using products of other people and are not that materialistic to have strong relationship with their products (Wong, 1997). Consequently, possessiveness and materialism lead people toward buying, while lack connection brings to sharing Belk (1985, 2010) (Bauer, Wilkie, Kim, & Bodenhausen, 2012; Burroughs & Rindfleisch, 2002; Wong, 1997) (Manjul Guptaa, Pouyan Esmaeilzadeha, Irem Uzb, Vanesa M. Tennantc. 2018). [59]
According to Hellwig et al. (K. Hellwig, F. Morhart, F. Girardin, M. Hauser,2015), consumers embrace sharing for several reasons. It can be ideological with the intent to cooperate, exchange goods and encourage sustainability. Another reason is the search for experience, customers through sharing economy can try and experiences services that otherwise could not afford. Nevertheless, some factors such as demographics, gender or income, influence drastically the motivations of people. (C. Lutz, G. Newlands, 2018) (Xun Xu,2019). [58]

Regarding the introduction of vehicles related to transportation, knowledge and comprehension of how it operates, are essential elements for the widespread adoption. According to the German authors of the Institute of Transportation Systems, three main steps are necessary for the success of sharing services. The first phase is to educate people on the existence of the vehicles and instruct them on how to use it. Inadequate details about sharing services or lack of clear and comprehensible of the system may contribute to a rejection from users. could lead (Finn et al., 2004) (Alexandra König, Niels Kowala, Jan Wegener, Jan Grippenkoven, 2019). [60]

In the second phase, firms have the duty to create positive attitude in users toward sharing mobility services (Ajzen, 1991), this is indispensable requirement for an approval and afterward the usage. Based on DRT model by König and Grippenkoven (2019a), the perceived utility for the public trnapsort lead to a favorable assessment by citizens. The last step is the acceptance. A positive attitude is a essential but not a sufficient prerequisite for a widespread adoption (Dethloff, 2004). The second step has to be transformed in an active desire to employ the mobility service (Ambrosino et al., 2003). In order to facilitate the successful adoption, is necessary to encourage people and proving great opportunity and incentives to try the products (Alexandra König, Niels Kowala, Jan Wegener, Jan Grippenkoven, 2019). [60]

The transport regulator in Malta, Transport Malta, conducted an public national awareness campaign to encourage the use of shared mobility services, specifically bike-sharing, and to instruct the people about cycling safety. Three survey were done in a range of time of a year, the first concerning the current knowledge of bike sharing, the second after the national campaign and the third after couple of months since the camping. The results demonstrated that the major obstacle for the utilization of bicycle is road safety, which negatively influences the attitude toward the use of bicycles (Suzanne Maasa, Maria Attarda, 2020). [55]

This outcome is similar to a research done in Greece, where the main reason for not using bicycles were 'Lack of adequate cycling infrastructure' by 49.1% sand 'limited road safety' by 43.6% of respondents. A positive case study happened in Seville, Spain, where 120km of bike lines were implemented, which contributed for the widespread adoption of the bike-sharing programme, from the 10.000 trip per day of 2006 to over 70.0000 trips per day in 2011(Marqués et al., 2015) (Suzanne Maasa, Maria Attarda, 2020). [55]

To encourage properly a behavioural change, suitable options for mobility are not enough, also limitations on the usage of private vehicles, both physically (limits on parking) and financially (high parking cost or congestions fees) are essential to facilitate the shift on mobility (Heinen et al., 2010) (Suzanne Maasa, Maria Attarda, 2020). These findings, even though related to bike-sharing programme, are suitable for the e-scooters case, which are a similar mode of transportation, in certain case are legislative identical, and should be taken in consideration to have a better understanding on how to promote these products as well as understand barriers of the usage.

3.9 Research Objective and Conceptual Framework

E-scooter sharing services have been spread all over the world, starting in the U.S and in the last two years with a rapid expansion in Europe. Italy has legislatively allowed the use of e-scooters only in July 2019, with a maximum speed of 30km/h, no mandatory helmets and insurance, and with the limitation on driving on sidewalks (HDMotori). As we have already seen for other cities, shared mobility services can diminish

vehicles ownership rate and create more free space, occupied by parked cars, for other recreational activity more beneficial for the society. However, the widespread adoption depends on several factors, characteristics of the city, quality and quantity of infrastructures, such as bike lines, and most important by the willingness of people to adopt the new technology.

The first e-scooters firm to introduce their fleet of vehicles in Italy was Helbiz.Co that in February 2020 started with 1000 e-scooters (Tomshw, 2020) [62]. Moreover, between May and June other three start-ups enter in the market of e-scooters: the American companies Lime, Bird and the Dutch company Dott, starting more and less with 1000 vehicles each for the cities of Rome, Milan and Turin (Vialelettrico, 2020). [63]

Nevertheless, firms to continue to operate in several cities and offering a quality service have to be profitable and sustainable in the long run. The success and the positive influence on society, giving an intermodal opportunity of mobility, rely on changes concerning travel behaviour and ownership of citizens. If individuals will be more inclined to switch from private cars or public transports so ESS (e-scooters sharing services), this will be an integrated part of the urban mobility. Therefore, it is essential to comprehend what are the factors that increase the willingness of adoption and the possible barriers, with the purpose to increase the efficacy of marketing campaign toward the right target (Timo Eccarius, Chung-Cheng Lu, 2020). [49]

Previous research has studied the phenomena of e-scooter in several cities such as: the attitude toward e-scooters in Munich, Germany by Hardt and Bogenberger (2016), Degele et al. (2018) in Stuttgart, Germany studied the consumer usage trends, the academic writers Eccarius and Lu, 2018 analysed the factors the push people toward a positive or negative attitude on e-scooters among Taiwanese students and finally Aguilera-Garcia et al. (2020) discovered the adoption of e-scooter in Spain (Timo Eccarius, Chung-Cheng Lu, 2020). [49]

All these studies do not consider the Italian market and also do not have a focus on behavioural influence regarding willingness to use e-scooters, personal value, or social norms. These elements have a significant influence on travel behavioural toward shared mobility programme (e.g. Kaplan et al., 2015; Wang et al., 2018; Si et al., 2019; Ullah et al., 2019).

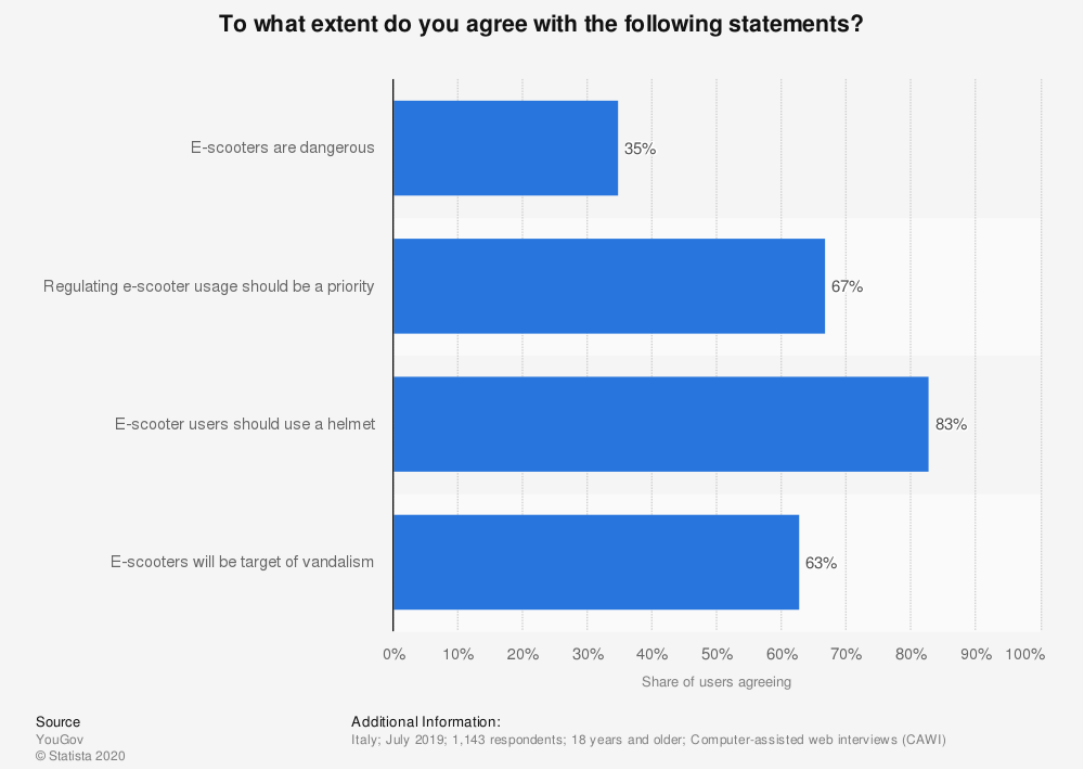


Figure 10 - Source: Statista, July 2019. [65]

Therefore, all the information is essential for start-ups and companies working in this market to have a better understanding on what to communicate and improve marketing campaign. Moreover, the results can be useful to local government and urban planners to help them reshape the infrastructure of the city. The study is among the first to be applied to Italian consumers and their perspective on ESS. Until now, the only survey is done by "YouGov" and distributed on Statista. The survey was done in Italy in 2019 with more than 1100 respondents. The first aspect underlines the fact that almost everyone (83%) agrees that when riding e-scooters should be mandatory wearing a helmet. Secondly, more than half (65%) confirms that e-scooters will be affected by vandalism and finally only one third (35%) think that e-scooters are risky (Statista, July 2019). [65]

Another survey was also done by YouGov in July 2019 with 1143 respondants. The question proposed to individuals was "For what reasons would you rent an e-scooter?", the most common answers with respectively 55%, 50% and 44% are "to travel fast", "to reduce emissions" and " to avoid using car". The resulsts show clearly that e-scooter is viewd as the fastest mode of transportation in certain case to move from a point A to a poin B, while the second answer demonstrate a stric correlation with enviromental concern. One interesting answer is "To avoid using public transport" (27%) that obtained a relative low answer. It is more probable that during this time, due to COVID-19, this reason might be one of the main driver to push people using e-scooters (Statista, July 2019). [65]

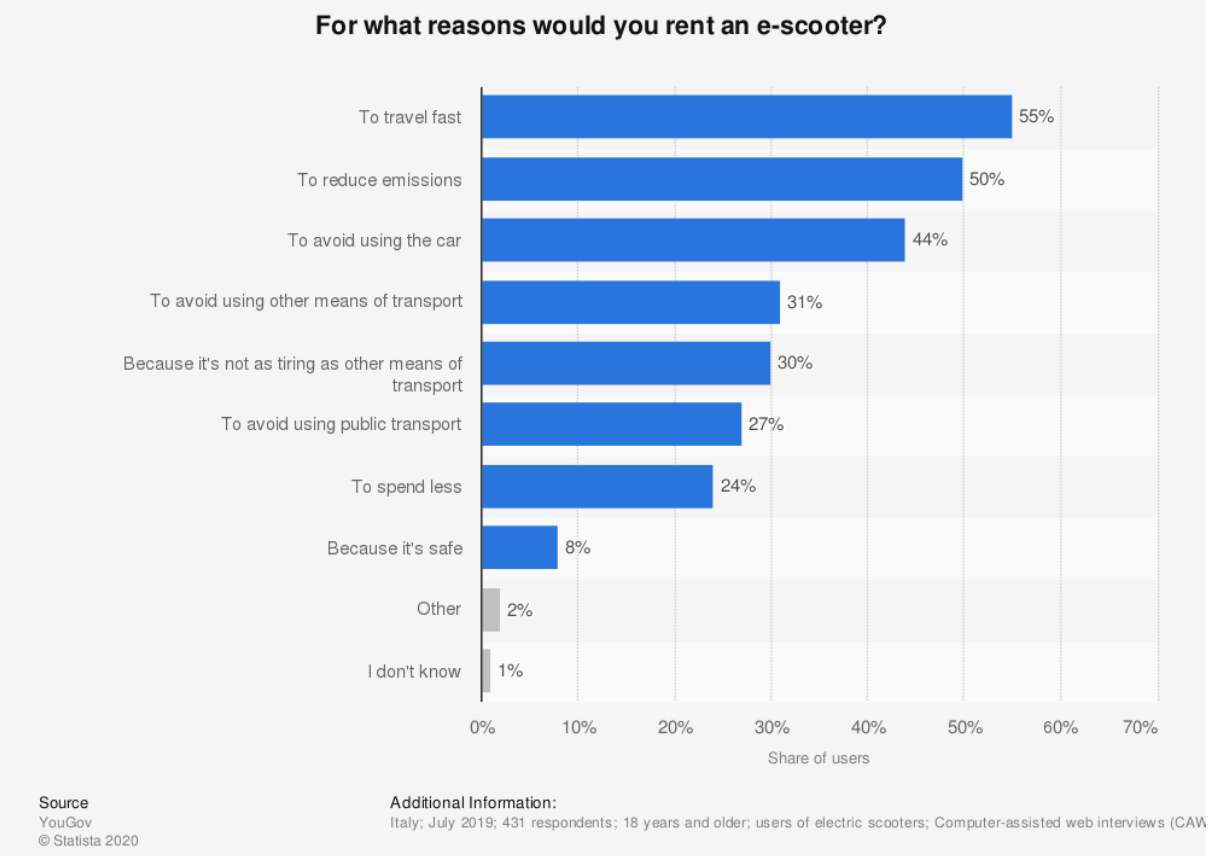


Figure 11 - Source: Statista, July 2019. [66]

The following research contribute to expand the academic knowledge and help managers of e-scooter company to better understand the behaviour of consumers. The study is the first done in the Italian market, which can significantly give an overview of the users in a fast and rapid growing market. Moreover, due to the recent introduction of e-scooters in the following Italian cities: Rome, Milan, Turin, Cesena, Pescara, Verona, Bari, Parma, Napoli (Helbiz, 2020). [63], the study can help mayors, transport council member, policymakers to understand better how to improve urban mobility and increase the usage of electric scooters (Statista, July 2019) [66].

Chapter 4 – Research objectives and Methodology

4.1 Model Framework

The model proposed studies the direct and intentional decision procedure when utilizing the e-scooter sharing programme with the framework of the theory of planned behaviour (TPB). This framework is also used to understand the human decision in travel behaviours studies. Previous research has shown how this model can be an effective instrument to describe the process that brings to a change in behaviour or adoption of new transportation means, such as e-scooter sharing. In the TPB framework, the intention is the dependent variable. "Intention is assumed to be an immediate antecedent of behaviour" (Ajzen, 2002, p. 665). Moreover, attitude, perceived control and social norm are other elements that influence the intention itself. The positive or negative emotions of users regarding the willingness to use e-scooters sharing are alternatively called attitude toward the behaviour (Ajzen and Fishbein, 2005).

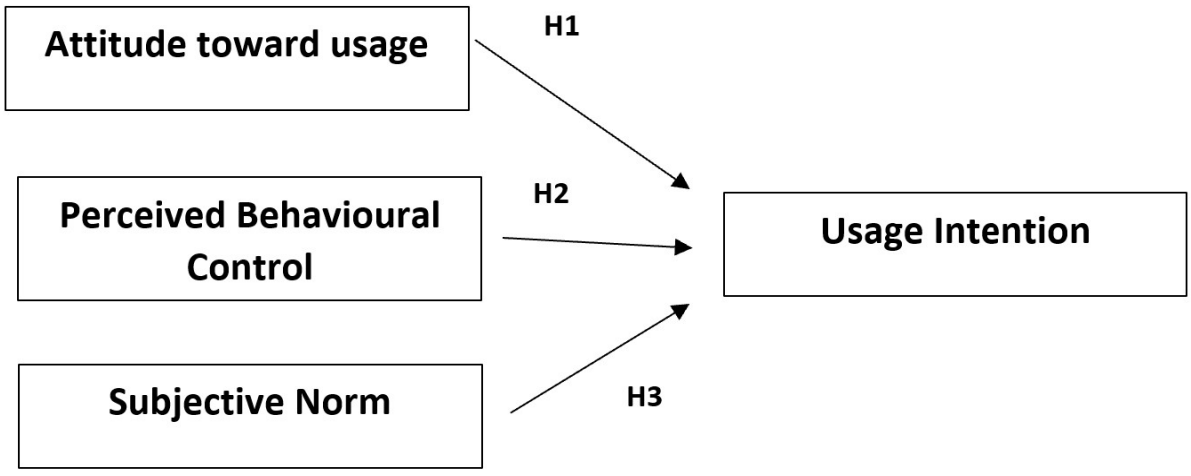
Early adopters do have expectations on the simplicity or complexity of e-scooter sharing system usage (Ajzen, 1991; Venkatesh et al., 2000), and different levels of self-confidence, income, and other factors necessary in their willingness to use e-scooters. The combination of tools is fundamental to formulate the concept of *perceived behavioural control.* Additionally, "*subjective norms* stand for perceived social pressure" (Ajzen, 1991, p. 188) from relatives and friends (Amjad and Wood, 2009).

Consequently, the hypotheses are:

H1. Positive attitudes toward E-scooters Sharing System use positively influence usage intention.

H2. Perceived behavioural control over use of E-scooters Sharing System positively influences usage intention.

H3. Social norms regarding the use of E-scooters Sharing System positively influence usage intention.



4.2 Survey instrument and data collection

In the survey for this research was used a 5-point Likert-type scale for all items. Concerning the demographic items were included gender (male/female), age (open item), average yearly income (above or below 10,000 €), frequency of usage of public transport (Bus, Tram, Metro, Train) and finally if the user ever used the e-scooter before.

The variable for analysis intention is organized with phrases like, "I am willing to …" or "I will …". Moreover, a willingness to suggest behaviour to others can be an indicator of behavioural intention. Regarding attitude toward e-scooter were adjusted from Claudy et al. (2015). For measuring subjective norms, two items represent injunctive social influence by family or friends (e.g. Taylor and Todd, 1995; Venkatesh et al., 2003; Westaby, 2005), and a third item presents a more descriptive social influence by strangers.

4.3 Methods and Analysis

The survey was chosen due to many factors, it was the best solution to distribute the study. The online survey allowed a broader reach geographically, which increased the number of participants, giving better representativeness of the Italian population, and also an easier way to contact people. The questionnaire was disseminated between June and July 2020, through word of mouth, instant message platforms such as WhatsApp, Facebook Messenger, and Instagram and also Facebook groups, reaching a total of 319 valid responses. The statistical analysis has been conducted through the use of SPSS software, with the aim to reach at least 200 participants.

4.3.1 Descriptive Analysis

The Italian language was used for the survey, and therefore, presumably, all participants are Italian. Moreover, the sample is constituted by 56.1% (179) males and 43.9% (140) females (Table 1), which is close to the ideal case of 50% each. Among all the 319 respondents more than half, 59,2% (189) is a student, then 25% (80) are employed and the remain people are freelancers or unemployed (Table 2). Regarding income information, 68% (217) of respondents earn less than 15.000€ per year, which confirm the high percentage of students 59,2% and the small percentage of unemployed 3,1%. Furthermore, people who earn between 15.000€ and 40.000€ are almost 25% (79) and finally, only 7,2% (23) of people interviewed earn more than 40.000€ (Table 3).

People who participated in the research can be divided into four main age group, 18-24, 25-34, 35-45, 45 and above. The first group refers more than half of the total 56,4%(177) then the second group is 36,9%

(118) and together the first two groups represents 93% of the sample, which confirm the majority of students and the low salary. The mean is 25,59 (Table 4).
Concerning the use of public transport, only 7.5% affirm that never use public transport, 36,1% sometimes, 10,7% half of the time, 30,1% often and finally 15,7% say that always use the public transport (Table 5).

In Table 6, we can see the number of people that have used the e-scooter at least once and the correlation with gender. Most of the participants, probably come from the region of Lazio, due to the fact that I have personally contacted people living in the same region, even though there is no evidence of that. Moreover, e-scooter has been introduced only in few cities (Rome, Milan, Rimini, Torino, and Verona) starting from the end of May 2020, for this reason, only 24.1% (77) of respondents have tried e-scooter before. Furthermore, e-scooters have been introduced in several other European cities last year and consequently people who answered positively to the answer "Have you tried e-scooter before?" might try the vehicles in another country. Most of these early adopters are male 61.7% and the rest are 38.3% females.

Concerning the correlation between public transport and new users, from table 7 is clear that almost half of the early adopters (people who have tried e-scooter at least once) use often the public transport 42% (Molto spesso + Sempre), while 91% (Qualche volta + La metà del tempo + Molto spesso + Sempre) of total respondents use public transport at least once in a while.

Table 8 shows the correlation between new users and the occupation of respondents. It is clear that most of the users are students 45.5% (35) of the early adopters, that can relate to a correlation with the young age. The second category with the highest number of trials is employed people 36% (28).

The last contingency table is shown in table 9, between new users and age. If it is taken in consideration the four group in which previously were divided age 18-24, 25-34, 35-45, 45 and above, the percentage of early adopter is 51% (39), 40% (31), 6,5% (5), 1,5% (1) respectively. It is unequivocal that the highest correlation between age and early adopters are among young people between 18-24, but also individuals between 25-34 with 40%. Moreover, it is important to underline that the range age 18-24 is smaller than 25-34, but despite this fact, the youngest group is still the majority which can give a better sense of how sharp the correlation is.

After preparing the data, all the variables have been analysed. Starting from the dependent variable "Usage Intention", the participants were asked to agree or disagree on a 5 - point Likert scale on the following statement:

- If I have access to an EMS system close to me, I will use it.

- I am willing to try out EMS.
- I am willing to recommend friends and family to use EMS.

The first statement has a result of M= 2,94, SD=1,237, while the second M=3,49 SD=1,338 and the last one M=3,26 SD=1,302. The mean of the whole item "Usage Intention" is M=3,22, SD=1,14, which is in a neutral position or slightly positive (Table 10). Analysing in depth the behaviour of respondents is clear the difference among people who have already tried the e-scooter once with M=3,97, SD=0,93 and users who have not tried yet the vehicle M=2,99, SD=1,10 showing a significant difference (Table 11). Another correlation has been done between Income and Usage Intention, but no differences have been found among incomes (Table 12). Furthermore, an analysis between Job Occupation and Usage Intention was done, founding that unemployed people and the category "Other" are slightly more inclined to usage intention with restrictively M=3,44, SD=0,77 and M=3,55, SD=1,22 compared to the standard M=3,22, SD=1,14 (Table 13). Finally, no significant difference was found between users with the various frequency of public transport usage (Table 14).

The first independent variable is "Attitude" and the participants were asked to agree or disagree on the 5-point Likert scale on the following statement:

- EMS is a great idea.
- EMS has many advantages or benefits.

The first statement has a result of M= 3,77, SD=1,136, while the second M=3,67 SD=1,105. The mean of the aggregate item "Attitude" is M=3,72, SD=1,06 that is closer toward a positive attitude (Table 15). Regarding the correlation between people who have tried the e-scooter and users who have not, we have a similar case of the variable usage intention. The first one has a result of M=4,05, SD=0,92 and users who have not tried yet the e-scooter M=3,61, SD=1,08 showing a significant difference and a slightly more positive attitude for respondents who have already tested the innovation and a lower score for the others (Table 11). Concerning the correlation between Income and Attitude, only the group with the highest annual salary, more than 40.000€ per year, has shown a slightly lower attitude with a score of M=3,30, SD=1,38 (Table 12). Also, an analysis between Job Occupation and Attitude was done, showing that unemployed people are slightly more inclined compared to the other category with a score of M=4,30, SD=0,71 (Table 13). Finally, a comparison among various frequency of public transport's usage and attitude was measured, with a result slightly higher for people who declared to never use public transport with a score of M=4,02, SD=1,24 (Table 14). This is an interesting result due to the fact that in this case, e-scooter might be seen more as an alternative to a private vehicle rather than to public transport, therefore a widespread diffusion of e-scooters might induce people to substitute private vehicles such as car and motorbikes with e-scooter.

The second independent variable is “Perceived Behavioural Control” and respondents were asked to agree or disagree on the 5-point Likert scale on the following statement:

- Using EMS is not entirely up to me.
- Provided there is an EMS system near me, I could use it if I wanted to.
- I feel confident that I could use EMS.
- I believe EMS would be easy to use for me.

The first statement has a result of M= 3,26, SD=1,33, the second M=3,29 SD=1,22, the third a score of M=2,91, SD=1,21 and the last M=3,44, SD=1,22. The mean of the whole item “Perceived Behaviour Control” is M=3,22, SD=1,00 which is close to a neutral position (Table 15). Concerning the relation between people who have tried the e-scooter and users who have not, we continue to find a similar path compared to the previous result. The first one has a result of M=3,74, SD=0,88 and users who have not tried yet the e-scooter M=3,05, SD=0,98 showing a significant difference and a slightly more positive attitude for respondents who have tested the product (Table 11). Concerning the correlation between Income and Attitude, no differences among the various groups were present. Regarding, the analysis between Job Occupation and Perceived Behavioural Control, freelancers have obtained a significantly lower score compared to the other groups with a score of M=2,76, SD=1,33 (Table 13). In the last analysis for comparison various frequency of public transport’s usage and perceived behavioural control, no differences were found (Table 14).

The third independent variable is “Social Norms” and respondents were asked to agree or disagree on the 5-point Likert scale on the following statement:

- My family or friends think using EMS is a good thing.
- People important to me think that using EMS is a good thing.
- In the near future people in the city will use EMS more and more.

The first question has a result of M= 2,96, SD=0,97, the second M=2,99 SD=1,03, the last a score of M=3,58, SD=1,06. The mean of the whole item “Social Norms” is M=3,17, SD=0,85 which is close to a neutral position (Table 17). About the link between individuals who have tried the e-scooter at least once and who have not, we continue to find a similar path compared to the previous result. The first one has a result of M=3,41, SD=0,71 and users who have not tried yet the e-scooter M=3,09, SD=0,88 showing a slightly more positive attitude for the first respondents. (Table 11). Regarding the correlation between Income and Social Norms, no significant differences have been found. Furthermore, an analysis between

Job Occupation and Social Norms was done, showing that unemployed people are slightly more inclined compared to the other category with a score of M=3,53, SD=0,74 (Table 13). Finally, a comparison among various frequency of public transport's usage and Social Norms was measured, with a result slightly higher for people who declared to never use public transport with a score of M=3,27, SD=1,09 (Table 14). This result is line with the variable Perceived Behavioural Control, confirming that e-scooter might be perceived more as a substitute for private vehicles rather than public transport.

The results show a discrepancy among people who never use the e-scooter and users who did. Therefore, people who have never tried the product rely only on their feelings, sensations, news as well as their willingness to try new products, based on previous experiences of new technology. Some outcomes are in line with previous researchers in other countries, such as the young age (18-34) being the most willing to try and use e-scooter, and older people less. Moreover, people with the highest income belong also to the older group who can assume using more private vehicles such as car and motorbikes.

4.3.2 Alpha Cronbach

All the question of the survey and the scale were already validated and used for similar research (Timo Eccarius, Chung-Cheng Lu, 2020) [49]. Consequently, I proceeded with the Alpha Cronbach for all the variables: Usage Intention, Attitude, Perceived Behavioural Control and Social Norms.

In table 18, I proceeded with the Alpha Cronbach analysis for the variable Usage Intention. The result is a high score of 0,867 ("Good") which confirm the validity of the factor. Moreover, in all the cases where one of the items would be eliminated the Cronbach would be lower. In table 19, the Alpha Cronbach of the factor Attitude is measured with a score of 0,896 ("Good"), which also confirm the validity. In table 20, I calculated the Alpha Cronbach of the factor Perceived Behavioural Control, which is 0,816 ("Good"). Finally, the Alpha Cronbach for the last factor was calculated with a result of 0,782 ("Acceptable"). Moreover, in table 24 in the column "Cronbach's Alpha if Item Deleted", the third element shows how the reliability of the factor could be higher if deleted. Therefore, I deleted the third item to have a score of 0,819 for the Alpha Cronbach of the variable social norms.

4.3.3 Linear Regression Analysis

A multilinear regression was carried out to verify if the three variables influence the usage intention. The regression was calculated between the independent variable Attitude, Perceived Behavioural Control and Social Norms and dependent variable Usage Intention. The model fit was good because F-Test was significant, but R-square had a medium score ($F(3,315) = 206,8$, p-value=0.00 <0.05, R-Square 0,663). The model accounts for 63% of the variability in the dependant variable "Usage Intention". Regarding all individual regressions coefficients, "Attitude" and "Perceived Behavioural Control" have a significant

result, while “Social Norm” has not a significant level, for this reason is not. The factor attitude has a coefficient of 0,363 while Perceived Behavioural Control 0,607.

4.4 Conclusion and Managerial Implications

The main goal of this research project has been to explore the new trend of urban mobility, e-scooters, that has gained rapid popularity among the major European cities. The research was one of the first in Italy to evaluate experimentally the intention of people trying the e-scooter, using a well-known behavioural model, the TPB theory. The survey was launched mainly among students and young workers of Italy, with several results. The research demonstrated a significant direct effect of the variable “Perceived Behavioural Control” and “Attitude” in the dependent variable Usage Intention, while the independent variable “Social Norms” did not have a significant effect. The independent variable “Perceived Behavioural Control” was the most significant and this might be explained by several other factors as we have seen previously. The willingness to use the e-scooter in a precise moment can be dictated by the weather, the number of kilometres to do, the alternatives available to do that same trip and also from the number of other e-scooters in case more than 1 need to travel from point A to point B.

From the results, we can also reach a different conclusion. First of all, there was a significant positive difference among people who have tried the e-scooter at least once and people who have not. This can be important information for managers who should focus more on the first part of the customer journey, the trial of the product, which can boost the usage of e-scooter in the future. Secondary, the e-scooter was not always perceived as an integrated part of the public transport or substitute but more a replacement for a private vehicle. Managers of e-scooter companies should take into consideration this information to better plan their future strategy, as e-scooter might be part of the public transport service or a separated service.

Policymakers also play a fundamental role to encourage people trying and using e-scooter. Safety is a factor that has not been analysed in the experiment but play a major role in the choice of consumers to use or try the vehicles, for this reason, is clear that an urban setting that prioritizes the safety of e-scooter and bikes users can incentivize the usage. Moreover, policymaker should work on making private vehicles less attractive for daily usage, by increasing the parking fees as well as enlarging the limited traffic area for private cars. Consequently, this could push some users to shift their everyday trip to work or school from cars to e-scooters, also due to the amount of time wasted in traffic.

The research could help urban planners to formulate a long-term strategy for urban mobility in the next five or ten years, and start working toward that objective. Urban mobility should be based mainly on sharing vehicles, autonomous vehicles, and their integration with the current public transport. From a

marketing perspective, managers should focus more on students and young workers as their target and create a special offer for the first trial, which is the most problematic part of the customer journey.

4.5 Limitations and Future Investigations

Several limitations were present in the study. First, the number of respondents was quite low and did not represent demographically the Italian population, indeed the majority of people were students. Another limitation was given by the moment in which the survey was launched, between May and June 2020. In these months, it was just launched the service of micro-mobility in towns such as Rome and Milan and consequently only a small part of respondents 25% have tried at least once the e-scooter. Moreover, users who already tried the e-scooter might have tested the e-scooter outside their city, in European capital such as Paris, Madrid, Lisbon, Berlin for recreational purpose. Other limitations as well as future investigations might be the size of the city, which can also influence the different perception of distance and consequently the usage of a private car rather than public transport.

Another factor which was not taken into consideration was the environmental values, which can influence in electric e-scooter usage. Indeed, in other studies, it was underlined the importance of environmental action, which is especially present in young people like the event “Friday for Future”. Adding the environmental sensibility variable might give a clearer overview for managers, who can decide to invest in a marketing campaign underlining the sustainability of e-scooter.

Future investigations might also explore emotional and non-rational motivations that push people to use e-scooter, as well as discovering if riding an e-scooter might be correlated with a certain status quo which can influence positively or negatively the attitude of consumers. Other investigations might examine the role of safety in roads and if the presence of bicycle routes might influence positively the usage of e-scooters.

Finally, future research might study deeply the difference between the recreational usage and e-scooter as an alternative to private or public transport. This information can give precious data to managers, for example, they can understand better if it is more suitable to charge and reposition the e-scooter during night or days according to the type of usage. One of the crucial points which can increase the usage of e-scooter is the first trial. This part of the customer journey is full of barriers which might be evaluated deeply to understand which factor is most influential. As we have seen previously, the use of helmet had different response around the globe, as well as the use or the ban of e-scooter in a pedestrian zone, these are all variable that can be studied in the Italian market in the future.

LUISS Guido Carli
LIBERA UNIVERSITA' INTERNAZIONALE DEGLI STUDI SOCIALI

Department of Business and Management
Chair of Machine Learning

SHARED MOBILITY: ADOPTION AND BARRIERS OF E-SCOOTERS

Supervisor

Prof. Luigi Laura

Co-Supervisor

Prof. Giuseppe Italiano

Prof. Giovanni Luca Cascio Rizzo

Candidate

Shadi Almaradi

Student No.

704061

- SUMMARY OF THESIS -

ACADEMIC YEAR
2019/2020

Summary Thesis

Introduction

The research project has the objective to explore and analysis the attitude of people toward the e-scooter sharing in the Italian market and is among the first to be applied to Italian consumers and their perspective on ESS. The phenomena of urbanization and the rise of megacities, 33 around the world made urban mobility over the years a challenge increasingly difficult. Digital technology is helping operators to provide infrastructure in a safer, cheaper, and more effective way, with stronger automation and allowing the customer to access to different options for travelling.

The most important innovation that has improved urban mobility is the shared mobility phenomena, which has been active in the major cities around the world and has brought several benefits. In 2020 the major e-scooters companies (Lime, Bird, Helbiz) have announced their launch in the Italian market, for this reason, I choose to investigate and explore deeply the attitude and willingness to try these new products in the Italian Market. The research project can be fundamental for e-scooters managers, who can better understand their marketing strategy but also the future of e-scooter sharing system in an integrated part of urban mobility, as well as a policymaker who can take advantage of this innovation to reduce traffic jams in cities, reduce gas emission, and creating new opportunities of travel mode that can better suit the different needs of people.

Chapter 1 – Sharing Economy

The Sharing Economy is a business model that allows customer, through the use of technology and a specific internet platform, to rent, share products or a service underutilized, without any constriction to buy the product itself but having only temporary access to it. Sharing economy does not include any sale activity or transfer of ownership, while some author includes also that actions [2].

The author's Daniel Schlagwein, Detlef Schoder, Kai Spindeldreher have been working to find an appropriate definition concluding that: *"The sharing economy is an IT-facilitated peer-to-peer model for commercial or non-commercial sharing of underutilized goods and service capacity through an intermediary without a transfer of ownership."* [2]

Sharing Economy is mainly based on three key pillars: access to the economy, a platform using ICT and a community-based economy [3]. The most common business model is characterised by a company that provides for a fee for the use of their product or service. Sharing Economy has had an impact in several industries and the pioneer of this new business model was Uber, that allows anyone with a vehicle to become a taxi driver, enabling people to share their vehicle as a taxi service and earning an income. Uber has disrupted the taxi industry by cutting the prices down significantly and allowing more consumers to satisfy their need for transportation [6].

According to Statista, the total value of the entire sharing economy will reach 335 billion in 2025 [10]. Sharing Economy, from an economic perspective, has increased the overall gross domestic product and revolutionize the labour market as it happened for the driver of Uber, where a huge debate is happening if drivers should be considered as an employed worker by Uber or a self-employed. From an environmental impact, Ala-Mantila et al. (2016) [3] affirms that the sharing economy increases the sustainability and environmental awareness, which could be confirmed by the massive introduction of the electric vehicle.

Chapter 2 – The Future of Mobility

2.1 Urban Mobility

According to the United Nations, over half of the population lives in urban areas. By 2050, it prospected a significant increase of people moving to cities that should reach 68% [12]. Data from the United Nation shows that up to 2018, North America has the highest urbanized areas (82%), Latin America 81%, Europe 74%, Oceania 68% and Asia is almost half of the regions.

In the coming years, local governments will face several obstacles to reshape towns from a living, economic, environmental and mobility perspective. By 2050, the average time spent by a citizen in traffic congestion will be 106 hours per year, traffic jams are already unsustainable in some cities, losing 2 to 4 per cent of national GDP and air pollution is responsible for 7 million premature deaths [13].

The rise of the population has contributed to an increase in demand for urban mobility and evolution of people behaviour. Most towns do not have a strategy and vision to re-think mobility systems and the lack of interaction between public and private sector initiatives leads to sub-optimal mobility results, which needs a more integrated approach. Public transport is being challenged by the introduction of new business models, such as ridesharing or in general mobility as service (MaaS). The future will be a multi-modal transportation system that allows consumer, based on their position, real-time events, traffic conditions and available parking space, to give you different choice on how to reach your destination.

To better adapt urban mobility, local governments have introduced Travel Demand Management (TDM) policies with the goal to change people's travel behaviour in a way to diminish and reallocate travel demand around the city. Such initiatives are classified as hard and soft policies depending on the application of various reward and disincentive system. Hard policies have the purpose to reduce the desirability of vehicle by introducing economic disincentives, regulations, rising parking rates, tolling roads, cut road capacity, raise fuel's price and congestion charges meanwhile "soft policies" act as a nudge, pushing gently inhabitants' behaviour for substituting vehicles toward a more sustainable way of

travel, intensifying awareness campaign related to pollution and the congestion problems and preference lanes for greener vehicles [25].

2.2 E-Vehicle

Global shipments of EV rose to more than two million units in 2018 and a 5.1 million electric car fleet, and it is expected that demand will grow to up to 3 million cars in 2020 globally. Nonetheless, despite a penetration rate of 2.2%, EV constitutes just a small portion of the overall demand for electric vehicles. For the next 5 years 2025–30, it is predicted that the difference between EVs and traditional vehicles will diminish. Moreover, with the persistent investment in research and developments, the cost of batteries could decrease by 50%, which could significantly increase sales due to the fact that batteries constitute one-quarter of today's EV costs [28].

2.3 Autonomous Driving

Autonomous Vehicles (AVs) are vehicles with different level of automation, that analyse the surrounding environment and do not need human assistance for all the activities. The society of Automotive Engineers (SAE) has identified various levels of automatic capability, varying from no automatic actions (level 0) to complete automation (level 5 – describing a driverless car). The implementation of AVs will offer various advantages for the citizens, such as increased traffic security, improved urban life and diminishment of cars accident. On the other hand, AVs will be not accessible to everyone due to the high cost and will bring some disadvantages such as loss of workers in the transportation and logistics industry as well as socioeconomic inequality [30].

Indeed, the recent innovation of autonomous vehicle in the automotive industry has brought a substantial gap in a legal context. With cars producers reaching a greater degree of vehicle autonomy, where the responsibility and control switch to the vehicle itself, different players such as car manufacturers, suppliers of component, car developer, will have significant responsibilities. Another problem that stakeholders such as programmer and regulators will face is including aspects of morality and ethics that must include several choices. Several issues will arise regarding “the prioritization of the safety of drivers over passengers, occupants over pedestrians, young versus old or vehicles with fewer occupants being sacrificed over ones with more” [32].

Chapter 3 – Shared Mobility

Shared mobility is a concept that refers to an innovative way of using transportation facilities among people. These include multiple modes of transportation, such as bike-sharing, e-scooter sharing, and carsharing, which can be based on a classical form of station-based to a free-floating system.

Shared mobility has been active in cities around the world and the several benefits that brought have been demonstrated such as cost reduction, comfort, diminishment in vehicles miles usage and decreased in vehicle ownership, and also reduced greenhouse gas emission. Furthermore, shared mobility has produced financial gains for the community and rise in productivity.

3.1 Car Sharing

One of the main examples is Share Now, a German company born from the merge between car2go and DriveNow. The service has reached 20,500 automobiles and 26 towns, characterised mainly by a free-floating service [35]. Car sharing is present around the world with several business models, the first to be introduced was the station based, which offers the customer a service based on minute usage, where users can choose between a collection of a different typology of cars, rent it and return the vehicle in the same place from it was collected. Later, with the development and improvement of safety and GPS technologies, has been launched, the "free-floating" system, which enables customers to collect an automobile whenever is located and leave it in a delimited area that covers a large part of the city [36]. Finally, the last trend among the car-sharing industry has been the personal vehicle sharing (PVS) or peer-to-peer carsharing.

3.2 SAV – Shared Autonomous Vehicle

At the moment, SAV is divided in reservation-based (booked in advance) and on-demand (the customers can book vehicles in real-time). Furthermore, SAV network can be categorized in a car–sharing, ride–sharing and mixed programme. In the second case, ride-sharing, people share the ride itself at the same moment, while in the first case, one person at the time can use the car-sharing programme [40].

Stocker and Shaheen (2018) have analysed also possible different business model, according to a reasonable scenario. The research distinguishes six distinct opportunities, based on vehicle ownership and system: Business–to–Consumer (B2C) with one company, B2C with the several firms handling a different part of the business, Peer–to–Peer (P2P) with third–party firm, P2P with the decentralized company, Hybrid ownership with one single company and Hybrid ownership with third–party firm [40].

SAV can have a significant impact also toward travel behaviour, or car ownership, that according to some research, with an accurate strategy from the government, can substitute from 1 to 11 car. Other expert forecast a substitution of 67% to 90%. One of the disadvantages predicted by the introduction of the autonomous vehicle is unoccupied travel that will rise kilometres travelled by the automobiles.

3.3 Autonomous Buses

The autonomous vehicle will not only disrupt the private cars but also the public transport with a direct consequence on buses and the entire public transport infrastructure. The introduction of AV technology can improve public mobility with a significant efficiency on labour productivity and decreasing operational cost for the firm [42].

A clear consequence is the optimization of the operational structure cost of the firms and the reduction of prices for citizens. Moreover, it could allow shorter waiting times for people, an expanded service in terms of units, and larger diffusion in the city. Furthermore, AV can increase more equity and accessibility on the use of public transport, enabling elderly citizens or who cannot drive and offering a better service compared to the current one [41] [42]

3.4 Micro-Mobility

Micro-mobility is a recent concept often utilized in transportation literature to indicate trips and journeys of few kilometres for personal needs with a small, light and two-wheelers vehicles that usually is bike or e-scooter. Several advantages are created with the introduction of micro-mobility services such as low emission of greenhouse gas emission, significant reduction of car ownership, more free space for public activities and, it can enhance access to a faster mode of transportation to economically vulnerable communities who cannot afford a private vehicle like a car.

The growth of micro-mobility riding in metropolitan areas is projected in an expansion of 8 to 15% in the market. The local government had to deal with a new form of regulation and investment to adapt the streets for the new vehicles and the main infrastructure development is the enhancement of cycleways. Research studying the most important element that brought to success the bike-sharing system was the investment on roads. The government had to deal with the update of new legislation, which is divided into two main topics: user behaviour, like helmets, maximum speed, or parking areas, and operator behaviour, such as a minimum or a maximum number of vehicles to serve or loyalties to the council. [48]

3.5 Bike-sharing

Bike-sharing schemes are divided into “station-based” and dockless. In the first case, bicycles are positioned at public docking station all over the city, offering an on-demand service for a different trip, connecting important spot in the city (University, city centre, bus station etc). In recent years, the dockless bicycle has been introduced allowing citizens to pick-up and drop-off the vehicle anywhere within a designed area. [47]

3.6 E-Scooter

Electric scooters, through several start-up-ups that introduced the sharing services, has gained great popularity around the world, becoming at the moment the latest innovation in micro-mobility. E-scooter has the advantage to be versatile, allowing people to use them for a range of kilometres that is not suitable for cars or too far for walking. Moreover, thanks to the small size of the vehicle, this can be used in roads as well as sidewalks or pedestrian area to overcome traffic jams.

One of the reasons that have given rapid popularity to e-scooter is the efficacy in solving the last-mile issue. The vehicle can quickly bring users to transportation hubs, like bus or metro station, from their home, without any constraints but giving more choice on intermodality mobility. Other reasons that increased the request for e-scooter is the high accessibility to the service, they are all dockless and give flexibility on the purpose of travel, no parking cost and it is not necessary practising before to use them [52]

The first start-up to enter in the market in 2017 were Bird, followed then by other competitors such as Lime, Helbiz, Voi, etc. All the firms working in shared micro-mobility raised 1.5$ billion with a global market value of $40 to 50$ billion by 2025, reaching cities with at least 100,000 inhabitants. [50]

3.7 Research Objective and Conceptual Framework

E-scooters firms are trying to expand globally in the fastest way. However, sharing mobility has had a different level of acceptance and success in several countries. Cultures play a crucial role that determines the failure or the fortune of sharing services.[59]

Italy has legislatively allowed the use of e-scooters only in July 2019, with a maximum speed of 25km/h, no mandatory helmets and insurance, and with the limitation on driving on sidewalks. All previous studies do not consider the Italian market and also do not have a focus on behavioural influence regarding willingness to use e-scooters, personal value, or social norms. These elements have a significant influence on travel behavioural toward shared mobility programme.

Until now, only “YouGov” has done a survey for the Italian market. In the survey, the most interesting factor underlines the fact that almost everyone (83%) agrees that when riding e-scooters should be mandatory wearing a helmet. The question proposed to individuals was “For what reasons would you rent an e-scooter?”, the most common answers with respectively 55%, 50% and 44% are “to travel fast”, “to reduce emissions” and “ to avoid usinga car”. The results show clearly that e-scooter is viewed as the fastest mode of transportation in the certain case to move from a point A to a point B, while the second answer demonstrates a strict correlation with environmental concern.

Chapter 4 – Research Objectives and Methodology

4.1 Model Framework

This study is one of the first done in the Italian market regarding e-scooters and can significantly give an overview of the users in a fast and rapidly growing market. Moreover, due to the recent introduction of e-scooters in the following Italian cities: Rome, Milan, Turin, Cesena, Pescara, Verona, Bari, Parma, Napoli (Helbiz, 2020). The study can help mayors, transport council member, policymakers to understand better how to improve urban mobility and increase the usage of electric scooters [66].

The model proposed studies the direct and intentional decision procedure when utilizing the e-scooter sharing programme with the framework of the theory of planned behaviour (TPB). This framework is also used to understand the human decision in travel behaviours studies. In the TPB framework, the intention is the dependent variable, while attitude, perceived control and social norm are other elements that influence the intention itself.

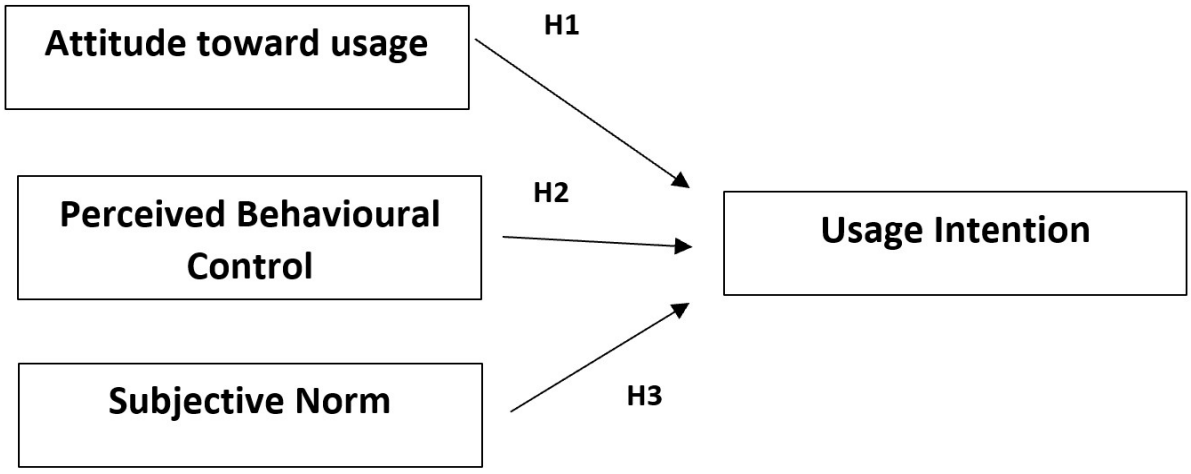
Early adopters do have expectations on the simplicity or complexity of e-scooter sharing system usage, and different levels of self-confidence, income, and other factors necessary in their willingness to use e-scooters. The combination of tools is fundamental to formulate the concept of *perceived behavioural control.* Additionally, "*subjective norms* stand for perceived social pressure" from relatives and friends.

Consequently, the hypotheses are:

H1. Positive attitudes toward E-scooters Sharing System use positively influence usage intention.

H2. Perceived behavioural control over the use of E-scooters Sharing System positively influences usage intention.

H3. Social norms regarding the use of E-scooters Sharing System positively influence usage intention.



4.2 Methods and Analysis

In the survey for this research was used a 5-point Likert-type scale for all items. Concerning the demographic items were included gender (male/female), age (open item), average yearly income (above or below 10,000 €), frequency of usage of public transport (Bus, Tram, Metro, Train) and finally if the user ever used the e-scooter before.

The questionnaire was disseminated between June and July 2020, through word of mouth, instant message platforms such as WhatsApp, Facebook Messenger, and Instagram and also Facebook groups, reaching a total of 319 valid responses. The statistical analysis has been conducted through the use of SPSS software.

The sample is constituted by 56.1% (179) males and 43.9% (140) females (Table 1). Among all the 319 respondents more than half, 59,2% (189) is a student, then 25% (80) are employed and the remain people are freelancers or unemployed (Table 2). Regarding income information, 68% (217) of respondents earn less than 15.000€ per year, which confirm the high percentage of students 59,2% and the small percentage of unemployed 3,1%. Furthermore, people who earn between 15.000€ and 40.000€ are almost 25% (79) and finally, only 7,2% (23) of people interviewed earn more than 40.000€ (Table 3).

People who participated in the research can be divided into four main age group, 18-24, 25-34, 35-45, 45 and above. The first group refers more than half of the total 56,4%(177) then the second group is 36,9% (118) and together the first two groups represents 93% of the sample, which confirm the majority of students and the low salary. The mean is 25,59 (Table 4).

Concerning the correlation between public transport and new users, from table 7 is clear that almost half of the early adopters (people who have tried e-scooter at least once) use often the public transport 42% (Often + Always), while 91% (Sometimes + Half of the time + Often + Always) of total respondents use public transport at least once in a while. Table 8 shows the correlation between new users and the occupation of respondents. Most of the users are students 45.5% (35) of the early adopters, that can relate to a correlation with the young age. The second category with the highest number of trials is employed people 36% (28).

The last contingency table is shown in table 9, between new users and age. If it is taken in consideration the four group in which previously were divided age 18-24, 25-34, 35-45, 45 and above, the percentage of early adopter is 51% (39), 40% (31), 6,5% (5), 1,5% (1) respectively. It is unequivocal that the highest correlation between age and early adopters are among young people between 18-24, but also individuals between 25-34 with 40%.

After preparing the data, all the variables have been analysed. Starting from the dependent variable "Usage Intention", the participants were asked to agree or disagree on the 5 - point Likert scale on three statements. The mean of the whole item "Usage Intention" is M=3,22, SD=1,14, which is in a neutral position or slightly positive (Table 10). Analysing in depth the behaviour of respondents is clear the difference among people who have already tried the e-scooter once with M=3,97, SD=0,93 and users who have not tried yet the vehicle M=2,99, SD=1,10 showing a significant difference (Table 11). Furthermore, an analysis between Job Occupation and Usage Intention was done, founding that unemployed people and the category "Other" are slightly more inclined to usage intention with restrictively M=3,44, SD=0,77 and M=3,55, SD=1,22 compared to the standard M=3,22, SD=1,14 (Table 13).

The first independent variable is "Attitude" and the participants were asked to agree or disagree on 5-point Likert scale on two statements. The mean of the aggregate item "Attitude" is M=3,72, SD=1,06 that is closer toward a positive attitude (Table 15). Regarding the correlation between people who have tried the e-scooter and users who have not, we have a similar case of the variable usage intention. The first one has a result of M=4,05, SD=0,92 and users who have not tried yet the e-scooter M=3,61, SD=1,08 showing a significant difference and a slightly more positive attitude for respondents who have already tested the innovation and a lower score for the others (Table 11). Concerning the correlation between Income and Attitude, only the group with the highest annual salary, more than 40.000€ per year, has shown a slightly lower attitude with a score of M=3,30, SD=1,38 (Table 12). Also, an analysis between Job Occupation and Attitude was done, showing that unemployed people are slightly more inclined compared to the other category with a score of M=4,30, SD=0,71 (Table 13). Finally, a comparison among various frequency of public transport's usage and attitude was measured, with a result slightly higher for people who declared to never use public transport with a score of M=4,02, SD=1,24 (Table 14). This is an interesting result due to the fact that in this case, e-scooter might be seen more as an alternative to a private vehicle rather than to public transport, therefore a widespread diffusion of e-scooters might induce people to substitute private vehicles such as car and motorbikes with e-scooter.

The second independent variable is "Perceived Behavioural Control" and respondents were asked to agree or disagree on the 5-point Likert scale on the four statements. The mean of the whole item "Perceived Behaviour Control" is M=3,22, SD=1,00 which is close to a neutral position (Table 15). Concerning the relation between people who have tried the e-scooter and users who have not, we continue to find a similar path compared to the previous result. The first one has a result of M=3,74, SD=0,88 and users who have not tried yet the e-scooter M=3,05, SD=0,98 showing a significant difference and a slightly more positive attitude for respondents who have tested the product (Table 11). Regarding, the analysis between Job Occupation and Perceived Behavioural Control, freelancers have obtained a significantly lower score compared to the other groups with a score of M=2,76, SD=1,33 (Table 13).

The third independent variable is “Social Norms” and respondents were asked to agree or disagree on the 5-point Likert scale on three statements. The mean of the whole item “Social Norms” is M=3,17, SD=0,85 which is close to a neutral position (Table 17). About the link between individuals who have tried the e-scooter at least once and who have not, we continue to find a similar path compared to the previous result. The first one has a result of M=3,41, SD=0,71 and users who have not tried yet the e-scooter M=3,09, SD=0,88 showing a slightly more positive attitude for the first respondents. (Table 11). Furthermore, an analysis between Job Occupation and Social Norms was done, showing that unemployed people are slightly more inclined compared to the other category with a score of M=3,53, SD=0,74 (Table 13). Finally, a comparison among various frequency of public transport’s usage and Social Norms was measured, with a result slightly higher for people who declared to never use public transport with a score of M=3,27, SD=1,09 (Table 14). This result is line with the variable Perceived Behavioural Control, confirming that e-scooter might be perceived more as a substitute for private vehicles rather than public transport.

The results show a discrepancy among people who never use the e-scooter and users who did. Therefore, people who have never tried the product rely only on their feelings, sensations, news as well as their willingness to try new products, based on previous experiences of new technology. Some outcomes are in line with previous researchers in other countries, such as the young age (18-34) being the most willing to try and use e-scooter, and older people less. Moreover, people with the highest income belong also to the older group who can assume using more private vehicles such as car and motorbikes.

All the question of the survey and the scale were already validated and used for similar research [49]. Consequently, I proceeded with the Alpha Cronbach for all the variables: Usage Intention, Attitude, Perceived Behavioural Control and Social Norms. The results for all the variables were “Good”, only the factor “Social Norms” had an “Acceptable” rate. The third element of this variable shows how the reliability of the factor could be higher if deleted. Therefore, I deleted the third item to have a higher score of 0,819 for the Alpha Cronbach of the variable social norms.

4.3 Linear Regression Analysis

A multilinear regression was carried out to verify if the three variables influence the usage intention. The regression was calculated between the independent variable Attitude, Perceived Behavioural Control and Social Norms and dependent variable Usage Intention. The model fit was good because F-Test was significant, but R-square had a medium score ($F(3,315) = 206,8$, p-value=0.00 <0.05, R-Square 0,663). The model accounts for 63% of the variability in the dependant variable “Usage Intention”. Regarding

all individual regressions coefficients, “Attitude” and “Perceived Behavioural Control” have a significant result, while “Social Norm” has not a significant level.

4.4 Conclusion and Managerial Implications

The main goal of this research project has been to explore the new trend of urban mobility, e-scooters, that has gained rapid popularity among the major European cities. The research was one of the first in Italy to evaluate experimentally the intention of people trying the e-scooter, using a well-known behavioural model, the TPB theory. The survey was launched mainly among students and young workers of Italy, with several results. The research demonstrated a significant direct effect of the variable “Perceived Behavioural Control” and “Attitude” in the dependent variable Usage Intention, while the independent variable “Social Norms” did not have a significant effect. The independent variable “Perceived Behavioural Control” was the most significant and this might be explained by several other factors as we have seen previously. The willingness to use the e-scooter in a precise moment can be dictated by the weather, the number of kilometres to do, the alternatives available to do that same trip and also from the number of other e-scooters in case more than one need to travel from point A to point B.

From the results, we can also reach a different conclusion. First of all, there was a significant positive difference among people who have tried the e-scooter at least once and people who have not. This can be important information for managers who should focus more on the first part of the customer journey, the trial of the product, which can boost the usage of e-scooter in the future. Secondary, the e-scooter was not always perceived as an integrated part of the public transport or substitute but more a replacement for a private vehicle. Managers of e-scooter companies should take into consideration this information to better plan their future strategy, as e-scooter might be part of the public transport service or a separated service.

Policymakers also play a fundamental role to encourage people trying and using e-scooter. Safety is a factor that has not been analysed in the experiment but play a major role in the choice of consumers to use or try the vehicles, for this reason, is clear that an urban setting that prioritizes the safety of e-scooter and bikes users can incentivize the usage. Moreover, policymaker should work on making private vehicles less attractive for daily usage, by increasing the parking fees as well as enlarging the limited traffic area for private cars. Consequently, this could push some users to shift their everyday trip to work or school from cars to e-scooters, also due to the amount of time wasted in traffic.

The research could help urban planners to formulate a long-term strategy for urban mobility in the next five or ten years, and start working toward that objective. Urban mobility should be based mainly on sharing vehicles, autonomous vehicles, and their integration with the current public transport. From a

marketing perspective, managers should focus more on students and young workers as their target and create a special offer for the first trial, which is the most challenging part of the customer journey.

4.5 Limitations and Future Investigations

Several limitations were present in the study. First, the number of respondents was quite low and did not represent demographically the Italian population, indeed the majority of people were students. Another limitation was given by the moment in which the survey was launched, between May and June 2020. In these months, it was just launched the service of micro-mobility in towns such as Rome and Milan and consequently only a small part of respondents 25% have tried at least once the e-scooter. Moreover, users who already tried the e-scooter might have tested the e-scooter outside their city, in European capital such as Paris, Madrid, Lisbon, Berlin for recreational purpose. Other limitations as well as future investigations might be the size of the city, which can also influence the different perception of distance and consequently the usage of the private car rather than public transport.

Another factor which was not taken into consideration was the environmental values, which can influence in electric e-scooter usage. Indeed, in other studies, it was underlined the importance of environmental action, which is especially present in young people like the event “Friday for Future”. Adding the environmental sensibility variable might give a clearer overview for managers, who can decide to invest in a marketing campaign underlining the sustainability of e-scooter.

Future investigations might also explore emotional and non-rational motivations that push people to use e-scooter, as well as discovering if riding an e-scooter might be correlated with a certain status quo which can influence positively or negatively the attitude of consumers. Other investigations might examine the role of safety in roads and if the presence of bicycle routes might influence positively the usage of e-scooters.

Finally, future research might study deeply the difference between the recreational usage and e-scooter as an alternative to private or public transport. This information can give precious data to managers, for example, they can understand better if it is more suitable to charge and reposition the e-scooter during night or days according to the type of usage. One of the crucial points which can increase the usage of e-scooter is the first trial. This part of the customer journey is full of barriers which might be evaluated deeply to understand which factor is most influential. As we have seen previously, the use of helmet had different response around the globe, as well as the use or the ban of e-scooter in a pedestrian zone, these are all variable that can be studied in the Italian market in the future.

Appendix

Survey Questions

Usage intention	INT1	If I have access to an EMS system close to me, I will use it.
	INT2	I am willing to try out EMS.
	INT3	I am willing to recommend friends and family to use EMS.
Attitude	ATT1	EMS is a great idea.
	ATT2	EMS has many advantages or benefits.
Perceived behavioural control	PBC1	Using EMS is not entirely up to me.
	PBC2	Provided there is an EMS system near me, I could use it if I wanted to.
	PBC3	I feel confident that I could use EMS.
	PBC4	I believe EMS would be easy to use for me.
Social norms	SN1	My family or friends think using EMS is a good thing.
	SN2	People important to me think that using EMS is a good thing.
	SN3	In the near future people in the city will use EMS more and more.

TABLE 1 - Gender

Di che sesso sei?

		Frequenza	Percentuale	Percentuale valida	Percentuale cumulativa
Valido	Maschile	179	56,1	56,1	56,1
	Femminile	140	43,9	43,9	100,0
	Totale	319	100,0	100,0	

TABLE 2 - Occupation

Indica la tua occupazione

		Frequenza	Percentuale	Percentuale valida	Percentuale cumulativa
Valido	Studente	189	59,2	59,2	59,2
	Libero Professionista	13	4,1	4,1	63,3

	Impiegato	80	25,1	25,1	88,4
	Disoccupato	10	3,1	3,1	91,5
	Altro	27	8,5	8,5	100,0
	Totale	319	100,0	100,0	

TABLE 3 – Income

Quanto guadagni in un anno?

		Frequenza	Percentuale	Percentuale valida	Percentuale cumulativa
Valido	meno di 15.000€	217	68,0	68,0	68,0
	Tra i 15.000 e 40.000€	79	24,8	24,8	92,8
	Più di 40.000€	23	7,2	7,2	100,0
	Totale	319	100,0	100,0	

TABLE 4 - Age

Indica l'età

		Frequenza	Percentuale	Percentuale valida	Percentuale cumulativa
Valido	00	1	,3	,3	,3
	16	1	,3	,3	,6
	17	1	,3	,3	,9
	18	1	,3	,3	1,3
	19	7	2,2	2,2	3,4
	20	15	4,7	4,7	8,2
	21	22	6,9	6,9	15,0
	22	27	8,5	8,5	23,5
	23	45	14,1	14,1	37,6
	24	60	18,8	18,8	56,4
	25	39	12,2	12,2	68,7
	26	24	7,5	7,5	76,2

	27	17	5,3	5,3	81,5
	28	5	1,6	1,6	83,1
	29	5	1,6	1,6	84,6
	30	10	3,1	3,1	87,8
	31	3	,9	,9	88,7
	32	5	1,6	1,6	90,3
	33	7	2,2	2,2	92,5
	34	3	,9	,9	93,4
	35	2	,6	,6	94,0
	36	2	,6	,6	94,7
	37	1	,3	,3	95,0
	38	4	1,3	1,3	96,2
	40	2	,6	,6	96,9
	44	1	,3	,3	97,2
	46	2	,6	,6	97,8
	47	4	1,3	1,3	99,1
	49	1	,3	,3	99,4
	50	1	,3	,3	99,7
	60	1	,3	,3	100,0
	Totale	319	100,0	100,0	

TABLE 5 – Public Transport Frequency

Public_Transport--Quanto sei d'accordo con la seguente affermazione? - Usi il trasporto pubblico (Treno, Metro, Bus)

		Frequenza	Percentuale	Percentuale valida	Percentuale cumulativa
Valido	Mai	24	7,5	7,5	7,5
	Qualche volta	115	36,1	36,1	43,6
	La metà del tempo	34	10,7	10,7	54,2

	Molto Spesso	96	30,1	30,1	84,3
	Sempre	50	15,7	15,7	100,0
	Totale	319	100,0	100,0	

TABLE 6 – Contingency Table between Gender and New User

Tavola di contingenza New User--Hai mai usato un monopattino elettrico in sharing? * Di che sesso sei?

Conteggio

		Di che sesso sei?		
		Maschile	Femminile	Totale
New User--Hai mai usato un monopattino elettrico in sharing?	Si	47	30	77
	No	132	110	242
Totale		179	140	319

TABLE 7 – Contingency Table between New User and Frequency Public Transport

Tavola di contingenza New User--Hai mai usato un monopattino elettrico in sharing? * Public_Transport--Quanto sei d'accordo con la seguente affermazione? - Usi il trasporto pubblico (Treno, Metro, Bus)

		Public_Transport--Quanto sei d'accordo con la seguente affermazione? - Usi il trasporto pubblico (Treno, Metro, Bus)				
		Mai	Qualche volta	La metà del tempo	Molto Spesso	Sempre
New User--Hai mai usato un monopattino elettrico in sharing?	Si	7	29	9	20	12
	No	17	86	25	76	38
Totale		24	115	34	96	50

TABLE 8 – Contingency Table between New User and Occupation

Tavola di contingenza New User--Hai mai usato un monopattino elettrico in sharing? * Indica la tua occupazione

Conteggio

		Indica la tua occupazione					
		Studente	Libero Professionista	Impiegato	Disoccupato	Altro	Totale
New User--Hai mai usato un monopattino elettrico in sharing?	Si	35	3	28	3	8	77
	No	154	10	52	7	19	242
Totale		189	13	80	10	27	319

TABLE 9 - Contingency Table between New User and Age

Tavola di contingenza New User--Hai mai usato un monopattino elettrico in sharing? * Indica l'età

Conteggio

		Indica l'età																
		00	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
New User--Hai mai usato un monopattino elettrico in sharing?	Si	1	0	0	0	1	0	5	4	11	18	9	4	3	2	4	2	1
	No	0	1	1	1	6	15	17	23	34	42	30	20	14	3	1	8	2
Totale		1	1	1	1	7	15	22	27	45	60	39	24	17	5	5	10	3

Tavola di contingenza New User--Hai mai usato un monopattino elettrico in sharing? * Indica l'età

Conteggio

		Indica l'età															
		32	33	34	34	35	36	37	38	40	44	46	47	49	50	60	Totale
	Si	3	3	0	0	2	0	0	1	1	1	0	1	0	0	0	77

New User--Hai mai usato un monopattino elettrico in sharing?	No	2	4	3	1	0	2	1	3	1	0	2	3	1	1	1	242
Totale		5	7	3	3	2	2	1	4	2	1	2	4	1	1	1	319

TABLE 10 – Usage Intention Question

Statistiche

		UI_1_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Se avessi accesso ad un monopattino elettrico in sharing vicino a me, lo userei	UI_2_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Sono disposto ad usare un monopattino elettrico in sharing	UI_3_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Sono disposto a raccomandare ad amici e parenti di utilizzare un monopattino elettrico in sharing.
N	Valido	319	319	319
	Mancante	0	0	0
Media		2,94	3,49	3,26
Deviazione std.		1,237	1,338	1,302
Minimo		1	1	1
Massimo		5	5	5

TABLE 11 – Usage Intention, Attitude, Perceveid Behaviour Control, Social Norms and New Users

Report

New User--Hai mai usato un monopattino elettrico in sharing?		UI_Mean	ATT_Mean	PCB_Mean	SN_Mean
Si	Media	3,9784	4,0584	3,7435	3,4113
	N	77	77	77	77
	Deviazione std.	,93555	,92826	,88479	,71307
No	Media	2,9904	3,6157	3,0599	3,0992

	N	242	242	242	242
	Deviazione std.	1,10883	1,08700	,98354	88181
Totale	Media	3,2288	3,7226	3,2249	3,1745
	N	319	319	319	319
	Deviazione std.	1,14904	1,06650	1,00302	,85365

TABLE 12 – Usage Intention, Attitude, Perceveid Behaviour Control, Social Norms and Income

Report

Quanto guadagni in un anno?		UI_Mean	ATT_Mean	PCB_Mean	SN_Mean
meno di 15.000€	Media	3,2243	3,7857	3,2281	3,2012
	N	217	217	217	217
	Deviazione std.	1,11844	1,04811	,96904	,81141
Tra i 15.000 e 40.000€	Media	3,2110	3,6709	3,1835	3,1308
	N	79	79	79	79
	Deviazione std.	1,18415	,99320	1,05666	,89382
Più di 40.000€	Media	3,3333	3,3043	3,3370	3,0725
	N	23	23	23	23
	Deviazione std.	1,34840	1,38776	1,15947	1,10076
Totale	Media	3,2288	3,7226	3,2249	3,1745
	N	319	319	319	319
	Deviazione std.	1,14904	1,06650	1,00302	,85365

TABLE 13 – Usage Intention, Attitude, Perceived Behaviour Control, Social Norms and Job Occupation

Report

Indica la tua occupazione		UI_Mean	ATT_Mean	PCB_Mean	SN_Mean
Studente	Media	3,2011	3,7328	3,2288	3,1781
	N	189	189	189	189
	Deviazione std.	1,13541	1,06506	,97418	,82407

Libero Professionista	Media	3,0000	3,5000	2,7692	2,9231
	N	13	13	13	13
	Deviazione std.	1,44016	1,52753	1,33253	,94432
Impiegato	Media	3,2042	3,6187	3,2125	3,1250
	N	80	80	80	80
	Deviazione std.	1,15164	,97515	,99770	,89124
Disoccupato	Media	3,4667	4,3000	3,5500	3,5333
	N	10	10	10	10
	Deviazione std.	,77300	,71492	,95598	,74037
Altro	Media	3,5185	3,8519	3,3333	3,2840
	N	27	27	27	27
	Deviazione std.	1,22067	1,16697	1,06066	,94147
Totale	Media	3,2288	3,7226	3,2249	3,1745
	N	319	319	319	319
	Deviazione std.	1,14904	1,06650	1,00302	,85365

TABLE 14 – Usage Intention, Attitude, Perceveid Behaviour Control, Social Norms and Public Trasnport

Report

Public_Transport--Quanto sei d'accordo con la seguente affermazione? - Usi il trasporto pubblico (Treno, Metro, Bus)		UI_Mean	ATT_Mean	PCB_Mean	SN_Mean
Mai	Media	3,1944	4,0208	3,0729	3,2778
	N	24	24	24	24
	Deviazione std.	1,17919	1,24655	1,09216	1,09309
Qualche volta	Media	3,3652	3,7391	3,2717	3,1507
	N	115	115	115	115
	Deviazione std.	1,17310	1,07880	1,02200	,81200
La metà del tempo	Media	3,0980	3,6912	3,2941	3,1078
	N	34	34	34	34
	Deviazione std.	1,07161	,87918	,92210	,75085

Molto Spesso	Media	3,1840	3,6875	3,1927	3,2049
	N	96	96	96	96
	Deviazione std.	1,10593	1,01631	,95523	,83683
Sempre	Media	3,1067	3,6300	3,2050	3,1667
	N	50	50	50	50
	Deviazione std.	1,22232	1,16851	1,08408	,94100
Totale	Media	3,2288	3,7226	3,2249	3,1745
	N	319	319	319	319
	Deviazione std.	1,14904	1,06650	1,00302	,85365

TABLE 15 – Attitude

		ATT_1_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - I monopattini elettrici in sharing sono un ottima idea	ATT_2_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - I monopattini elettrici in sharing hanno molti benefici
N	Valido	319	319
	Mancante	0	0
Media		3,77	3,67
Deviazione std.		1,136	1,105
Minimo		1	1
Massimo		5	5

TABLE 16 – Perceived Behavioural Control

		PCB_1_Recoded_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Usare monopattini elettrici in sharing non è adatto a me	PCB_2_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Se ci fosse un monopattino elettrico in sharing vicino a me, potrei usarlo	PCB_3_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Mi sento sicuro di usare un monopattino elettrico in sharing	PCB_4_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Credo che usare i monopattini elettrici in sharing sarebbe facile per me.
N	Valido	319	319	319	319
	Mancante	0	0	0	0
Media		3,26	3,29	2,91	3,44
Deviazione std.		1,332	1,228	1,211	1,224
Minimo		1	1	1	1
Massimo		5	5	5	5

TABLE 17 – Social Norms

		SN_1_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - La mia famiglia o i miei amici pensano che usare monopattini elettrici in sharing sia una buona cosa.	SN_2_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Le persone più importanti per me pensano che usare monopattini elettrici in sharing sia una buona cosa.	SN_3_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Nel prossimo futuro le persone in città useranno sempre più i monopattini elettrici in sharing.
N	Valido	319	319	319
	Mancante	0	0	0
Media		2,96	2,99	3,58
Deviazione std.		,975	1,031	1,061
Minimo		1	1	1
Massimo		5	5	5

TABLE 18 – Alpha Cronbach Usage Intention

Statistiche di affidabilità

Alpha di Cronbach	Alpha di Cronbach basata su elementi standardizzati	N. di elementi
,867	,866	3

Statistiche elemento-totale

	Media scala se viene eliminato l'elemento	Varianza scala se viene eliminato l'elemento	Correlazione elemento-totale corretta	Correlazione multipla quadratica	Alpha di Cronbach se viene eliminato l'elemento
UI_1_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Se avessi accesso ad un monopattino elettrico in sharing vicino a me, lo userei	6,74	6,009	,716	,545	,840
UI_2_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Sono disposto ad usare un monopattino elettrico in sharing	6,20	5,142	,815	,665	,745
UI_3_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Sono disposto a raccomandare ad amici e parenti di utilizzare un monopattino elettrico in sharing.	6,43	5,749	,711	,533	,844

TABLE 19 – Alpha Cronbach Attitude

Statistiche di affidabilità

Alpha di Cronbach	Alpha di Cronbach basata su elementi standardizzati	N. di elementi
,896	,897	2

Statistiche elemento-totale

	Media scala se viene eliminato l'elemento	Varianza scala se viene eliminato l'elemento	Correlazione elemento-totale corretta	Correlazione multipla quadratica
ATT_1_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - I monopattini elettrici in sharing sono un ottima idea	3,67	1,220	,812	,660
ATT_2_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - I monopattini elettrici in sharing hanno molti benefici	3,77	1,290	,812	,660

TABLE 20 – Alpha Cronbach Perceived Behavioural Control

Statistiche di affidabilità

Alpha di Cronbach	Alpha di Cronbach basata su elementi standardizzati	N. di elementi
,816	,817	4

Statistiche elemento-totale

	Media scala se viene eliminato l'elemento	Varianza scala se viene eliminato l'elemento	Correlazione elemento-totale corretta	Correlazione multipla quadratica	Alpha di Cronbach se viene eliminato l'elemento
PCB_1_Recoded_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Usare monopattini elettrici in sharing non è adatto a me	9,64	9,389	,605	,370	,785
PCB_2_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Se ci fosse un monopattino elettrico in sharing vicino a me, potrei usarlo	9,61	9,893	,607	,382	,782
PCB_3_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Mi sento sicuro di usare un monopattino elettrico in sharing	9,99	9,362	,711	,529	,734

PCB_4_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Credo che usare i monopattini elettrici in sharing sarebbe facile per me.	9,46	9,797	,627	,447	,773

TABLE 21 – Alpha Cronbach Social Norms

Statistiche di affidabilità

Alpha di Cronbach	Alpha di Cronbach basata su elementi standardizzati	N. di elementi
,782	,784	3

Statistiche elemento-totale

	Media scala se viene eliminato l'elemento	Varianza scala se viene eliminato l'elemento	Correlazione elemento-totale corretta	Correlazione multipla quadratica	Alpha di Cronbach se viene eliminato l'elemento
SN_1_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - La mia famiglia o i miei amici pensano che usare monopattini elettrici in sharing sia una buona cosa.	6,56	3,328	,640	,487	,685

SN_2_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Le persone più importanti per me pensano che usare monopattini elettrici in sharing sia una buona cosa.	6,54	2,960	,715	,543	,597
SN_3_Quanto sei d'accordo con le seguenti affermazioni? 1= Totalmente in disaccordo, 5= Totalmente d'accordo - Nel prossimo futuro le persone in città useranno sempre più i monopattini elettrici in sharing.	5,95	3,409	,517	,280	,819

TABLE 22 – Multiple Linear Regression

Riepilogo del modello

Modello	R	R-quadrato	R-quadrato adattato	Errore std. della stima
1	,814[a]	,663	,660	,66995

a. Predittori: (costante), SN1_2_Mean, PCB_Mean, ATT_Mean

ANOVA[a]

Modello		Somma dei quadrati	gl	Media quadratica	F	Sign.
1	Regressione	278,466	3	92,822	206,806	,000[b]
	Residuo	141,384	315	,449		
	Totale	419,850	318			

a. Variabile dipendente: UI_Mean

b. Predittori: (costante), SN1_2_Mean, PCB_Mean, ATT_Mean

Coefficienti[a]

Modello		Coefficienti non standardizzati		Coefficienti standardizzati		
		B	Errore standard	Beta	t	Sign.
1	(Costante)	-,343	,154		-2,228	,027
	ATT_Mean	,363	,049	,337	7,424	,000
	PCB_Mean	,607	,046	,530	13,238	,000
	SN1_2_Mean	,088	,052	,071	1,699	,090

a. Variabile dipendente: UI_Mean

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